

DIVISION OF CLINICAL LABORATORY SCIENCE (GRAD)

Master of Clinical Laboratory Science – Medical Laboratory Science Track (MLS Program)

The master of clinical laboratory science – medical laboratory science track (MLS program) prepares certified laboratory professionals to be leaders in the field through advanced coursework in molecular diagnostics, research design, laboratory administration, and educational methods. This program is designed for laboratory professionals who wish to deepen their scientific knowledge, prepare for teaching roles, or advance in administrative roles.

The MLS graduate program consists of primarily web-based courses and culminates in a capstone project. The web-based courses allow students greater flexibility in learning, but they are no less demanding than traditional classroom courses. Students interested in the MLS graduate program will be allowed to complete the program on a full-time or part-time basis but should be ready to make a commitment to studying at the graduate level. This commitment in time and resources will enable professional growth and development and contribute to career advancement.

Program Goals

Upon completion of the UNC–Chapel Hill master in clinical laboratory science – medical laboratory science track, MLS graduates will be prepared to:

1. Serve as leaders in the clinical laboratory profession in technical, educational, research, and administrative roles.
2. Critically analyze professional literature and apply that information in work settings.
3. Communicate effectively with health care providers and the public.
4. Continue to learn throughout their professional careers.

Admission to the program is required.

Student Learning Outcomes

At the completion of the MCLS–MLS program, students will be able to:

1. Explain the principles and methods used in molecular laboratory tests.
2. Explain the clinical significance of molecular laboratory procedures in diagnosis and treatment of disease and maintenance of health.
3. Interpret and evaluate patient results and suggest or select appropriate additional testing.
4. Use quality assurance principles and practices to ensure the accuracy and reliability of laboratory information.
5. Use the principles of method evaluation to select new techniques and instruments.
6. Explain and apply the major principles and practices of laboratory administration, supervision, and budgeting.
7. Explain and apply principles of effective test utilization.

8. Use educational methods to present information and develop instructional materials.
9. Use research methods to design, conduct, and disseminate results of studies on new technologies, procedures, or diagnostic correlations in molecular science.
10. Interpret, implement, and comply with laws, regulations, and accrediting standards and guidelines of relevant governmental and non-governmental agencies.
11. Apply principles of management to the acquisition and evaluation of laboratory information systems.
12. Design, implement, and evaluate resource management strategies to maintain optimal laboratory efficiency.
13. Communicate effectively with laboratory personnel, other health care professionals, patients, and the public.
14. Communicate effectively in both written and spoken English.
15. Formulate a strategic plan for professional career development.
16. Develop and complete a capstone project in advanced clinical laboratory practice, education, or laboratory operations.

MCLS–MLS Admissions Requirements

Applicants must have either:

- a baccalaureate degree and certification as a medical laboratory scientist MLS(ASCP) or medical technologist M.T.(ASCP) or equivalent U.S. certification. (Applicants who are eligible for certification must schedule the exam so that certification can be obtained by the first fall semester of the MLS program.)

OR

- a baccalaureate degree in a biological science and certification as an MLT(ASCP), or equivalent U.S. certification, plus two years full-time* experience working in the U.S. or Canada in an accredited** clinical laboratory within the last four years.

OR

- a baccalaureate degree in a biological science and U.S. certification in a specialty area (e.g., HT, CT, or categorical certification) plus two years full-time* experience working in the U.S. or Canada in an accredited** clinical laboratory within the last four years.

**Full-time experience is defined as a minimum of thirty-five (35) hours per week.*

***CLIA, CAP, AABB, Joint Commission accreditation, JCI accreditation, or accreditation under ISO 15189.*

Program Requirements

Students are subject to the requirements in place when they are admitted to this program; consequently, the requirements described in this catalog particularly apply to students admitted during the summer of 2023.

Students must

- earn grades of Pass or High Pass in all courses
- complete 27 academic credit hours of required courses and 6 credits of elective courses.

Required Courses

CLSC 708 Biostatistics for Laboratory Professionals (3 credit) Summer Session II

CLSC 710 Molecular Diagnostic Science Principles (3 credits) Fall

CLSC 720 Molecular Genetics and Diseases (3 credits) Spring

CLSC 730 Research Methods (3 credits) Fall

CLSC 735 Method Evaluation (3 credits) Spring

CLSC 750 Clinical Laboratory Administration (3 credits) Spring

CLSC 770 Educational Methods (3 credits) Fall

CLSC 780 Capstone I (3 credits) Fall or Spring

CLSC 790 Capstone II (3 credits) Fall or Spring

Electives

All elective courses applied to the M.C.L.S. degree must be taken during the time in which the student is enrolled in the program and must be approved by the student's advisor. Students may choose electives in the Division of CLS, in other UNC departments, or at another college or university. One of the electives can be an undergraduate course, as long as the content is applicable to the student's capstone project. Up to 6 credits of **electives** that are taken during enrollment in the MLS graduate program may be transferred from another college or university for the degree. Students are encouraged to seek out elective courses that support their individual professional goals.

Recent UNC CLS Graduates (Within the Past 10 Years)

Students who graduated from the UNC–Chapel Hill Clinical Laboratory Science program within the past 10 years will take CLSC 772 (Education and Research in CLS: 3 credits) instead of CLSC 730 and 770. They are not required to take CLSC 750 and will take one additional elective for a total of 30 credits.

Sample Plan of Study

A sample plan of study for full-time and part-time students is available on the Division of Clinical Laboratory Science website (<https://www.med.unc.edu/healthsciences/clinical/prospectivestudents/mls-program/mls-curriculum-2/sample-curricula/>).

Course Formats

All required courses are available online. Electives may be on campus, online, or hybrid (online and on-campus components). Students may also take elective courses at other colleges and universities.

Advising

Enrolled students will be assigned a CLS faculty advisor who will review the student's proposed plan of study and work with the student to adjust the plan as needed. MCLS–MLS students also have assistance from the Department of Health Sciences Student Services Office for issues related to registration and graduation.

Certification

Students who hold ASCP certification at the technologist/scientist or specialist level are eligible for several other technologist/scientist certification exams through the ASCP Board of Certification, including the Molecular Biology exam (MB), via Route 1 (<https://www.ascp.org/content/board-of-certification/get-credentialed/>). The courses in molecular diagnostic science are good preparation for the MB(ASCP) certification exam. The education practicum and/or electives taken, along with the student's work experience, may serve as good preparation for other technologist/scientist or specialist examinations.

Professor

Tara C. Moon

Assistant Professors

Bai Li

Shawn Luby

Sara Taylor

Susan Taylor

Advanced Undergraduate and Graduate-level Courses

CLSC 410. Laboratory Mathematics. 1 Credits.

Permission of the instructor for nonmajors. Basic mathematical principles, calculations, quality assurance, and method validation relevant to the clinical laboratory.

Rules & Requirements

Grading Status: Letter grade.

CLSC 410L. Basic and Molecular Laboratory Methods. 2 Credits.

Majors only. Basic skills associated with the clinical laboratory including pipetting, spectrophotometry, standard curves, dilutions, and immunoassays. Molecular methods include small volume pipetting, microwell plating, nucleic acid extraction, and PCR techniques.

Rules & Requirements

Grading Status: Letter grade.

CLSC 420. Urinalysis and Body Fluids. 1 Credits.

Permission of the instructor for nonmajors. The physical, chemical, and microscopic analysis of body fluids in the clinical laboratory with an emphasis on correlation of laboratory data.

Rules & Requirements

Grading Status: Letter grade.

CLSC 420L. Urinalysis Laboratory. 1 Credits.

For Clinical Laboratory Science majors only. The physical, chemical, and microscopic examination of urine with an emphasis on the correlation of laboratory data.

Rules & Requirements

Grading Status: Letter grade.

CLSC 430. Biochemistry. 3 Credits.

Permission of the instructor for nonmajors. Physiological biochemistry of the metabolic pathways and alterations in selected diseases. Also includes principles and applications of molecular techniques in the clinical laboratory.

Rules & Requirements

Grading Status: Letter grade.

CLSC 440. Hematology I. 2 Credits.

Permission of the instructor for nonmajors. Introduction to normal hematopoiesis, blood cell function and identification, hematologic tests, principles of hemostasis, and hemostasis disorders.

Rules & Requirements

Grading Status: Letter grade.

CLSC 440L. Hematology I Laboratory. 1 Credits.

Permission of the instructor for nonmajors. Basic clinical assays for identification and evaluation of erythrocytes, leukocytes, and platelets with an emphasis on microscopy. Also includes coagulation testing.

Rules & Requirements

Grading Status: Letter grade.

CLSC 442. Hematology II. 3 Credits.

Majors only. Hematologic disorders involving erythrocytes and leukocytes, with an emphasis on the analysis and interpretation of laboratory data.

Rules & Requirements

Grading Status: Letter grade.

CLSC 442L. Hematology II Laboratory. 1 Credits.

Majors only. Microscopic identification and evaluation of abnormal erythrocyte and leukocyte morphology, correlation with other laboratory data, and clinical interpretation.

Rules & Requirements

Grading Status: Letter grade.

CLSC 450. Immunology. 3 Credits.

Permission of the instructor for nonmajors. Basic immunology and serology. Innate and immune body defenses. The development and properties of cellular and humoral elements and their alterations in pathological and other conditions.

Rules & Requirements

Grading Status: Letter grade.

CLSC 460. Special Pathogens. 2 Credits.

Permission of the instructor for nonmajors. Study of clinically significant fungi, parasites, and atypical or unusual bacteria. Correlation of disease, disease transmission, mechanisms of pathogenicity, and diagnostic testing.

Rules & Requirements

Grading Status: Letter grade.

CLSC 460L. Parasitology and Mycology Laboratory. 1 Credits.

Permission of the instructor for nonmajors. Clinical laboratory diagnostic methods for human parasitic and fungal infections. Microscopic morphology of fungal organisms and parasites, including their various life cycle forms.

Rules & Requirements

Grading Status: Letter grade.

CLSC 462. Clinical Bacteriology. 3 Credits.

Majors only. Principles and practice of clinical bacteriology. Study of medically significant bacteria with correlation of human disease, mechanisms of bacterial pathogenicity, and laboratory diagnostics.

Rules & Requirements

Grading Status: Letter grade.

CLSC 462L. Clinical Bacteriology Laboratory. 2 Credits.

Majors only. A comprehensive course describing bacteria that infect humans. Correlation of diseases and pathological mechanisms of bacteria.

Rules & Requirements

Grading Status: Letter grade.

CLSC 470. Clinical Chemistry. 3 Credits.

Majors only. An introduction to the methods of analysis used in the clinical chemistry laboratory. Emphasis on the correlation of chemistry laboratory values with disease states.

Rules & Requirements

Grading Status: Letter grade.

CLSC 470L. Clinical Chemistry Laboratory. 2 Credits.

Majors only. Performance of clinical laboratory assays for significant biochemical molecules. Principles of analysis, quality control, method evaluation, and basic laboratory instrumentation are presented.

Rules & Requirements

Grading Status: Letter grade.

CLSC 480. Immunohematology. 3 Credits.

Majors only. Introduction to blood group serology with an emphasis on the major blood group systems, pretransfusion testing, and antibody identification.

Rules & Requirements

Grading Status: Letter grade.

CLSC 480L. Immunohematology Laboratory. 2 Credits.

Majors only. Laboratory techniques for red cell typing, antibody identification, and pretransfusion testing.

Rules & Requirements

Grading Status: Letter grade.

CLSC 540L. Clinical Hematology Laboratory. 4 Credits.

Majors only. Laboratory rotation in clinical hematology.

Rules & Requirements

Making Connections Gen Ed: EE- Field Work.

Requisites: Prerequisite, CLSC 440.

Grading Status: Letter grade.

CLSC 542L. Clinical Hemostasis Laboratory. 2 Credits.

Majors only. Laboratory rotation in clinical coagulation.

Rules & Requirements

Requisites: Prerequisite, CLSC 440.

Grading Status: Letter grade.

CLSC 550L. Clinical Immunology Laboratory. 1 Credits.

Majors only. Laboratory rotation in clinical immunology.

Rules & Requirements

Requisites: Prerequisite, CLSC 450.

Grading Status: Letter grade.

CLSC 560L. Clinical Microbiology Laboratory. 4 Credits.

Majors only. Laboratory rotation in clinical microbiology.

Rules & Requirements

Requisites: Prerequisite, CLSC 462.

Grading Status: Letter grade.

CLSC 570L. Clinical Chemistry Laboratory Rotation. 4 Credits.

Majors only. Laboratory rotation in clinical chemistry.

Rules & Requirements

Requisites: Prerequisite, CLSC 470.

Grading Status: Letter grade.

 **CLSC 580L. Clinical Immunohematology Laboratory. 4 Credits.**

Laboratory rotation in clinical immunohematology. Majors only.

Rules & Requirements

 **IDEAs in Action Gen Ed:** HI-INTERN.

Making Connections Gen Ed: EE- Field Work.

Requisites: Prerequisites, CLSC 480 and 480L.

Grading Status: Letter grade.

CLSC 582L. Clinical Transplantation Medicine Laboratory. 1 Credits.

Majors only. Clinical rotation in histocompatibility, flow cytometry, and hematopoietic progenitor cell laboratories.

Rules & Requirements

Requisites: Prerequisite, CLSC 480.


Grading Status: Letter grade.

CLSC 620. Clinical Laboratory Management. 2 Credits.

Majors only. Foundation in the technical and nontechnical aspects of supervision and management of clinical laboratory testing.

Rules & Requirements

Grading Status: Letter grade.

 **CLSC 630. Research Methods in Clinical Laboratory Science. 2 Credits.**

Majors only. An overview of the knowledge of research design and methods commonly used in the clinical laboratory research arena, providing the basis for the critical examination of professional literature.

Rules & Requirements

 **IDEAs in Action Gen Ed:** RESEARCH.

Making Connections Gen Ed: CI.

Grading Status: Letter grade.

 **CLSC 670. Clinical Laboratory Science Educational Methods. 2 Credits.**

Majors only. Introduction to the basic principles of clinical laboratory education, including objectives, learning formats, test development, and clinical teaching.

Rules & Requirements

 **IDEAs in Action Gen Ed:** COMMBEYOND.

Grading Status: Letter grade.

CLSC 695. Undergraduate Research in Clinical Laboratory Science. 3 Credits.

This mentored and self-directed course provides students with research experience in the clinical laboratory field. Students will apply knowledge of research methods to generate results and communicate results to others. This is a clinical laboratory science elective course. Seniors only.

Rules & Requirements

Requisites: Prerequisite, CLSC 630 or CLSC 730.

Grading Status: Pass/Fail.

Graduate-level Courses

CLSC 708. Biostatistics for Laboratory Professionals. 3 Credits.

This course prepares MCLS students to be critical consumers of scientific publications describing clinical research. Topics include organization and quality of data, types of research studies, frequency distributions, summary statistics, random and discrete variables, probability distributions, statistical inference, hypothesis testing, confidence intervals, parametric vs. non-parametric tests, descriptive statistics, drawing inferences from and comparing means, correlation and regression analysis, and the analysis of proportions. Majors only.

Rules & Requirements

Grading Status: Letter grade.

CLSC 710. MDS PRINCIPLES. 3 Credits.

Fundamental principles of molecular technology and techniques used in clinical and research laboratories. Topics include: an overview of nucleic acid chemistry, molecular genetics & cytogenetics; nucleic acid extraction and hybridization; target, signal and probe amplification; sequencing, microarrays, and in-situ hybridization techniques.

Techniques will be addressed in the context of the different areas of the laboratory that use molecular technology to include genetics, oncology, infectious disease, and identity testing both for forensic purposes and transplantation.

Rules & Requirements

Grading Status: Letter grade.

CLSC 720. Molecular Genetics and Diseases. 3 Credits.

This course offers an overview of molecular genetics in relation to human variation and disease. Basics of disease are discussed, and diagnosis and treatment explored. Molecular techniques are addressed in context of different areas of the laboratory that use molecular technology: inherited disease, oncology, infectious disease, and identity testing. By the end of the course, students will better understand molecular causes of many diseases and disorders that are investigated using molecular diagnostics. MCLS majors only.

Rules & Requirements

Requisites: Prerequisite, CLSC 710.

Grading Status: Letter grade.

CLSC 722. Molecular Diagnostic Science Applications. 3 Credits.

This course covers the performance of basic and advanced techniques used in molecular testing, to include nucleic acid extraction, quantitation, hybridization, amplification, and analysis. Interpretation and quality control techniques are emphasized throughout the course. Students will learn about the different applications of molecular diagnostic testing in the clinical laboratory setting and understand how this testing is used to help patients. Previously offered as CLSC 720L. MCLS majors only.

Rules & Requirements

Requisites: Prerequisite, CLSC 710.

Grading Status: Letter grade.

CLSC 730. Research Methods. 3 Credits.

An overview of research design and methods used in clinical laboratory research. The course covers methodological and ethical considerations influencing research design and prepares student to critically examine professional literature.

Rules & Requirements

Requisites: Prerequisite, CLSC 708.

Grading Status: Letter grade.

CLSC 735. Method Evaluation. 3 Credits.

This course covers the knowledge and skills needed to determine the clinical value, diagnostic accuracy, and cost of establishing a new assay in a molecular diagnostic laboratory.

Rules & Requirements

Requisites: Prerequisite, CLSC 730 or 772.

Grading Status: Letter grade.

CLSC 750. Clinical Laboratory Science Laboratory Administration. 3 Credits.

This course provides a foundation in the technical and non-technical aspects of supervising and managing clinical laboratory testing services within the current health care delivery system. Topics include: regulation of clinical laboratories, accreditation of laboratories, financial management, information systems management, management of the quality of clinical laboratory testing, personnel management, leadership and communication skills, and ethics in the clinical laboratory testing environment. Previously offered as CLSC 650. MCLS majors only.

Rules & Requirements

Grading Status: Letter grade.

CLSC 765. Principles of Health Care Systems and Leadership for Laboratory Professionals. 3 Credits.

This course provides a foundation in the health care system, public health, and leadership aspects for clinical laboratory professionals. Major topic areas addressed include: the history of the healthcare system and its organization, the financing of the healthcare system and its costs, the healthcare workforce, the core functions of public health, social determinants of health, and leadership within the healthcare arena. Majors only.

Rules & Requirements

Grading Status: Letter grade.

CLSC 770. Educational Methods and Applications. 3 Credits.

This course provides an overview of educational methods to prepare students for future roles as educators in clinical laboratories, educational programs and in corporate settings. Topics include continuing education, competency assurance, certification and accreditation.

Rules & Requirements

Grading Status: Letter grade.

CLSC 772. Education and Research in Clinical Laboratory Science. 3 Credits.

This is a required course in the Master's of Clinical Laboratory Science for students who have graduated from the UNC-CLS program in the past 10 years. This course builds on the content of the UNC CLS undergraduate courses in education and research and prepares students for future roles as educators and researchers in the clinical laboratory profession. Majors only.

Rules & Requirements

Requisites: Prerequisite, CLSC 708.

Grading Status: Letter grade.

CLSC 775. Education Practicum. 3 Credits.

This course prepares MCLS-MLS students for future roles as educators and includes course design, writing goals and objectives, presenting lectures, preparing student laboratory exercises, and evaluating instruction. Students will work closely with a CLS faculty advisor in the design, delivery and evaluation of an instructional unit. Majors only.

Rules & Requirements

Requisites: Pre- or corequisite, CLSC 770 or 772.

Grading Status: Letter grade.

CLSC 780. Capstone. 3 Credits.

This course represents the culmination of the MCLS-MLS program. Students will use the information from all their courses to address a problem or important issue in the clinical laboratory profession. Students will design and complete a project in laboratory education, laboratory operations, or advanced laboratory practice. Majors only.

Rules & Requirements

Requisites: Pre- or corequisites, CLSC 730, 750 and 770, or CLSC 772.

Grading Status: Letter grade.

CLSC 790. Capstone II. 3 Credits.

This course represents the culmination of the MCLS-MLS program. Students will use the information from all their courses to address a problem or important issue in the clinical laboratory profession. In Capstone II, students will complete a project in laboratory education, laboratory operations, or advanced laboratory practice. Restricted to majors only.

Rules & Requirements

Requisites: Prerequisite, CLSC 780.

Grading Status: Letter grade.

Contact Information

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Student Services Support

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