Medical Diagnostic & Translational Sciences

Web Site: http://www.odu.edu/mdts (http://www.odu.edu/mdts/)

Harold Riehtman, Chair

The School of Medical Diagnostic and Translational Sciences offers a coordinated program of courses and clinical experiences leading to degrees of Bachelor of Science in Medical Laboratory Science (formerly medical technology) and Bachelor of Science in Nuclear Medicine Technology and a post-baccalaureate certificate in cytotecology. Students may also pursue a concentration in cytotecology through the Bachelor of Science in Health Sciences degree program. In addition, the school offers a minor in medical laboratory science (formerly medical technology) and a degree completion program for certificed medical laboratory technicians (MLT) pursuing a baccalaureate degree. For those seeking a graduate certificate in molecular diagnostics, please refer to the ODU Graduate Catalog.

Bachelor of Science in Medical Laboratory Science (formerly Medical Technology)

http://www.odu.edu/mdts/medical-laboratory-science/

Program Director:
Barbara Kraj, PhD, MLS(ASCP)CM,MBCM
College of Health Sciences
4608 Hampton Blvd, Rm 2122
Phone: 757-683-6039
E-mail: bkraj@odu.edu (bkraj@odu.edu/757-683-6039)

The medical laboratory scientist/medical technologist plays a vital role in the diagnosis and treatment of disease by performing clinical laboratory tests on patients' blood, body fluids, and other specimens. This includes clinical tests within the areas of chemistry, microbiology, hematology, immunology/serology, urinalysis, immunohematology (blood banking), and molecular pathology.

The program has been continually accredited by the National Accrediting Agency for Clinical Laboratory Sciences, 5600 N River Road, Suite 720, Rosemont, IL 60018, 773 714-8880. Due to accreditation, upon successful completion of the program graduates are eligible to take the national certification exam for Medical Laboratory Scientist, administered by the American Society for Clinical Pathology, MLS(ASCP).

Admission

Admission to the University does not constitute admission to the medical laboratory science program. Students are admitted to the program after completion of two years of college study, which includes all program prerequisite courses. All program prerequisite courses must be completed with a grade of C (2.00) or better. Additionally, applicants must be in good academic standing (cumulative GPA 2.0 or greater). The students then enter two years of a combined didactic and clinical phase congruent with the 2 + 2 concept. A grade of C (2.00) or better is required in all medical laboratory science/medical technology course work for continuance in the program.

The program does not offer just the final clinical phase to transfer applicants from 3 + 1 programs. Applications to the program, including all materials, must be submitted no later than February 1 for consideration for admission the following fall. Exemptions may be appealed only through the program director. Prospective students who fail to meet the February 1 deadline for formal admission may be allowed to take on-campus medical laboratory science/medical technology courses on a space-available basis. Permission must be first granted by the program director in advance of registration.

Four-Year Plan - Medical Laboratory Science - BSMLS (http://catalog.odu.edu/undergraduate/collegeofhealthsciences/medicaldiagnostictranslationalsciences/medicallabsci-bsmls-fouryearplan/)

• The four-year plan is a suggested curriculum to complete this degree program in four years based on placement into BIOL 121N/BIOL 122N and foreign language met in high school. It is just one of several plans that will work and is presented only as broad guidance to students. Each student is strongly encouraged to develop a customized plan in consultation with their academic advisor. Additional information can also be found in Degree Works.

Requirements

Lower-Division General Education

Skills
Written Communication (grade of C or better required in both courses) 6
Oral Communication (satisfied through major course requirements) 6

Mathematics
STAT 130M Elementary Statistics *
MATH 102M College Algebra (Required for The Nature of Science courses) *
or MATH 103M College Algebra with Supplemental Instruction 0-6

Language and Culture
Information Literacy and Research 3

Ways of Knowing
Human Creativity 3
Interpreting the Past 3

Literature
3

Philosophy and Ethics
3

PHIL 345E Bioethics (preferred; 300/400 level P or E course meets upper division general education/Option D) 6

The Nature of Science
BIOL 121N General Biology I 3
& BIOL 122N and General Biology I Lab *

CHEM 121N Foundations of Chemistry I Lecture 3
& CHEM 122N and Foundations of Chemistry I Laboratory (CHEM 103 may be needed as a prerequisite) 3

CHEM 123N Foundations of Chemistry II Lecture 3
& CHEM 124N and Foundations of Chemistry II Laboratory *

Human Behavior
Impact of Technology (300/400 level preferred; any 300/400 level T course EXCEPT DNTH 440T meets upper-division general education/Option D) 3

Total Hours 45-51

* Grade of C or better required.

Departmental Requirements

BIOL 250 Human Anatomy and Physiology I 8
& BIOL 251 and Human Anatomy and Physiology II
CHEM 211 Organic Chemistry I Lecture 5
& CHEM 212 and Organic Chemistry I Laboratory
Students must complete the following courses with a C or better prior to entering the Medical Laboratory Science/Medical Technology program: BIOL 121N and BIOL 122N, BIOL 250 and BIOL 251, CHEM 121N and CHEM 122N, CHEM 123N and CHEM 124N, CHEM 211 and CHEM 212 and STAT 130M.

**Total Hours** 13

### Major Requirements

#### Third Year

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<tr>
<th>First Term</th>
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| MLS 311   | 3     | MLS 319     | 2     |
| MLS 312   | 1     | MLS 326     | 3     |
| MLS 324   | 3     | MLS 336     | 1     |
| MLS 325   | 1     | MLS 328     | 2     |
| MLS 330   | 2     | MLS 339     | 1     |
| MLS 331   | 1     | MLS 340     | 1     |
| MDT5 401  | 3     | MLS 351     | 3     |

18 18 6

#### Fourth Year

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| MLS 457   | 1     |

6 15

**Total credit hours: 63**

**Note:** Junior year core courses that are over three years old prior to starting a rotation (practicum course) must be reevaluated by the faculty member at ODU in charge of the specialty, in both theoretical knowledge and technical skills. Reevaluation may result in the need to repeat and/or audit out-of-date courses. This applies to both part-time and returning students.

### Upper-Division General Education

- Option A. Approved Disciplinary Minor, 12 hours minimum; also second degree or second major.
- Option B. Interdisciplinary Minor (specifically 12 hours, 3 of which may be in the major)
- Option C. An approved Certification Program such as teaching licensure
- Option D. Two Upper-Division Courses from outside the College of Health Sciences and not required by the major (6 hours)

### Requirements for Graduation

Requirements for graduation include a cumulative grade point average of 2.00 overall and in the major, a minimum of 121 credit hours, which must include both a minimum of 30 credit hours overall and 12 credit hours in upper-level courses in the major program from Old Dominion University, completion of ENGL 110C, ENGL 211C or ENGL 221C or ENGL 231C, and the writing intensive (W) course in the major with a grade of C or better, and completion of Senior Assessment.

### Bachelor of Science in Medical Laboratory Science/Medical Technology—Degree Completion Program

The Bachelor of Science in Medical Laboratory Science degree completion program (previously medical technology) is available for graduates of accredited associate degree university and hospital-based or military Medical Laboratory Technician (MLT) programs. MLT certification is required for admission. The curriculum is designed to meet the needs of local and distant practitioners. Program courses are delivered online to accommodate the schedules of working students. Distance learning enrollment coordinators for health sciences programs may be reached at healthsciencesonline@odu.edu.

Admission to the University does not constitute admission to the medical laboratory science/medical technology degree completion program. All program prerequisite courses must be completed with a grade of C (2.00) or better. Additionally, applicants must be in good academic standing (cumulative GPA 2.0 or greater).

For consultation and evaluation of eligibility for the degree completion program contact MLS Program Director:

Barbara Kraj, PhD, MLS(ASCP)CMMB
College of Health Sciences
4608 Hampton Blvd, Rm 2122
Phone: 757-683-6039
E-mail: bkraj@odu.edu (bkraj@odu.edu757-683-6039)

### Lower-Division General Education

#### Skills

- Written Communication (grade of C or better required in both courses) 6
- Oral Communication (satisfied through major course requirements)

#### Mathematics

- STAT 130M 6
- College Algebra (Required for the Nature of Science courses) 6
- or MATH 103M College Algebra with Supplemental Instruction

#### Language and Culture

- Information Literacy and Research 0-6
- Bioethics (preferred; 300/400 level P or E course meets upper division general education/Option D) 3

#### Ways of Knowing

- Human Creativity 3
- Interpreting the Past 3
- Literature 3
- Philosophy and Ethics 3

- PHIL 345E 3
- Bioethics (preferred; 300/400 level P or E course meets upper division general education/Option D)

#### The Nature of Science

- BIOL 121N 12
- General Biology I
- & BIOL 122N
- and General Biology I Lab *
- CHEM 121N 3
- Foundations of Chemistry I Lecture
- & CHEM 122N
- and Foundations of Chemistry I Laboratory *
- CHEM 123N 3
- Foundations of Chemistry II Lecture
- & CHEM 124N
- and Foundations of Chemistry II Laboratory *
- Human Behavior 3
- Impact of Technology (300/400 level preferred; any 300/400 level T course EXCEPT DNTH 440T meets upper-division general education/Option D) 3

**Total Hours** 45-51
GRADUATION REQUIREMENTS

Requirements for Graduation

Requirements for graduation include a minimum cumulative grade point average of 2.00 overall and in the major, minimum 120 credit hours, which must include both a minimum of 30 credit hours overall and 12 credit hours in upper-level courses in the major program from Old Dominion University, completion of ENGL 110C, ENGL 211C or ENGL 221C or ENGL 231C, and the writing intensive (W) course in the major with a grade of C or better, and completion of Senior Assessment.

Continuance Policy

1. A grade of C (2.00) or better is required in all NMED courses to continue in the nuclear medicine technology program.
2. A cumulative grade point average of 2.00 or better is required to continue in the nuclear medicine technology program.
3. A nuclear medicine technology student who leaves the major must apply for readmission to the major.
4. A nuclear medicine technology student who fails a nuclear medicine technology course and is readmitted to the program is allowed to repeat the failed course only once.
5. A student who leaves the major and is readmitted may be required to take additional course work prior to or concurrent with readmission at the discretion of the Program Director.
6. A student may be readmitted to the nuclear medicine technology major only once.

Bachelor of Science in Nuclear Medicine Technology

http://www.odu.edu/mdts/nuclear-medicine

Sara M. Maynard, Program Director
smaynard@odu.edu
2128 Health Sciences Building
757 683-4702

Nuclear medicine technology is the medical specialty that utilizes sealed and unsealed radioactive materials in the diagnosis and treatment of disease. The nuclear medicine technology program at Old Dominion University is designed to prepare individuals as entry-level nuclear medicine technologists. Upon successful completion of the program, graduates are eligible to sit for a national exam for certification as a nuclear medicine technologist.

Nuclear medicine technologists are allied health professionals certified in nuclear medicine technology who, under the direction of an authorized physician, are committed to applying the art and skill of diagnostic and therapeutic nuclear medicine procedures through the safe and effective use of radionuclides. Responsibilities include but are not limited to: direct patient contact, the preparation and administration of radiopharmaceuticals, patient imaging procedures including computer processing, laboratory testing, patient preparation, quality control and radiation safety. Nuclear medicine technologists can be employed in hospitals and imaging centers.

The program is accredited by the Joint Review Committee on Educational Programs in Nuclear Medicine Technology.

Admission

All admission materials must be received by October 15. Interviews are then scheduled for early November. All applicants must be in good academic standing (cumulative GPA of 2.0 or greater).
7. A student seeking readmission to a clinical course is responsible for securing an approved clinical site. Preference for clinical space is always given to currently enrolled students and is at the discretion of the NMED Program Director and Program Clinical Coordinators and in alignment with the Joint Review Committee on Educational Programs in Nuclear Medicine Technology policies.

Note: Policies and procedures are outlined in more detail in the School of Medical Diagnostic & Translational Sciences Nuclear Medicine Technology Program Student Handbook Program Policies. All students accepted into the Nuclear Medicine Technology major are responsible for familiarizing themselves with this handbook upon entry into the major.

Four-Year Plan - Nuclear Medicine Technology - BSNMT (http://catalog.odu.edu/undergraduate/collegeofhealthsciences/medicaldiagnostictranslationalsciences/nuclearmedtech-bsnmt-fouryearplan/)

- The four-year plan is a suggested curriculum to complete this degree program in four years based on foreign language met in high school. It is just one of several plans that will work and is presented only as broad guidance to students. Each student is strongly encouraged to develop a customized plan in consultation with their academic advisor. Additional information can also be found in Degree Works.

Requirements

Lower-Division General Education

Skills
Written Communication (grade of C or better required in both courses) 6
Oral Communication 3
Mathematics 6
- STAT 130M Elementary Statistics
- MATH 102M or MATH 103M College Algebra with Supplemental Instruction
Language and Culture 0-6
Information Literacy and Research 3

Ways of Knowing

Human Creativity 3
Interpreting the Past 3
Literature 3
Philosophy and Ethics 3
- PHIL 345E Bioethics (preferred; 300/400 level P or E course meets upper division general education/Option D)

The Nature of Science 16
- CHEM 105N Introductory Chemistry
& CHEM 106N and Introductory Chemistry Laboratory
- CHEM 107N & CHEM 108N Introductory Organic and Biochemistry and Introductory Organic and Biochemistry Laboratory
- PHYS 101N & PHYS 102N Conceptual Physics and Conceptual Physics

Human Behavior 3
Impact of Technology 3
- HIST 304T History of Medicine, Disease, and Health Technology (preferred but any 300/400 level T course EXCEPT DNTH 440T meets upper-division general education/Option D)

Total Hours 52-58

Departmental Requirements

BIOL 240 Fundamentals of Anatomy and Physiology I 4

Major Course Requirements

Third Year

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<th>First Term</th>
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Fourth Year

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<td>NMED 475W</td>
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Total credit hours: 57

Elective credit may be needed to meet the minimum requirement of 120 credit hours.

Upper-Division General Education

- Option A. Approved Disciplinary Minor, 12 hours minimum; also second degree or second major.
- Option B. Interdisciplinary Minor (specifically 12 hours, 3 of which may be in the major)
- Option C. An approved Certification Program such as teaching licensure
- Option D. Two Upper-Division Courses from outside the College of Health Sciences and not required by the major (6 hours)

Requirements for Graduation

A variety of clinical facilities in the Hampton Roads area are utilized for clinical education experiences. Students are responsible for providing their own transportation to these sites. Students must meet established programmatic technical standards.

Requirements for graduation include a minimum cumulative grade point average of 2.00 overall and in the major, a minimum of 120 credit hours, which must include both a minimum of 30 credit hours overall and 12 credit hours in upper-level courses in the major program from Old Dominion University, completion of ENGL 110C, ENGL 211C or ENGL 221C or ENGL 231C, and the writing intensive (W) course in the major with a grade of C or better, and completion of Senior Assessment.

Cytotechnology Concentration—Bachelor of Science in Health Sciences

http://www.odu.edu/mdts/cytotechnology/ (http://www.odu.edu/mdts/cytotechnology/)

Deborah Krzyzaniak, M.S., C.T.(ASCP), S.C.T.(ASCP) Program Director

The School of Medical Diagnostic and Translational Sciences offers a program in cytotechnology through the Bachelor of Science in Health Sciences...
Sciences. The program offers a first and second degree option as well as a post-baccalaureate certificate option.

Cytotechnologists are specially trained medical laboratory professionals who work with pathologists in detecting changes in cell samples from numerous body sites which allows the early diagnosis of cancer. This is done primarily with the use of the microscope to evaluate slide preparation of cell samples for abnormalities in structure, indicating cancer, precancerous lesions, benign tumors, infectious agents and inflammatory processes. They are also trained in specimen preparation, molecular, FISH, flow cytometry techniques, and fine needle aspiration cytology.

The program of study is accredited by the Commission on Accreditation of Allied Health Education Programs (CAAHEP), 9355 113th Street, N.W. Seminole, FL. 33775; phone: 727-210-2350; e-mail: mail@caahep.org; website: www.caahep.org (http://www.caahep.org), in association with the American Society of Cytopathology. Theory is reinforced through an integrated clinical phase that allows the student direct experience in a hospital or lab setting providing additional training in screening techniques and diagnostic procedures. Students are required to obtain a minimum grade of 70 percent or C in all didactic coursework. Clinical coursework requires a minimum passing grade of 80, 85 and 90 percent during the first, second and third internship, respectively. Graduates are eligible to sit for the national board exam given by the ASCP (American Society of Clinical Pathology) upon successful completion of the program.

Application to the cytotechnology program must be submitted by March 15 for the fall semester. Competitive applicants should have an overall GPA of 2.8 or higher.

Application to the cytotechnology program must be submitted by March 15 for the fall semester. Competitive applicants should have an overall GPA of 2.8 or higher.

Four-Year Plan - Cytotechnology
Concentration - BSHS
Four-Year Plan - Cytotechnology

- The four-year plan is a suggested curriculum to complete this degree program in four years based on placement into BIOL 121N/BIOL 122N and foreign language met in high school. It is just one of several plans that will work and is presented only as broad guidance to students. Each student is strongly encouraged to develop a customized plan in consultation with their academic advisor. Additional information can also be found in Degree Works.

Requirements
Lower-Division General Education

Skills
Written Communication
ENGL 110C English Composition (grade of C or better required)
ENGL 211C Introduction to Academic Writing (grade of C or better required)

Oral Communication

Mathematics
MATH 102M College Algebra
or MATH 103M College Algebra with Supplemental Instruction

Language and Culture

Information Literacy and Research
HLTH 120G Information Literacy for Health Professions (preferred)

Ways of Knowing

Human Creativity
Interpreting the Past
Literature
Philosophy and Ethics

Major Course Requirements

First Semester:

- BIOL 240 Fundamentals of Anatomy and Physiology I
- BIOL 251 Fundamentals of Anatomy and Physiology II
- MDT 401 Molecular Diagnostics Laboratory

Second Semester:

- BIOL 194 Human Anatomy and Physiology I
- BIOL 195 Human Anatomy and Physiology II
- MDT 404 Cell and Molecular Biology

Third Semester:

- BIOL 240 Fundamentals of Anatomy and Physiology I
- BIOL 251 Fundamentals of Anatomy and Physiology II
- MDT 401 Molecular Diagnostics Laboratory

Fourth Semester:

- BIOL 240 Fundamentals of Anatomy and Physiology I
- BIOL 251 Fundamentals of Anatomy and Physiology II
- MDT 401 Molecular Diagnostics Laboratory

Total Hours: 46-52

Human Behavior 3
Impact of Technology 3

PHIL 345E Bioethics (recommended; 300/400 level P or E course meets upper division general education/Option D)

The Nature of Science

BIOL 121N General Biology I
 BIOL 122N and General Biology I Lab
BIOL 123N General Biology II
 BIOL 124N and General Biology II Lab
CHEM 105N Introductory Chemistry
and Introductory Chemistry Laboratory
CHEM 107N Introductory Organic and Biochemistry
and Introductory Organic and Biochemistry Laboratory

Human Behavior

HIST 304T History of Medicine, Disease, and Health Technology (preferred but any 300/400 level T course EXCEPT DNTH 440T meets upper-division general education/Option D)

Total Hours: 12

Departmental Requirements

BIOL 240 Fundamentals of Anatomy and Physiology I
BIOL 251 Fundamentals of Anatomy and Physiology II
MATH 102M College Algebra
or MATH 103M College Algebra with Supplemental Instruction

Information Literacy and Research

HLTH 120G Information Literacy for Health Professions (preferred)

Ways of Knowing

Human Creativity
Interpreting the Past
Literature
Philosophy and Ethics

5 Medical Diagnostic & Translational Sciences
CYTO 457  Fine Needle Aspiration Cytology II  3
CYTO 478  Cytology Internship III  8
CYTO 497  Cytology Senior Seminar  1
CYTO 499  Comprehensive Cytology Review  1

Total Hours  62

**Upper-Division General Education**

- Option A. Approved Disciplinary Minor, 12 hours minimum; also second degree or second major.
- Option B. Interdisciplinary Minor (specifically 12 hours, 3 of which may be in the major)
- Option C. An approved Certification Program such as teaching licensure
- Option D. Two Upper-Division Courses from outside the College of Health Sciences and not required by the major (6 hours)

**Requirements for Graduation**

Requirements for graduation include a minimum cumulative grade point average of 2.00 overall and in the major, a minimum of 120 credit hours, which must include both a minimum of 30 credit hours overall and 12 credit hours in upper-level courses in the major program from Old Dominion University, completion of ENGL 110C, ENGL 211C or ENGL 221C or ENGL 231C, and the writing intensive (W) course in the major with a grade of C or better, and completion of Senior Assessment.

**Certificate Option/Second Degree**

A certificate in cytotechnology or second degree in health sciences is available to students who have a Bachelor of Science degree, with a minimum of 20 credit hours in biology and eight credit hours in chemistry. The certificate in cytotechnology requires 62 credit hours and a minimum 2.8 GPA. Courses included in the certificate mirror the cytotechnology major requirements.

**CYTOTECHNOLOGY Courses**

**CYTO 403. Gynecological Screening Laboratory. 3 Credits.**
Laboratory experience in the screening of gynecological smears. Prerequisites: Acceptance into the Cytotechnology Program and/or permission of the cytotechnology program director. Pre- or corequisite: CYTO 405 and CYTO 415.

**CYTO 404. General Pathology. 3 Credits.**
This course is an overview of general disease processes and causes in the human. All body systems will be covered including respiratory, gastrointestinal, circulatory, nervous, reproductive, and urinary. Aging, dietary, and stress factors will be discussed in the disease process. Bacteria, fungi, and viruses will be discussed in general and for each body system. Neoplasms will be covered for each body site. This course will be of benefit to anyone interested in diseases of the human body or entering the medical field. (cross listed with MLS 401) Prerequisites: junior standing. Pre- or corequisite: BIOL 250 and BIOL 251 or equivalent.

**CYTO 405. Normal Gynecological Cytology. 3 Credits.**
Introduction to histological and cytological features of the normal female genital tract with emphasis on normal and non-neoplastic abnormalities. Principles of cytological diagnostic techniques will be discussed. Prerequisites: Acceptance into the Cytotechnology Program or permission of program director. Pre- or corequisite: CYTO 403.

**CYTO 407. Clinical Histology. 3 Credits.**
This course consists of the systematic study of cellular components as well as the grouping/organization of tissues into major ‘organ’ systems. Additionally, the cellular basis of examples of human diseases will be studied. Microscopic and virtual identification and morphology of cells, tissues, and organ substructures will be emphasized. This course will be of benefit to anyone interested in diseases of the human body or entering the medical field. Prerequisites: permission of the instructor.

**CYTO 415. Abnormal Gynecological Cytology. 4 Credits.**
Introduction to diagnostic cytological techniques and pathology of the female reproductive tract with emphasis on premalignant and malignant changes. Pre- or corequisite: CYTO 403 and CYTO 405.

**CYTO 424. Respiratory Cytology. 4 Credits.**
Principles of diagnostic cytology and pathology of the respiratory tract, including benign conditions, inflammatory and infectious diseases, premalignant conditions and primary and metastatic malignancies. Prerequisites: Admission to the cytotechnology program. Pre- or corequisite: CYTO 405 and CYTO 415.

**CYTO 428W. Cytopreparatory Techniques and Procedures. 3 Credits.**
Introduction to collection, processing and preparation of cytopathologic specimens from all body sites and general laboratory procedures and regulations. A portion of this course consists of practical experience acquired in the laboratory. Practical experience will be perfected during clinical site rotations throughout the Cytotechnology Program. Students will learn how to properly write lab reports and papers related to health science fields. This is a writing intensive course. Prerequisites: Pre-admission to the Cytotechnology Program or Program Director permission; completion of ENGL 110C and ENGL 211C or ENGL 221C or ENGL 231C with a grade of C or higher.

**CYTO 430. Cytology Laboratory Operations & Ancillary Techniques. 3 Credits.**
The course offers an introduction to laboratory regulations and ancillary diagnostic techniques. In addition, this course studies the cytology lab’s role in conforming to regulatory and accrediting agency requirements. Students will learn ancillary techniques that are used in the cytopathology practice. Prerequisites: CYTO 428W.

**CYTO 442. Gastro-Intestinal Cytology. 2 Credits.**
Study of the pathology and cytology of the gastro-intestinal tract, including the oral cavity, esophagus, stomach, colon, and rectum. Emphasis on normal conditions, benign inflammatory, infections, parasitic conditions, gastric ulcers, premalignant and malignant lesions. Pre- or corequisite: CYTO 405 and CYTO 415.

**CYTO 444. Genitourinary Cytology. 2 Credits.**
Study of the pathology and cytology of the genitourinary tract, with emphasis in normal conditions, benign inflammatory and infectious conditions, crystals, premalignant and malignant lesions. Pre- or corequisite: CYTO 405 and CYTO 415.

**CYTO 445. Breast Cytology. 2 Credits.**
Study of pathology and cytology of the breast, with emphasis on benign, inflammatory conditions, premalignant and malignant disease in both breast smears and fine needle aspirations. Prerequisite: CYTO 407. Pre- or corequisite: CYTO 405 and CYTO 415.

**CYTO 446. Body Fluids Cytology. 3 Credits.**
Study of the pleural, peritoneal and pericardial cavity fluids, synovial and cerebral spinal fluids, with emphasis on benign, inflammatory conditions, and primary and metastatic malignancies. Prerequisite: CYTO 407. Pre- or corequisite: CYTO 405 and CYTO 415.

**CYTO 448. Non-Epithelial Cytology. 1 Credit.**
Study of the pathology and cytology of non-epithelial lesions with emphasis on benign, inflammatory, and malignant conditions. Prerequisites: Admission to the cytotechnology program. Pre- or corequisite: CYTO 405, CYTO 415, CYTO 424, CYTO 443, CYTO 444, and CYTO 446.

**CYTO 456. Fine Needle Aspiration Cytology I. 3 Credits.**
Study of specialized collection techniques, processing and diagnosis of fine needle aspirations from various body sites, including thyroid, liver, lymph nodes, pancreas, lung, mediastinum, salivary gland, and ovary. Clinical practical application of these principles will be continued at the clinical sites. Prerequisites: CYTO 403, CYTO 405, CYTO 415, and CYTO 428W.

**CYTO 457. Fine Needle Aspiration Cytology II. 3 Credits.**
Study of specialized collection techniques, processing and diagnosis of fine needle aspirations from various body sites, including kidney, retroperitoneum, breast, soft tissue, bone, eye, central nervous system, and skin. Clinical practical application of these principles will be continued at the clinical sites. Prerequisites: CYTO 403, CYTO 405, CYTO 415, CYTO 424, CYTO 428W, CYTO 445, CYTO 446, CYTO 448, and CYTO 456.
**CYTO 458. Cytology Internship I. 3 Credits.**
Directly supervised experience in a clinical setting: includes evaluation of gynecologic smears and study set assignments. Students will be exposed to cytopreparatory techniques. Pre- or corequisite: CYTO 405 and CYTO 415.

**CYTO 468. Cytology Internship II. 4 Credits.**
Directly supervised experience in a clinical setting. Includes evaluation of gynecologic and non-gynecologic specimen studies and study set assignments. Students will pre-screen gynecologic and non-gynecologic smears and study set assignments. Students will be exposed to cytopreparatory techniques. Pre- or corequisite: CYTO 405, CYTO 415, CYTO 424, CYTO 444, CYTO 445, and CYTO 446.

**CYTO 478. Cytology Internship III. 8 Credits.**
Directly supervised experience in a clinical setting. Includes evaluation of gynecologic and non-gynecologic smears and study set assignments. Students will be exposed to cytopreparatory techniques. Prerequisite: Admission to the cytotechnology program. Pre- or corequisite: CYTO 405, CYTO 415, CYTO 424, CYTO 444, CYTO 445, CYTO 446, CYTO 456, and CYTO 457.

**CYTO 495. Topics in Cytology. 1-3 Credits.**
Independent study of selected topics in clinical cytology. Review of cytologic specimens from various body sites. Prerequisites: permission of the program director.

**CYTO 497. Cytology Senior Seminar. 1 Credit.**
Supervised experience consists of clinical cases and seminar presentations into current advances within the specialty of clinical cytology. A student research project and oral presentation of current journal articles and the research paper are required. Prerequisites: permission of the program director.

**CYTO 498. Topics. 1-3 Credits.**

**CYTO 499. Comprehensive Cytology Review. 1 Credit.**
The course is a comprehensive review course that includes the review and study of the exfoliative and non-exfoliative (including fine needle aspirations) cytomorphic features of neoplastic and non-neoplastic lesions of the female genital tract, respiratory tract, urinary tract, body fluids, lymph nodes, thyroid, salivary glands, pancreas and biliary tract, the diagnostic pitfalls associated with the various body sites, the appropriate use of ancillary techniques in diagnostic cytology, the principles of quality assurance, and the new developments in the field of cytopathology. Prerequisites: CYTO 403, CYTO 405, CYTO 415, CYTO 424, CYTO 428W, CYTO 442, CYTO 444, CYTO 445, CYTO 446, CYTO 448, CYTO 456, CYTO 457, CYTO 458, and CYTO 468.

**MEDICAL LABORATORY SCIENCE Courses**

**MLS 210. Orientation to Medical Laboratory Science. 1 Credit.**
An introduction to the profession of medical laboratory science (previously called medical technology). Professional, ethical and operational issues will be discussed.

**MLS 307. Clinical Methods in Microbiology. 1 Credit.**
Laboratory techniques in the diagnosis of clinically relevant microorganisms. Prerequisite: admission to the major or minor in medical laboratory science. Pre- or corequisite: MLS 308.

**MLS 308. Clinical Microbiology. 2 Credits.**
A fundamental course in microbiology that includes bacterial growth, synthesis, differentiation, microbial nutrition and metabolism. Prerequisites: BIOL 121N, BIOL 122N, BIOL 123N, and BIOL 124N; CHEM 211 is recommended or permission of the instructor.

**MLS 309. Medical Bacteriology. 3 Credits.**
A comprehensive survey of bacteria, including colonial morphology, cultural characteristics, biochemical identification, pathogenicity, epidemiology, and treatment. Prerequisites: MLS 307 and MLS 308.

**MLS 310. Urinalysis and Body Fluids. 1 Credit.**
A study of the chemical, physical and microscopic analysis of human urine and other body fluids, with abnormal results interpreted and correlated to disease processes and cancer cytology of the urinary tract. Prerequisites: BIOL 250 and BIOL 251 or permission of the instructor.

**MLS 311. Hematology. 3 Credits.**
The study of the principles of the formation and development of blood, including the interpretation of normal and abnormal blood morphology and diagnostic procedures in the investigation of hematological disorders. Prerequisites: BIOL 250 and BIOL 251 or permission of the instructor. Pre- or corequisite: MLS 312.

**MLS 312. Hematology Laboratory. 1 Credit.**
Laboratory methods utilizing microscopy and other analytical procedures in the diagnosis and investigation of hematological disorders. Prerequisite: admission to the major or minor in medical laboratory science. Pre- or corequisite: MLS 311.

**MLS 313. Diagnostic Methods in Urinalysis. 1 Credit.**
Laboratory experience in the chemical, physical, and microscopic examination of the urine and body fluids with emphasis on quality control, osmometry, and disease correlates. Prerequisite: BIOL 250 or equivalent. Pre- or corequisite: MLS 310.

**MLS 319. Medical Bacteriology Methods. 2 Credits.**
Laboratory methods emphasizing isolation, identification and media requirements for pathogenic microorganisms. Prerequisite: admission to the major or minor in medical laboratory science. Pre- or corequisite: MLS 309.

**MLS 320. Blood Collection Techniques. 2 Credits.**
Laboratory methods in the procurement of blood by capillary, venipuncture and arterial draws, analytical variables, special phlebotomy tests, isolation techniques, safety, forensic, molecular, legal and ethical implications, pediatric, geriatric, and compromised patient concerns. All students must submit to venipuncture by fellow students. Prerequisite: BIOL 250 or equivalent or permission of the instructor.

**MLS 322. Phlebotomy Internship. 2 Credits.**
A 120-hour clinical internship for those desiring to qualify for the ASCP certification exam in phlebotomy. Prerequisite: MLS 320.

**MLS 324. Clinical Instrumentation. 3 Credits.**
This course covers the theory of operation of instrumentation used in the clinical chemistry laboratory. Methodologies discussed include: atomic absorption spectrometry, automation, blood gas instrumentation, chromatography, electrochemistry, electrophoresis, fluorometry, immunochemistry, luminometry, mass spectrometry, nephelometry, osmometry, POCT, spectrophotometry, and turbidimetry. Basic laboratory mathematics applicable to serial and compound dilutions, conversion between metric units, and determination of analyte concentration are presented. Statistical applications for quality control data analysis are introduced. Prerequisites: CHEM 211 or CHEM 321, MATH 102M or permission of the instructor. Pre- or corequisite: MLS 325.

**MLS 325. Clinical Instrumentation Methods. 1 Credit.**
A laboratory course designed for students entering the clinical laboratory field. The course includes the instrumental and data processing techniques required for the clinical analysis of body fluids, as well as statistical techniques applied to the interpretation of laboratory data, method comparison studies, quality control, calibration, maintenance, and troubleshooting of clinical chemistry analytics. Prerequisites: MATH 102M, CHEM 121N, CHEM 122N, CHEM 123N, CHEM 124N, and CHEM 211.

**MLS 326. Immunohematology. 3 Credits.**
The study of the identification of blood group antigens and antibodies, standard testing procedures, decision criteria for component selection, and regulations of blood banks and transfusion services. Prerequisites: MLS 311, MLS 312, MLS 330, MLS 331, BIOL 250, and BIOL 251 or permission of the instructor. Pre- or corequisite: MLS 336.

**MLS 328. Advanced Hematology and Hemostasis. 2 Credits.**
The microscopic study of blood cells in blood and body fluids, emphasizing morphologic identification and correlation of laboratory data in order to identify specific disease states. Fundamentals of hemostasis, emphasizing principles, evaluation techniques, and diagnostic applications. Prerequisites: MLS 311, MLS 312 or permission of the instructor.
MLS 330. Clinical Immunology/Serology. 2 Credits.
The study of the body's immune response, its cellular and non-cellular components, in-vitro manifestations, diagnostic techniques and interpretations related to the investigation and diagnosis of infectious and non-infectious disease states. Prerequisite: BIOL 121N, BIOL 122N, BIOL 250 and BIOL 251 or permission of the instructor. Pre- or corequisite: MLS 331.

MLS 331. Clinical Immunology/Serology Laboratory. 1 Credit.
Laboratory methods emphasizing in-vitro antigen and antibody reactions used to aid in the diagnosis of infectious and non-infectious disorders. Prerequisites: admission to the major or minor in medical laboratory science. Pre- or corequisite: MLS 330.

MLS 336. Immunohematology Laboratory. 1 Credit.
Laboratory methods emphasizing procedures that lead to the identification of blood group antigens and antibodies and the selection of therapeutic components necessary for making transfusion-related decisions. Prerequisite: admission to the major or minor in medical laboratory science. Pre- or corequisite: MLS 330.

MLS 339. Medical Parasitology and Mycology Laboratory. 1 Credit.
Laboratory methods emphasizing the identification of medically relevant parasites and fungi. Prerequisite: admission to the major or minor in medical laboratory science. Pre- or corequisite: MLS 340.

MLS 340. Medical Parasitology, Mycology, and Virology. 1 Credit.
A study of the medically important parasites, fungi, and viruses, and their medical significance. Prerequisite: MLS 307, MLS 308 or permission of the instructor.

MLS 351. Clinical Biochemistry. 3 Credits.
An introduction to the applications of biochemistry and clinical testing in the diagnosis of human disease. Practice given in the interpretation of laboratory data in the areas of carbohydrate, protein, lipid, genetic disorders, liver, renal, pancreatic, G.I., enzymatic, and cardiac testing. Also enzyme kinetics, electrolytes, acid base physiology, tumor markers, endocrinology, pharmacokinetics, therapeutic drug monitoring, and molecular diagnostics. Special emphasis on specimen collecting, pre- and post-analytical variables, and case studies. Prerequisites: BIOL 250, BIOL 251, CHEM 211, and CHEM 212, or permission of the instructor.

MLS 401. General Pathology. 3 Credits.
This course is an overview of general disease processes and causes in the human. All body systems will be covered including respiratory, gastrointestinal, circulatory, nervous, reproductive, and urinary. Aging, dietary, and stress factors will be discussed in the disease process. Bacteria, fungi, and viruses will be discussed in general and for each body system. Neoplasms will be covered for each body site. This course will be of benefit to anyone interested in diseases of the human body or entering the medical field. (cross listed with CYTO 404) Prerequisite: junior standing. Pre- or corequisites: BIOL 250 and BIOL 251 or equivalent.

MLS 402. Survey of Clinical Molecular Techniques. 2 Credits.
A brief review of nucleic acid chemistry, followed by discussion of clinical applications of FDA approved assays used to detect pathogens for which testing algorithms include molecular based testing. Prerequisites: MLT certification and admission to MLT-to-MLS degree completion program or permission of the instructor.

MLS 403W/503. Management in the Clinical Setting. 3 Credits.
A course concerned with organization and management in the clinical setting including personnel supervision, planning, equipment justification, quality assurance, data processing, budgeting, fiscal techniques, marketing, regulatory agencies, educational methodologies, current issues, as well as legal and ethical considerations. This is a writing intensive course. Prerequisites: junior standing and a grade of C or better in ENGL 110C and ENGL 211C or ENGL 221C or ENGL 231C.

MLS 404. Clinical Hematology Practicum. 4 Credits.
Direct clinical experience offered in automated and manual hematology procedures used in distinguishing blood dyscrasias and coagulation abnormalities. (qualifies as a CAP experience) Prerequisites: MLS 311, MLS 312, MLS 328, and permission of the program director.

MLS 406. Clinical Microbiology Practicum. 5 Credits.
Direct clinical experience offered in isolating and identifying human pathogens such as bacteria, fungi, and parasites from various clinical specimens. Prerequisites: MLS 307, MLS 308, MLS 309, MLS 319 and permission of the program director.

MLS 440/540. Statistical Applications and Data Analysis in the Clinical Laboratory. 3 Credits.
Topics include review of basic statistics used in the laboratory; use of statistics for quality control, reference range determination, method comparisons, test utility assessment, techniques for searching the literature and assessing quality and applicability of published studies; and data organization and retrieval via queries. Students will perform projects, preferably using actual laboratory data, that relate to lecture topics. Prerequisites: STAT 130M and permission of the instructor.

MLS 441. Clinical Hematology Competencies. 1 Credit.
Demonstration of stated clinical laboratory competencies within the discipline of hematology. Prerequisites: MLS 328.

MLS 442. Clinical Microbiology Competencies. 1 Credit.
Demonstration of stated clinical laboratory competencies within the discipline of clinical microbiology. Prerequisite: MLS 309 and MLS 340.

MLS 443. Clinical Chemistry Competencies. 1 Credit.
Demonstration of stated clinical laboratory competencies within the discipline of clinical chemistry. Prerequisites: MLS 324 and MLS 351.

MLS 444. Clinical Blood Bank Competencies. 1 Credit.
Demonstration of stated clinical laboratory competencies in the discipline of blood banking. Prerequisites: MLS 326 and MLS 330.

MLS 452. Clinical Biochemistry Practicum. 5 Credits.
Direct clinical experience offered in automated and manual clinical chemistry determinations with emphasis on the principles, instrumentation, interpretation, and diagnostic significance. Prerequisites: MLS 324, MLS 325, MLS 351, and permission of the program director.

MLS 454. Clinical Blood Bank Practicum. 4 Credits.
Direct clinical experience offered in the theories and principles of blood banking with emphasis on the instruction of technical procedures used in an AABB approved blood bank. Prerequisites: MLS 311, MLS 312, MLS 326, MLS 336, and permission of the program director.

MLS 457. Medical Laboratory Science Seminar. 1 Credit.
In-depth review for Medical Laboratory Scientist (MLS) certification exam. Prerequisite: permission of the program director.

MLS 495. Special Topics in Medical Laboratory Science. 1-3 Credits.
The advanced study of selected topics within the medical field. Prerequisite: permission of the program director.

MLS 497. Directed Study in Medical Laboratory Science. 1-3 Credits.
Supervised experience in medical laboratory science specialties, allowing students to pursue areas of interest under faculty direction. Prerequisite: permission of the program director.

MLS 498. Clinical Research Methods. 3 Credits.
An introduction to clinical research methods to include sampling techniques, data collection and analysis, inferential statistics, multivariate analysis, hypothesis testing and research design. The student will be expected to develop a research proposal based upon a critical review of the literature. Prerequisite: STAT 130M or permission of the instructor.

NUCLEAR MEDICINE TECHNOLOGY Courses

NMD 300. Medical Terminology. 3 Credits.
A course designed to cover the terminology and abbreviations used in the clinical sciences. Prerequisites: ENGL 110C or equivalent.

NMD 331. Fundamental Concepts in Nuclear Medicine Technology. 4 Credits.
A course designed to cover the physical principles related to nuclear medicine technology. The methods and mathematics of radioactive decay, types of radiation, radiation interactions, origins of radionuclides, including SPECT and PET/CT radionuclides also presented. Prerequisites: PHYS 101N and PHYS 102N or equivalent.
NMED 332. Nuclear Instrumentation. 4 Credits.
This course is designed to familiarize the student with the theory, operation and quality assurance associated with the instrumentation found in a typical nuclear medicine department. The course also covers the instrumentation of PET/CT scanners as well as the common radiopharmaceuticals, imaging protocols, and radiation safety currently employed in diagnostic PET/CT imaging practice. Prerequisites: NMED 331 or permission of program director.

NMED 335. Radiation Health. 3 Credits.
Discussions of radiation effects on cellular systems as well as guidelines for radiation protection and safe handling of radioactive materials in the nuclear medicine clinical setting. Prerequisites: NMED 331 or permission of the instructor.

NMED 401. Nuclear Medicine Technology I. 4 Credits.
A course designed to cover the nuclear medicine procedures and protocols of the gastrointestinal, genitourinary, central nervous, skeletal systems. Other current or emerging clinical nuclear medicine procedures are also covered. Prerequisites: BIOL 240 or BIOL 250 and BIOL 241 or BIOL 251 and admission to the nuclear medicine program.

NMED 402. Nuclear Medicine Technology II. 4 Credits.
A course designed to cover the nuclear medicine protocols and procedures of the respiratory, cardiovascular, endocrine, infection/inflammation and lymphatic systems. Other current and emerging clinical nuclear medicine procedures and protocols are also presented. Prerequisites: NMED 401 or permission of the program director.

NMED 403. Radiopharmacy. 3 Credits.
This course is designed to cover the concepts and techniques related to the field of radiopharmacy for nuclear medicine technology practice. The production, preparation, uses and quality assurance of radiopharmaceuticals are presented. Interventional and adjunctive pharmaceutical agents used in nuclear medicine will be covered. Prerequisites: NMED 331, CHEM 105N-CHEM 106N and CHEM 107N-CHEM 108N or equivalent or permission of the program director.

NMED 410. Nuclear Medicine and Molecular Imaging. 3 Credits.
This course covers the concepts, instrumentation and procedures pertaining to molecular imaging as related to nuclear medicine. Topics include: Positron Emission Tomography (PET), Computed Tomography (CT), PET/CT, Magnetic Resonance Imaging (MRI), and other emerging technologies. Cross-sectional anatomy and radionuclide therapy, including monoclonal antibodies are also discussed. Prerequisites: NMED 401 and NMED 402.

NMED 440. Clinical Nuclear Medicine Technology I. 3-8 Credits.
Clinical instruction in patient care, radiation safety, radiopharmaceutical administration, imaging and non-imaging techniques and quality assurance procedures, including PET/CT. Prerequisites: admission to the program and permission of the program director.

NMED 450. Clinical Nuclear Medicine Technology II. 8 Credits.
Continued clinical instruction in diagnostic and therapeutic nuclear medicine procedures. The correlation of nuclear medicine procedures is also presented. Clinical experiences include patient care, radiation safety, radiopharmaceutical administration, imaging and non-imaging techniques and quality assurance procedures. Prerequisites: NMED 440 and permission of the program director.

NMED 460. Clinical Nuclear Medicine Technology III. 8 Credits.
Advanced clinical instruction in diagnostic and therapeutic nuclear medicine procedures, including PET/CT. The correlation of nuclear medicine procedures is also presented. Prerequisites: NMED 450 and permission of the program director.

NMED 475W. Administration and Management in Nuclear Medicine Technology. 3 Credits.
This writing intensive, capstone course is designed to provide a review of the administration, management, policies, and practices relevant to nuclear medicine technology. The leadership, legal, ethical and planning aspects of operating a nuclear medicine department are covered. Prerequisites: Admission to the NMED program and a grade of C or better in ENGL 110C and ENGL 211C or ENGL 221C or ENGL 231C.

NMED 495. Special Topics in Nuclear Medicine Technology. 1-3 Credits.
A study of selected current topics in nuclear medicine technology. Prerequisites: permission of the program director.

NMED 497. Directed Study in Nuclear Medicine Technology. 1-3 Credits.
Directed study in a topic relevant to nuclear medicine technology. Prerequisites: Permission of the program director.