FALL 2015 CHEMISTRY / BIOLOGY ELECTIVES

SB453: Neuroscience and Developmental Biology (3-2-4)
Assistant Professor D. Isaac
This course offers an advanced treatment of neuroscience and developmental biology that builds on both the molecular and cellular background provided in SB251 and the basic principles underlying nervous system function introduced in SB252 and applies them to topics including both somatic and special sensory modalities, initiation, execution and coordination of motor programs and the neuroanatomical organization of the pathways that control these functions. Additional special topics will be introduced on a rotating basis. The course will also use the examples set by studies performed in model organisms to elucidate the mechanisms by which normal development proceeds in higher eukaryotes with an emphasis on neural development. *Prereq: SB252.* ***The course does not count as a chemistry major elective.***

SC221 Chemistry in Modern Warfare (3-0-3)
Dr. Brian Pate
This course will examine the science behind conventional weapons and weapons of mass destruction. The course will begin by examining high explosives and propellants by studying the structure, synthesis, and properties of these materials. The second part of the course will focus on chemical and biological agents to include history, structure, modes of action, detection, protective measures, and methods of decontamination. *Prereq.* SC112

SC451 Bioinorganic Chemistry (3-0-3)
Prof. Joseph Lomax
Life is inorganic, too. Every breath uses the iron protein, hemoglobin, and every step is supported by bone made of calcium salts and driven by phosphate containing molecules such as ATP. This course will shed light on the structure and function of these bioinorganic compounds using a host of techniques such as X-ray diffraction and NMR spectroscopy. *Prereq*. SC335 and SC356 or permission of the department chair.

SC485D: Astrochemistry (3-0-3)
Prof. Robert Ferrante

Astrochemistry is the study of chemistry throughout space. It is an inherently interdisciplinary topic of (literally) universal significance. Although spectroscopy had been used to identify elements in the sun, prior to the dawn of radioastronomy and space exploration in the 50s it was not clear that there was anything "out there" except such already-formed objects as the stars or planets. Furthermore, it was not obvious that we could ever hope to understand the dynamics of their formation or ongoing processes. Now, terrestrial observation, manned exploration and ever more sophisticated space probes have revealed an amazing wealth of detail on the chemistry of distant worlds. By looking at the instruments, methods, data and conclusions, this course will attempt to survey some broad areas of astrochemistry, including processes in molecular clouds that might lead to star formation and planetary nebula; the evolution of such nebula into planets

and their atmospheres; clues available from comets and asteroids about interstellar space; and the possible implications of it all for the development of life, on earth and otherwise. *Prereq*: SC346

SC485F - The Chemistry of Cooking (2-2-3)
Professor Maria Schroeder

This course will investigate the physical processes and chemical reactions involved in cooking. Knowing "kitchen" chemistry will help you understand the basis for many cooking techniques and recipes. Topics will include the basic components of food, chemical transformations in the kitchen, Maillard reactions, how we taste, food toxins, nutrition, and molecular gastronomy. Laboratory experiments will investigate thermal transitions of chocolate, crystal formation in candy, egg protein behavior, food analysis methods, fermentation, and the kinetics of food spoilage. *Prereq: SC216.*

SC485C: Energy Analysis, Policy, and Security (3-0-3)
Professor Jeff Fitzgerald and team.

Access to affordable energy is the single biggest predictor of standard of living and has a significant impact on national competitiveness. Currently the U. S. is enjoying gasoline in the $2 / gallon range. Such was not the case even a year ago and will surely not be the case in the future. This course will present midshipmen with a high-level view of energy analysis, policy, and security, and in particular, how energy affects critical missions of the U.S. military and U.S. national security. The class will cover topics such as (1) underlying energy ***science***, (2) best estimates of energy ***supplies*** and current ***usage*** profiles, (3) current energy ***policy*** in different sectors and policy trends, including salient factors that drive policy such as environmental science and political movements, (4) current ***technology*** for energy feedstock harvesting, fuel development, and likely near/middle/long-term technology developments, (5) ***economics*** of energy development and usage. Underlying all these topics is the omnipresent question: How does innovation, policy, technology, and economics of energy affect the ability of the U.S. military to successfully and efficiently succeed in its various missions?

This course will fulfill a major elective for chemistry majors. However, it will be interdisciplinary; one day each week we will meet concurrently with students taking related courses in oceanography, economics, mechanical engineering and political science to learn about and discuss topics of common interest or hear from guest speakers. The remaining two days each week will be devoted to more in-depth investigation of the relevant chemistry, chemistry-related field trips, etc. This interdisciplinary model will allow students to learn about energy analysis and security from a variety of perspectives and still earn credit for a major elective. *Prerequisite:* SC345

Spring 2016 CHEMISTRY / BIOLOGY ELECTIVES

SB338: Molecular and General Genetics (3-0-3)
Assistant Professor D. Isaac
Students in this course will study the inheritance of traits, starting with basic (Mendelian) genetics and ending with modern molecular biology. The course will examine incomplete dominance, epistasis, pleiotropy, transformation, cloning, genetic *engineering*, imprinting, and experimental techniques. Colisted as SC338. *Prereq: SB251 or SC335.*

SC336: Biochemistry II (3-0-3)
CDR Larry Kennedy
This course will provide advanced treatment of topics covered in SC335, such as biomolecular structure, bioenergetcs and enzyme kinetics, and cover the following new material as well: biosynthesis of amino acids, nucleotides and cofactors; photosynthesis and plant metabolic cycles; signal transduction; molecular genetics; regulation of eukaryotic and prokaryotic gene expression. There will be an introduction to virology, immunology and the metabolism of specialized cells. *Prereq: SC335.*

SC416 - Analytical Chemistry in Forensics (3-0-3)
Professor Graham Cheek

This course is designed to use your knowledge of analytical chemistry to appreciate how modern forensic investigators solve criminal cases. The chemical and instrumental methods covered in the Integrated Laboratory sequence will be applied to important investigations such as sampling a crime scene, DNA fingerprinting, drug detection, arson, bombings, and characterization of fibers and paint. Some "hands-on" experience in laboratory techniques is also planned for this course. In addition, the use of case studies will help the student understand the role of science in the larger world. *Prereq: SC216.*

SC486C: Organic Chemistry of Biological Processes and Medicinal Applications (3-0-3).
Associate Professor Clare Gutteridge
Pharmaceutical drugs are typically small organic molecules designed to participate in a particular biochemical process to bring about an improvement in health. An understanding of the organic mechanism for such a process, coupled an ability to design and synthesize an effective drug molecule, is therefore helpful. This course will explore both of these by building upon the coverage of biochemical processes from SC335 (particularly those associated with disease, with an emphasis on the underlying organic mechanisms involved) and by investigating how drugs are discovered and how they work, focusing on those for infectious disease and/or with military significance. *Prerequisites SC226 and SC335*

SC486D: Biophysical Chemistry (3-0-3)
Asst. Prof. Elizabeth Yates

Biophysical Chemistry is the study of biological systems through the use of theories and methods of the physical sciences. Fundamental principles from biology, physics and chemistry are utilized in the field of biophysics to gain molecular and structural insights into the mechanisms of biological processes. This course will apply the principles of thermodynamics, kinetics and equilibria toward biological systems including proteins, nucleic acids and membranes. This course further develops a physicochemical description of biological systems through physical and chemical explanations of biological phenomenon, as well as physical chemistry theories and experimental methods applied to biological systems to understand their physical properties. Some topics to be covered in the course include protein structure, aggregation and self-assembly, membranes, thermodynamics and interactions, chemical equilibrium, kinetics, spectroscopy, scanning probe microscopy, nanotechnology, surface phenomena and biomacromolecule dynamics. *Prerequisites*: SC345 and SC346