Chemistry is the science of molecules. Scientific, medical, and technological phenomena ultimately are understood in terms of molecular structure and interactions. Understanding chemistry is essential to effective work in all sciences, and some knowledge of chemistry is useful in such fields as law, government, business, and art. Many aspects of our high-technology society can be understood better from the viewpoint of chemistry.

The following are typical important chemical problems: the structure of DNA, the molecular details of the resistance of bacteria to penicillin, the chemistry of biofuel production, the synthesis of new molecules that might be expected to have medical applications, the consequences of putting electrons and photons into molecules, the details of what happens as two molecules collide, the fundamental basis of the energies of molecules, and the synthesis of nanomaterials. These are all areas of research by Wesleyan faculty and their undergraduate and graduate coworkers.

FACULTY

Michael A. Calter
BS, University of Vermont; PHD, Harvard University
Professor of Chemistry

Carlos Alberto Jimenez Hoyos
MA, Rice University; PHD, Rice University
Assistant Professor of Chemistry

Joseph L. Knee
BA, SUNY at Binghamton; PHD, SUNY at Stony Brook
Dean of the Natural Sciences and Mathematics; Beach Professor of Chemistry; Professor of Chemistry

Brian Hale Northrop
BA, Middlebury College; PHD, University of California LA
Associate Professor of Chemistry; Associate Professor, Integrative Sciences

Stewart E. Novick
BS, SUNY at Stony Brook; MA, Harvard University; MAA, Wesleyan University; PHD, Harvard University
Joshua Boger University Professor of the Sciences and Mathematics; Professor of Chemistry

Michelle Louise Personick
BA, Middlebury College; PHD, Northwestern University
Assistant Professor of Chemistry

Andrea Roberts
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Associate Professor of the Practice, Chemistry

Irina M. Russu
BS, University of Bucharest; MAA, Wesleyan University; PHD, University of Pittsburgh
E. B. Nye Professor of Chemistry; Professor of Chemistry; Professor, Integrative Sciences

Colin A. Smith
BA, New York University; PHD, University of California San F

Assistant Professor of Chemistry

Erika A. Taylor
BS, University of Michigan; PHD, University of Illinois Urbana
Associate Professor of Chemistry; Associate Professor, Environmental Studies; Associate Professor, Integrative Sciences

T. David Westmoreland
BS, Massachusetts Institute of Technology; PHD, University of North Carolina at Chapel Hill
Associate Professor of Chemistry; Chair, Chemistry; Associate Professor, Integrative Sciences

AFFILIATED FACULTY

Stephen Anthony Cooke
Visiting Scholar in Chemistry

Michael J. Frisch
Research Professor in Chemistry

Rachel D. Lowe
Research Scientist in Chemistry

Herbert M. Pickett
Research Professor in Chemistry

VISITING FACULTY

Anthony P. Davis
BS, USCGA; MS, Ohio State University; PHD, Wesleyan University
Visiting Associate Professor of Chemistry

EMERITI

David L. Beveridge
BA, College of Wooster; MAA, Wesleyan University; PHD, University of Cincinnati
Joshua Boger University Professor of the Sciences and Mathematics, Emeritus; Co-Director, Susan B. and William K. Wasch Center for Retired Faculty

Philip H. Bolton
BS, Michigan State University; MAA, Wesleyan University; PHD, University of California, San Diego
Professor of Chemistry, Emeritus

Joseph W. Bruno
BA, Augustana College; MAA, Wesleyan University; PHD, Northwestern University
Professor of Chemistry, Emeritus

Albert J. Fry
BS, University of Michigan; MAA, Wesleyan University; PHD, University of Wisconsin
E. B. Nye Professor of Chemistry, Emeritus

George A. Petersson
BS, City College; PHD, California Institute Tech
Fisk Professor of Natural Science, Emeritus; Visiting Faculty (Tutorial)

Rex F. Pratt
BS, University of Melbourne; MAA, Wesleyan University; PHD, University of Melbourne
Beach Professor of Chemistry, Emeritus
CHEM118 DNA
This course provides an interdisciplinary view of the DNA molecule and its impact upon medicine, law, philosophy, agriculture, ethics, politics, and society at large. The course has two parts. In the first part, we will learn the chemistry and physics of DNA and the processes by which the information stored in DNA is expressed. In the second part of the course, we will discuss what DNA has done and still can do for us, for example, treat and prevent genetic diseases, improve our food through genetic engineering, achieve criminal justice through genetic fingerprinting, understand the evolutionary origin of humans, and enrich our idea of what it is to be human. The course assumes basic knowledge of chemistry and biology at the general high school level. Independent exploration and inquiry are encouraged.
Offering: Host
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-CHEM
Prereq: None

CHEM119 Biology and Chemistry in the Modern World: A Survey of Drugs and Disease
This course will cover a wide range of topics of current interest that are at the intersection of biology and chemistry. In particular, the molecular basis of issues related to drugs and disease will form a focus of the course. Topics to be discussed will include psychoactive and performance-enhancing drugs, mad cow, cancer, viral and bacterial diseases, and the chemistry of foods.
Offering: Crosslisting
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-CHEM
Identical With: MB&B119
Prereq: None

CHEM120 Science and Humanity
This course will provide an introduction to the important concepts of writing in science. We will discuss the major components of scientific writing while viewing scientific issues from an analytical and interdisciplinary perspective. We will discuss contemporary problems influenced by technological advantages and the effects they have on science and humanity. This course assumes basic knowledge in chemistry and biology at the high school level.
Offering: Host
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-CHEM

CHEM125 Chemistry and Society
An introductory course for nonscience majors emphasizing the role of chemistry in environmental and technological problems of concern to society such as air and water pollution, current energy sources and alternatives, nuclear chemistry, household chemicals, pharmaceuticals, plastics and recycling, and food and agriculture.
Offering: Host
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-CHEM
Prereq: None

CHEM132 Seminars in Physical Science
Each student will give one 50-minute talk on a topic they choose in chemistry, physics, astronomy, or mathematics. Students will consult with the instructor on the choice of their topic and in the organization of their presentation. Possible topics might include (chosen at random): the origin of the periodic table; the transition from alchemy to chemistry; cold fusion; various Nobel Prize in Chemistry or Physics topics; dark matter, dark energy; the nature of galaxies; why stars shine; the roles of amateurs in modern astronomical research; visualizing the fourth dimension; Einstein’s “greatest blunder”; Bose-Einstein condensates; the race toward absolute zero; the interaction of radiation and matter; the Heisenberg Uncertainty Principle; how prime numbers are used in cryptology; the discovery of C60; the list is almost inexhaustible.
Offering: Host
Grading: Cr/U
Credits: 1.00
Gen Ed Area: NSM-CHEM
Prereq: None

CHEM141 Introductory Chemistry I
This course emphasizes rigorous descriptive reasoning. While intended for students with little or no previous background in chemistry, the course is taught at a relatively high level. The topical coverage emphasizes the relationships between electronic structure, chemical reactivity, and the physical properties of the elements and their compounds.
Offering: Host
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-CHEM
Prereq: None

CHEM142 Introductory Chemistry II
This course is a continuation of CHEM141. CHEM152, the associated laboratory course, may be taken concurrently. The lab should be taken by those who plan to take more than one year of chemistry.
Offering: Host
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-CHEM
Prereq: CHEM141

CHEM143 Principles of Chemistry I
An introduction to chemistry intended for motivated students with a solid high school chemistry background and exposure to calculus, this course will emphasize the fundamental principles of chemistry and is recommended for students interested in pursuing majors in science or mathematics. This course will focus on the concepts of equilibrium, thermodynamics, and kinetics with applications. This course provides the best basic foundation for further study of chemistry and is strongly recommended for chemistry and MB&B majors. CHEM143, with CHEM144, satisfies premedical general chemistry requirements.
methods, small-group problem solving, peer-group workshops and
lecture format. A broad understanding of Organic Chemistry terminology,
structures, nomenclature, applications and basic concepts will provide
students with a firm foundation for success in CHEM 251.
Offering: Host
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-CHEM
Prereq: CHEM251
CHEM252 Principles of Organic Chemistry II
This course is a continuation of the chemistry of carbon compounds
with emphasis on the relationship between structure and reactivity. The
laboratory course CHEM257 is normally elected concurrently but is not
required.
Offering: Host
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-CHEM
Prereq: CHEM251
CHEM258 Organic Chemistry Laboratory
This course presents laboratory techniques of organic chemistry.
Offering: Host
Grading: A-F
Credits: 0.50
Gen Ed Area: NSM-CHEM
Prereq: CHEM251 AND CHEM257
biophysical chemistry from journals including but not limited to the Biophysical Journal, Biopolymers, Current Opinion in Structural Biology, Journal of Biomolecular Structure and Dynamics, and the Annual Review of Molecular Biophysics and Biomolecular Structure.

Offering: Host
Grading: Cr/U
Credits: 0.50
Gen Ed Area: NSM-CHEM
Identical With: MB&B307, CHEM507, MB&B507, PHYS317, PHYS517
Prereq: None

CHEM308 Molecular Biophysics Journal Club II

Offering: Host
Grading: Cr/U
Credits: 0.50
Gen Ed Area: NSM-CHEM
Identical With: MB&B308, CHEM508, MB&B508, PHYS318, PHYS518
Prereq: None

CHEM309 Molecular and Cellular Biophysics
This course is an integrated consideration of the biophysics and biophysical chemistry of biological systems from molecules to cells. The objective is to develop a critical sense of the quantitative data currently being obtained from microscopy to spectroscopy, considering both ensemble and single-molecule experiments, and to gain familiarity and facility with interpretation using mathematical and computational models. Biological systems are inherently complex, and some form of modeling is always involved in developing an explanation of how they work. However, these models typically involve only a few basic constructs (simple harmonic motion, ideal fluids, two-state Ising models, random walks, electrostatic interactions, classical dynamics, rate equations, QM energy levels, distribution functions, and network analysis) and only elementary aspects of linear algebra, calculus, differential equations, and statistics. This course deals with how these constructs are integrated in the framework of Boltzmann statistical mechanics to formulate mathematical models of biological phenomena, how these models are validated and refined, and how they are used to form explanations and make testable predictions. Model systems to be considered include the nucleosome, the ribosome, membrane dynamics and ion channels, molecular devices and motors, prototype signal transduction systems, and regulatory processes. This course is suitable for physics and chemistry students who wish to learn about biological applications and for molecular and cellular biology students to develop skills with quantitative physicochemical modes of inquiry applied to the life sciences.

Offering: Host
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-CHEM
Identical With: MB&B325
Prereq: (CHEM251 AND CHEM383 or MB&B383)

CHEM325 Introduction to Biomolecular Structure
This course aims to provide a framework for understanding three-dimensional structures of proteins, nucleic acids, and their complexes. The first half of the course emphasizes structural modules and topological patterns in major classes of proteins and nucleic acids. The second part of the course covers novel structural motifs, such as helix-turn-helix, zinc-finger, and leucine zipper, that are responsible for recognition of specific nucleotide sequences in nucleic acids by proteins. Analysis of structures using tools available on the Web and independent exploration of protein and nucleic acid databases are strongly encouraged.

Offering: Host
Grading: OPT
Credits: 1.00
Gen Ed Area: NSM-CHEM
Identical With: MB&B325
Prereq: [MB&B181 or BIOL181] OR [MB&B191 or BIOL191]

CHEM337 Physical Chemistry I: Quantum Mechanics and Spectroscopy
This course is a rigorous introduction to quantum mechanics. The course covers wave mechanics, operator methods, matrix mechanics, perturbation theory, angular momentum, molecular vibrations, atomic and molecular structure, symmetry, and spectroscopy.

Offering: Host
Offering: opportunities in the pharmaceutical industry will be discussed. Methods will be emphasized, and how pharmaceutical research is enhanced use of rational design and combinatorial technology, and the story of some that did not, and why. Emerging new design strategies such as fusion-protein therapies, crisper toxicology will be presented. Case studies of the development of drugs recently successful in making the journey from molecule to medicine will be explored, including factors from synthetic chemistry to patent law. The basic science of molecular recognition, computer-aided drug design, and the role of factors from synthetic chemistry to toxicology will be presented. Case studies of the development of drugs recently successful in making the journey from molecule to medicine will be discussed, as well as the story of some that did not, and why. Emerging new design strategies such as fusion-protein therapies, crisper technology, and enhanced use of rational design and combinatorial methods will be emphasized, and how pharmaceutical research is evolving in the post-genomic era, particularly with biologics. Job opportunities in the pharmaceutical industry will be discussed.

CHEM383 Physical Chemistry II: Thermodynamics, Statistical Mechanics, and Kinetics
This course investigates chemical aspects of statistical mechanics and the laws of thermodynamics including free energy, chemical potential and chemical equilibria, and rates of chemical reactions.
Offering: Host
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-CHEM
Prereq: (CHEM141 AND CHEM142 AND MATH121 AND MATH122) OR (CHEM143 AND CHEM144 AND MATH121 AND MATH122)

CHEM338 Physical Chemistry II: Thermodynamics, Statistical Mechanics, and Kinetics
This course investigates chemical aspects of statistical mechanics and the laws of thermodynamics including free energy, chemical potential and chemical equilibria, and rates of chemical reactions.
Offering: Host
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-CHEM
Prereq: (CHEM141 AND CHEM142 AND MATH121 AND MATH122) OR (CHEM143 AND CHEM144 AND MATH121 AND MATH122)

CHEM340 Physical Chemistry IV: Introduction to Quantum Chemistry
This course is an introduction to modern concepts of atomic and molecular quantum mechanics, molecular orbital theory, and qualitative and quantitative concepts of molecular electronic structure. The second half of the course will emphasize numerical calculations with commonly used approximations in many electron calculations on atomic and molecular systems using currently popular computer programs.
Offering: Host
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-CHEM
Prereq: CHEM337 OR PHYS214

CHEM341 Physical Chemistry IVB: Quantum Chemistry
This survey of lab intro electronic structure theory studies basis sets, many-body perturbation theory, coupled cluster theory, and density functional methods. These methods will be applied to molecular geometry optimizations, calculations of vibrational frequencies, NMR spectra, and thermochemistry including transition states for chemical reactions. The thermochemical methods covered include the complete basis set (CBS) models.
Offering: Host
Grading: A-F
Credits: 0.50
Gen Ed Area: NSM-CHEM
Prereq: CHEM337 OR PHYS214 OR [PHYS315 or PHYS515]

CHEM342 Molecules to Medicine
This course will explore the process of drug development, including target selection, lead discovery using computer-based methods and combinatorial chemistry high-throughput screening, organic synthesis, bioavailability, clinical trials, and other factors (some economics and politics) involved in bringing a drug to the marketplace. Critical consideration of the variables to contend with at each step will be described and discussed, including aspects of research ethics, patent law. The basic science of molecular recognition, computer-aided drug design, and the role of factors from synthetic chemistry to toxicology will be presented. Case studies of the development of drugs recently successful in making the journey from molecule to medicine will be discussed, as well as the story of some that did not, and why. Emerging new design strategies such as fusion-protein therapies, crisper technology, and enhanced use of rational design and combinatorial methods will be emphasized, and how pharmaceutical research is evolving in the post-genomic era, particularly with biologics. Job opportunities in the pharmaceutical industry will be discussed.
Offering: Host
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-CHEM
Prereq: CHEM251 AND CHEM252 AND CHEM257 AND CHEM258

CHEM353 Applications of Spectroscopic Methods in Organic Chemistry
The use of NMR infrared and mass spectroscopy in structure determinations will be discussed.
Offering: Host
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-CHEM
Prereq: CHEM141 and CHEM251

CHEM358 Structure and Mechanism
This course will cover several important aspects of traditional and contemporary physical organic and mechanistic chemistry, including frontier molecular orbital theory and pericyclic reactions, organic photochemistry reactive intermediates (carbocations, carbanions, radicals, and carbenes), the thermodynamics and kinetics of organic reactions, and polymer chemistry.
Offering: Host
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-CHEM
Prereq: (CHEM251 AND CHEM252)

CHEM359 Advanced Organic Synthesis
The control of reactivity and selectivity to achieve specific syntheses is one of the overarching goals of organic chemistry. This course is intended to provide advanced undergraduate and graduate students in chemistry with a sufficient foundation to comprehend and use the research literature in organic chemistry. Concentrating on the most important reactions and efficient synthetic methods used for organic synthesis, this course presents the material by reaction type. The planning and execution of multistep synthesis will also be included.
Offering: Host
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-CHEM
Prereq: None

CHEM361 Advanced Inorganic Chemistry
This course is a survey of the chemistry of the inorganic elements, focusing on the relationship between electronic structure, physical properties, and reactivity across the periodic table.
Offering: Host
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-CHEM
Prereq: CHEM252

CHEM375 Integrated Chemistry Laboratory I
An advanced laboratory course in chemistry involving work from the major subdisciplines: organic, inorganic, biochemistry, physical, and instrumental. Emphasis will be placed on integrating aspects of chemical synthesis, spectroscopic characterization, and determination of physical properties in each exercise.
Offering: Host
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-CHEM
Prereq: (CHEM251 AND CHEM252 AND CHEM257 AND CHEM258)
CHEM376 Integrated Chemistry Laboratory II
An advanced laboratory course in chemistry involving work from the major subdisciplines: organic, inorganic, biochemistry, physical, and instrumental. Emphasis will be placed on integrating aspects of chemical synthesis, spectroscopic characterization, and determination of physical properties in each exercise.
Offering: Host
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-CHEM
Prereq: CHEM375

CHEM377 Chemistry of Materials and Nanomaterials
This course will provide an introduction to materials chemistry, with a special emphasis on nanomaterials. Topics covered will include colloidal metal nanomaterials; semiconductors and quantum dots; carbon nanotubes, fullerenes, and graphene; metal-organic frameworks; self-assembly and metamaterials; electron and scanning probe microscopies; and lithography. The course will also discuss applications of these materials and techniques in areas such as plasmonics and sensing, catalysis, energy generation, and medicine.
Offering: Host
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-CHEM
Identical With: PHYS377
Prereq: CHEM251

CHEM379 Nanomaterials Lab
This course will be a combination of weekly lecture and laboratory exercises designed to introduce students to new developments in the chemistry of materials and nanomaterials. Concepts and theoretical background will be discussed during weekly lectures. Students will then apply those concepts to the preparation of materials/nanomaterials in weekly lab sections. Students will synthesize quantum dots, build solar cells, pattern surfaces using both photolithography and soft lithography, make conductive carbon nanofiber films, prepare high-temperature superconductors, and learn scanning probe microscopy techniques.
Offering: Host
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-CHEM
Identical With: PHYS377
Prereq: CHEM251

CHEM381 Physical Chemistry for the Life Sciences
The course is concerned with the basic physicochemical principles and model systems essential to understanding, explaining, and predicting the behavior of biological systems in terms of molecular forces. PCLS integrates fundamental concepts in thermodynamics, kinetics, and molecular spectroscopy with the structures, functions, and molecular mechanisms of biological processes. The objectives of the course are to (a) familiarize life science students at the advanced undergraduate and beginning graduate level with basic physicochemical laws, theories, and concepts important to the life sciences; (b) provide a working knowledge of mathematical methods useful in the life science research; (c) develop a critical perspective on explanation of biological processes and understanding biological systems; and (d) survey the major applications of physical chemistry in the life sciences with an emphasis on spectroscopy and microscopy. Theory, methodology, and biophysical concepts are distributed throughout the course and are presented in the context of case studies including respiration, light harvesting and photosynthesis, ATP hydrolysis, NAD/NADH redox, energy transfer, FRET spectroscopy, with an emphasis on single molecule as well as ensemble experiments and their interpretation.
Offering: Crosslisting
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-MBB
Identical With: MB&B381, MB&B581
Prereq: (CHEM141 AND CHEM142 AND MATH117 AND CHEM251) OR (CHEM143 AND CHEM144 AND MATH121 AND CHEM251)

CHEM382 Practical NMR
This course will cover how a spectrometer works as well as the theory and application of NMR experiments. The topics will include one-dimensional proton and heteronuclear experiments as well as decoupling. The course will begin with how the spectrometer works and how data processing is carried out, as well as how to calibrate the spectrometer and shim the magnet. The one-dimensional TOCSY and NOESY experiments will then be covered. The course will also cover heteronuclear and homonuclear two-dimensional NMR experiments. The experiments will include two-dimensional DQF COSY, TOCSY, NOESY, and ROESY proton experiments as well as heteronuclear experiments to correlate the chemical shifts of protons and heteronuclei, as well as how to select heteronuclear resonances on the basis of the number of directly attached protons. The course will consist of lectures as well as a laboratory component in which the Mercury 300 will be used to obtain data that will be analyzed using the methods developed in the lecture part of the course. This course is specifically aimed at the general users of the Mercury spectrometer who wish to learn how to carry out and analyze advanced one-dimensional as well as two-dimensional NMR experiments.
Offering: Host
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-CHEM
Identical With: MB&B382
Prereq: None

CHEM383 Biochemistry
This introductory course to the principles and concepts of contemporary biochemistry presents both the biological and chemical perspectives. The major themes will be the structure of proteins and the basis of enzymatic activity, cellular metabolism and the generation and storage of metabolic energy, and general principles of the biosynthesis of cellular components.
Offering: Host
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-CHEM
Identical With: MB&B383
Prereq: (CHEM251 AND CHEM252)

CHEM385 Advanced Biochemistry: Enzyme Kinetics
This course presents an introduction to the theory and practice of enzyme kinetics, both steady-state and pre-steady-state.
Offering: Host
Grading: A-F
Credits: 0.50
Gen Ed Area: NSM-CHEM
Identical With: MB&B385
Prereq: [CHEM383 or MB&B383]

CHEM386 Biological Thermodynamics
This course is addressed to undergraduate and graduate students interested in biological chemistry and structural biology. The course presents thermodynamic methods currently used to relate structure to function in biological molecules. Topics include binding curves, chemical ligand linkages, binding polynomial, cooperativity, site-specific binding processes, and allosteric effects. Several models for allosteric systems,
such as the Monod-Wyman-Changeux model, the induced-fit model, and the Pauling model, are analyzed in detail. Applications of these models are illustrated for functional regulation of respiratory proteins and for protein-nucleic-acid complexes involved in control of gene expression.

Offering: Host
Grading: OPT
Credits: 1.00
Gen Ed Area: NSM-CHEM
Identical With: MB&B386
Prereq: (MATH121 AND MATH122)

CHEM387 Enzyme Mechanisms
The chemical mechanisms involved in the action of a series of typical enzymes will be considered.

Offering: Host
Grading: A-F
Credits: 0.50
Gen Ed Area: NSM-CHEM
Identical With: MB&B387
Prereq: [CHEM383 or MB&B383]

CHEM390 Practical Methods in Biochemistry
This course centers on currently used techniques for protein separation, characterization, and purification, such as ultracentrifugation, gel electrophoresis, and chromatography. These topics will be introduced within the general context of the behavior of macromolecules in solution. The relative stability of proteins in different media, the forces stabilizing protein structure, and the interaction of proteins will be discussed.

We will explicitly consider different techniques used to study proteins. Relatively novel techniques to be discussed include surface plasmon resonance, microarray methods and mass spectrometry, and single molecule microscopy. In the course, we will go through 3-4 different protein purification protocols and discuss the methods used in each one.

We will also touch upon the commonly used spectroscopic techniques used to characterize proteins including absorption, fluorescence, and circular dichroism. The course focuses on biochemical techniques and understanding the physical principles underlying these techniques.

The course will also discuss tactics for optimizing established isolation and purification procedures and also for isolating and characterizing an unknown protein. The course content is appropriate for advanced undergraduates (juniors/seniors) and beginning graduate students from chemistry, biology, molecular biophysics or MB&B.

Offering: Crosslisting
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-MBB
Identical With: CHEM596
Prereq: [MB&B208 or BIOL208] AND CHEM141 AND CHEM142 OR ([MB&B208 or BIOL208] AND CHEM143 AND CHEM144)

CHEM396 Molecular Modeling
The theory behind molecular modeling techniques will be discussed, along with hands-on experience using HyperChem. Techniques such as energy minimization, Monte Carlo, molecular dynamics, Brownian dynamics, and quantum simulations will be discussed in detail.

Relevant statistical mechanical concepts will be reviewed. Algorithms, implementations, limitations, and problems associated with existing modeling techniques will then be examined. Theory and implementation of selected free-energy simulation techniques will be discussed. Hands-on session using HyperChem on a 486-PC will involve direct application of techniques such as performing EM on a molecule of choice.

Offering: Crosslisting
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-CHEM
Identical With: CHEM337

CHEM401 Individual Tutorial, Undergraduate
Topic to be arranged in consultation with the tutor.
Offering: Host
Grading: OPT

CHEM402 Individual Tutorial, Undergraduate
Topic to be arranged in consultation with the tutor.
Offering: Host
Grading: OPT

CHEM407 Senior Tutorial (downgraded thesis)
Downgraded Senior Thesis Tutorial - Project to be arranged in consultation with the tutor. Only enrolled in through the Honors Coordinator.
Offering: Host
Grading: A-F

CHEM408 Senior Tutorial (downgraded thesis)
Downgraded Senior Thesis Tutorial - Project to be arranged in consultation with the tutor. Only enrolled in through the Honors Coordinator.
Offering: Host
Grading: A-F

CHEM409 Senior Thesis Tutorial
Topic to be arranged in consultation with the tutor.
Offering: Host
Grading: OPT

CHEM410 Senior Thesis Tutorial
Topic to be arranged in consultation with the tutor.
Offering: Host
Grading: OPT

CHEM411 Group Tutorial, Undergraduate
Topic to be arranged in consultation with the tutor.
Offering: Host
CHEM412 Group Tutorial, Undergraduate
Topic to be arranged in consultation with the tutor.
Offering: Host
Grading: OPT

CHEM419 Student Forum
Student-run group tutorial, sponsored by a faculty member and approved by the chair of a department or program.
Offering: Host
Grading: Cr/U

CHEM420 Student Forum
Student-run group tutorial, sponsored by a faculty member and approved by the chair of a department or program.
Offering: Host
Grading: Cr/U

CHEM421 Undergraduate Research, Science
Individual research projects for undergraduate students supervised by faculty members.
Offering: Host
Grading: OPT

CHEM422 Undergraduate Research, Science
Individual research projects for undergraduate students supervised by faculty members.
Offering: Host
Grading: OPT

CHEM423 Advanced Research Seminar, Undergraduate
Advanced research tutorial; project to be arranged in consultation with the tutor.
Offering: Host
Grading: OPT

CHEM424 Advanced Research Seminar, Undergraduate
Advanced research tutorial; project to be arranged in consultation with the tutor.
Offering: Host
Grading: OPT

CHEM491 Teaching Apprentice Tutorial
The teaching apprentice program offers undergraduate students the opportunity to assist in teaching a faculty member’s course for academic credit.
Offering: Host
Grading: OPT

CHEM492 Teaching Apprentice Tutorial
The teaching apprentice program offers undergraduate students the opportunity to assist in teaching a faculty member’s course for academic credit.
Offering: Host
Grading: OPT

CHEM495 Research Apprentice, Undergraduate
Project to be arranged in consultation with the tutor.
Offering: Host
Grading: Cr/U

CHEM496 Research Apprentice, Undergraduate
Project to be arranged in consultation with the tutor.
Offering: Host
Grading: Cr/U

CHEM500 Graduate Pedagogy
The elements of good teaching will be discussed and demonstrated through lectures, practice teaching sessions, and discussions of problems encountered in the actual teaching environment. The staff consists of faculty and experienced graduate students. An integral part of the course is a required one-day workshop BEFORE the first day of formal classes. Training in pedagogy in the first semester of attendance is required for all incoming Wesleyan MA and PhD students who have not already fulfilled this requirement at Wesleyan. BA/MA students are not required to get training in pedagogy but may choose to do so.
Offering: Crosslisting
Grading: Cr/U
Credits: 0.50
Gen Ed Area: None
Identical With: BIOL500, E&ES500, ASTR500, MB&B500, MUSC500, PHYS500, PSYC500, MATH500
Prereq: None

CHEM501 Individual Tutorial for Graduates
Topic to be arranged in consultation with the tutor.
Offering: Host
Grading: OPT

CHEM502 Individual Tutorial for Graduates
Topic to be arranged in consultation with the tutor.
Offering: Host
Grading: OPT

CHEM504 Selected Topics, Graduate Science
Topic to be arranged in consultation with the tutor. A seminar primarily concerned with papers taken from current research publications designed for, and required of, graduate students.
Offering: Host
Grading: OPT

CHEM507 Molecular Biophysics Journal Club I
This course includes presentation and active discussion of a series of current research articles in the field of molecular biophysics and biophysical chemistry from journals including but not limited to the Biophysical Journal, Biopolymers, Current Opinion in Structural Biology, Journal of Biomolecular Structure and Dynamics, and the Annual Review of Molecular Biophysics and Biomolecular Structure.
Offering: Crosslisting
Grading: Cr/U
Credits: 0.50
Gen Ed Area: NSM-CHEM
Identical With: CHEM307, MB&B307, MB&B507, PHYS317, PHYS517
Prereq: None

CHEM508 Molecular Biophysics Journal Club II
Offering: Crosslisting
Grading: Cr/U
Credits: 0.50
Gen Ed Area: NSM-CHEM
Identical With: CHEM308, MB&B308, MB&B508, PHYS318, PHYS518
Prereq: None

CHEM509 Molecular and Cellular Biophysics
This course is an integrated consideration of the biophysics and biophysical chemistry of biological systems from molecules to cells. The objective is to develop a critical sense of the quantitative data
currently being obtained from microscopy to spectroscopy, considering both ensemble and single-molecule experiments, and to gain familiarity and facility with interpretation using mathematical and computational models. Biological systems are inherently complex, and some form of modeling is always involved in developing an explanation of how they work. However, these models typically involve only a few basic constructs (simple harmonic motion, ideal fluids, two-state Ising models, random walks, electrostatic interactions, classical dynamics, rate equations, QM energy levels, distribution functions, and network analysis) and only elementary aspects of linear algebra, calculus, differential equations, and statistics. This course deals with how these constructs are integrated in the framework of Boltzmann statistical mechanics to formulate mathematical models of biological phenomena, how these models are validated and refined, and how they are used to form explanations and make testable predictions. Model systems to be considered include the nucleosome, the ribosome, membrane dynamics and ion channels, molecular devices and motors, prototype signal transduction systems, and regulatory processes. This course is suitable for physics and chemistry students who wish to learn about biological applications and for molecular and cellular biology students to develop skills with quantitative physicochemical modes of inquiry applied to the life sciences.

Offering: Crosslisting
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-CHEM
Identical With: CHEM309, MB&B309, MB&B509, PHYS339, PHYS539
Prereq: (CHEM251 AND CHEM252)

CHEM511 Group Tutorial, Graduate
Topic to be arranged in consultation with the tutor.
Offering: Host
Grading: OPT

CHEM512 Group Tutorial, Graduate
Topic to be arranged in consultation with the tutor.
Offering: Host
Grading: OPT

CHEM519 Structural Mechanisms of Protein-Nucleic Acid Interactions
This course focuses on recent advances in the understanding of the structural basis of the recognition of nucleic acids by proteins. Macromolecular systems to be discussed include site-specific DNA endonucleases, topoisomerases, the histone fold, helicases, site-specific recombinases, nuclear RNA-protein complexes, tRNA-binding proteins, and the ribosome.
Offering: Host
Grading: OPT
Credits: 0.50
Gen Ed Area: None
Identical With: MB&B519
Prereq: (CHEM251 AND CHEM252)

CHEM520 Scientific Research Ethics
This course involves critical consideration of the ethical issues that arise in the conduct of scientific research. The course will begin with an overview of the ethical issues commonly encountered in research, including what is and is not an ethical issue and how ethical issues are dealt with in principle and in practice. Initial topics include record keeping, conflict of interest, responsible authorship, ownership of projects, policies for handling misconduct, policies regarding the use of human and animal subjects, and data management and distribution. The course will proceed to a consideration of a series of case studies based on instances in the recent scientific literature in which ethical problems were encountered.
Offering: Crosslisting
Grading: A-F
Credits: 0.50
Gen Ed Area: NSM-CHEM
Identical With: CHEM320
Prereq: None

CHEM521 Chemistry Symposia I
Weekly seminars by distinguished national and international chemists.
Offering: Host
Grading: Cr/U
Credits: 0.25
Gen Ed Area: None
Prereq: None

CHEM522 Chemistry Symposia II
Weekly seminars by distinguished national and international chemists.
Offering: Host
Grading: Cr/U
Credits: 0.25
Gen Ed Area: None
Prereq: None

CHEM540 Physical Chemistry IV: Advanced Quantum Chemistry
This course covers electron wave function theory, operator formalisms and second quantization; fundamentals of restricted and unrestricted Hartree-Fock theory; electron correlation methods; pair and coupled pair theories; many-body perturbation theory; and coupled-cluster theory. Suitable for advanced graduate students in physical chemistry and chemical physics.
Offering: Host
Grading: A-F
Credits: 1.00
Gen Ed Area: None
Prereq: CHEM340 OR [PHYS315 or PHYS515]

CHEM541 Physical Chemistry IV: Quantum Chemistry
Second half of the semester, computer lab.
Offering: Host
Grading: A-F
Credits: 0.50
Gen Ed Area: None
Prereq: CHEM337 OR PHYS214

CHEM545 Modern High-Resolution Spectroscopy
This is a graduate-level lecture/discussion course in selected topics in modern high-resolution spectroscopy. Microwave spectroscopy, angular momentum theory, electronic spectroscopy of diatomic molecules, vibrational normal mode analysis, and other topics will be covered. While there are no formal prerequisites for this course, a working knowledge of quantum mechanics will be assumed.
Offering: Host
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-CHEM
Prereq: None

CHEM547 Seminar in Chemical Physics
Weekly seminars presented jointly with the Physics Department under the auspices of the Chemical Physics Program. These informal seminars will be presented by students, faculty, and outside visitors on current research and other topics of interest.
Offering: Host
Grading: Cr/U
Credits: 0.25  
Gen Ed Area: None  
Identical With: PHYS587  
Prereq: None

**CHEM548 Seminar in Chemical Physics**  
Weekly seminars presented jointly with the Chemistry Department under the auspices of the Chemical Physics Program. These informal seminars will be presented by students, faculty, and outside visitors on current research and other topics of interest.  
Offering: Crosslisting  
Grading: Cr/U  
Credits: 0.25  
Gen Ed Area: None  
Identical With: PHYS588  
Prereq: None

**CHEM549 Advanced Research Seminar, Graduate**  
Advanced research tutorial; project to be arranged in consultation with the tutor.  
Offering: Host  
Grading: OPT

**CHEM550 Advanced Research Seminar, Graduate**  
Advanced research tutorial; project to be arranged in consultation with the tutor.  
Offering: Host  
Grading: OPT

**CHEM557 Seminar in Organic and Inorganic Chemistry**  
This graduate-level seminar in organic and inorganic chemistry will include weekly presentations and discussions based on current research. Speakers will present the details of their topic using specific examples and will place the research in a broader context with respect to the current literature while also providing adequate background information and drawing concepts together with critical concluding analysis.  
Offering: Host  
Grading: Cr/U  
Credits: 0.25  
Gen Ed Area: None  
Prereq: None

**CHEM558 Seminar in Organic and Inorganic Chemistry**  
This graduate-level seminar in organic and inorganic chemistry will include weekly presentations and discussions based on current research. Speakers will present the details of their topic using specific examples and will place the research in a broader context with respect to the current literature while also providing adequate background information and drawing concepts together with critical concluding analysis.  
Offering: Host  
Grading: Cr/U  
Credits: 0.25  
Gen Ed Area: None  
Prereq: None

**CHEM561 Graduate Field Research**  
Research in the field, normally on thesis project.  
Offering: Host  
Grading: OPT

**CHEM565 Physical Methods in Chemistry**  
An introduction to the use of physical methods to characterize the structures and dynamics of chemical systems with a particular emphasis on applications in inorganic chemistry. Topics will include a variety of spectroscopies (e.g., optical absorption, circular dichroic techniques, infrared and Raman spectroscopies, NMR techniques), small molecule X-ray crystallography, and magnetic susceptibility measurements. Group theoretical techniques will be used extensively to develop selection rules.  
Offering: Host  
Grading: A-F  
Credits: 1.00  
Gen Ed Area: NSM-CHEM  
Prereq: CHEM361 OR CHEM337

**CHEM587 Seminar in Biological Chemistry**  
Weekly presentations and discussions based on current research.  
Offering: Host  
Grading: Cr/U  
Credits: 0.25  
Gen Ed Area: None  
Identical With: MB&B587  
Prereq: (CHEM383 or MB&B383 or CHEM325 or MB&B325 or MB&B208) OR (CHEM383 or MB&B383)

**CHEM588 Seminar in Biological Chemistry**  
Weekly presentations and discussions based on current research.  
Offering: Host  
Grading: Cr/U  
Credits: 0.25  
Gen Ed Area: None  
Identical With: MB&B588  
Prereq: (CHEM383 or MB&B383 or CHEM325 or MB&B325 or MB&B208) OR (CHEM383 or MB&B383)

**CHEM596 Molecular Modeling**  
The theory behind molecular modeling techniques will be discussed, along with hands-on experience using HyperChem. Techniques such as energy minimization, Monte Carlo, molecular dynamics, Brownian dynamics, and quantum simulations will be discussed in detail. Relevant statistical mechanical concepts will be reviewed. Algorithms, implementations, limitations, and problems associated with existing modeling techniques will then be examined. Theory and implementation of selected free-energy simulation techniques will be discussed. Hands-on session using HyperChem on a 486-PC will involve direct application of techniques such as performing EM on a molecule of choice.  
Offering: Host  
Grading: A-F  
Credits: 1.00  
Gen Ed Area: NSM-CHEM  
Identical With: CHEM396  
Prereq: CHEM337