

# NUCLEAR MEDICINE TECHNOLOGY

## Objectives

Lewis University partners with Northwestern Memorial Hospital and with the College of DuPage in a 3+1 program leading to the Bachelor of Science in Nuclear Medicine Technology. The Bachelor of Science program in Nuclear Medicine Technology offers a course of study that will prepare students for careers as Nuclear Medicine Technologists (NMT). Majors will gain a strong background in the concepts of modern biology with a particular concentration in human anatomy and physiology, biochemistry, and genetics. This background is further strengthened by courses in chemistry, physics, computer science, and mathematics. Students choose one of the three options according to their academic goals.

Students may elect to enter the four-year program for the **B.S. in Nuclear Medicine Technology** awarded by Lewis University in which the first three years of classes would be at Lewis University with the final semesters of clinical classes at Northwestern Memorial Hospital (NMH) or the College of DuPage (COD). Admission to the professional phase of the program is based upon successful application to the program at NMH or COD after the second semester of the junior year. Student applicants are considered and evaluated solely by the faculty and staff at NMH and COD. Student admission to the NMH and/or COD program is not guaranteed. Students must obtain/maintain health insurance and submit to a criminal background check as requirements of this program. Students accepted by COD will register through COD and pay in-district tuition and associated fees directly to COD. The clinical courses will be transferred back to Lewis University for completion of the degree.

Another option is for students to complete the four-year **B.S. in Biology** and then apply for admission to Northwestern Memorial Hospital or the College of DuPage for a one-year **certificate program in Nuclear Medicine Technology**.

Students may also **double major in Biology and Nuclear Medicine Technology**. This would take five years with the first four years spent taking classes at Lewis University and the last year at Northwestern Memorial Hospital or the College of DuPage. Students would apply for the NMT program in the spring of their fourth year with the understanding that Northwestern Memorial Hospital and/or the College of DuPage determines acceptance into this program.

Transfer students must have a minimum cumulative and biology GPA of 3.0 to be accepted. Students currently attending Lewis University who wish to declare NMT as a major must meet the same requirements as transfer students. Transfer students must complete a minimum of three semesters of the program before they can apply as an affiliated student for the NMT program.

## Programs Partnership

- Nuclear Medicine Technology / Bachelor of Science 3 + 1 Program (<https://catalog.lewisu.edu/undergraduate/aviation-science-technology/nuclear-medicine-technology/nuclear-medicine-technology-bachelor-science-3-1-program/>)

## Courses

### BIOL 10000 - Introduction to Biology (3)

Basic concepts pertinent to a general understanding of the biological sciences constitute the subject matter in this introduction.

### BIOL 10100 - Anatomy and Physiology 1 (4)

The basic principles of human anatomy and physiology are covered in lecture and lab. Emphasis is placed on the normal, non-diseased state of the human body as a basis for advanced courses. This course is intended for Nursing majors.

Corequisite: BIOL 10200

Attributes: Science General Education

### BIOL 10101 - Human Anatomy and Physiology 1 (4)

This course covers the basic principles and systems of normal human anatomy and physiology. It is designed for students considering a career in the health field. The course is taught from a systemic standpoint and provides a foundation for the derivation of pathological conditions. Systems to be presented include integumentary, bones, muscles, nervous system, senses, endocrinology, and oral and dental applications. This course is for Dental Hygiene students.

Corequisite: BIOL 10201

Program Restrictions: Must be enrolled in the following Program: Dental Hygiene .

### BIOL 10102 - Anatomy & Physiology for Respiratory Therapists (4)

Introduction to the human body, human organization, maintenance of the body with emphasis on the cardiovascular, respiratory, nervous, muscular, and skeletal systems. Laboratory exercises include microscopic observations, chemistry of the organic molecule, cell structure and function, microscopic study of tissues, blood typing, and others.

Prerequisite: ENGL 11100 (may be taken concurrently)

### BIOL 10200 - Anatomy and Physiology 1 Lab (1)

This lab emphasizes a hands-on approach to learning and understanding the various organ systems in the human body. Lab consists of both anatomical dissection and multiple computer modulated activities to demonstrate and comprehend non-diseased physiological mechanisms

Corequisite: BIOL 10100

### BIOL 10201 - Human Anatomy and Physiology 1 Lab (1)

This lab emphasizes a hands-on approach to learning and understanding the various organ systems in the human body. Lab consists of both anatomical dissection and multiple computer modulated activities to demonstrate and comprehend non-diseased physiological mechanisms with oral applications. This course is for Dental Hygiene students.

Corequisite: BIOL 10101

Program Restrictions: Must be enrolled in the following Program: Dental Hygiene .

### BIOL 10202 - Anatomy & Physiology for Respiratory Therapists Lab (0)

This is a laboratory course that complements BIOL 10102.

Corequisite: BIOL 10102

**BIOL 10300 - Anatomy and Physiology 2 (4)**

This course is a continuation of BIOL 10100, focusing on the normal anatomy and physiology of the human body. The course material is taught from a systemic standpoint and physiological mechanisms are emphasized to provide the students with a basis for future coursework involving the derivation of pathological conditions. Critical material covered includes the cardiovascular, respiratory, urinary, immune, lymphatic, digestive and reproductive systems. This course is intended for Nursing majors.

Prerequisite: BIOL 10100 and BIOL 10200

Corequisite: BIOL 10400

Attributes: Science General Education

**BIOL 10301 - Human Anatomy and Physiology 2 (4)**

This course is a continuation of BIOL 10101, and focuses on the normal anatomy and physiology of the human body. The course material is taught from a systemic standpoint and physiological mechanisms are emphasized to provide the students with a basis for future coursework involving the derivation of pathological conditions. Material to be covered includes blood, cardiovascular, respiratory, lymphatic, immune, renal, digestive, and reproductive systems, along with acid-base and fluid balance, and oral and dental applications. This course is for Dental Hygiene students.

**BIOL 10302 - Cardio-Pulmonary Anatomy & Physiology (4)**

Respiratory and renal systems. Special emphasis in mechanics of ventilation, control of ventilation, gas diffusion, ventilation-perfusion relationships, acid-base regulation and cardio-pulmonary hemodynamics. Laboratory includes patient assessment, pulmonary function measurements, thoracic imaging and E.K.G.

Prerequisite: BIOL 10202 (may be taken concurrently) and CHEM 10100 (may be taken concurrently) and CHEM 10200 (may be taken concurrently)

**BIOL 10400 - Anatomy and Physiology 2 Lab (1)**

A continuation of BIOL 10200, which includes dissection of various mammal organs and the fetal pig. The human body is explored from a systemic approach using both inquiry based labs and computer modeled exercises.

Prerequisite: BIOL 10100 and BIOL 10200

Corequisite: BIOL 10300

**BIOL 10401 - Human Anatomy and Physiology 2 Lab (1)**

A continuation of BIOL 10201, which includes dissection of various mammal organs and the fetal pig. The human body is explored from a systemic approach using both inquiry-based labs and computer modeled exercises. This course is for Dental Hygiene Students.

Prerequisite: BIOL 10101 and BIOL 10201

Corequisite: BIOL 10301

**BIOL 10402 - Cardio-Pulmonary A & P Lab (0)**

is a laboratory course that complements BIOL-10302.

Corequisite: BIOL 10302

**BIOL 10600 - Introduction to Environmental Science (3)**

As an introduction to environmental issues, this course covers basic ecology of ecosystems, the effects and consequences of human activity on the environment, and current laws and policies. Students investigate issues and sustainable solutions. The course is designed for non-science majors and fulfills the General Education requirement.

Attributes: Science General Education

Illinois Articulation Initiative (IAI): L1905.

**BIOL 10700 - Human Heredity (3)**

An introduction to the genetic principles that govern human inheritance, the course emphasizes modern interpretations of genetic laws as they apply to humans. The course is designed for non-science majors and fulfills the General Education requirement.

Attributes: Science General Education

Illinois Articulation Initiative (IAI): L1907.

**BIOL 10800 - Introduction to Human Biology (3)**

An introduction to the structure and function of human biology, this course focuses on the role of anatomy and physiology in everyday life. The course is designed for non-science majors and fulfills the General Education requirement.

Attributes: Science General Education

Illinois Articulation Initiative (IAI): L1904.

**BIOL 11000 - General Biology 1 (4)**

Students explore the organization of living things, from the molecular level through the organismic levels. Emphasis is placed on the chemistry of life, cell structure and function, energy pathways in respiration and photosynthesis, structure and function of animal organ systems and homeostasis in animals.

Prerequisite: MATH 19900 or MATH 20400 or MATH 20600 or MATH 20900 (may be taken concurrently)

Corequisite: BIOL 11100

Attributes: Science/Lab Gen Ed

**BIOL 11100 - General Biology 1 Lab (1)**

This laboratory is designed to allow students to explore scientific principles introduced in the lecture component using an inquiry-based method. Student will perform experiments which examine cell structure and function (prokaryotic and eukaryotic, uni- and multicellular) as well as designing experiments in enzyme kinetics and organ physiology. Concepts such as molarity, percent solutions, and pH/acid-base balance will be reinforced through student-driven experimentation. This course partially fulfills the advanced writing requirement.

Corequisite: BIOL 11000

Attributes: Experiential Learning Gen Ed, Science/Lab Component Gen Ed

**BIOL 11200 - Introduction to Forensic Biology (3)**

An introduction to forensic biology and its relationship to criminal investigations. Students will learn about topics related to crime scenes such as decay, discovery and recovery of human bodies, body fluids, human skeleton, waste products, blood spatter analysis, as well as the role of invertebrates, vertebrates, protists, fungi, plants and microbes in forensics. There will be a review of the significance of blood typing, DNA collection and analysis, skeletal biological profiles, and plant and animal toxins. An emphasis will be placed on the proper collection, and preservation of different types of evidence found at crime scenes.

**BIOL 11500 - General Biology 2 (4)**

This course is a continuation of BIOL 11000, with emphasis on the reproduction, development, inheritance, evolution, ecology and behavior of biological systems.

Prerequisite: BIOL 11000

Corequisite: BIOL 11600

**BIOL 11600 - General Biology 2 Lab (1)**

In this laboratory course students investigate the cell cycle, gametogenesis, and principles of inheritance including the normal human karyotype and chromosomal disorders. Students survey the microbial world and compare the anatomy and physiology of invertebrates and vertebrates with a focus on evolutionary differences. Students are expected to complete a semester-long investigative project designed to familiarize students with data collection, analysis, and presentation skills.

Prerequisite: BIOL 11100

Corequisite: BIOL 11500

Attributes: Experiential Learning Gen Ed

**BIOL 12200 - Integrated Science 2 (3)**

This is a continuation of PHYS 12000, focusing on the history and origins of life, ecology and the environment, human biology and Mendelian genetics. Emphasis is placed on the integration of these concepts across the physical, chemical and biological disciplines. This course is designed for students requiring a general science class that integrates physics, chemistry, biology and environmental science. This course fulfills the General Education requirement for science.

Corequisite: BIOL 12300

Attributes: Science/Lab Gen Ed

**BIOL 12300 - Integrated Science 2 Lab (1)**

This is the second semester laboratory component of a two-semester lecture and laboratory sequence in integrated science. Topics investigated in this lab include history and origins of life, ecology and the environment, human biology and Mendelian genetics. Emphasis is placed on the integration of these concepts across the physical, chemical and biological disciplines.

Corequisite: BIOL 12200

Attributes: Science/Lab Component Gen Ed

**BIOL 13800 - Medical Terminology (0-3)**

Study of root words, prefixes, and suffixes of the medical vocabulary. Also included are medical abbreviations and applicable symbols. A combination of learning exercises and chapter quizzes are utilized. Emphasis is on application of terminology through the use of chapter objectives, learning exercises, and critical thinking exercises.

**BIOL 14000 - Molecular and Cellular Sciences for Secondary Educators (1)**

The basic principles of cellular structure and function are presented. Students develop an understanding of the molecular basis of life, the cell cycle, and the structure and function of organelles, tissues, organs and organ systems. These principles are studied in the context of the theories of biological evolution. This course is designed for Chemistry and Physics majors with Secondary Education minors and does not fulfill the General Education Science requirement.

Program Restrictions: Must be enrolled in one of the following Programs: Chemistry or Physics.

**BIOL 14200 - Environmental Science for Secondary Educators (1)**

This course is designed for Secondary Education minors majoring in either Chemistry or Physics who need some background in the environmental sciences. The course examines the strategies and adaptations used by organisms to obtain the basic requirements of life. It does so in the context of living and non-living factors interacting with one another and their dynamic environment through population, community, ecosystem and ecoregion processes. Emphasized throughout the course is the fact that humans are part of these systems and interact with the environment. This course does not fulfill the General Education Science requirement.

Program Restrictions: Must be enrolled in one of the following Programs: Chemistry or Physics.

**BIOL 14400 - Fundamentals of Earth Science (1)**

This course is designed for Secondary Education minors majoring in Biology, Chemistry or Physics who need some background in Earth Sciences. Topics include the structure, composition and transfer of energy within and among the Earth's land, water and atmospheric systems. It covers the interrelationships among the Earth's resources and how these relationships are influenced by the physical changes that occur over geologic time. This course does not fulfill the General Education Science requirement.

Program Restrictions: Must be enrolled in one of the following Programs: Biology, Chemistry or Physics.

**BIOL 19900 - Scientific Inquiry (1)**

This course is designed to provide students with a foundation of skills necessary to be successful in the Biology Department at Lewis University. The course will focus on research skills, approaches to scientific writing and critical thinking. May be repeated for credit.

**BIOL 22000 - Genetics (4)**

A study of the mechanisms of inheritance in plants, animals and man, this course emphasizes the cytological basis of inheritance, gene linkage, crossover, chromosomal aberration, genetic coding and gene action at the molecular level, as well as developmental genetics.

Prerequisite: BIOL 11500

Corequisite: BIOL 22100

**BIOL 22100 - Genetics Lab (1)**

Students will engage in laboratory exercises designed to convey fundamental concepts in genetics while gaining experience with modern techniques pertaining to cytogenetic analysis, transmission, molecular and population genetics.

Corequisite: BIOL 22000

Attributes: Experiential Learning Gen Ed

**BIOL 22200 - Earth Science (4)**

Students learn about the Earth as a system with four major parts: atmosphere, hydrosphere, biosphere, and geosphere. The interactions and inter-dependencies of the four parts are emphasized. Map reading and GIS are covered. Some fieldwork may be included as well.

**BIOL 22400 - General Microbiology (4)**

This course provides study of the taxonomy, morphology, physiology, genetics, culture, and control of prokaryotes, viruses, and eukaryotic microbes. The relationships between pathogenic microorganisms and their hosts are studied, as well as host defense mechanisms.

Prerequisite: BIOL 11500

Corequisite: BIOL 22600

**BIOL 22500 - Microbiology (4)**

Students explore the morphology, physiology, nutrition, culture, and control of bacteria, viruses, fungi and related microbes. Emphasis is on infectious diseases by body system, pathogenicity of selected microbes, antimicrobial factors, immune mechanisms, and the human microbiome.

Prerequisite: BIOL 10300 or BIOL 10301

Corequisite: BIOL 22700

**BIOL 22501 - Introduction to Microbiology for Respiratory Therapy (4)**

This course introduces the student to the microbial world, molecular biology, physiology and metabolism of microorganisms, immunobiology and infectious diseases; as well as the relationships between humans and microorganisms. This course includes lectures and laboratory. Prerequisite: BIOL 10202 (may be taken concurrently) and CHEM 10100 (may be taken concurrently) and CHEM 10200 (may be taken concurrently)

**BIOL 22600 - General Microbiology Lab (1)**

Students participate in laboratory investigations into the structure, culture, nutrition, identification, and ecology of selected microbes. This course partially fulfills the advanced writing requirement.

Corequisite: BIOL 22400

Attributes: Experiential Learning Gen Ed

**BIOL 22700 - Microbiology Lab (1)**

Students perform laboratory investigations into the structure, culture, nutrition, and identification of medically important microorganisms.

Corequisite: BIOL 22500

**BIOL 22701 - Intro to Microbio Lab (0)**

This is a laboratory course that complements BIOL-22501.

Corequisite: BIOL 22501

**BIOL 23300 - Principles of Environmental Science (4)**

This course focuses on the principles of Environmental Science with the main emphasis on the study of ecosystem principles, the human population, soils, the hydrologic cycle and living natural resource management and protection. The course is continued as BIOL 37500 Issues in Environmental Science. Some fieldwork may be included.

**BIOL 24300 - Principles of Sustainability (4)**

This course focuses on the multidisciplinary nature of sustainability needed for effective change. Students will be presented with the concepts and practices of sustainability as a process that meets the needs of the present without compromising the planet for the future. This course will take a holistic approach to develop a firm grounding on the health and integrity of systems that govern sustainability: ecology, climate, energy, society, economy, food, and culture.

**BIOL 27000 - Pathophysiology (3)**

This course provides an introduction to the physiological basis of human diseases with special emphasis on the role of normal feedback servomechanisms in maintaining health. Physiological disequilibrium of the major organ systems is discussed in terms of such concepts as cellular disruptions, inflammation, obstruction, and overload.

Prerequisite: (BIOL 22500 and CHEM 10500)

**BIOL 27001 - Pathophysiology for Registered Nurses (3)**

This course is specifically designed for registered nurses. It provides a general review to the physiological basis of human diseases with special emphasis on the role of normal feedback servomechanisms in maintaining health. Physiological disequilibrium of the major organ systems is discussed in terms of such concepts as cellular disruptions, inflammation, obstruction, and overload.

**BIOL 29800 - Field Biology (2)**

This class offers four field trip studies to local ecosystems, including hardwood forests, dune and bog ecology, tallgrass prairie and river systems. The class meets all day for five days during the week prior to the start of the fall semester.

Prerequisite: BIOL 11500 and BIOL 11600

**BIOL 30200 - Introduction to Radiography and Medical Imaging (3)**

Introductions to the art and science of medical radiography and medical imaging are presented. Included is a discussion of the history of radiology, basic radiation safety and protection, imaging terminology, and an introduction to exposure factors and image formation. Other course components include an introduction to professional organizations, and cultural diversity in healthcare.

Program Restrictions: Must be enrolled in the following Program: Radiography .

**BIOL 30300 - Imaging Principles 1 (3)**

Examines the factors controlling and influencing the production of radiographic images. Exercises will demonstrate application of theoretical principles and concepts. Topics include beam filtration, beam restriction, image receptors, computed and digital radiography concepts, radiographic grids, and technical factor selection and manipulation. Emphasis will be placed on methods of improving radiographic image quality, while emphasizing patient and technologist radiation protection. Program Restrictions: Must be enrolled in the following Program: Radiography .

**BIOL 31200 - Introduction to Geographic Information Systems (3)**

This course is an introduction to the concepts and technology of geographic information systems (GIS) for Environmental Science majors. Students will study theory, applications, and data representation and analysis of GIS.

**BIOL 31500 - General Ecology and Evolution (3)**

A study of the interactions between individuals, species, communities and environments, including competition, mutualism, predation, and parasitism. Population, genetics, the evolution of life-history strategies, and coevolution are emphasized.

Prerequisite: BIOL 22000 or BIOL 22400 or BIOL 23300

**BIOL 31600 - General Ecology Lab (1)**

This is the laboratory companion to the General Ecology course. Investigations focus on techniques to gauge interactions between the biological and physical environments, field and conceptual sampling methods, population models, and an exploration of emerging technologies in ecology.

Corequisite: BIOL 31500

Attributes: Experiential Learning Gen Ed

**BIOL 31800 - Radiographic Procedures I and Lab (4)**

Radiographic anatomy and positioning skills are presented as they relate to performing radiographic procedures of the human body. Specific areas presented include positioning and procedures of the chest, abdomen, and extremities. Emphasis will be placed on the production of quality images while minimizing radiation exposure to the patient. Laboratory exercises will demonstrate the application of theoretical principles and concepts, while reinforcing didactic lecture content. Commonly encountered pathological conditions will be examined. Pathology reports will be assigned as part of this course

Program Restrictions: Must be enrolled in the following Program: Radiography .

**BIOL 32000 - Biostatistics (3)**

An introduction to the design and analysis of tests and experimental procedures in the physical and life sciences, this course covers distribution T-tests, analysis of variance, regression, chi-square and other tests of significance. Students are required to design and analyze experiments of both a scientific and technical nature. This class is recommended for graduate oriented students and those who intend to enter technical based industries.

**BIOL 32200 - Environmental Microbiology (2)**

This course will examine microbial processes in the environment, microbial communities, microbial interactions, and microbial applications.

Prerequisite: BIOL 22400

**BIOL 32300 - Environmental Microbiology Lab (1)**

This course gives students the opportunity to perform basic laboratory and molecular techniques used to investigate microbes in the environment.

Prerequisite: BIOL 22600



**BIOL 32600 - Introduction to Histotechnology (2)**

This course introduces the students to: the principles and theories of histotechnology, departmental and hospital orientation, laboratory safety and regulatory requirements, laboratory math and chemistry, and the selection and operation of a laboratory information system (LIS) will also be discussed.

**BIOL 32601 - Fixation/Gross Pathology (3)**

This course includes an introduction to medical terminology applicable to histology. The students will learn gross room operations such as workflow, common surgical procedures and terminology, specimen dissection plans of various types of tissues, and basic grossing techniques and requirements. The course also covers current frozen section techniques, cryostat maintenance, and current operating procedures for frozen sections. The students will acquire intermediate to advanced knowledge in the theory of fixation with a focus on the varying types of fixatives used, action of simple and compound fixatives, factors affecting the quality of fixation, and compatibility between fixatives and stains.

**BIOL 32602 - Embedding/Processing (3)**

This course will instill students with: proper knowledge on how to embed various types of tissue, principles of tissue processing-automated, manual, and microwave/rapid, troubleshooting, reprocessing, maintenance, programming, and correct selection of programs for tissue type will be discussed in depth with case studies. There will be a focus on embedding techniques and different infiltrating media. Principles and theories regarding decalcification will also be discussed.

**BIOL 32603 - Microtomy/Instrumentation (3)**

This course covers the basic principles of microtomy applicable to both paraffin and frozen sections and techniques necessary to provide quality microscopic slides. There will be a focus on the varying types of microtomes, blades, water baths, slides, troubleshooting and different paraffin section cutting. This course is very lab centered as the student will learn to cut various types of tissue, learns ribboning, cutting different thicknesses, smoothing sections, cutting difficult tissue, cutting levels, recuts, controls and more. The student will become familiar with various instruments and their maintenance used in the day-to-day histology laboratory.

**BIOL 32604 - Routine Staining/Quality Control (2)**

This course presents the theories and principles of hematoxylin and eosin (H&E) staining. There will be a focus on the properties of these dyes, varying methods of staining, troubleshooting, different types of hematoxylin and eosins and quality assurance. Students will learn to: operate, program, do scheduled maintenance on H&E stainers, manually coverslip slides along with maintenance and operation of coverslipping machines. Different mounting mediums, refractive indexes, slide thickness, and solvents for mounting media, along with coverslipping troubles will also be discussed.

**BIOL 32605 - Laboratory Management (2)**

This course covers laboratory management and educational methodologies. It includes management and motivational theories, communication skills, regulatory and accreditation requirements, budget and strategic planning, curriculum design and examination instruction. There is a focus on performance improvement, critical pathways, human resource management, financial management, training, management styles, team building skills, dynamics of health care and laboratory, communications, ethics, selection of laboratory computer systems and government regulations and standards.

**BIOL 32606 - Microanatomy (3)**

This course covers the study of microscopic structures of normal and abnormal human tissues and organs. It will focus on the relationship between structure and function, along with slide review and tissue identification.

**BIOL 32700 - Special Stains (4)**

This course studies the theory underlying the principles and techniques of special staining as applied to microscopic identification of connective tissue, muscle, neurological tissues, carbohydrates, lipids, proteins, blood elements, pigments, and minerals. The clinical significance of these stains in diagnoses will be discussed. The student will perform a majority of stains by hand learning about all of the reagents involved, alternatives, and safety and storage. They will become proficient in using current automated staining platforms, performing quality assurance checks of stained tissue, and providing maintenance to the equipment.

**BIOL 32701 - Electron Microscopy (2)**

This course encompasses the theory, fundamental operating principles, and specimen preparation techniques of the electron microscope. The student will learn the use of the instrument, specimen preparation, ultramicrotomy and basic techniques needed to prepare biological and non-biological samples for electron microscopy.

**BIOL 32702 - Immunohistochemistry (3)**

A comprehensive course that focuses on the fundamentals of immunohistochemistry as applied to the theory and practical techniques in histopathology. The students will apply basic knowledge of immunology to the development of immunohistochemistry protocols and techniques. Emphasis will be placed on the clinical significance of diagnostic and prognostic indicators used in immunohistochemistry techniques, troubleshooting, and validation of new antibodies.

**BIOL 32703 - Seminar- Education and Research (3)**

This course will introduce the basic language and concepts of empirical research with emphasis on the applicability of research methodology in the area of clinical laboratory sciences. Students will analyze current scientific publications for research questions, hypothesis, study design and statistical analysis and the application of proper scientific formats in the clinical laboratory professions. Curriculum will include a blend of lectures, group work, presentations by guest researchers and development of a group research poster and paper.

**BIOL 32704 - Immunofluorescence/Enzyme histochemistry/In-Situ Hybridization (2)**

This course focuses on the fundamentals and practice of Immunofluorescence, Enzyme histochemistry and in-situ hybridization. The students acquire basic knowledge on specimen preparation, development of reagents, various methods and visualization of final results.

**BIOL 32705 - Process Improvement (2)**

This is a self-study course. This course combines the student's knowledge and experience from the program. The students will conduct a process improvement project in the laboratory where they will be required to work collaboratively in the design, implementation, and presentation of what they believe should be redeveloped.

**BIOL 32706 - Clinical Rotations (2)**

Students rotate through various areas of Surgical and Anatomic Pathology laboratories.

**BIOL 32800 - Fluoroscopic Procedures 1 (1)**

This course examines the radiographic anatomy and positioning skill required to perform radiographic procedures of the digestive system. Also is an overview of contrast media and venipuncture instruction. Emphasis will be placed on the production of quality radiographs while minimizing radiation exposure to the patient and technologist. Pathology reports will be assigned to examine commonly encountered pathological conditions. Program Restrictions: Must be enrolled in the following Program: Radiography .

**BIOL 32900 - Technical Radiation Oncology 1 (2)**

This course will provide the student therapist with the technical aspects of radiation therapy. Discussion will include modalities of treatment and the distinctive properties of each patient setup consideration. This will also include basic hand calculations. Program Restrictions: Must be enrolled in the following Program: Radiation Therapy .

**BIOL 33000 - Management and Methods of Patient Care for Sonography (1,4)**

This course will present basic patient care techniques related to the medical imaging environment. Topics presented include sterile and aseptic technique, standard precautions, venipuncture, patient transfer, care of medical equipment, infection control, patient communication, basic EKG, and monitoring and recording of vital signs. Program Restrictions: Must be enrolled in one of the following Programs: DiagnosticSonography or Radiography .

**BIOL 33001 - Introduction to Sonography and Patient Care (2)**

An introduction to the fundamental responsibilities and considerations of the diagnostic medical sonography professional. Topics include; the history of diagnostic medical sonography, sonographic terminology, knobology, biomechanics, ergonomics, scope of practice, accreditation processes, medical ethics, medical law, maintaining health records, pharmacology, infection control, patient transfer methods, obtaining patient history, and vital signs. Program Restrictions: Must be enrolled in the following Program: DiagnosticSonography .

**BIOL 33100 - Principles and Practice of Radiation Therapy 1 (3)**

Content is designed to provide an overview of cancer and the specialty of radiation therapy. The medical, biological, and pathological aspect as well as the physical and technical aspects will be discussed. The roles and responsibilities of the radiation therapist, the treatment prescription, the documentation of treatment parameters and delivery will also be discussed. Program Restrictions: Must be enrolled in the following Program: Radiation Therapy .

**BIOL 33201 - Sonography Principles and Instrumentation 1 (2)**

An introduction to the fundamentals and characteristics of physics principles applied in the use of diagnostic medical sonography. Basic theories of physics and instrumentation are discussed and reviewed with an emphasis on clinical application including; sound wave parameters, pulsed waves, intensity, interactions of sound waves and media, range equation, transducer construction, beam focusing, axial resolution, lateral resolution, and two-dimensional imaging. Program Restrictions: Must be enrolled in the following Program: DiagnosticSonography .

**BIOL 33202 - Sonography Principles and Instrumentation 2 (2)**

The continuation of BIOL 33201 with the introduction of advanced theories of physics and instrumentation including; Doppler physics, hemodynamics, dynamic range, image artifacts, contrast agents, and real-time imaging. Program Restrictions: Must be enrolled in the following Program: DiagnosticSonography .

**BIOL 33203 - Sonography Principles and Instrumentation 3 (1)**

The continuation of BIOL 33202 with the introduction to optimizing the Doppler image, quality assurance, bioeffects, and ultrasound artifacts. Program Restrictions: May not be enrolled in the following Program: DiagnosticSonography .

**BIOL 33300 - Pathology/Sectional Anatomy (2)**

The course content is presented in two parts: general pathology and neoplasia. General pathology introduces basic disease concepts, theories of disease causation and system-by-system pathophysiologic disorders most frequently encountered in clinical practice. Neoplasia provides an in-depth study of new and abnormal development of cells. The processes involved in the development and classification of both benign and malignant tumors and site-specific information on malignant tumors is presented. Content is designed to study normal sectional anatomy via diagrams and radiologic images. Program Restrictions: Must be enrolled in the following Program: Radiation Therapy .

**BIOL 33400 - Radiation Therapy Physics 1 (2)**

Content is designed to establish a basic knowledge of physics pertinent to developing an understanding of radiations used in the clinical setting. Fundamental physical units, measurements, principles, atomic structure, and types of radiation are emphasized. Also presented are the fundamentals of x-ray generating equipment, x-ray production, and its interaction with matter. Program Restrictions: Must be enrolled in the following Program: Radiation Therapy .

**BIOL 33500 - Advanced Clinical Physiology (3)**

Designed for the Biology/Pre-Professional major, this course is structured with focus on medical physiology. All major organ systems are covered as well as an in-depth analysis of the maintenance of acid-base balance as a consequence of renal and respiratory interplay. Students will examine each independent system beginning at the cellular level, followed by organ/system function, and their learning experience will culminate with the complete multi-system functioning of the entire organism. Emphasis is on the normal, non-diseased state. Prerequisite: BIOL 35500 or BIOL 35700 or PHYS 20000

**BIOL 33600 - Case Studies in Human Physiology (1)**

Designed to be taken in conjunction with BIOL 33500 Advanced Clinical Physiology, this non-traditional laboratory component looks at issues in medical physiology and systems function using the case study approach. Students are given medical/laboratory data from a patient and asked to apply knowledge of cell/organ/system function as well as feedback loops to provide potential diagnoses and treatment regimens. Cases are modeled after USMLE Step I (Clinical Board) testing. Lecture notes and outside readings provide the basis for assignments and discussion each class period. Prerequisite: BIOL 35500 (may be taken concurrently) or BIOL 35700 (may be taken concurrently) or PHYS 20000 (may be taken concurrently)

**BIOL 33700 - Clinical Practicum 1 (3)**

Content is designed to provide sequential development, application, analysis, integration, synthesis, and evaluation of concepts and theories in radiation therapy. Through structured sequential assignments in clinical facilities, concepts of team practice, patient-centered clinical practice, and professional development shall be discussed, examined, and evaluated. This includes supervised clinical education, which offers a sufficient and well-balanced variety of radiation treatments, examinations, and equipment. Various rotations include: three general radiation therapy treatment rooms, Simulator/CT Simulator, Nursing Department, and Physics/Dosimetry Department.

Program Restrictions: Must be enrolled in the following Program: Radiation Therapy .

**BIOL 33900 - Medical Imaging/Processing (2)**

Content is designed to establish a knowledge base in factors that govern and influence the production and recording of radiographic images for patient simulation, treatment planning, and treatment verification in radiation oncology. Radiation oncology imaging equipment and related devices will be emphasized.

Program Restrictions: Must be enrolled in the following Program: Radiation Therapy .

**BIOL 34000 - Management and Methods of Patient Care 1 (1-3)**

Skills in problem solving, critical thinking, and decision-making are developed, as well as oral and written communication skills. Career skills are enhanced through the interview process, resume writing, and administrative duties including: budgeting, medical and legal considerations, and political issues affecting health care. Special emphasis is placed on research methods, medical law and ethics, and scheduling guidelines. Focus on basic measures necessary to provide quality patient care. Basic principles of record keeping and maintaining confidentiality of information are explained.

Program Restrictions: Must be enrolled in one of the following Programs: Nuclear Medicine Technology or Radiation Therapy .

**BIOL 34100 - Sectional Imaging Anatomy Sonography (2)**

Study of anatomy of the abdominal, pelvic, and thoracic cavities, the extremities, and the cervical area. Focus is on the cross-sectional and 3-dimensional relationships.

Program Restrictions: Must be enrolled in the following Program: DiagnosticSonography .

**BIOL 34200 - Radiation Safety and Protection (2-3)**

Supervised practice and procedures for the receipt, handling, transporting, storage, usage, record keeping, disposal, and decontamination of radioactive materials. Emphasis on licensing and regulations set forth by local, state, and federal agencies. Academic and clinical instruction provides students with radiation safety techniques to minimize exposure to patients, the public, fellow workers, and themselves. Regulations regarding therapeutic dosages and follow-up procedures are also considered. Focus on practical mathematics in nuclear medicine including radiation unit conversion, dose conversion, dose calculation, determination of specific activity, decay, and half-life calculation, counting efficiency, and statistics.

Program Restrictions: Must be enrolled in one of the following Programs: Nuclear Medicine Technology or Radiation Therapy .

**BIOL 34300 - Principles of Ultrasound Physics 1 (3)**

Introduction to and study of the fundamental principles of diagnostic ultrasound physics and instrumentation. Study of acoustic physics and various diagnostic equipment along with artifacts and quality control.

Program Restrictions: Must be enrolled in the following Program: DiagnosticSonography .

**BIOL 34400 - Radiation Physics/ Instrumentation (3)**

Theory and physical principles associated with atomic structure, nuclear and quantum physics related to radioactive decay. Properties of the elements and the production of characteristic x and gamma rays, anger electrons, and Bremstahlung. Instruction on the modes of decay, radiation dosimetry, and interaction of ionizing radiation with matter. Basic physics, instrumentation, and radiochemistry of SPECT (Single Photon Emission Computed Tomography), SPECT/CT, Positron Emission Tomography (PET), and PET/CT.

Program Restrictions: Must be enrolled in the following Program: Nuclear Medicine Technology .

**BIOL 34501 - Abdomen Sonography 1 (2)**

The first of a multi-course sequence covering normal anatomy, physiology, and pathology of the abdominal organs and superficial structures. Emphasis will be placed on the sonographic features, clinical presentation, and scan protocol of the great vessels, liver, biliary system, pancreas, gastrointestinal tract, and the abdominal wall.

Program Restrictions: Must be enrolled in the following Program: DiagnosticSonography .

**BIOL 34502 - Abdomen Sonography 1 Lab (1)**

Application of ultrasound scan techniques and imaging protocols of the great vessels, liver, pancreas, biliary system and pleural space.

Program Restrictions: Must be enrolled in the following Program: DiagnosticSonography .

**BIOL 34503 - Abdomen Sonography 2 (3)**

The continuation of BIOL 34501 with the introduction of the anatomy, physiology, pathology, and pathophysiology of the spleen, thyroid, urinary system, retroperitoneum, scrotum, prostate, and the musculoskeletal system. An emphasis will be placed on the sonographic features, clinical presentations, and scan protocols.

Program Restrictions: Must be enrolled in the following Program: DiagnosticSonography .

**BIOL 34504 - Abdomen Sonography 2 Lab (1)**

Application of ultrasound scan techniques and imaging protocols of the spleen, thyroid, urinary system, prostate, salivary glands, Achilles' tendon, water bath scanning, stand-off pads.

Program Restrictions: May not be enrolled in the following Program: DiagnosticSonography .

**BIOL 34600 - Diagnostic Nuclear Imaging Clinical Practicum 1 (4)**

Supervised clinical education that gives the student the opportunity to perform a variety of patient procedures on both Single Photon Emission Computed Tomography (SPECT), SPECT/CT, PET and PET/CT imaging systems for all diagnostic, therapeutic, non-imaging, in-vivo and in-vitro procedures. Clinical competencies developed in patient care, positioning techniques, analyzing images, and the selection of imaging parameters and collimators. Knowledge of integrated computer systems designed for use with clinical gamma cameras, SPECT, SPECT/CT, PET, and PET/CT images. The clinical practicum is designed to promote independent critical thinking, balanced responsibility, organization, and accountability in the student. Students will demonstrate competence in all procedures presented.

Program Restrictions: Must be enrolled in the following Program: Nuclear Medicine Technology .

**BIOL 34700 - Obstetrical-Gynecological Sonography with Embryology (3)**

Study of obstetrical and gynecological anatomy with clinical applications and sonographic methods used to visualize pelvic organs, pregnant uterus and related structures. Discussion of embryogenesis and a review of the reproductive cycle is included. Normal sonographic patterns are studied.

Program Restrictions: Must be enrolled in the following Program: DiagnosticSonography .

**BIOL 34800 - Clinical Nuclear Medicine Procedures I (4)**

Emphasis on theory and techniques of clinical procedures used in nuclear medicine imaging. Areas emphasized include patient care, developing acquisition parameters, imaging techniques, radionuclide identification, energies, half-lives, and principles of radionuclides in imaging and non-imaging procedures. Students will continue to develop an increased degree of competence in their performance of the skills related to critical thinking and problem solving.

Program Restrictions: Must be enrolled in the following Program: Nuclear Medicine Technology .

**BIOL 34900 - Clinical Education 1 (3)**

Practical implementation of the sonographic imaging and patient care process in a clinical setting where students will observe, assist, and perform a variety of sonographic examinations and procedures under the guidance of a registered diagnostic sonographer. Emphasis will be placed on abdomen, superficial structures, obstetric, gynecology, and vascular exams.

Program Restrictions: Must be enrolled in the following Program: DiagnosticSonography .

**BIOL 35000 - Radiography Clinical 1 (2)**

This is the first of a sequence of clinical courses designed to introduce students to the hospital clinical setting, while providing an opportunity for students to participate in or observe radiographic procedures. Students will complete general patient care competencies during this course, while rotating through various areas within the radiology department. Additionally, they will begin completing clinical competencies related to the chest, abdomen, routine contrast procedures, mobile examinations, extremities, and pediatric procedures. Students will perform under the supervision of qualified radiographers

Program Restrictions: Must be enrolled in the following Program: Radiography .

**BIOL 35100 - Clinical Education 2 (3)**

Practical implementation of the sonographic imaging and patient care process in a clinical setting where students will observe, assist, and perform a variety of sonographic examinations under the guidance of a registered diagnostic sonographer. Emphasis will be placed on abdomen, superficial structures, obstetric, gynecology, and vascular exams.

Prerequisite: BIOL 34+00 (may be taken concurrently)

Program Restrictions: Must be enrolled in the following Program: DiagnosticSonography .

**BIOL 35200 - Radiation Biology (1-2)**

This course provides an introduction to the principles and concepts underlying the effects of ionizing radiation at the molecular, cellular, tissue, and organismal level. Topics covered include: cell survival curves, linear energy transfer, relative biological effectiveness, oxygen effects, radiation damage to the DNA and chromosomes, acute and late effects of radiation, radiation effects in utero, acute radiation syndrome, and radiation-induced carcinogenesis. Examples and discussion related to radiation therapy treatment, dosimetry, and radiation protection are covered.

Program Restrictions: Must be enrolled in one of the following Programs: Nuclear Medicine Technology or Radiation Therapy .

**BIOL 35500 - Molecular Biochemistry with Clinical Correlates (3)**

The role of proteins and their molecular precursors, the nucleic acids, is the focus of this course in Biochemistry. As such, students will advance basic understanding of transcription and translation achieved from BIOL 22000 Genetics using clinically relevant models. Drawing from this knowledge base, students will apply their understanding of protein structure/function in an in depth analysis of enzyme biochemistry as well as cell signaling mechanisms. Terminology is utilized from both Organic Chemistry and the Biological sciences.

Prerequisite: BIOL 22000 and CHEM 23000

**BIOL 35600 - Molecular Biochemistry Lab (1)**

Students participate in laboratory investigations using biochemical techniques for the separation, identification and analysis of biological compounds. Molecular techniques utilized in this lab include ELISA, gel filtration chromatography, protein titration, advanced enzyme kinetic assays, 2-dimensional gel electrophoresis, isoelectric focusing, and Southern blot analysis.

Prerequisite: BIOL 35500 (may be taken concurrently) or BIOL 35700 (may be taken concurrently)

**BIOL 35700 - Nutritional Biochemistry with Clinical Correlates (3)**

A study of the chemistry of carbohydrates, lipids, and proteins as sources of nutrition is the focus of this course. Students will learn about the detailed anatomy and physiology of the gastrointestinal tract as well as the various mechanisms by which the biopolymers are digested and absorbed into general circulation. The interdependent biochemical processes that allow cells to utilize food energy, hormonal regulation of these processes, as well as the impact of minerals and vitamins on the cellular mechanisms, are addressed.

Prerequisite: BIOL 22000 and CHEM 23000

**BIOL 35800 - Nutritional Biochemistry Lab (1)**

This lab is a continuation of BIOL 35600 and is designed to round out the Biology student's preparation for the modern cell/molecular lab. Laboratory investigations include the use of biochemical techniques for the separation/purification and analysis of biological compounds, enzyme assays, affinity chromatography, competitive binding assays, immunoprecipitation, and Western blotting.

Corequisite: BIOL 35700

**BIOL 35900 - Cellular Pathophysiology (2)**

Pathophysiology is reviewed at the cellular level and progresses to tissues and body systems. The disruption of cellular processes by infections, genetic disorders, and environmental factors are discussed. Neoplastic growth and carcinogenesis are examined, and the types and effects of diseases in various organ systems are studied.

Program Restrictions: Must be enrolled in the following Program: DiagnosticSonography .



**BIOL 36000 - Radiation Detection and Instrumentation (3)**

Evaluation, maintenance, and function of instrumentation used in imaging and in the laboratory. Principles and theory of PET/CT and scintillation camera operation and performance. Radiation measurement, event counting activity, pulse height spectra, detection efficiency, resolving time and statistics. Flood field and bar phantom use for assessing camera uniformity, relative sensitivity, spatial linearity, and resolution testing. Quality assurance procedures for the PET scanner include radial, tangential and axial resolution, sensitivity, linearity, uniformity, attenuation accuracy, scatter determination, and dead time corrections. Knowledge of the operations and maintenance of computer hardware and software. Emphasis on data collection, analysis and processing used in clinical imaging. Application of computer devices and memory usage. Emphasis on SPECT, SPECT/CT, PET, and PET/CT quality control procedures.

Program Restrictions: Must be enrolled in the following Program: Nuclear Medicine Technology .

**BIOL 36100 - Physics of Radiography (3)**

An introduction to basic concepts of physics with emphasis on the fundamentals of x-ray generating equipment. Topics include atomic structure, the structure of matter, ionization, magnetism 1, electrodynamics, the control of high voltage and rectification, x-ray tubes, x-ray circuits, and the production 1 of radiation.

Program Restrictions: Must be enrolled in the following Program: Radiography .

**BIOL 36300 - Biomimicry and Whole Systems Thinking (3)**

Biomimicry is a branch of study which focuses on imitating nature's best ideas as an inspiration to solve problems faced by humans on earth. The course is designed to get students to think ecologically and work with complex whole living systems and apply them to solve human problems. This course is intended to give students the opportunity to explore past, present and future examples of biomimetic solutions and designs to human problems.

**BIOL 36500 - Medical Law and Ethics (1)**

This course examines the medicolegal issues involving patient care and medical imaging. Professional Ethics and ethical dilemmas will also be presented. Additional topics include confidentiality, HIPPA, medical documentation and elements of informed consent. Subject matter experts serve as guest presenters.

Program Restrictions: Must be enrolled in the following Program: Radiography .

**BIOL 36600 - Radiographic Procedures II and Lab (4)**

Radiographic anatomy and positioning skills are presented as they relate to performing radiographic procedures of the human body. Specific areas presented include the pelvic girdle, bony thorax, spinal column, sacrum and coccyx. Emphasis will be placed on the production of quality images while minimizing radiation exposure to the patient. Laboratory exercises will demonstrate the application of theoretical principles and concepts, while reinforcing didactic lecture content. Commonly encountered pathological conditions will be examined. Pathology reports will be assigned as part of this course.

Program Restrictions: Must be enrolled in the following Program: Radiography .

**BIOL 36800 - Fluoroscopic Procedures 2 (1)**

This course examines the radiographic anatomy and positioning skill required to perform radiographic procedures of the urinary, biliary, and reproductive systems. Also included are imaging studies of the spinal cord and arthrography. Emphasis will be placed on the production of quality radiographs while minimizing radiation exposure to the patient and technologist. Pathology reports will be assigned to examine commonly encountered pathological conditions.

Program Restrictions: Must be enrolled in the following Program: Radiography .

**BIOL 37300 - Renewable Energy Technologies (4)**

Students will take a look at conventional energy systems, peak oil, global warming, global energy issues, and a comprehensive examination of alternative renewable energy resources. Fundamentals of renewable technologies such as bioenergy, hydroelectricity, geothermal, wind, and solar power will be studied. The key goal is to challenge students to consider energy production and distribution with an eye toward long-term, low impact solutions.

**BIOL 37500 - Issues in Environmental Science (3)**

This course is a continuation of BIOL 23300 Principles of Environmental Science. The approach considers effects of human activity on ecosystems. Topics include environmental ethics, restoration ecology, the atmosphere, energy and pollution. Some fieldwork may be included.

Prerequisite: BIOL 23300 (may be taken concurrently)

**BIOL 37800 - Radiography Clinical 2 (4)**

Students will continue to rotate through various areas of the radiology department and begin surgical rotations. Additional clinical competencies will be obtained on routine spine and cranium procedures, pediatric procedures and mobile studies. Students will continue to perform under the supervision of qualified radiographers

Program Restrictions: Must be enrolled in the following Program: Radiography .

**BIOL 38000 - Biochemistry Journal Club (1)**

This course will introduce junior and senior level students to peer-reviewed literature in Biochemistry. Students will be expected to interpret and relate data, critically evaluate hypotheses, and develop a succinct, intelligible presentation style to convey scientific principles to their peers. Biochemistry Journal Clubs will focus on principles related to basic cellular chemistry including enzyme kinetics, molecular physiology, cellular nutrition, and cellular regulatory/ feedback mechanisms. At least one journal club must be successfully completed before matriculating into any of the Research Methods courses.

Class Restrictions: Must be enrolled in one of the following Classes: Junior or Senior.

**BIOL 38100 - Physiology Journal Club (1)**

This course will introduce junior and senior level students to peer-reviewed literature in Physiology. Students will be expected to interpret and relate data, critically evaluate hypotheses, and develop a succinct, intelligible presentation style to convey scientific principles to their peers. Physiology Journal Clubs will introduce students to the wide array of literature related to structure/function studies and the application of this knowledge. At least one journal club must be successfully completed before matriculating into any of the Research Methods courses.

Class Restrictions: Must be enrolled in one of the following Classes: Junior or Senior.

**BIOL 38200 - Microbiology Journal Club (1)**

This course will introduce junior and senior level students to peer-reviewed literature in Microbiology. Students will be expected to interpret and relate data, critically evaluate hypotheses, and develop a succinct, intelligible presentation style to convey scientific principles to their peers. Microbiology journal clubs will focus on current literature related to microbial interactions, physiology, and clinically relevant topics. At least one journal club must be successfully completed before matriculating into any of the Research Methods courses.

Class Restrictions: Must be enrolled in one of the following Classes: Junior or Senior.

**BIOL 38300 - Ecology Journal Club (1)**

This course will introduce junior and senior level students to peer-reviewed literature in Ecology. Students will be expected to interpret and relate data, critically evaluate hypotheses, and develop a succinct, intelligible presentation style to convey scientific principles to their peers. A mix of classic and contemporary studies covering field, laboratory, and theoretical ecology are considered. At least one journal club must be successfully completed before matriculating into any of the Research Methods courses.

Class Restrictions: Must be enrolled in one of the following Classes: Junior or Senior.

**BIOL 38400 - Genetics Journal Club (1)**

This course will introduce junior and senior level students to peer-reviewed literature in Genetics. Students will be expected to interpret and relate data, critically evaluate hypotheses, and develop a succinct, intelligible presentation style to convey scientific principles to their peers. Genetics Journal Club will introduce students to a diverse selection of primary literature focusing on the design and techniques of experiments and the application of these findings.

Class Restrictions: Must be enrolled in one of the following Classes: Junior or Senior.

**BIOL 38500 - Biology Journal Club (1)**

This course will introduce junior and senior level students to peer-reviewed literature in the life sciences. Students will be expected to interpret and relate data, critically evaluate hypotheses, and develop a succinct, intelligible presentation style to convey scientific principles to their peers. The topic or theme of the course will be decided by the instructor at the start of the semester. Biology Journal Club must be successfully completed before matriculating into BIOL 49600 Senior Thesis.

Class Restrictions: Must be enrolled in one of the following Classes: Junior or Senior.

Attributes: Advanced Writing

**BIOL 39000 - Professional Clinical Practicum (2)**

This is a clinically based course designed to familiarize Biology students with intentions of pursuing a health profession with the medical environment. The students experience seven different departments in a clinical setting, such as surgery, oncology, acute care for the elderly, physical therapy, respiratory therapy, and short stay emergency room care during a seven week period. Students must apply and meet specific requirements to be eligible for the course. Enrollment is selective and requires instructor approval. Please see your advisor for more information.

Class Restrictions: Must be enrolled in one of the following Classes: Junior, Sophomore or Senior.

**BIOL 39300 - Green Building and LEED Rating Systems (3)**

The built environment focuses on community growth, local economic opportunity, and the protection of public health and the environment while creating and enhancing the places where people live. How and where development occurs can effect ecosystem quality and services, habitat protection, water resources, energy consumption, and indoor and outdoor air quality. Students will integrate these concepts related the built environment with emphasis on the Leadership in Energy and Environmental Design (LEED) Green Building Rating System.

**BIOL 39400 - Major Field Test (0)**

The Major Field Test (MFT) is an assessment exam designed to measure basic student learning outcomes in a major field of study. Test results enable academic departments to refine and improve curriculum development, and gauge the progress of students compared to others in similar programs at schools throughout the country. Educational Testing Service (ETS) created the exam, and updates the content on a regular basis. ETS is well known for its professional and standardized testing services.

**BIOL 39500 - Neuroscience and Neurodegenerative Disease (3)**

The main objective in this course is to focus on the neuroanatomy and function associated with normal aging and neurodegenerative disease. The course will also examine common neurological diseases symptoms, diagnosis and treatments.

Class Restrictions: Must be in the following Class: Senior.

**BIOL 39700 - ACCA Seminars (1-4)**

These classes are seminars offered by member institutions of the Associated Colleges of the Chicago Area (ACCA). The topics vary from one semester to another. These courses do not fulfill the upper division requirement for any program offered by the Biology department.

Attributes: Workshop/Seminar

**BIOL 39900 - Human Identification in Criminal Investigations (3)**

This practical course is designed to provide an in-depth study of human vs. non-human osteology, bone biology, and pathology. Key information includes the history of anthropology, biological age, sex, stature, ancestry, skeletal trauma, forensic DNA and how this information is used in criminal investigations. This is a travel study course; students must attend two 4-hour preparation workshops, Osteology and Criminal Investigations, prior to the course start date.

Prerequisite: BIOL 10100 (may be taken concurrently) or BIOL 10300 (may be taken concurrently) or BIOL 11000 (may be taken concurrently) or BIOL 11200 (may be taken concurrently)

**BIOL 40200 - Imaging Principles 2 (3)**

This course is designed as a continuation of RAD 104. Course focus will be on continued knowledge development of the factors governing and influencing the production of radiographic images. Topics include technique chart formation

Program Restrictions: Must be enrolled in the following Program: Radiography .

**BIOL 40400 - Radiography Clinical 3 (4)**

This course continues to provide a clinical setting in which students continue to develop proficient clinical skills. Students will continue rotating through modalities in order to gain knowledge of other aspects of medical imaging. Terminal competency evaluations will begin during this clinical course. Students will complete any remaining procedural and general patient care competencies.

Prerequisite: BIOL 37800 (may be taken concurrently)

**BIOL 40500 - Invertebrate Zoology (4)**

A systematic study of the phylogeny, morphology and life histories of the major phyla of invertebrates, this course includes laboratory studies on selected invertebrate phyla.

Prerequisite: BIOL 11500 (may be taken concurrently) and BIOL 11600 (may be taken concurrently)

**BIOL 40600 - Molecular Cell Biology (4)**

Students examine the physical and chemical processes involved in the vital functions of cells, including ultrastructure, energy transformation, biosynthesis, photosynthesis, membrane transport and neuro-muscular physiology.

Prerequisite: BIOL 22000

**BIOL 40800 - Radiographic Procedures III and Lab (3)**

Radiographic anatomy and positioning skills are presented as they relate to performing radiographic procedures of the human body. Specific areas presented include the skull, facial and nasal bones, zygomatic arches, paranasal sinuses and mandible. Emphasis will be placed on the production of quality images while minimizing radiation exposure to the patient. Laboratory exercises will demonstrate the application of theoretical principles and concepts, while reinforcing didactic lecture content. Commonly encountered pathological conditions will be examined.

Program Restrictions: Must be enrolled in the following Program:

Radiography .

**BIOL 41100 - Imaging Modalities and Equipment (2)**

This course is designed to examine the equipment routinely used in the production of diagnostic images in greater depth. Various recording media and techniques are discussed. Topics include: radiographic equipment, image intensified fluoroscopy, recording media and techniques, image noise, specialized imaging equipment, and state and federal regulations. An overview of other imaging modalities will also be presented including IR, Mammography, Radiation Therapy, Nuclear Medicine, PET, BMD, CT and Sonography.

Program Restrictions: Must be enrolled in the following Program:

Radiography .

**BIOL 41500 - Radiographic Procedures IV and Lab (4)**

This course examines the radiographic anatomy and positioning skills required to perform radiographic procedures of the human skull, facial bones, and paranasal sinuses. Additional areas include the spinal column and pelvic girdle. Emphasis will be placed on the production of quality radiographs while minimizing radiation exposure to the patient. Laboratory exercises will demonstrate the application of theoretical principles and concepts and reinforce didactic lecture content. Commonly-encountered pathological conditions will be presented.

Program Restrictions: Must be enrolled in the following Program:

Radiography .

**BIOL 41501 - Radiographic Procedures 5/Lab (4)**

Presents the radiographic anatomy and positioning skills required to perform radiographic procedures of the cranium and related examinations. Emphasis will be placed on the production of quality images while minimizing radiation exposure to the patient. Laboratory exercises will demonstrate the application of theoretical principles and concepts and reinforce didactic lecture content. Commonly-encountered pathological conditions will be examined.

**BIOL 41600 - Conservation Biology (3)**

This course is an introduction to conservation biology emphasizing ecological relationships between populations, biological communities and local and regional ecosystems. Stressors to biological diversity (exotic species invasions, habitat modification, etc.) will be discussed along with emerging solutions varying from structural (protected areas and reserve design), lifestyle (attitudes and environmental economics), to legislation.

Corequisite: BIOL 41700

**BIOL 41700 - Conservation Biology Lab (1)**

Laboratory course emphasizing the use emerging technology of conservation biology (Vortex software, population modeling, and other tools) and examining primary literature in this area. This course will also include field trips to see conservation biology in action (Brookfield Zoo, Midewin Tallgrass Prairie, Chicago Botanic Garden, etc.).

Corequisite: BIOL 41600

**BIOL 41800 - Limnology (3)**

This course is designed for Environmental Science majors wishing some exposure to the study of inland waters: lakes, rivers and wetlands. This course will cover physical, chemical, and biological factors affecting inland waters and discuss such human-environment interactions as water pollution, acid deposition, and habitat modification (both physical and ecological).

Prerequisite: BIOL 11500 (may be taken concurrently) and BIOL 11600 (may be taken concurrently)

Corequisite: BIOL 41900

**BIOL 41900 - Limnology Lab (1)**

Laboratory course focusing on physical measurement, water quality, water chemistry, and ecological interactions taking place within inland waters. Field trips to area freshwater resources are planned.

Corequisite: BIOL 41800

**BIOL 42000 - Botany (3)**

This course lecture in laboratory study of the structure of vascular plants, with an emphasis on growth, development, reproduction, systems of translocation and environmental and evolutionary relationships.

Prerequisite: BIOL 11500 (may be taken concurrently) and BIOL 11600 (may be taken concurrently)

Corequisite: BIOL 42100

**BIOL 42100 - Botany Lab (1)**

Laboratory investigations into the structure of vascular plants will provide students with practical experience in the growth and development of these organisms as well as their role in environmental and evolutionary relationships.

Corequisite: BIOL 42000

**BIOL 42200 - Human Anatomy (3)**

This course is an upper-division elective for Biology majors and prepares students for graduate school in multiple disciplines. Three credit hours of lecture material cover regional anatomy throughout the human body and focus strictly on understanding only anatomy and its application to clinical problems. Students finishing this class should have a firm understanding of anatomical terms, planes, views, etc., and a solid foundation in the study of the vessels, nerves, muscles, and bones associated with all regions of the body.

Corequisite: BIOL 42300

Class Restrictions: Must be enrolled in one of the following Classes: Junior or Senior.

**BIOL 42300 - Functional Human Anatomy Lab (1)**

This is a one-credit hour, laboratory-based class devoted to mammalian gross anatomy dissection. Dissection techniques and suturing are also learned on a variety of organs. This lab utilizes various programs such as virtual cadavers to emphasize human anatomy and the origin, insertion, and action of muscles. This class is meant to accompany BIOL 42200 lecture material

Corequisite: BIOL 42200

**BIOL 42500 - Medical Microbiology (3)**

This course is designed to present a survey of pathogenic microorganisms, including bacteria, fungi and viruses. The morphology, virulence, diagnosis and treatment of these organisms are considered.

Prerequisite: BIOL 22400 and BIOL 22600

**BIOL 42600 - Immunology (3)**

This upper-division course is designed to provide students with a systematic study of the cellular and molecular components of the immune system. Topics will include the cells and organs of the immune system, generation of B-cell and T-cell responses, immune effector mechanisms, and the immune system in health and disease.

Prerequisite: BIOL 22000 and BIOL 22100 and BIOL 22400 and BIOL 22600

**BIOL 43000 - Radiographic Clinical 4 (3)**

Clinical rotations continue through the areas of general radiography, mobile, surgical, and pediatric areas. During this course, students gain proficiency and gradually transition from working under direct supervision to indirect. Advanced modality and evening trauma rotations begin during this course.

Program Restrictions: Must be enrolled in the following Program: Radiography .

**BIOL 43100 - Principles and Practice of Radiation Therapy II (3)**

Content is designed to examine and evaluate the management of neoplastic disease using knowledge in arts and sciences, while promoting critical thinking and the basics of ethical clinical decision making. The epidemiology, etiology, detection, diagnosis, patient condition, treatment, and prognosis of neoplastic disease will be presented, discussed, and evaluated in relationship to histology, anatomical site, and patterns of spread. The radiation therapist's responsibility in the management of neoplastic disease will be examined and linked to the skills required to analyze complex issues and make informed decisions while appreciating the character of the profession.

Program Restrictions: Must be enrolled in the following Program: Radiation Therapy .

**BIOL 43300 - Radiation Therapy Physics 2 (2)**

Content is designed to review and expand concepts and theories in the radiation physics course. Detailed analysis of the structure of matter, properties of radiation, nuclear transformations, x-ray production, and interactions of ionizing radiation are emphasized. Also presented are treatment units used in external radiation therapy, measurement and quality of ionizing radiation produced, absorbed dose measurement, dose distribution, and scatter analysis.

Program Restrictions: Must be enrolled in the following Program: Radiation Therapy .

**BIOL 43400 - Quality Management (2)**

Content is designed to focus on the evolution of quality management (QM) programs and continuing quality improvement in radiation oncology. Topics will include the need for quality assurance (QA) checks; QA of the clinical aspects and chart checks, film checks; the various types of evaluations and tests performed on simulators, megavoltage therapy equipment, and therapy planning units; the role of radiation therapists in quality management programs; legal and regulatory implications for maintaining appropriate QM guidelines as well as the role computers and information systems serve within the radiation oncology department.

Program Restrictions: Must be enrolled in the following Program: Radiation Therapy .

**BIOL 43500 - Ethics: Scientific Principles and Practices (3)**

This upper division course introduces students to the wide range of ethical issues prominent in the natural sciences and relevant in the modern world. As society becomes ever more technologically and scientifically advanced, science must be increasingly aware of its central role in a variety of socio-economic arenas. Paradoxically, all too often knowledge considered to be an advancement in the scientific venue has sociological implications that leave much of modern society mortified. This class looks at topics that potentially fall into these categories and addresses the role of science/scientists in our rapidly evolving environment. Topics are presented in lecture, discussion and case study format and include both ethical and scientific considerations.

Class Restrictions: Must be enrolled in one of the following Classes: Junior or Senior.

**BIOL 43600 - Operational Issues in Health Care Environment (1-2)**

Content is designed to focus on various healthcare department operational issues. CQI project development and evaluation and assessment techniques will be emphasized. Human resource issues and regulations impacting technologists will be examined. Accreditation agencies and the role of the technologist in the accreditation process will be emphasized. Billing and reimbursement issues pertinent to the radiation therapy department will be presented.

Program Restrictions: Must be enrolled in one of the following Programs: Radiation Therapy or Radiography .

**BIOL 43700 - Clinical Practicum II (3)**

Content is designed to provide sequential development, application, analysis, integration, synthesis, and evaluation of concepts and theories in radiation therapy. Through structured sequential assignments in clinical facilities, concepts of team practice, patient-centered clinical practice, and professional development shall be discussed, examined, and evaluated. This includes supervised clinical education, which offers a sufficient and well-balanced variety of radiation treatments, examinations, and equipment. Various rotations include: three general radiation therapy treatment rooms, Simulator/CT Simulator, Nursing Department, and Physics/Dosimetry Department.

Program Restrictions: Must be enrolled in the following Program: Radiation Therapy .

**BIOL 43801 - Diagnostic Medical Sonography Seminar (2)**

This course presents an integrated coverage of ultrasound topics, as related to image production and evaluation, ultrasound procedures, and patient care and management. Emphasis is placed on the development of skills, attitudes, and knowledge necessary to exercise independent judgment and discretion in the performance of ultrasound imaging procedures.

Program Restrictions: Must be enrolled in the following Program: DiagnosticSonography .



**BIOL 43901 - Obstetrics and Gynecology Sonography 1 (2)**

The first of a multi-course sequence covering the normal anatomy, physiology, pathology, and pathophysiology of the female pelvis including embryology and first trimester fetal development, fetal anomalies, and the management of maternal and fetal disease from the sonographic assessment perspective.

Program Restrictions: Must be enrolled in the following Program: DiagnosticSonography .

**BIOL 43902 - Obstetrics and Gynecology Sonography I Lab (1)**

Application of ultrasound scan techniques and imaging protocols of the female pelvis including the vagina, cervix, uterus, ovaries, and adnexa.

Program Restrictions: Must be enrolled in the following Program: DiagnosticSonography .

**BIOL 43903 - Obstetrics and Gynecology Sonography 2 (3)**

The continuation of BIOL 43901 with the introduction of the normal anatomy, anomalies, pathology, and pathophysiology of the developing human fetus and female pelvis in the second and third trimester. Emphasis will be placed on the sonographic features, clinical presentations, and scan protocols.

Program Restrictions: Must be enrolled in the following Program: DiagnosticSonography .

**BIOL 43904 - Obstetrics and Gynecology Sonography 2 Lab (1)**

Application of ultrasound scan techniques and imaging protocols of the gravid female pelvis.

Program Restrictions: Must be enrolled in the following Program: DiagnosticSonography .

**BIOL 44000 - Management/Methods Patient Care 2 (1)**

Skills in problem solving, critical thinking, and decision-making are developed as well as oral and written communication skills. Career skills are enhanced through the interview process, resume writing, and administrative duties including: budgeting, medical and legal considerations, and political issues affecting health care. Special emphasis is placed on research methods, medical law and ethics, and scheduling guidelines. Focus on basic measures necessary to provide quality patient care. Basic principles of record keeping and maintaining confidentiality of information are explained.

Program Restrictions: Must be enrolled in one of the following Programs: Nuclear Medicine Technology or Radiation Therapy .

**BIOL 44101 - Vascular Sonography 1 (2)**

The first of a multi-course sequence assessing the anatomy, pathology, and related hemodynamics of the vascular system from the sonographic imaging perspective. Pathology, clinical signs, and systems, applicable laboratory values, pathophysiology, and differential diagnosis will be presented.

Program Restrictions: Must be enrolled in the following Program: DiagnosticSonography .

**BIOL 44102 - Vascular Sonography 1 Lab (1)**

Application of ultrasound scan techniques and imaging protocols of the upper and lower extremity arterial systems and the extracranial duplex.

Program Restrictions: Must be enrolled in the following Program: DiagnosticSonography .

**BIOL 44103 - Vascular Sonography 2 (2)**

The second of a multi-course sequence assessing the anatomy, pathology, and related hemodynamics of the vascular system from the sonographic imaging perspective. Pathology, clinical signs, and systems, applicable laboratory values, pathophysiology, and differential diagnosis will be presented.

Program Restrictions: Must be enrolled in the following Program: DiagnosticSonography .

**BIOL 44104 - Vascular Sonography 2 Lab (2)**

Application of ultrasound scan techniques and imaging protocols of the upper and lower extremity venous systems, liver Doppler, and renal Doppler.

Program Restrictions: Must be enrolled in the following Program: DiagnosticSonography .

**BIOL 44200 - Computed Tomography and Cross-Sectional Anatomy (2)**

This course is designed to present fundamental concepts and principles of computed technology and its role in medical imaging. Specific topics include physics and instrumentation of CT scanning, image production, and cross-sectional anatomy of the head, neck, thorax, abdomen, and pelvis. Emphasis placed on patient consideration, patient safety, and radiation protection.

Program Restrictions: Must be enrolled in one of the following Programs: Nuclear Medicine Technology , Radiation Therapy or Radiography .

**BIOL 44300 - Principles of Ultrasound Physics II (2)**

Continuation of the study of the fundamental principles of diagnostic ultrasound physics and instrumentation. Study of Doppler physics, spectral and color flow principles and instrumentation, artifacts and QA, plus a review of bioeffects, safety and AIUM guidelines.

Program Restrictions: Must be enrolled in the following Program: DiagnosticSonography .

**BIOL 44400 - Clinical Education 3 (3)**

A continuation of BIOL 35100 that builds on the practical implementation of the sonographic imaging and patient care processes in a clinical setting where student observe, assist, and perform a variety of sonographic examinations under the guidance of a registered diagnostic sonographer. Emphasis will be placed on abdomen, superficial structures, obstetric, gynecology, and vascular exams.

Prerequisite: BIOL 35100 (may be taken concurrently)

Program Restrictions: Must be enrolled in the following Program: DiagnosticSonography .

**BIOL 44501 - Pediatric and Breast Sonography (1)**

An introduction to the anatomy, anomalies, pathology, and pathophysiology of the pediatric abdomen, pediatric gastrointestinal tract, neonatal spine, infant hips, neurosonography, and breast. Comparative diagnostic imaging modality relating to anatomy and pathology of the breast will also be reviewed.

Program Restrictions: Must be enrolled in the following Program: DiagnosticSonography .

**BIOL 44600 - Diagnostic Nuclear Imaging Clinical Practicum II (4)**

Supervised clinical education that gives the student the opportunity to perform a variety of patient procedures on both SPECT, SPECT/CT, PET and PET/CT imaging systems for all diagnostic, therapeutic, non-imaging, in-vivo and in-vitro procedures. Clinical competencies developed in patient care, positioning techniques, analyzing images, and the selection of imaging parameters and collimators. Knowledge of integrated computer systems designed for use with clinical gamma cameras, SPECT, SPECT/CT, PET, PET/CT images. The clinical practicum is designed to promote independent critical thinking, balanced responsibility, organization and accountability in the student. Students will demonstrate competence in all procedures presented.

Program Restrictions: Must be enrolled in the following Program: Nuclear Medicine Technology .

**BIOL 44800 - Clinical Nuclear Medicine Procedures II (3)**

Emphasis on theory and techniques of clinical procedures used in nuclear medicine imaging. Areas emphasized include patient care, developing acquisition parameters, imaging techniques, radionuclide identification, energies, half-lives, and principles of radionuclides in imaging and non-imaging procedures. Students will continue to develop an increased degree of competence in their performance of the skills related to critical thinking and problem solving.

Program Restrictions: Must be enrolled in the following Program: Nuclear Medicine Technology .

**BIOL 44900 - Quality Control (2)**

Emphasis on the evaluation of the performance of scintillation cameras by assessing camera uniformity, detector spatial linearity, and resolution checks and SPECT quality control procedures. The quality control practicum will encourage the student to maintain principles of good record keeping by maintaining the required records for checking computer parameters settings and data interface. Knowledge of the operation and performance of survey meters, dose calibrators, scintillation probes, well counters, and film processors.

Program Restrictions: Must be enrolled in the following Program: Nuclear Medicine Technology .

**BIOL 45000 - Radionuclide Chemistry and Radiopharmacy (3)**

The chemical, physical, and biological properties of radiopharmaceuticals used in diagnosis and therapy. Emphasis is given to the preparation, calculation, identification, administration, and disposal of radiopharmaceuticals. Performance of all radionuclide quality control and quality assurance procedures. Principles of decay and half-life, tissue localization, chemical impurities, generator systems, dose preparation, and techniques of good laboratory practices and cell labeling.

Program Restrictions: Must be enrolled in the following Program: Nuclear Medicine Technology .

**BIOL 45100 - Specialty Sonography (2)**

Study of abdominal, OB, and superficial parts pathologies and sonographic patterns. Comparison of normal sonographic patterns with pathologic appearances, clinical symptoms and labs, differentials, and related organ involvement. Introduction to musculoskeletal imaging, organ transplant evaluation, and the abdominal cavity and GI Tract. Discussion of obstetrical procedures including the Biophysical Profile, post-partum examination, reproductive assistance, and assessment of Intrauterine Growth Restriction parameters. A discussion of RMI is presented.

Program Restrictions: Must be enrolled in the following Program: DiagnosticSonography .

**BIOL 45200 - Radiation Biology (1-3)**

Knowledge of cell structure and function as a basis for understanding cellular and organ responses to the effects of ionizing radiation, radionuclides, and radiation oncology and protection. Understanding of units of exposure, organ dose calculation and body distribution.

Program Restrictions: Must be enrolled in one of the following Programs: Nuclear Medicine Technology , Radiation Therapy or Radiography .

**BIOL 45300 - Clinical Education 4 (4)**

A continuation of BIOL 44400 that builds on the practical implementation of the sonographic imaging and patient care processes in a clinical setting where student observe, assist, and perform a variety of sonographic examinations under the guidance of a registered diagnostic sonographer. Emphasis will be placed on abdomen, superficial structures, obstetric, gynecology, and vascular exams. The opportunity to rotate through specialty clinics will present including; pediatric, musculoskeletal, breast, interventional radiology, and the vascular lab.

Prerequisite: BIOL 44400 (may be taken concurrently)

Program Restrictions: Must be enrolled in the following Program: DiagnosticSonography .

**BIOL 45400 - Radiographic Pathology (1)**

Pathological conditions will be discussed as they present radiographically. Emphasis will be placed on appropriate technical factor adjustments to compensate for additive and destructive disease processes. The goal of this course is to increase the student awareness of pathology and how it impacts radiographic examinations.

Program Restrictions: Must be enrolled in the following Program: Radiography .

**BIOL 45501 - Professional Research (2)**

This course emphasizes both research and accreditation procedures of a sonography program with original research presented using oral and graphic methods as a group project.

Program Restrictions: Must be enrolled in the following Program: DiagnosticSonography .

**BIOL 45600 - Clinical Correlations/Pathology (2)**

Focus on the study of the structure and function of human cells, tissues, organs, and systems. Clinical interpretations of organ systems with emphasis on immunology, and anatomy and physiology, which will provide a basis for understanding abnormal or pathological conditions as applied to nuclear medicine. Causes, symptoms, and treatments of disease are discussed as well as its effects on the images. In addition, the student is scheduled to observe the interpretation of images with the physician staff.

Program Restrictions: Must be enrolled in the following Program: Nuclear Medicine Technology .

**BIOL 45700 - Technical Radiation Oncology II (2)**

This course provides the student therapist with advanced technical aspects of radiation therapy. Discussion will include modalities of treatment and the distinctive properties of each patient setup consideration. Also provides sessions on concepts of treatment techniques and treatment planning rationale.

Prerequisite: BIOL 32900 (may be taken concurrently)

**BIOL 45800 - Radiographic Clinical V (3)**

Students will complete any remaining clinical procedural and general patient care competencies during this clinical course. Students will be rotated through areas where competencies are still needed. The focus of this clinical course will be for students to further develop their clinical skills in preparation for an entry-level position as a radiographer upon program completion. Terminal competency evaluations will conclude during this course. Students will continue modality (observation) rotations during this course and continue operating room, CT, and Interventional Radiology rotations.

Program Restrictions: Must be enrolled in the following Program: Radiography .

**BIOL 45801 - Radiographic Clinical 6 (3)**

This course continues to provide a hospital setting in which students continue to develop proficiency levels in skills introduced in previous Radiographic Procedures courses and practiced in previous clinical radiography courses. Students will also rotate through modalities in order to gain knowledge of other aspects of medical imaging. Execution of radiographic procedures will be conducted under direct and indirect supervision.

**BIOL 45802 - Radiographic Clinical 7 (3)**

Students must complete any remaining clinical procedural and general patient care competencies during this clinical course. Students will be rotated through areas where competencies are still needed. The focus of this clinical course will be for students to further develop their clinical skills in preparation for an entry-level position as a radiographer upon program completion.

**BIOL 45900 - ARRT Review (3)**

This course is designed to review materials presented throughout the curriculum. The intent of this course is to prepare students for the certification examination in radiography administered by the American Registry of Radiologic Technologists (ARRT). A hybrid of on-line activities, classroom discussions, with problem-solving / self-assessment activities will be utilized.

Program Restrictions: Must be enrolled in the following Program: Radiography .

**BIOL 47000 - Great Books in Biology (1)**

Great Books courses will examine pieces of literature, both current and historically relevant, that have had significant impact on the way we perceive the world around us. Course content may include multi-media presentations and ancillary compositions in addition to the text being examined. Great Books in Biology will cover topics in the living world in general from the micro to the macroscopic.

**BIOL 47200 - Great Books in Microbiology (1)**

Great Books courses will examine pieces of literature, both current and historically relevant, that have had significant impact on the way we perceive the world around us. Course content may include multi-media presentations and ancillary compositions in addition to the text being examined. This class will focus on the interactions between microbes and other forms of life, particularly humans.

**BIOL 47600 - Great Books in Ecology (1)**

Great Books courses will examine pieces of literature, both current and historically relevant, that have had significant impact on the way we perceive the world around us. Course content may include multi-media presentations and ancillary compositions in addition to the text being examined. This course is an exploration of ecological concepts framed within the context of contemporary ecological research. The discussion format of the course gives students a chance to reflect upon ecological research/observations within this applied setting.

**BIOL 47700 - Great Books in Genetics (1)**

Great Books courses will examine pieces of literature, both current and historically relevant, that have had significant impact on the way we perceive the world around us. Course content may include multi-media presentations and ancillary compositions in addition to the text being examined. Great Books in Genetics will examine books that address topics brought about from the advancement of the field of genetics and the potential social, legal and ethical implications.

**BIOL 47900 - Pharmacology (2)**

This upper division elective is a seminar style course that will introduce the student to the basic rationale for understanding current drug therapy. Emphasis will be placed on drug classifications, mechanisms of action, pharmacokinetics, and therapeutic application(s). We will examine experimental design, address model validity, and develop a deeper appreciation of the difficulties that occur in whole animal/organism studies. Students will be expected to consider the influence(s) of age, sex, health and other environmental factors that affect the efficacy of pharmaceutical agents. Ultimately, student learning will be assessed through in-class discussion, clinically based critical thinking questions, student presentations, as well as traditional tests.

Prerequisite: BIOL 35500 (may be taken concurrently) or BIOL 35700 (may be taken concurrently)

**BIOL 49000 - Undergraduate Research (1)**

Students gain practical research experience by setting up experiments, testing hypotheses, collecting data, reporting results, and forming conclusions from their analyses. Research projects can be a continuation of pre-existing research projects or student-inspired. Successful projects are expected to be presented at scientific meetings and/or submitted for publication. This course is intended for Biology majors only.

Class Restrictions: Must be enrolled in one of the following Classes: Junior, Sophomore or Senior.

**BIOL 49600 - Biology Senior Capstone (2)**

Working in association with a member of the Biology faculty, the student will write a comprehensive literature review of a topic approved by the instructor. Upon successful completion of the paper, the student will submit and present this paper for approval by the Biology faculty. All students enrolling in Senior Capstone must have successfully completed at least one Biology Journal Club. This course partially fulfills the advanced writing requirement for Biology and Environmental Science majors.

Prerequisite: BIOL 38000 or BIOL 38100 or BIOL 38200 or BIOL 38300 or BIOL 38400 or BIOL 38500

Attributes: Advanced Writing

**BIOL 49700 - Special Topics (1-4)**

Special Topics courses are offered periodically, in the fall, spring or summer, to upper-division students who wish to expand their knowledge on a particular subject. Such courses are often presented in a seminar format and require significant student participation. These courses are designed to encourage a greater understanding of topics covered in earlier courses so as to prepare students for future challenges.

**BIOL 49701 - ST: Pathophysiology - Survey of Human Disease (3)****BIOL 49702 - Special Topics: Oral Microbiology (3)****BIOL 49900 - Independent Study (1-4)**

Students wishing to undertake special studies in Biology may design a topic to fit their needs. The topic must be coordinated with the biology faculty.

Class Restrictions: Must be enrolled in one of the following Classes: Junior or Senior.