

# NATURAL SCIENCES

## Courses

### Our Courses

#### **NSCI 1010. Physical Sciences: From Past to Present. (3 Credits)**

Designed to introduce the non-science major to the development of concepts and theories in chemistry and physics. Topics will include atomic theory, interactions of energy and matter, light, and astronomy. Laboratory sessions will complement the lecture topics.

**Attribute:** PSCI.

#### **NSCI 1020. Physical Science: Today's World. (3 Credits)**

This course will introduce the non-science major to the applications of physics and chemistry to medical, industrial, and environmental issues. Laboratory sessions will complement the lecture topics.

**Attributes:** ENST, ESNS, ESPS, PSCI.

#### **NSCI 1030. Human Function and Dysfunction. (3 Credits)**

Introduces the non-science major to intrinsic and extrinsic factors affecting the human body. Topics include genetic engineering, neuroscience, behavior, and disease. Laboratory sessions will complement the lecture topics.

**Attributes:** BESN, BIOE, LSCI.

**Prerequisites:** NSCI 1010 or NSCI 1020.

#### **NSCI 1040. People and the Living Environment. (3 Credits)**

Introduces the non-science major to the place of humans in global biological systems. Topics include principles of population and community ecology, learning and behavior, evolution and sustainability. Laboratory sessions will complement the lecture topics.

**Attributes:** ENST, ESLS, ESNS, INST, ISIN, LSCI, PJEN, PJST, SOIN, URST.

**Prerequisites:** NSCI 1010 or NSCI 1020.

#### **NSCI 1050. Health and Disease I. (3 Credits)**

Designed to introduce the non-science major to basic and applied physics and chemistry impacting human health. Topics include: radiation, medical imaging, pharmacology, toxicology, and biochemistry. Laboratory sessions will complement the lecture topics. This is the first of a two-course sequence. Health and Disease II (NSCI 1051) must be taken to complete the Physical and Life science core requirements.

**Prerequisites:** MATH 1100 or MATH 1203 or MATH 1206 or CISC 1100 or CISC 1400 or CISC 1600.

#### **NSCI 1051. Health and Disease II. (3 Credits)**

Designed to introduce the non-science major to basic and applied life sciences as they impact human health. Topics to include diseases associated with genetic, pathogenic, immunologic and neurologic dysfunction, and current and future treatments of these disorders. Laboratory sessions will complement the lecture topics. This is the second of a two-course sequence that fulfills the science core requirement.

**Prerequisite:** NSCI 1050.

#### **NSCI 1321. General Chemistry Lecture I. (4 Credits)**

An introductory course covering treachemical bonding, thermochemistry, properties of gases. Lecture: three hours; recitation: one hour. (Every fall.) Four-credit courses that meet for 150 minutes per week require three additional hours of class preparation per week on the part of the student in lieu of an additional hour of formal instruction.

**Attributes:** ENST, ENVS, ESNS, ESPS, NEUR.

**Prerequisites:** MATH 1203 (may be taken concurrently) or MATH 1206 (may be taken concurrently) or AP Mathematics: Calculus AB with a score of 004.

**Corequisite:** NSCI 1331.

**Mutually Exclusive:** CHEM 1321.

#### **NSCI 1322. General Chemistry Lecture II. (4 Credits)**

A continuation of NSCI 1321. Properties of liquids, solids and solutions; chemical kinetics, equilibria, and thermodynamics. Lecture: three hours; recitation: one hour. Four-credit courses that meet for 150 minutes per week require three additional hours of class preparation per week on the part of the student in lieu of an additional hour of formal instruction.

**Attributes:** ENVS, NEUR.

**Prerequisite:** NSCI 1321.

**Corequisite:** NSCI 1332.

**Mutually Exclusive:** CHEM 1322.

#### **NSCI 1331. General Chemistry Lab I. (2 Credits)**

The laboratory to accompany NSCI 1321. Lab fee.

**Corequisite:** NSCI 1321.

**Mutually Exclusive:** CHEM 1331.

#### **NSCI 1332. General Chemistry Lab II. (2 Credits)**

The laboratory to accompany NSCI 1322. Lab fee.

**Prerequisite:** NSCI 1331.

**Corequisite:** NSCI 1322.

**Mutually Exclusive:** CHEM 1332.

#### **NSCI 1403. General Biology Lecture I. (3 Credits)**

Theoretical and experimental aspects of biology through study of structural and functional interrelationships at the cellular and organismal levels. Chemical and cellular basis of life, integrating and functional systems and maintenance of homeostasis. Lecture: three hours. (Every Fall)

**Attributes:** ENST, ENVS, ESLS, ESNS, NEUR.

**Corequisite:** NSCI 1413.

**Mutually Exclusive:** BISC 1403.

#### **NSCI 1404. General Biology Lecture II. (3 Credits)**

Theoretical and experimental aspects of biology through study of structural and functional interrelationships of various aspects of self-perpetuation. Genetics and reproduction, adaptation, and organism-environment interaction. Lecture: three hours.

**Attributes:** ENST, ENVS, ESLS, ESNS, NEUR.

**Prerequisites:** NSCI 1403 or NSCI 1423.

**Corequisite:** NSCI 1414.

**Mutually Exclusive:** BISC 1404.

#### **NSCI 1413. General Biology Lab I. (2 Credits)**

The laboratory to accompany NSCI 1403. Lab fee.

**Corequisite:** NSCI 1403.

**Mutually Exclusive:** BISC 1413.

#### **NSCI 1414. General Biology Lab II. (2 Credits)**

The laboratory to accompany NSCI 1404. Lab fee.

**Prerequisite:** NSCI 1413.

**Corequisite:** NSCI 1404.

**Mutually Exclusive:** BISC 1414.

**NSCI 1423. Concepts in Biology Lecture I. (3 Credits)**

The goal of this course is to provide insight into the fundamentals of Biology. Particular areas of emphasis include understanding the theoretical and experimental aspects of the biology of animals emphasizing structural and functional interrelationships at the cellular and organismal levels. Topics include cellular and biochemical basis of life, functional anatomy, neurobiology and homeostasis. Lecture: three hours. (Every Fall)

**Attributes:** ENST, ESLS, ESNS, NEUR.

**Corequisite:** NSCI 1433.

**NSCI 1424. Concepts in Biology Lecture II. (3 Credits)**

Theoretical and experimental aspects of the biology of animals emphasizing structural and functional aspects of self-perpetuation. Topics include reproduction, heredity, behavioral biology, evolution and organism-environment interactions. Lecture: three hours. (Every Spring)

**Attributes:** ENST, ESLS, ESNS, NEUR.

**Prerequisites:** NSCI 1423 or NSCI 1403.

**Corequisite:** NSCI 1434.

**NSCI 1433. Concepts in Biology Lab I. (2 Credits)**

The laboratory to accompany NSCI 1423. Lab fee.

**Attribute:** ENV5.

**Corequisite:** NSCI 1423.

**NSCI 1434. Concepts in Biology Lab II. (2 Credits)**

The laboratory to accompany NSCI 1424. Lab fee.

**Attribute:** ENV5.

**Prerequisite:** NSCI 1433.

**Corequisite:** NSCI 1424.

**NSCI 1501. General Physics Lecture I. (3 Credits)**

The fundamental physics course for majors in natural sciences. A study of physical quantities, phenomena, and laws in mechanics, heat and sound. Lecture: three hours; recitation: one hour. (Every fall.)

**Attributes:** ENST, ESNS, ESP5.

**Prerequisites:** MATH 1203 or MATH 1206 or MATH 12AB or MATH 12BC.

**Corequisite:** NSCI 1511.

**NSCI 1502. General Physics Lecture II. (3 Credits)**

The continuation of General Physics I with studies in electromagnetism, optics, relativity, atomic and nuclear physics. Lecture: three hours; recitation: one hour. (Every spring.)

**Prerequisite:** NSCI 1501.

**Corequisite:** NSCI 1512.

**NSCI 1511. General Physics Lab I. (1 Credit)**

The laboratory to accompany NSCI 1501. Lab fee.

**NSCI 1512. General Physics Lab II. (1 Credit)**

The laboratory to accompany NSCI 1502. Lab fee.

**Prerequisites:** NSCI 1511 or PHYS 1511.

**NSCI 1701. Physics I. (3 Credits)**

A study of mechanics, thermodynamics, electricity and magnetism, optics and atomic physics.

**Prerequisites:** MATH 1207 or AP Mathematics: Calculus BC with a score of 004.

**Corequisites:** NSCI 1511, NSCI 1703.

**Mutually Exclusive:** PHYS 1701.

**NSCI 1702. Physics II. (3 Credits)**

Continuation of NSCI 1701.

**Prerequisites:** NSCI 1701 or PHYS 1701.

**Corequisites:** NSCI 1512, NSCI 1704.

**Mutually Exclusive:** PHYS 1702.

**NSCI 1703. Physics I Recitation. (0 Credits)**

Discussion and problem solving on topics to be covered in NSCI 1701 Physics I.

**Corequisite:** NSCI 1701.

**NSCI 1704. Physics II Recitation. (0 Credits)**

Discussion and problem solving on topics to be covered in NSCI 1702 Physics II.

**NSCI 1999. Tutorial. (1 Credit)**

Independent research and reading with supervision from a faculty member.

**NSCI 2010. Global Ecology Lecture. (3 Credits)**

An introduction to the principles of ecology, with emphasis on global environmental problems of the present day. The interaction of biological principles with social, political and economic systems. Selected topics include the ecology of global habitats, population biology, air and water pollution, waste disposal and environmental impacts. (Fall, even years).

**Attributes:** ENST, ENV5, ESLS, ESNS, INST, ISIN, PJEN, PJST.

**Prerequisites:** NSCI 1030 or NSCI 1040 or NSCI 1051 or NSCI 1404 or NSCI 1424 or HPLC 1604.

**NSCI 2011. Global Ecology Lab. (2 Credits)**

The laboratory to accompany NSCI 2010. Lab fee.

**Prerequisite:** NSCI 2010 (may be taken concurrently).

**NSCI 2018. Biology of Aging. (3 Credits)**

The emphasis in this course is on present knowledge regarding biological, anatomical, physiological, and cytological changes in people during the aging process. Topics include somatic mutation, cancer and changes in the genetic material, immune systems in aging, free radicals, hormones, sensory systems, neurobiology of aging, and possible directions for future research. (Spring, odd years).

**Attributes:** DISA, NECM, NEUR.

**Prerequisites:** NSCI 1404 or NSCI 1424 or HPLC 1604.

**NSCI 2020. An Introduction to Geology. (3 Credits)**

This course covers the basic principles of physical geology and looks at the Earth holistically in time and space, and across different spheres (atmosphere-biosphere-hydrosphere-lithosphere).

**Attributes:** ENSE, ENST, ENV5, ESP5, PSCI.

**NSCI 2040. Research Design and Analysis. (3 Credits)**

Modern methods in the natural sciences generate an embarrassment of riches with respect to data. Scientists need effective methods for acquiring, interpreting, and presenting data. This course provides an overview of the theory and practice of data handling in the modern natural sciences. Topics will include efficient and effective study designs, statistical and graphical aids to summarizing, presenting, and drawing conclusions from data, and accessing and drawing conclusions from biological data bases. The course will reflect the fact that the data handling today is heavily computer based. (Annually in the spring or fall).

**Attribute:** NEUR.

**Prerequisites:** (NSCI 1404 and NSCI 1414) or (NSCI 1424 and NSCI 1434) or (HPLC 1604) and (MATH 1206 or MATH 1203).

**NSCI 2060. Environment: Science, Law, and Policy. (3 Credits)**

Using problem-based investigations and case studies, students will examine scientific, legal and policy aspects of selected topics. The course includes field trips to environmentally sensitive sites and guest speakers.

**Attributes:** ENST, ENV5, EPLE, ESEL, ESLS, ESNS, ESPL, ESP5, LPGP, SOIN, URST.

**Prerequisites:** (NSCI 1404 and NSCI 1414) or (NSCI 1424 and NSCI 1434) or NSCI 1040 or HPLC 1604.

**NSCI 2122. Immunology Lecture. (3 Credits)**

(Formerly NSCI 2012 or 2022.) An introduction to the concepts of immunology, including theory, clinical applications and techniques.

**Attributes:** NECM, NEUR.

**Prerequisites:** (NSCI 1404 and NSCI 1414 or HPLC 1604 or NSCI 1424 and NSCI 1434) and (NSCI 1322 and NSCI 1332).

**Mutually Exclusive:** NSCI 2012, NSCI 2022.

**NSCI 2141. Vertebrate Anatomy Lecture. (3 Credits)**

(Formerly NSCI 2041.) The origin, relationships and anatomy of vertebrates. Current concepts in evolutionary theory. Emphasis is given to mammals, particularly humans. A systems approach is used to consider the embryological origins as a guide to the anatomical structures in the adult. It is recommended to have previously taken NSCI 3154.

**Attributes:** NECM, NEUR.

**Prerequisites:** (NSCI 1404 and NSCI 1414) or (NSCI 1424 and NSCI 1434) or HPLC 1604.

**Corequisite:** NSCI 2841.

**Mutually Exclusive:** NSCI 2041.

**NSCI 2142. Paleoecology Lecture. (3 Credits)**

An exploration of life and landscapes of the deep past with a focus on the last 2.5 million years of ecosystem change or islands and continents. Readings will be drawn from current sources and peer reviewed publications. Laboratory work will include evaluation of pollen, spores and micro-charcoals data from lake and bog deposits. With a view to understanding current trends, we will examine how prehistoric animal and floral communities have transformed with climate and the arrival of modern humans.

**Attributes:** ENSE, ENST, ENVS, ESLS, ESNS.

**Prerequisites:** (NSCI 1404 and NSCI 1414) or (NSCI 1424 and NSCI 1434) or HPLC 1604.

**Corequisite:** NSCI 2842.

**NSCI 2800. Internship. (2 Credits)**

Internship.

**NSCI 2822. Immunology Lab. (2 Credits)**

(Formerly part of NSCI 2022.) Optional lab for NSCI 2122 Immunology. Laboratory work will include hematology, serology, and antibody biochemistry. Laboratory section meets weekly. Spring even years. Lab fee.

**Prerequisites:** (NSCI 1404 and NSCI 1414 or NSCI 1424 and NSCI 1434 or HPLC 1604) and (NSCI 1332 and NSCI 1322).

**Corequisite:** NSCI 2122.

**NSCI 2841. Vertebrate Anatomy Lab. (2 Credits)**

(Formerly part of NSCI 2041.) Lab for NSCI 2141, required. Lab fee.

**Prerequisites:** (NSCI 1404 and NSCI 1414) or HPLC 1604.

**Corequisite:** NSCI 2141.

**NSCI 2842. Paleoecology Lab. (2 Credits)**

Lab work will include evaluation of pollen, spores and micro-charcoal data from lake and bog deposits. Lab work may also include field work. With a view to understanding current trends, we will examine how prehistoric animal and floral communities have transformed with climate and the arrival of modern humans.

**Prerequisites:** NSCI 1322 and (NSCI 1404 and NSCI 1414) or (NSCI 1424 and NSCI 1434) or HPLC 1604.

**Corequisite:** NSCI 2142.

**NSCI 2999. Tutorial. (2 Credits)**

Independent research and reading with supervision from a faculty member.

**NSCI 3014. Molecular Ecology Lab. (2 Credits)**

This course will introduce students to the field of Molecular Ecology, the use of molecular methods to address evolutionary, behavioral, conservation, and ecological questions. This laboratory course will provide hands-on training in molecular ecology experimental and analytical skills. In addition, students will gain experience in experimental design, the critical evaluation of the scientific literature and in written and oral scientific communication. This will be accomplished in the context of semester projects that the students design and implement.

**Prerequisites:** (NSCI 1404 and NSCI 1414) or (NSCI 1424 and NSCI 1434) or (HPLC 1604).

**NSCI 3101. Biological Modeling. (4 Credits)**

Computational models and methods have become vital techniques for 21st-century scientific research in the biological sciences. New experimental technologies and increasingly powerful tools for gathering, storing, and processing large amounts of experimental data require flexible methods for analyzing and understanding these modern biological datasets. Basic programming and analytical and computational modeling methods are now required skills for scientists to understand, analyze, and present data in biology and neuroscience. In this course, we will provide students with the basic skills of programming, data analysis, and mathematical modeling for researchers in the biological sciences using the programming language Python. Students will learn techniques from linear algebra and review basic calculus ideas in the service of understanding and implementing mathematical models used in biology and neuroscience. The course will consist of two lectures a week which will introduce students to the necessary biological, mathematical, statistical, and programming concepts, and a 2.5 hour weekly recitation where students will work in pairs to implement the ideas they've learned in class. Note: Four-credit courses that meet for 150 minutes per week require three additional hours of class preparation per week on the part of the student in lieu of an additional hour of formal instruction.

**Attributes:** ENSE, ENVS, NESY, NEUR.

**Prerequisites:** NSCI 1404 or NSCI 1424 or HPLC 1604 and (NSCI 2040 or MATH 1205).

**Corequisite:** NSCI 3102.

**NSCI 3102. Biological Modeling Recitation. (0 Credits)**

This recitation is part of the Biological Modeling lecture course. Students will work in pairs to implement ideas and topics from NSCI 3101.

**Attribute:** ENVS.

**Prerequisites:** NSCI 1404 or NSCI 1424 or HPLC 1604 and (NSCI 2040 or MATH 1205).

**Corequisite:** NSCI 3101.

**NSCI 3121. Organic Chemistry Lecture I. (4 Credits)**

(Formerly NSCI 3021.) Comprehensive organic chemistry course which includes an understanding of how structure relates to activity, pi bond chemistry, stereochemistry, elimination versus substitution reactions, and an introduction to infrared and nuclear magnetic resonance spectroscopies, and mass spectroscopy.

**Attributes:** ENSE, ENVS.

**Prerequisites:** NSCI 1322 or CHEM 1322.

**Corequisite:** NSCI 3821.

**Mutually Exclusive:** CHEM 2521.

**NSCI 3122. Organic Chemistry Lecture II. (4 Credits)**

(Formerly NSCI 3031.) A continuation of NSCI 3121. Topics include electrophilic aromatic substitution carbonyl chemistry, condensation reactions, UV and mass spectroscopy, proteins, carbohydrates and lipids. Every spring. Four-credit courses that meet for 150 minutes per week require three additional hours of class preparation per week on the part of the student in lieu of an additional hour of formal instruction.

**Attributes:** ENSE, ENVS, NECM, NEUR.

**Prerequisite:** NSCI 3121.

**Corequisite:** NSCI 3822.

**NSCI 3133. Genetics Lecture. (3 Credits)**

(Formerly NSCI 3023 or 3033.) This course will examine aspects of genetics including the biological basis of inheritance, the molecular and cellular biology of genes, genetic engineering, and evolution and population genetics. We will focus on classic and cutting edge genetic experiments, tools, and model organisms in order to understand fundamental genetics principles and to explore real-world applications in medicine, agriculture, and industry.

**Attributes:** ENSE, ENVS, NECM, NEUR.

**Prerequisites:** (NSCI 1404 and NSCI 1414) or (NSCI 1424 and NSCI 1434) or (HPLC 1604) and (NSCI 1331 and NSCI 1332).

**Mutually Exclusive:** BISC 2539, NSCI 3023, NSCI 3033.

**NSCI 3154. Cell and Development Biology Lecture. (3 Credits)**

(Formerly NSCI 3054 or 3044.) Study of growth, patterning, and differentiation in multicellular organisms, with an emphasis on vertebrate and invertebrate model organisms. This course discusses our current understanding of how multicellular organisms are formed based on experiments in classical embryology, cell biology and developmental genetics. This course emphasizes interpretation and analysis of experiments. (Spring, even years)

**Attributes:** NECM, NEUR.

**Prerequisites:** (NSCI 1404 and NSCI 1414 or NSCI 1424 and NSCI 1434 or HPLC 1604) and (NSCI 1322 and NSCI 1332).

**Mutually Exclusive:** BISC 3754, NSCI 3044, NSCI 3054.

**NSCI 3280. Machine Learning Methods for Neural and Biological Data. (4 Credits)**

This course will introduce undergraduate students to introductory machine learning and statistics concepts for use on scientific data, with an emphasis on neuroscience and biological and medical examples. This class is open to students studying both computer science/data science as well as neuroscience and natural science. Students are expected to be familiar with scientific computing in python, and basic ideas in calculus and probability and statistics (derivatives and integrals, as well as random variables, common probability distributions, mean and variance). Some familiarity with linear algebra (e.g., matrix and vector notation and multiplication) is expected. As such, students must have taken introductory calculus, as well as a course in data analysis/statistics and a course in algorithmic modeling. If students have not taken these classes but believe they have sufficient background, permission from the instructor is needed. Familiarity with neuroscience concepts is helpful but not required. Four-credit courses that meet for 150 minutes per week require three additional hours of class preparation per week on the part of the student in lieu of an additional hour of formal instruction.

**Attributes:** NESY, NEUR.

**Prerequisites:** (MATH 1203 or MATH 1206) and (NSCI 2040 or CISC 4631 or PSYC 2000 or CISC 2850) and (NSCI 3101 or CISC 4020 or CISC 2011 or CISC 1800 or CISC 1600).

**NSCI 3821. Organic Chemistry Lab I. (2 Credits)**

(Formerly NSCI 3022.) A laboratory course introducing the student to the experimental techniques of organic chemistry. Lab Fee.

**Attribute:** ENVS.

**Corequisite:** NSCI 3121.

**Mutually Exclusive:** CHEM 2541.

**NSCI 3822. Organic Chemistry Lab II. (2 Credits)**

(Formerly NSCI 3032.) A continuation of NSCI 3821. Lab Fee.

**Attribute:** ENVS.

**Prerequisite:** NSCI 3821.

**Corequisite:** NSCI 3122.

**Mutually Exclusive:** CHEM 2542.

**NSCI 3833. Genetics Lab. (2 Credits)**

(Formerly part of NSCI 3033.) Optional lab for NSCI 3133 Genetics. Lab fee.

**Prerequisites:** (NSCI 1404 and NSCI 1414) or (NSCI 1424 and NSCI 1434) or (HPLC 1604) and (NSCI 1331 and NSCI 1332 and NSCI 3133 (may be taken concurrently)).

**Corequisite:** NSCI 3133.

**Mutually Exclusive:** BISC 2549.

**NSCI 3854. Cell and Development Biology Lab. (2 Credits)**

(Formerly part of NSCI 3054.) Optional lab for NSCI 3154 Cell & Development Biology. Lab fee.

**Prerequisites:** (NSCI 1404 and NSCI 1414 or NSCI 1424 and NSCI 1434 or HPLC 1604) and (NSCI 1332 and NSCI 1322).

**Corequisite:** NSCI 3154.

**NSCI 3999. Tutorial. (3 Credits)**

Independent research and reading with supervision from a faculty member.

**NSCI 4032. Neuroscience Lab. (2 Credits)**

Laboratory course designed to complement Neuroscience (NSCI 4630) or Animal Physiology (NSCI 4112). This course provides hands-on experience that reinforces theoretical knowledge of Neuroscience, including circuits, intrinsic properties of neurons, synaptic communication, and the role of genes in behavior. We use electrophysiological methods to record electrical activity in invertebrate neurons, muscle cells, and plant cells. We also use behavioral approaches using different species to understand the link between neuronal function and behavior. Lab fee.

**Prerequisites:** NSCI 4630 (may be taken concurrently) or NSCI 4112 (may be taken concurrently).

**Mutually Exclusive:** .

**NSCI 4080. Pharmacological Chemistry. (3 Credits)**

This course presents the chemistry of molecular recognition between drugs and their targets (receptors, ion-channels, enzymes and nucleic acids) and how this information is used to design new drugs with specific biological functions. In addition to traditional theories of structure and function in drug design, the course will include the most recent research publications in nanoparticle drug delivery, pharmacogenetics (the study of genetic factors and gene-environment interactions that influence drug delivery, bio-availability, metabolism, clearance, and toxicity) and innovative methods for treating cancer. Ethical considerations of the use and misuse of drugs will also be addressed.

**Prerequisites:** NSCI 3122 and (NSCI 1404 and NSCI 1414) or (NSCI 1424 and NSCI 1434) or (HPLC 1604).

**NSCI 4081. Neurochemistry. (3 Credits)**

This course explores the function of the nervous system on the chemical level, with emphasis on the structure and function of the neurotransmitters and their receptors and psychoactive drugs of use and abuse.

**Attribute:** NECM.

**Prerequisites:** NSCI 3122 (may be taken concurrently) and (NSCI 1404 and NSCI 1414) or (NSCI 1424 and NSCI 1434) or (HPLC 1604).

**NSCI 4112. Human and Comparative Physiology Lecture. (3 Credits)**

This course presents fundamental principles of human physiology using a comparative approach. The focus is on the homeostasis of vital parameters within the body, and the functional and biophysical properties of cells, tissues, and organs that lead to normal and abnormal function. The course also emphasizes how the environment, including stress or enrichment, can impact physiological function at the cellular and systems level. Students should be able to understand the molecular, physiological, and biophysical underpinnings at the cellular, tissue, and systems level. They should also be able to integrate localized function within the context of the whole organism. Formerly NSCI 4012 or 4022.

**Attributes:** ENSE, ENVS, NECM, NEUR.

**Prerequisites:** (NSCI 1404 and NSCI 1414) or (NSCI 1424 and NSCI 1434) or HPLC 1604 and (NSCI 1322 and NSCI 1332).

**Mutually Exclusive:** NSCI 4012, NSCI 4022.

**NSCI 4143. Advanced Microbiology Lecture. (3 Credits)**

(Formerly NSCI 4043.) Study of structural and functional characteristics of bacteria, fungi, viruses, and unicellular and multicellular eukaryotic animal parasites. Topics will include cell structure, physiological pathways, microbial genetics, disease mechanisms, and ecology. Laboratory experiments will acquaint students with techniques of isolation, culture, and identification of organisms from soil, water, food, and air; bacterial genetics and ecology.

**Attributes:** ENSE, ENVS.

**Prerequisites:** HPLC 1604 or (NSCI 1404 and NSCI 1414) or (NSCI 1424 and NSCI 1434) and (NSCI 1322).

**Corequisite:** NSCI 4843.

**Mutually Exclusive:** NSCI 4043.

**NSCI 4144. Microanatomy Lecture. (3 Credits)**

(Formerly NSCI 4044.) Microscopic anatomy of mammalian cells and tissues. Theoretical analysis and practical techniques illustrate the interrelationships of structure and function in tissues and organs. Spring, odd years.

**Attributes:** NECM, NEUR.

**Prerequisites:** (NSCI 1404 and NSCI 1414) or (NSCI 1424 and NSCI 1434) or (HPLC 1604).

**Corequisite:** NSCI 4844.

**Mutually Exclusive:** NSCI 4044.

**NSCI 4153. Biological Chemistry Lecture. (3 Credits)**

An introduction to the chemistry of biological molecules (carbohydrates, proteins, polynucleic acid and their constituents, and lipids), emphasizing their biosynthesis and role as biostructural building blocks. Other specialized topics to be covered include enzyme kinetics, mechanism and regulation; energy conversion and dynamics. (Every fall)

**Attributes:** ENSE, ENVS, NECM, NEUR.

**Prerequisites:** NSCI 3031 or NSCI 3122.

**Mutually Exclusive:** CHEM 4221.

**NSCI 4172. Diverse Biologies/Shared Humanity. (4 Credits)**

This course draws on readings and approaches from biology and literary studies to gain understanding of the diversity of human experience. Students will study the biological (genetic, metabolic, developmental, and neuronal) factors contributing to differences in human behavior, cognition, ability/disability, and appearance. Through the study of first-person narratives, poems, and other texts (including film), students will gain insight into the lived experiences of people they might not otherwise have come to know, even as they deepen their appreciation of the interdependence of self and other. Through reflection on readings in literature and science, students will come to recognize more fully what these disciplinary approaches offer to understanding our place in the world and our responsibilities to one another.

**Attributes:** BEHR, BESN, BIOE, COLI, DISA, ENGL, ICC, PLUR.

**Prerequisites:** (ENGL 2000 or COLI 2000 or CLAS 2000 or MLAL 2000 or HPLC 1201 or HPRH 1001) and (NSCI 1030 or NSCI 1040 or NSCI 1051 or NSCI 1322 or NSCI 1404 or NSCI 1424 or NSCI 1502 or NSCI 1702 or HPLC 1604).

**NSCI 4176. Molecular Biology Lecture. (3 Credits)**

(Formerly NSCI 4076.) This course covers the biology of the gene, including regulation and mechanism of replication, transcription and translation as well as principles of genetic engineering. The course emphasizes interpretation and analysis of experiments. The laboratory focuses on analysis and manipulation of DNA and RNA. (Spring, odd years). Completion of NSCI 3133 or NSCI 4143 are recommended along with required courses.

**Attributes:** NECM, NEUR.

**Prerequisites:** NSCI 3122 and (NSCI 1404 and NSCI 1414) or (NSCI 1424 and NSCI 1434) or (HPLC 1604).

**Mutually Exclusive:** BISC 3752, NSCI 4076.

**NSCI 4222. Science, Technology, and Society Values. (4 Credits)**

This course serves as a capstone seminar for senior natural science majors. Students will explore original literature, the relationship of the natural sciences to other disciplines, and ethical considerations in the sciences. Four-credit courses that meet for 150 minutes per week require three additional hours of class preparation per week on the part of the student in lieu of an additional hour of formal instruction.

**Attributes:** ENVS, EPLE.

**NSCI 4630. Neuroscience. (3 Credits)**

The goal of this course is to provide students majoring in integrative neuroscience or in natural sciences with a sophisticated understanding of neuroscience. The topics covered in the first half of the course focus on fundamental properties of neurons, including intrinsic biophysical properties, synaptic transmission, neurogenetics, and anatomical organization. This knowledge is essential and serves as a foundation for more complex topics in the second half, such as understanding of all sensory systems, circadian rhythms, behavior, and learning and memory. We use several neuroscience texts as well as recently published science literature.

**Attribute:** NEUR.

**Prerequisites:** NSCI 1322 and (NSCI 1404 and NSCI 1414) or (NSCI 1424 and NSCI 1434) or (HPLC 1604).

**Corequisite:** NSCI 4032.

**Mutually Exclusive:** BISC 4532.

**NSCI 4812. Human and Comparative Physiology Lab. (2 Credits)**

(Formerly part of NSCI 4012.) Optional lab for NSCI 4112 Human and comparative Physiology. This course provides hands-on experience that reinforces theoretical knowledge of human and animal physiology, including circuits, intrinsic properties of neurons, synaptic communication, cardiac function, muscle function, lung function, and human brain activity. We use electrophysiological methods to record physiological activity, including: cardiac, respiratory and muscle function in humans, and synaptic activity from invertebrate neurons. Lab fee.

**Corequisite:** NSCI 4112.

**Mutually Exclusive:** .

**NSCI 4843. Advanced Microbiology Lab. (2 Credits)**

(Formerly part of NSCI 4043.) Lab for NSCI 4143, required. Lab fee.

**Corequisite:** NSCI 4143.

**NSCI 4844. Microanatomy Lab. (2 Credits)**

(Formerly part of NSCI 4044.) Lab for NSCI 4144, required. Lab fee.

**Corequisite:** NSCI 4144.

**NSCI 4853. Biological Chemistry Lab. (2 Credits)**

(Formerly NSCI 4065.) A one-semester laboratory course to familiarize advanced students with the research techniques applied to proteins and nucleic acids. Included are subcellular fractionation, spectrophotometry, gel electrophoresis, centrifugation, and column chromatography. Lab fee. (Every semester) Prerequisites: NSCI 3031 or NSCI 3122; corequisite NSCI 4153 or NSCI 4065.

**Prerequisites:** (NSCI 3031 or NSCI 3122) and NSCI 4153 (may be taken concurrently).

**Mutually Exclusive:** CHEM 4231.

**NSCI 4876. Molecular Biology Lab. (2 Credits)**

(Formerly part of NSCI 4076.) Lab for NSCI 4176, required. Lab fee.

**Corequisite:** NSCI 4176.

**NSCI 4999. Tutorial. (4 Credits)**

A laboratory project under faculty supervision is an integral component of the course. One course may be counted as a laboratory elective in the major. (Every semester).