FALL 2017 CHEMISTRY / BIOLOGY ELECTIVES

SB453: Neuroscience and Developmental Biology (3-2-4)
Professor B. Rehill
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. *Prerequisites*: SB252. The course does not count as a chemistry major elective.

SC485D: Biophysical Chemistry (3-0-3)
Asst. Prof. Elizabeth Yates
Everything in biology is based on a chemical or physical foundation. Biophysical chemistry is the study of biological systems through the use of theories and methods of the physical sciences. In this course, we will use fundamental principles originating from the field of physics and chemistry, to gain molecular and structural insights into the mechanisms of biological processes. This course will introduce physical techniques used in the detection and analysis of biomolecules as well as develop the description of the physicochemical properties of such molecules. 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, SC346 or permission of the instructor.

SC416 Analytical Chemistry in Forensic Investigations (3-0-3)
Professor C. Copper
This course will allow you to use your knowledge of chemistry to appreciate how modern forensic investigators solve criminal cases, both high-profile and routine. The ingenuity of the criminal mind can be thwarted by the application of chemical and instrumental methods such as DNA fingerprinting, drug detection, arson investigations, bombings, and characterization of fibers and paint. In the Integrated Laboratory sequence, we have used many of the chemical and instrumental techniques used to solve crimes, and their application to forensics will help you to understand their basic principles and applicability. Some "hands-on" experience in laboratory techniques is also planned for this course. In addition, the use of case studies will help you understand the role of science in the larger world. *Prerequisites*: SC363.

SC485C Nobel Prize-winning Catalysis (3-0-3)
Prof. Shirley Lin
The four Nobel Prizes in Chemistry awarded in 1963, 2001, 2005, and 2010 were given for significant achievements in the area of catalytic synthetic reactions. The history and the state-of-the-art of the chemistry behind each prize will be explored in this seminar-style course. The impact of these transformations on medicine and the production of specialty chemicals will also be discussed. *Prerequisites*: SC226 and SC356 or permission of instructor.

SPRING 2018 CHEMISTRY / BIOLOGY ELECTIVES

SC486F Modern Techniques in Microscopy (3-0-3)
Asst. Prof. R. Calhoun

In 1981, Gerd Binning and Heinrich Rohrer introduced the scanning tunneling microscope (STM) while working at IBM Zurich Research. They would win the Nobel Prize five years later for this work because we could now start to 'see' individual atoms. In the years since dozens of techniques now give us unprecedented views on the nanometer scale. This course will use published journal articles to survey the current landscape of these techniques, a surprising number of which exist here at USNA. *Prerequisites*: SC364

SB431 Microbial Chemistry (2-2-3)
Asst. Prof. Ina O'Carroll

This course will explore the interesting and important interactions that occur between microbes and their surroundings, including human hosts and extreme environments. Species of these "simple" organisms have evolved diverse mechanisms to combat assault by antibiotics, heavy metals, pollutants and extreme irradiation. The lab component of the class will include identifying, cultivating and testing organisms with survival mechanisms of interest. Co-listed as SC431. *Prerequisites*: SB251 and SC335

SC336 Biochemistry II (3-0-3)
Prof. J. Schlessman

This course will expand and build on topics from SC335, such as biomolecular structure, bioenergetics and enzyme kinetics, to cover biosynthesis of amino acids, nucleotides and cofactors; photosynthesis and plant metabolic cycles; signal transduction; molecular genetics; regulation of eukaryotic and prokaryotic gene expression. *Prerequisites*: SC335

SC446 Quantum Chemistry (3-0-3)
Prof. Mark Campbell

The principles of quantum mechanics are reviewed and used to develop molecular orbital theory which is applied to the structure and properties of molecules. Modern quantum chemistry software will be used for electronic structure calculations. *Prerequisites*: SC346

SC351 Chemical Structures by X-Rays (2-2-3)
Assoc. Prof. Wayne Pearson

X-ray diffraction is the most powerful tool for determining the three-dimensional structures of molecules. This course is a practical, hands-on, introduction to modern methods of 3D molecular structure determination by X-ray diffraction. Students will learn the basics of the technique from crystal growth to final structure solution. Prerequisites: SC112, SM219 or SM212

SC486C Global Challenges in Chemistry: Climate Change and Sustainable Energy (3-0-3)
Professor J. Fitzgerald

The popular media is filled with messages from politicians, industrialists, scientists and environmental groups about two major and interconnected challenges facing the U.S. and indeed all of mankind – access to affordable and sustainable energy and global warming due to man-made CO_2 emissions. These challenges will only become more pronounced as developing countries (primarily China and India) seek to attain living standards enjoyed by the U.S. and other developed countries.

This course will present students with an overview of the trade-offs between energy use and the environment. We will critically evaluate the scientific evidence relevant to man-made climate change.

The historical record clearly documents natural variations in climate – is the current warming trend due to human activities? If so, what are appropriate policies? We will also cover basic energy science, current energy usage, the best estimates of energy supplies and developing technologies for energy feedstock harvesting. Energy alternatives which have received recent attention, including "clean" coal, biofuels, nuclear, solar, wind, geothermal, ocean thermal and biomass, will be discussed. The relative advantages and disadvantages of these technologies as well as roadblocks to implementation will be considered. *Pre or corequisite*: SC345 or EM300