Medical Diagnostic & Translational Sciences

Web Site: 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 cytotechnology. Students may also pursue a concentration in cytotechnology 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 certified 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,MB
College of Health Sciences
4608 Hampton Blvd, Rm 2122
Phone: 757-683-6039
E-mail: bkraj@odu.edu (bkradj@odu.edu757-683-6039)

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 coursework 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.

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)

<table>
<thead>
<tr>
<th>Mathematics</th>
<th>Hours</th>
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</thead>
<tbody>
<tr>
<td>STAT 130M</td>
<td>Elementary Statistics</td>
</tr>
<tr>
<td>MATH 102M</td>
<td>College Algebra (Required for The Nature of Science courses)</td>
</tr>
<tr>
<td></td>
<td>or MATH 103M College Algebra with Supplemental Instruction</td>
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<table>
<thead>
<tr>
<th>Language and Culture</th>
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<tbody>
<tr>
<td>Information Literacy and Research</td>
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<tr>
<td>Ways of Knowing</td>
<td></td>
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<tr>
<td>Human Creativity</td>
<td>3</td>
</tr>
<tr>
<td>Interpreting the Past</td>
<td>3</td>
</tr>
<tr>
<td>Literature</td>
<td>3</td>
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<tr>
<td>Philosophy and Ethics</td>
<td>3</td>
</tr>
<tr>
<td>PHIL 345E Bioethics (preferred)</td>
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</tr>
<tr>
<td>The Nature of Science</td>
<td>12</td>
</tr>
<tr>
<td>BIOL 121N &amp; BIOL 122N General Biology I and General Biology I Lab</td>
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<tr>
<td>CHEM 121N &amp; CHEM 122N Foundations of Chemistry I Lecture and Foundations of Chemistry I Laboratory</td>
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<tr>
<td>CHEM 123N &amp; CHEM 124N Foundations of Chemistry II Lecture and Foundations of Chemistry II Laboratory</td>
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<tr>
<td>Human Behavior</td>
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<tr>
<td>Impact of Technology (any upper-division T course outside the College of Health Sciences; meets upper-division general education)</td>
<td>3</td>
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</table>

Total Hours 45-51

* CHEM 103 may be needed as a prerequisite.

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 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

<table>
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<tr>
<th>Third Year</th>
<th>Hours</th>
<th>Second Term</th>
<th>Summer Term</th>
<th>Hours</th>
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<td>1</td>
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<tr>
<td>MLS 308</td>
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<td>MLS 313</td>
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<td>Clinical Practica 4 to 5 credits from fourth year second term courses</td>
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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 327 | 1 |
|        | MLS 330 | 2 | MLS 337 | 1 |
|        | MLS 331 | 1 | MLS 339 | 1 |
|        | MDT 401 | 3 | MLS 340 | 1 |
health sciences programs may be reached at healthsciencesonline@odu.edu

schedules of working students. Distance learning enrollment coordinators for practitioners. Program courses are delivered online to accommodate the admission. The curriculum is designed to meet the needs of local and distant laboratory technician (MLT) programs. MLT certification is required for accredited associate degree university and hospital-based or military medical technology program (previously medical technology) is available for graduates of the bachelor of science in 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:
Ellie Luethy, MHS, MT(ASCP)
Education Coordinator
eluethy@odu.edu
(757) 683-3016

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

Language and Culture

Information Literacy and Research 3
Ways of Knowing

Human Creativity 3
Interpreting the Past 3

Literature

Philosophy and Ethics 3

PHIL 345E  Bioethics (preferred)

The Nature of Science

Biology

BIOL 121N & BIOL 122N  General Biology I and General Biology I Lab
CHEM 212N  Foundations of Chemistry I Lecture
& CHEM 212N  Foundations of Chemistry I Laboratory
CHEM 232N & CHEM 234N  Foundations of Chemistry II Lecture
& CHEM 234N  Foundations of Chemistry II Laboratory

Human Behavior 3
Impact of Technology (any upper-division T course outside the College of Health Sciences; meets upper-division general education) 3

Total Hours 45-51

Departmental Requirements

Biology

BIOL 250  Human Anatomy and Physiology I
& BIOL 251  Human Anatomy and Physiology II

Chemistry

CHEM 211  Organic Chemistry I Lecture
& CHEM 212  Organic Chemistry I Laboratory

Students must complete the following courses 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

Electives (including transfer and Prior Learning Assessment Credit from MLT Training Program) 17-23

MLS 309  Medical Bacteriology 3
MLS 310  Urinalysis and Body Fluids 1
MLS 311  Hematology 3
MLS 315  Clinical Laboratory Diagnosis 3
MLS 324  Clinical Instrumentation and Electronics 3

Medical Diagnostic & Translational Sciences 2

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. International Business and Regional Courses or 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 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.

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

This is a suggested curriculum plan to complete this degree program in four years. Please consult information in this Catalog, Degree Works, and your academic advisor for more specific information on course requirements for this degree.

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 (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:
Ellie Luethy, MHS, MT(ASCP)
Education Coordinator
eluethy@odu.edu
(757) 683-3016

<table>
<thead>
<tr>
<th>Year</th>
<th>Term</th>
<th>Hours</th>
<th>Total Hours</th>
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<td>45-51</td>
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<tr>
<td>First</td>
<td>2nd</td>
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<tr>
<td>First</td>
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Total credit hours: 63

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<td>4-15 credits from fourth year second term courses</td>
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<tr>
<td>MLS 403W</td>
<td>3</td>
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<td>MLS 404</td>
<td>4</td>
</tr>
<tr>
<td>MLS 440</td>
<td>3</td>
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<td>MLS 452</td>
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<tr>
<td>MLS 457</td>
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Final Year First Term

<table>
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<th>Hours</th>
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<td>MLS 404</td>
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<td>MLS 440</td>
<td>3</td>
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<td>MLS 406</td>
<td>5</td>
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<td>MLS 452</td>
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<td>MLS 457</td>
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Fourth Year

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<td>1st</td>
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<tr>
<td>2nd</td>
<td>18</td>
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</table>
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 user, 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.

A grade of C (2.00) or better in all nuclear medicine course work is required to continue in the program.

**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).

**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 College Algebra
  - 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

**The Nature of Science**

- CHEM 105N Introductory Chemistry
  - or CHEM 106N and Introductory Chemistry Laboratory
- CHEM 107N Introductory Organic and Biochemistry
  - or CHEM 108N and Introductory Organic and Biochemistry Laboratory
- PHYS 101N Conceptual Physics
  - or PHYS 102N and Conceptual Physics

**Human Behavior** 3
- HIST 304T History of Medicine, Disease, and Health Technology (or upper-division T course outside the College of Health Sciences; meets upper-division general education)

**Impact of Technology** 3

**Total Hours** 52-58

### Departmental Requirements

- BIOL 240 Fundamentals of Anatomy and Physiology I 4
  - or BIOL 250 Human Anatomy and Physiology I
- BIOL 241 Fundamentals of Anatomy and Physiology II 4
or BIOL 251  Human Anatomy and Physiology II

Students must complete the following courses (or equivalent) prior to entering the nuclear medicine technology Program: BIOL 240 or BIOL 250 and BIOL 241 or BIOL 251, CHEM 105N, CHEM 106N, CHEM 107N and CHEM 108N, PHYS 101N and PHYS 102N, and MATH 102M and STAT 130M.

Total Hours 8

**Major Course Requirements**

**Third Year**

<table>
<thead>
<tr>
<th>First Term</th>
<th>Hours</th>
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<th>Summer Term</th>
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<td>NMED 335</td>
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<td>7</td>
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<td>13</td>
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**Fourth Year**

<table>
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<td>NMED 460</td>
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<td>NMED 402</td>
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<td>NMED 410</td>
<td>3</td>
</tr>
<tr>
<td>NMED 403</td>
<td>3</td>
<td>NMED 475W</td>
<td>3</td>
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<tr>
<td></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. International Business and Regional Courses or 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 2.0 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.

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

This is a suggested curriculum plan to complete this degree program in four years. Please consult information in this Catalog, Degree Works, and your academic advisor for more specific information on course requirements for this degree.

**Cytotechnology Concentration—Bachelor of Science in Health Sciences**

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. The program offers a first and second degree option as well as a post-baccalaureate degree 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), 1361 Park Street, Clearwater, FL 33756; 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.

**Requirements**

**Lower-Division General Education**

**Skills**

<table>
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<tr>
<th>Written Communication</th>
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<tbody>
<tr>
<td>ENGL 110C</td>
<td>English Composition (grade of C or better required)</td>
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<tr>
<td>ENGL 211C</td>
<td>English Composition (grade of C or better required)</td>
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<td>Oral Communication</td>
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<tr>
<td>Mathematics</td>
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<tr>
<td>MATH 102M</td>
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<tr>
<td>or MATH 103M</td>
<td>College Algebra with Supplemental Instruction</td>
</tr>
<tr>
<td>Language and Culture</td>
<td>0-6</td>
</tr>
<tr>
<td>Information Literacy</td>
<td>3</td>
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<tr>
<td>HLTH 120G</td>
<td>Information Literacy for Health Professions (preferred)</td>
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**Ways of Knowing**

| Human Creativity | 3 |
| Interpreting the Past | 3 |
| Literature        | 3 |
| Philosophy and Ethics | 3 |
| PHIL 345E         | Bioethics (recommended) |

The Nature of Science 16
## Departmental Requirements

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
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</tr>
<tr>
<td>BIOL 123N &amp; BIOL 124N</td>
<td>General Biology II and General Biology II Lab</td>
<td>0</td>
</tr>
<tr>
<td>CHEM 105N &amp; CHEM 106N</td>
<td>Introductory Chemistry and Introductory Chemistry Laboratory</td>
<td>0</td>
</tr>
<tr>
<td>CHEM 107N &amp; CHEM 108N</td>
<td>Introductory Organic and Biochemistry and Introductory Organic and Biochemistry Laboratory</td>
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**Total Hours:** 46-52

* Met in the major with CYTO 424 and CYTO 497.

### Major Course Requirements

#### First Semester:

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<td>CYTO 407</td>
<td>Clinical Histology (Strongly Recommended)</td>
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<tr>
<td>MDT 401</td>
<td>Molecular Diagnostics Laboratory</td>
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</tr>
<tr>
<td>CHP 450</td>
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<td>CYTO 405</td>
<td>Normal Gynecological Cytology</td>
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<td>Abnormal Gynecological Cytology</td>
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<tr>
<td>CYTO 424</td>
<td>Respiratory Cytology</td>
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<td>CYTO 428W</td>
<td>Cytopreparatory Techniques and Procedures</td>
<td>3</td>
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<td>CYTO 458</td>
<td>Cytology Internship I</td>
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#### Third Semester:

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<tr>
<td>CYTO 444</td>
<td>Genitourinary Cytology</td>
<td>2</td>
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<tr>
<td>CYTO 445</td>
<td>Breast Cytology</td>
<td>2</td>
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<tr>
<td>CYTO 446</td>
<td>Body Fluids Cytology</td>
<td>3</td>
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<tr>
<td>CYTO 448</td>
<td>Non-Epithelial Cytology</td>
<td>1</td>
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<tr>
<td>CYTO 468</td>
<td>Cytology Internship II</td>
<td>4</td>
</tr>
</tbody>
</table>

#### Fourth Semester:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
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<tbody>
<tr>
<td>CYTO 455</td>
<td>Fine Needle Aspiration</td>
<td>6</td>
</tr>
<tr>
<td>CYTO 478</td>
<td>Cytology Internship III</td>
<td>8</td>
</tr>
<tr>
<td>CYTO 497</td>
<td>Cytology Senior Seminar</td>
<td>1</td>
</tr>
</tbody>
</table>

**Total Hours:** 61

### 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. International Business and Regional Courses or 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.

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

This is a suggested curriculum plan to complete this degree program in four years. Please consult information in this Catalog, Degree Works, and your academic advisor for more specific information on course requirements for this degree.

**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.

### 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. 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 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 444, CYTO 445, and CYTO 446.

CYTO 455. Fine Needle Aspiration, 6 Credits.
Study of specialized collection techniques, processing and diagnosis of fine needle aspirations from various body sites, including, but not limited to, thyroid, liver, lymph nodes, pancreas, lung, kidney, etc. Emphasis will be on benign, inflammatory, primary, and metastatic malignancies of all sites. Clinical practical application of these principles will be continued at the clinical sites. Prerequisite: CYTO 403. Pre- or corequisite: CYTO 405, CYTO 415, CYTO 424, CYTO 444, CYTO 445, and CYTO 446.

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 slides 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. Pre- or corequisite: CYTO 405, CYTO 415, CYTO 424, CYTO 444, CYTO 445, CYTO 446, and CYTO 445.

CYTO 495. Topics in Cytology, 1-3 Credits.
Independent study of selected topics in clinical cytology. Review of cytopathologic specimen slides 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 in the diagnosis of clinically relevant microorganisms. A student research project and oral presentation of current journal articles are required. Prerequisites: permission of the program director.

CYTO 498. Topics, 1-3 Credits.

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 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 blood and platelet function 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 315. Clinical Laboratory Diagnosis, 3 Credits.
Clinical 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 and Electronics. 3 Credits.
A course covering the theory, operation, selection, maintenance and quality control of instruments in the clinical laboratory. Instruments discussed include spectrophotometers, flame photometry, atomic absorption, fluorometry, gas and liquid chromatography, mass spectroscopy, chemiluminescence, immunochromatographic and nephelometric methods, electrophoresis, radiation detection and dosimetry, osmometry, electrochemistry and applications to molecular diagnostic and forensic testing, and basic electronic applications. Statistical applications to data analysis of both instrument and method comparisons, trouble shooting and quality control in the clinical lab. 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 applied statistical techniques to the interpretation of laboratory data, and statistical comparison methods. Lab to include lab sessions in molecular diagnostic testing, comparison studies, quality control, calibration, maintenance, and trouble shooting of clinical chemistry analyzers. 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 326.

MLS 327. Hemostasis. 1 Credit.
The study of the fundamentals of hemostasis, emphasizing principles, evaluation techniques, and diagnostic applications. Class meets the first seven weeks of the semester. 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 326.

MLS 337. Advanced Hematology. 1 Credit.
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. Class meets the second seven weeks of the semester. Prerequisites: MLS 311 and MLS 312 or permission of the instructor.

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: MLS 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 327, MLS 337, 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 311 and MLS 315.
MLS 442. Clinical Microbiology Competencies. 1 Credit.
Demonstration of stated clinical laboratory competencies within the discipline of clinical microbiology. Prerequisite: MLS 309.

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 315 and MLS 326.

MLS 445. Advanced Clinical Practicum. 3 Credits.
A project-based advanced clinical experience for laboratory practitioners emphasizing enhancement of basic procedures and techniques and development of management, research, computer and educational skills, resulting in a written paper and oral presentation. (qualifies as a CAP experience) Prerequisite: MLS 440 or approved research methods course; or permission of instructor.

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

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

NMED 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. 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 procedures of the respiratory, cardiovascular and endocrine 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. 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. 8 Credits.
Clinical instruction in patient care, radiation safety, radiopharmaceutical administration, imaging and nonimaging techniques and quality assurance procedures. 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, including PET/CT. The correlation of nuclear medicine procedures is also presented. 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 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.