

## Department of Medical Laboratory Sciences, Public Health, and Nutrition Science

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Department of Medical Laboratory Sciences, Public Health, and Nutrition Science  
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### Master of Science in Medical Laboratory Sciences

The Master of Science in Medical Laboratory Sciences offers students either a non-thesis track with two concentrations (Molecular Diagnostics and MLS ASCP Certification) or a thesis track with a concentration in Molecular Diagnostics. The program accepts new classes in Spring and Fall with deadlines of September 1st and May 1st, respectively. Upon successful completion of the program, students with Molecular Diagnostic concentrations are eligible to sit for the Molecular Biology Board of Certification exam through the American Society for Clinical Pathology (ASCP). Students with MLS Certification concentration are eligible to sit for the Medical Laboratory Science Certification exam through the ASCP. This program is accredited by the National Accrediting Agency for Medical Laboratory Sciences (NAACLS), 5600 N. River Road, Suite 720, Rosemont, IL 60018, (773) 714-8880.

#### Admission to either the Molecular Diagnostics thesis or non-thesis tracks of the M.S. in Medical Laboratory Sciences requires:

- Application and approval of the MS in MLS Admissions Committee
- Admission to the Graduate School
- One of the following:
  - Professional certification in one of the following areas:
    - MLS/MT (ASCP)
    - HTL (ASCP)
    - CT (ASCP)
    - CG (ASCP)
    - ASCP Specialist certification including:
      - SM
      - SC
      - SH
      - SBB
  - Bachelor of Science in:
    - Biology
    - Biochemistry
    - Molecular Biology
    - Microbiology
    - Related Field<sup>1</sup>

**Admission to the MS in MLS ASCP Certification track requires application to the MLS undergraduate program.** Qualified applicants will have been accepted into the BS/ MLS certificate program and have successfully completed the introductory portion of the MLS program.

<sup>1</sup> With a minimum of 16 credit hours in biology (including microbiology, immunology, molecular biology), 16 credit hours in chemistry (including 8 hours in inorganic chemistry and 8 hours of organic chemistry or 4 hours organic chemistry and 4 hours biochemistry), approval of the Program Director and admission to the Graduate school.

Applications, deadlines and additional information may be found at [www.tarleton.edu/medicallab](http://www.tarleton.edu/medicallab) (<http://www.tarleton.edu/medicallab/>)

### Master of Science in Medical Laboratory Sciences

#### Required Courses

MDLS 5101	CLS Literature review Seminar	1
MDLS 5174	Intro Lab Safety and Operations	1

MDLS 5202	Molecular Diagnostics	2
MDLS 5220	Medical Genetics	2
MDLS 5330	Medical Biochemistry	3
MDLS 5450	Molecular Diagnostics Techniques I <sup>2</sup>	4
MDLS 5451	Molecular Diagnostics Techniques II <sup>3</sup>	4
MDLS 5244	Applications in Molecular Diagnostics I <sup>2</sup>	2
MDLS 5245	Applications in Molecular Diagnostics II <sup>4</sup>	2
MDLS 5206	Laboratory Management	2
MDLS 5298	Statistical Methods for Healthcare Research	2
MDLS 5099	Practicum, Field Problem, or Internship <sup>1</sup>	1-3
<b>Total Hours</b>		<b>28</b>

### Additional Required Courses for Concentrations

#### Molecular Diagnostics Thesis

MDLS 5088	Thesis	6
<b>Total Hours</b>		<b>6</b>

#### Molecular Diagnostics Non-Thesis

MDLS 5086	Clinical Laboratory Science Problems	2
<b>Total Hours</b>		<b>2</b>

<sup>1</sup> Both the thesis and non-thesis Molecular Diagnostics options require a three credit hour practicum, in which students gain exposure and practice molecular techniques

<sup>2</sup> Students must complete MDLS 5174, MDLS 5202, and MDLS 5220 prior to taking MDLS 5450 and MDLS 5244

<sup>3</sup> Students must complete MDLS 5450 prior to taking MDLS 5451

<sup>4</sup> Students must complete MDLS 5244 prior to taking MDLS 5245

## Master of Science in Medical Laboratory Sciences with Certification

The Master of Science in Medical Laboratory Sciences with Certification offers students a non-thesis track within the Medical Laboratory Sciences program. The program accepts new classes in Spring and Fall with deadlines of September 1st and May 1st, respectively. Upon successful completion of the program, students are eligible to sit for the Medical Laboratory Science (MLS) Board of Certification exam through the American Society for Clinical Pathology. This program is accredited by the National Accrediting Agency for Medical Laboratory Sciences (NAACLS), 5600 N. River Road, Suite 720, Rosemont, IL 60018, (773) 714-8880.

**Admission to the MS in MLS ASCP Certification track requires application to the MLS undergraduate program.** Qualified applicants will have been accepted into the BS/ MLS certificate program and have successfully completed the introductory portion of the MLS program

### Master of Science in Medical Laboratory Sciences with Certification

#### Required Courses

Undergraduate Coursework		23
MDLS 5226	Hematology II Lecture	2
MDLS 5127	Hematology II Lab	1
MDLS 5336	Medical Microbiology II Lecture	3
MDLS 5378	Clinical Chemistry II Lecture	3
MDLS 5179	Clinical Chemistry II Lab	1
MDLS 5444	Immunohematology Lecture	4
MDLS 5149	Immunohematology Lab	1
MDLS 5202	Molecular Diagnostics	2
MDLS 5092	Clinical Laboratory Practicum I	2
MDLS 5093	Clinical Laboratory Practicum II	2
MDLS 5094	Clinical Laboratory Practicum III	2
MDLS 5095	Clinical Laboratory Practicum IV	2
MDLS 5204	Clinical Correlations and Capstone Review	2
MDLS 5206	Laboratory Management	2
MDLS 5091	Integrated Clinical Laboratory Science and Research	2
<b>Total Hours</b>		<b>54</b>

#### Professors

- Lewis
- Murray

#### Associate professors

- Han
- Ryou

#### Assistant professors

- Hutson
- Rijal

## Courses

### **MDLS 5086. Clinical Laboratory Science Problems. 1-3 Credit Hours (Lecture: 1-3 Hours, Lab: 0 Hours).**

Independent research under the supervision of an instructor. A formal report will be submitted to the instructor. A maximum of six hours may be taken.

### **MDLS 5088. Thesis. 1-6 Credit Hours (Lecture: 1-6 Hours, Lab: 0 Hours).**

Scheduled when the student is ready to begin thesis. No credit until thesis is completed.

### **MDLS 5090. Special Topics. 1-3 Credit Hours (Lecture: 1-3 Hours, Lab: 0 Hours).**

Study of selected topic(s) directly related to medical laboratory science. May be repeated once for credit as topic varies.

### **MDLS 5091. Integrated Clinical Laboratory Science and Research. 1-3 Credit Hours (Lecture: 0 Hours, Lab: 5 Hours).**

An integrated clinical laboratory course designed to introduce the concepts of specimen tracking and processing using a laboratory information system, test result utilization, utilization review, and clinical research. Emphasis will be placed on workload organization; quality control evaluation accuracy; consistency; validity of results generated; and appropriate reporting of high complexity results.

### **MDLS 5092. Clinical Laboratory Practicum I. 1-5 Credit Hours (Lecture: 0 Hours, Lab: 16 Hours).**

Structured clinical experience directed toward development of laboratory skills, organizing work, and solving problems in hematology, hemostasis, and body fluid analysis. Emphasis is placed on the analysis of high complexity quality assurance data and application of laboratory information systems and automation. Grading in this course is satisfactory/unsatisfactory.

### **MDLS 5093. Clinical Laboratory Practicum II. 1-5 Credit Hours (Lecture: 0 Hours, Lab: 16 Hours).**

Structured clinical experience directed toward development of laboratory skills, organizing work, and solving high complexity problems in medical microbiology and parasitology. Emphasis is placed on the analysis of quality assurance data and application of laboratory information systems and automation. Grading in this course is satisfactory/unsatisfactory.

### **MDLS 5094. Clinical Laboratory Practicum III. 1-5 Credit Hours (Lecture: 0 Hours, Lab: 16 Hours).**

Structured clinical experience directed toward development of laboratory skills, organizing work, and solving problems in immunology, serology, and blood banking. Emphasis is placed on the analysis of high complexity quality assurance data and application of laboratory information systems and automation. Grading in this course is satisfactory/unsatisfactory.

### **MDLS 5095. Clinical Laboratory Practicum IV. 1-5 Credit Hours (Lecture: 0 Hours, Lab: 16 Hours).**

Structured clinical experience directed toward development of laboratory skills, organizing work and solving problems in clinical chemistry, toxicology, and molecular pathology. Emphasis is placed on the analysis of high complexity quality assurance data and application of laboratory information systems and automation. Grading in this course is satisfactory/unsatisfactory.

### **MDLS 5099. Practicum, Field Problem, or Internship. 1-3 Credit Hours (Lecture: 0 Hours, Lab: 8-24 Hours).**

Supervised professional activities in specialized laboratory settings. A maximum of six hours may be taken.

### **MDLS 5101. CLS Literature review Seminar. 1 Credit Hour (Lecture: 1 Hour, Lab: 0 Hours).**

Review of current literature topics in the medical laboratory sciences. Emphasis is placed on critique of methods, research design and value to the current body of knowledge. May be repeated for credit for a maximum of 6 credit hours.

### **MDLS 5127. Hematology II Lab. 1 Credit Hour (Lecture: 0 Hours, Lab: 4 Hours).**

Supervised experiences with emphasis placed on the enumeration, morphology, and staining characteristics of abnormal blood cells. Emphasis will be placed on specimen processing and generation and evaluation of diagnostic data and additional analysis and troubleshooting skills. Prerequisite: Students must be admitted into the Medical Laboratory Sciences Master of Science program. Co-requisite MDLS 5226.

### **MDLS 5137. Medical Microbiology II Lab. 1 Credit Hour (Lecture: 0 Hours, Lab: 4 Hours).**

Supervised experience with emphasis on staining, isolation, identification, and antimicrobial susceptibility testing of microorganisms isolated from clinical specimens. Emphasis is also placed on specimen processing and generation and evaluation of diagnostic data and additional analysis and troubleshooting skills. Prerequisite: Students must be admitted into the Medical Laboratory Sciences Master of Science program. Co-requisite MDLS 5336.

### **MDLS 5149. Immunochemistry Lab. 1 Credit Hour (Lecture: 0 Hours, Lab: 4 Hours).**

Supervised experiences related to blood grouping and typing and compatibility testing, antibody detection and identification, incompatibility and transfusion reaction resolution; component processing and storage; and selection for therapy. Emphasis is placed on specimen processing, laboratory techniques, and generation and evaluation of diagnostic data.

### **MDLS 5174. Intro Lab Safety and Operations. 1 Credit Hour (Lecture: 1 Hour, Lab: 1 Hour).**

Introduction to the theories and principles of instrument operation and safety practices commonly used in the clinical laboratory. Supervised learning experience in instrument operation and troubleshooting.

### **MDLS 5179. Clinical Chemistry II Lab. 1 Credit Hour (Lecture: 0 Hours, Lab: 4 Hours).**

Supervised learning experiences with emphasis on manual, semi-automated, and automated procedures for assaying metabolites, drugs, enzymes, hormones, and tumor markers. Emphasis is placed on specimen selection, processing, analyses, and evaluation of diagnostic data and on high complexity analysis and troubleshooting skills. Prerequisite: Students must be admitted into the Medical Laboratory Sciences Master of Science program. Co-requisite MDLS 5378.

### **MDLS 5202. Molecular Diagnostics. 2 Credit Hours (Lecture: 2 Hours, Lab: 1 Hour).**

An overview of molecular mechanisms including replication, transcription, and translation. Emphasis is placed on the principles of molecular methods and their application in diagnosis of microbiologic, immunologic, genetic, endocrine, hematopoietic, and metabolic disease.

### **MDLS 5204. Clinical Correlations and Capstone Review. 2 Credit Hours (Lecture: 2 Hours, Lab: 0 Hours).**

Course employs an integrative approach to laboratory medicine with emphasis on the review of patient cases and appropriate utilization of laboratory tests in diagnosis and case management. A comprehensive review and assessment of the concepts in clinical laboratory medicine.

### **MDLS 5206. Laboratory Management. 2 Credit Hours (Lecture: 2 Hours, Lab: 0 Hours).**

Designed to acquaint students with the principles of operating a clinical laboratory. Emphasis is on personnel, financial, marketing, and general administrative management. Also, the student is introduced to writing instructional objectives, constructing evaluation instruments, and planning instructional strategies and establishing a professional development program. Ethical issues in laboratory medicine are also discussed.

### **MDLS 5220. Medical Genetics. 2 Credit Hours (Lecture: 2 Hours, Lab: 0 Hours).**

Study of human genetics including chromosome structure, principles of inheritance, anatomy and physiology of a gene, genetic expression and regulation, cytogenetics, immunogenetics, molecular genetics, with an emphasis on diagnostic testing for human genetic diseases and the genetic basis of cancer. Prerequisite: Students must be admitted into the Medical Laboratory Sciences Master of Science program.

### **MDLS 5221. Immunopathology. 2 Credit Hours (Lecture: 2 Hours, Lab: 0 Hours).**

Principles of innate and adaptive immunity including antigen recognition, signal transduction, lymphocyte development and homeostasis of lymphocyte populations, cytokine effects, failure of host defense mechanisms such as autoimmunity, immunodeficiencies, immunoproliferative diseases, analysis of the immune response in intact and manipulated organisms, and tumor immunobiology, with emphasis on clinical induction, measurement and manipulation of the human immune response. Prerequisite: Students must be admitted into the Medical Laboratory Sciences Master of Science program.

### **MDLS 5226. Hematology II Lecture. 2 Credit Hours (Lecture: 2 Hours, Lab: 0 Hours).**

Studies on the formation and identification of abnormal cellular blood elements are discussed. Emphasis is placed on abnormal physiology and hematologic manifestations of disease and high complexity analysis and troubleshooting. Prerequisite: Students must be admitted into the Medical Laboratory Sciences Master of Science program. Co-Requisite Course: MDLS 5127 or approval of department head.

**MDLS 5244. Applications in Molecular Diagnostics I. 2 Credit Hours (Lecture: 2 Hours, Lab: 0 Hours).**

Discussion of the theory and applications of molecular testing in microbiology, immunology, and pharmacogenomics. Methods discussed to include quantitative analysis, qualitative analysis, and methods of genotypic characterization.

**MDLS 5245. Applications in Molecular Diagnostics II. 2 Credit Hours (Lecture: 2 Hours, Lab: 0 Hours).**

Discussion of the theory and applications of molecular testing in oncology and genetics. Topics to include diagnosis of leukemia/lymphomas, solid tumors, hereditary cancer syndromes, and other genetic disorders.

**MDLS 5272. Clinical Laboratory Administration. 2 Credit Hours (Lecture: 2 Hours, Lab: 0 Hours).**

Principles and practices of administration of the clinical laboratory. Emphasis is placed on administrative issues unique to the clinical laboratory including coding, billing, reimbursement, government regulation, accreditation and information management processes. Prerequisite: MDLS 5206.

**MDLS 5296. Clinical Cytogenetics Pract II. 2 Credit Hours (Lecture: 0 Hours, Lab: 13 Hours).**

Under the supervision and instruction of a clinical instructor in a hospital or reference laboratory setting, the student will have the opportunity to expand their knowledge of principles and techniques involved in the practice of cytogenetics that were introduced in the didactic portion of the curriculum. The student will gain experience in procedures related to karyotyping with an emphasis on amniotic fluid, chorionic villi samples, bone marrow and solid tumor specimens. Clinical correlations of the chromosomal findings are emphasized. Field assignment fee \$75. Grading in this course is satisfactory or unsatisfactory.

**MDLS 5298. Statistical Methods for Healthcare Research. 2 Credit Hours (Lecture: 2 Hours, Lab: 0 Hours).**

Practical applications of general principles of descriptive and inferential statistics used in health care research. Skill development in use of statistical software as a tool to analyze health data available from national databases. Emphasis will be placed on the interpretation and communication of research results.

**MDLS 5325. Clinical Molecular Microbiology. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**

Studies of the genetics and physiology of microbes, including fundamental processes of gene regulation, genome structure, and protein synthesis and processing. Emphasis is placed on the clinical molecular identification of bacteria, viral, fungal and parasitic organisms including real-time PCR techniques, quality assurance practices, and interpretation of results in a clinical setting.

**MDLS 5330. Medical Biochemistry. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**

A review of the major biochemical processes in the human body, their physiology role and their relationship to human disease. Emphasis will be placed upon emerging diagnostic testing and clinical correlations in the areas of endocrinology, tumor biology, lipoprotein structure and function, diabetes case management, protein structure and function, and toxicology. Prerequisite: Students must be admitted into the Medical Laboratory Sciences Master of Science program.

**MDLS 5331. Molecular and Cellular Pathology. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**

A study of the molecular and cellular aspects of human disease. Emphasis will be placed on microarrays and other emerging diagnostic testing as applied to the regulation of the eukaryotic cell cycle, signal transduction pathways, molecular mechanisms, receptor/membrane function and their relationship to tumor biology, endocrine dysfunction, dyslipidemia and other pathophysiologic conditions. Prerequisite: BIOL 5309 or MDLS 5202.

**MDLS 5336. Medical Microbiology II Lecture. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**

Discussion of advanced microbiological concepts including anaerobic bacteria, mycobacterium, antimicrobial susceptibility, mycology, virology, and infections by organ system. Emphasis is on epidemiology, pathogenesis, source of isolation, and conventional and molecular methods of diagnosis of human pathogenic organisms. Prerequisite: Students must be admitted into the Medical Laboratory Sciences Master of Science program. Co-requisite MDLS 5137.

**MDLS 5340. Clinical and Anatomic Pathology. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**

Clinical and anatomic pathology is focused on the development of pathophysiologic mechanisms underlying human disease. Students are introduced to basic etiologies and pathogenesis that underlie all diseases. More detailed discussions of pathologic mechanisms including structural lesions (morphology) and functional consequences (clinical presentation) will be discussed within specific diseases of organ systems. Applications of the clinical laboratory in disease diagnosis and management will also be included.

**MDLS 5378. Clinical Chemistry II Lecture. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**

Discussion and comparison of diagnostic methods employed in the clinical chemistry laboratory. Emphasis is placed on diagnostic metabolites, enzymology, endocrinology, and tumor markers. Normal physiology and biochemical manifestations of disease are discussed. Prerequisite: Students must be admitted into the Medical Laboratory Sciences Master of Science program. Co-requisite MDLS 5179.

**MDLS 5398. Statistical Methods Health Care Research. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**

Practical applications of general principles of descriptive and inferential statistics used in health care research. Skill development in use of statistical software as a tool to analyze health data available from national databases. Emphasis will be placed on the interpretation and communication of research results.

**MDLS 5444. Immunohematology Lecture. 4 Credit Hours (Lecture: 4 Hours, Lab: 0 Hours).**

Discussion of the principles of immunohematology in relation to blood grouping, typing, compatibility testing, and antibody detection and identification, transfusion and transplant medicine, donor processing, and component preparation and storage.

**MDLS 5450. Molecular Diagnostics Techniques I. 4 Credit Hours (Lecture: 1 Hour, Lab: 9 Hours).**

This course provides an introduction to the basic genetic techniques used in a clinical molecular genetics laboratory. Laboratory technique instruction, skill development and practice in isolation of DNA and RNA from clinical samples, preparation of nucleic acid probes, molecular hybridization techniques, amplification techniques and hybridization analysis will be addressed. Emphasis will be placed on laboratory design issues, prevention of product contamination, quality assurance and regulatory issues, safety, and interpretation and application of test results.

**MDLS 5451. Molecular Diagnostics Techniques II. 4 Credit Hours (Lecture: 1 Hour, Lab: 9 Hours).**

This course provides a continuation of the basic genetic techniques covered in Molecular Diagnostics Techniques I, which may be used in a clinical molecular genetics laboratory. Laboratory technique instruction, skill development and practice in real-time PCR, reverse transcriptase PCR, nested PCR and single nucleotide polymorphism (SNP) detection will be emphasized. Emphasis will be placed on laboratory design issues, prevention of product contamination, quality assurance and regulatory issues, safety, and interpretation and application of test results. Prerequisite: MDLS 5450.