

FALL 2023 (AY24) CHEMISTRY / BIOLOGY ELECTIVES

SC486A: Atmospheric Chemistry: Advanced Topics in Physical Chemistry Elective (3-0-3)

Assoc. Prof. Melonie Teichert

This course will extend what students learned in their physical chemistry courses to advanced topics, with a focus on both important foundational research as well as current research trends. Real-world applications, specifically in atmospheric chemistry, will be highlighted. The effects of human activity on air quality and climate will be discussed in contexts such as greenhouse gases, ozone depletion, and pollution. Possible topics to be discussed include advanced kinetics, molecular reaction dynamics, photochemistry, spectroscopy, potential energy surfaces, and statistical mechanics. There will be a focus on the very important connections between the macroscopic world and the molecular level using chemistry content covered previously in the major as well as new topics from this course. Students will consult the primary research literature to complete a final project.

Prerequisites: SC345 and SC346

SC486C: Polymer Synthesis: From ATRP to Ziegler-Natta (3-0-3)

Prof. Shirley Lin

Although the age of synthetic polymers began only in the mid-20th century, by 2015 more than 320 million tons of commodity plastics were manufactured world-wide. In the span of a mere 60 years, synthetic polymers have become an integral part of our lives, appearing in diverse applications ranging from precision drug delivery systems to smart bullet-proof vests. During this course, we will investigate the science behind the production of both large-scale commodity and high-performance polymers and explore the cutting edge of macromolecular design. Students will have opportunities for hands-on experience with polymeric materials throughout the semester.

Prerequisites: SC226, SC262, SC356 (or chair approval)

SC485D: Environmental Organic Chemistry (3-0-3)

Asst. Prof. Jennifer Guerard

Examination of the properties and characterization of natural organic macromolecules in the environment, their role in ecology and chemical cycling, and the fate and transformation of organic contaminants. Topics include partitioning into environmental compartments, chemical and biological transformations, contaminant remediation, applications of advanced measurement techniques including NMR and optical spectroscopy to environmental problems, and introduction to modeling concepts.

Prerequisites: SC225, SC226, SC262 (or chair approval)

SC485E: Chemistry of Food and Cooking (3-0-3)

Prof. Maria Schroeder

This course will investigate the physical processes and chemical reactions involved in food and cooking. Knowing “kitchen” chemistry will help students understand the basis for many cooking techniques and recipes. Topics will include the basic components of food, chemical transformations in the kitchen, Maillard reactions, the science of taste and smell, food analysis, and molecular gastronomy. Demonstrations or “hands-on” activities will investigate the thermal transitions of chocolate, crystal formation in candy, egg protein transformations, and biochemical processes in bread-making. This is a chemistry majors elective that will build on previous chemistry knowledge.

Prerequisites: SC216 (or chair approval)

SPRING 2023 (AY24) CHEMISTRY / BIOLOGY ELECTIVES

SC486A: (3-0-3) Fluorescence Imaging and Spectroscopy (3-0-3)

Asst. Prof. Michael Konopka

Fluorescence detection is a powerful non-invasive tool for monitoring biological and chemical processes with applications ranging from basic research to diagnostics, drug discovery and medical imaging. Instrumentation is so sensitive that it is possible to detect a single molecule and locate it to an accuracy of one-nanometer. This course will begin with the fluorescence principles and expand into specific imaging methods and applications. Topics that will be covered include: fundamentals of fluorescence, optics and image creation, fluorescence probe design, principles of microscopy, photochemistry, live-cell imaging, single-molecule microscopy, image processing and analysis, detectors and cameras, and clinical applications.

Prerequisites: SC345 and SC346 (or chair approval)

SB/SC486: Genomics and Bioinformatics (3-0-3)

Assoc. Prof. Charles Sweet

“The genome is a book that wrote itself, continually adding, deleting and amending over four billion years.” – Matt Ridley

What is the information structure of life? 215 petabytes of information can be stored in the quaternary structural code of a single gram of DNA, far surpassing the information density of traditional storage media. How can we leverage this genetic information for better understanding of the living world and our own wellbeing? This elective course will explore these questions and more as we study biological applications of data science including genomics, proteomics, and metagenomics. Analytical techniques will include DNA and protein homology, structural prediction, sequence validation and interpretation, genome assembly and annotation, taxonomy and systematics, metagenomic processing, diversity analysis, and principal component analysis.

Prerequisites: SB251

SC486D: Chemistry of Drugs, Poisons, and Toxins (3-0-3)

Assoc. Prof. Chris Kinter

This course will explore how biologically relevant compounds are discovered and synthesized. Students will examine how chemical structure relates to biological activity. While studying a variety of pharmaceuticals, the students will look at the role chemist play in the process of discovering, optimizing activity, testing, and bringing drugs to market. The class will also examine the adverse effects of common poisons and agents used as chemical weapons.

Prerequisites: SC225, SC226, SC262 (or chair approval)

SC336: Biochemistry II (3-0-3)

Prof. Virginia Smith

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