

Chemistry (CHEM)

College of Natural Science and Mathematics

Department of Chemistry and Biochemistry (<https://www.uaf.edu/chem/>)
907-474-5510

CHEM F100X Chemistry in Complex Systems (n)

4 Credits

Offered Fall, Spring and Summer

Fundamentals of chemistry with an emphasis on the role of chemistry in environmental and life systems. The role of feedback systems on chemical behavior is illustrated in atmospheric, aquatic, nuclear and nutritional systems.

Prerequisites: Placement in WRTG F111X; placement in MATH F105.

Special Notes: For non-science majors.

Attributes: UAF GER Natural Science Req

Lecture + Lab + Other: 3 + 3 + 0

Grading System: Letter Grades with option of Plus/Minus

CHEM F103L CHEM F103X Laboratory

0 Credit

Co-requisites: CHEM F103X.

Attributes: UAF GER Natural Science Req

Lecture + Lab + Other: 0 + 0 + 0

Grading System: Non-Graded

CHEM F103X Introduction to General Chemistry (n)

4 Credits

Offered Fall

Introductory chemistry survey course for health science majors and preparatory course for science majors. Topics include: measurement, energy and matter, periodic trends, chemical composition, chemical reactions, solutions, bond theory, phases, oxidation-reduction, nuclear chemistry, problem-solving (applied mathematics), and special topics.

Prerequisites: Placement in WRTG F111X; placement in MATH F105.

Co-requisites: CHEM F103L.

Special Notes: This course fulfills the laboratory part of the natural science requirement and provides preparation for subsequent training in chemistry in CHEM F104X and CHEM F105X.

Attributes: UAF GER Natural Science Req

Lecture + Lab + Other: 3 + 3 + 0

Grading System: Letter Grades with option of Plus/Minus

CHEM F104L CHEM F104X Laboratory

0 Credit

Co-requisites: CHEM F104X.

Attributes: UAF GER Natural Science Req

Lecture + Lab + Other: 0 + 0 + 0

Grading System: Non-Graded

CHEM F104X Introduction to Organic Chemistry and Biochemistry (n)

4 Credits

Offered Spring

This is the second semester course in the sequence for health-science majors and comprises a survey of the fundamentals of chemistry as applied to biological systems. Topics include nomenclature of organic compounds, organic functional groups and reactions, biochemical processes and pathways, biological macromolecules, and metabolites.

Prerequisites: CHEM F103X; placement in WRTG F111X; placement in MATH F105.

Co-requisites: CHEM F104L.

Attributes: UAF GER Natural Science Req

Lecture + Lab + Other: 3 + 3 + 0

Grading System: Letter Grades with option of Plus/Minus

CHEM F105L Chemistry F105X Lab

0 Credit

Attributes: UAF GER Natural Science Req

Lecture + Lab + Other: 0 + 0 + 0

Grading System: Non-Graded

CHEM F105X General Chemistry I (n)

4 Credits

Offered Fall, Spring and Summer

This course is an introduction to general chemistry and explores topics to a much greater depth than preparatory courses. Topics include: measurement, energy and matter, periodic trends, chemical composition, chemical reactions, solutions, bond theory, gases, thermodynamics, problem-solving (applied mathematics), and special topics. Students must be enrolled in both CHEM F105X and CHEM F105L to receive full credit.

Prerequisites: B- or better in CHEM F103X or (placement in WRTG F111X; placement in MATH F151X) or permission of instructor and department.

Corequisite: CHEM F105L.

Special Notes: CHEM F105X-CHEM F106X, together with their laboratory components, constitute the standard one year engineering and science major general chemistry course.

Attributes: UAF GER Natural Science Req

Lecture + Lab + Other: 3 + 3 + 0

Grading System: Letter Grades with option of Plus/Minus

CHEM F106L Chemistry F106X Lab

0 Credit

Attributes: UAF GER Natural Science Req

Lecture + Lab + Other: 0 + 0 + 0

Grading System: Non-Graded

CHEM F106X General Chemistry II (n)

4 Credits

Offered Fall, Spring and Summer

The second semester in the general chemistry sequence. Topics include: kinetics, equilibrium chemistry (including acids and bases, solubility, and complex ion formation), nuclear chemistry, electrochemistry, thermodynamics, and special topics. Students must be enrolled in both CHEM F106X and CHEM F106L to receive full credit.

Prerequisites: Grade of C- or better in CHEM F105X; placement in WRTG F111X; placement in MATH F151X; or permission of instructor and department chair.

Corequisites: CHEM F106L.

Special Notes: CHEM F105X-CHEM F106X, together with their laboratory components, constitute the standard one year engineering and science major general chemistry course.

Attributes: UAF GER Natural Science Req

Lecture + Lab + Other: 3 + 3 + 0

Grading System: Letter Grades with option of Plus/Minus

CHEM F111X Introduction to Environmental Chemistry of the Arctic

4 Credits

Offered As Demand Warrants

This course introduces students to environmental chemistry through investigating the air, water and soil quality of the Arctic environment as affected by natural and anthropogenic cycling of nutrients and contaminants. The lab component will focus on characterization of natural waters collected around the state. Presented both on-campus and by distance.

Prerequisites: MATH F105.**Attributes:** UAF GER Natural Science Req**Lecture + Lab + Other:** 3 + 3 + 0**Grading System:** Letter Grades with option of Plus/Minus**CHEM F190 Alaska Statewide High School Science Symposium**

2 Credits

Offered Spring

Students employ the scientific method to approach a problem of personal interest. Student work is molded into a research paper delivered orally in a formal scientific presentation for judges with wide-ranging experiences.

Prerequisites: High School student grades 9-12.**Recommended:** Research completion, abstract and paper writing/submission, ASHSSS presentation.**Lecture + Lab + Other:** 0 + 10 + 0**Grading System:** Pass/Fail Grades**Repeatable for Credit:** May be taken 4 times for up to unlimited credits**CHEM F202 Basic Inorganic Chemistry (n)**

3 Credits

Offered Spring

Introduction to coordination theory, crystal field theory, kinetics and mechanisms of substitutions and redox reactions, unit cells and ionic bonding, periodic law, and descriptive chemistry of selected main group elements.

Prerequisites: CHEM F106X.**Lecture + Lab + Other:** 2 + 3 + 0**Grading System:** Letter Grades with option of Plus/Minus**CHEM F212 Chemical Equilibrium and Analysis (n)**

4 Credits

Offered Fall

Aqueous chemical equilibrium as applied to chemical analysis, separations, spectrophotometry, potentiometry and factors considered in the analytical approach. Lab portion will include introductory experiments in analytical and instrumental techniques.

Prerequisites: Grade of C or better in CHEM F106X; MATH F151X.**Lecture + Lab + Other:** 3 + 3 + 0**Grading System:** Letter Grades with option of Plus/Minus**CHEM F288 Introduction to Chemical Research**

2 Credits

Offered As Demand Warrants

Scientific research is creative and engaging when properly planned and executed. This course introduces students to the process of planning and executing a research project. We will begin with an idea, review primary literature, brainstorm project ideas, pose a testable hypothesis, plan experiments and execute a small research project.

Prerequisites: CHEM F212, CHEM F321.**Lecture + Lab + Other:** 1 + 3 + 0**Grading System:** Letter Grades with option of Plus/Minus**CHEM F314 Analytical Instrumental Laboratory (n)**

3 Credits

Offered Spring

A laboratory course focusing on the acquisition and interpretation of spectroscopic and chromatographic data for qualitative characterization and quantitative chemical measurements. Students will learn to design and execute experiments with a variety of instruments, critically evaluate experimental data, and communicate their findings through scientific writing.

Prerequisites: CHEM F212; WRTG F211X, WRTG F212X, WRTG F213X or WRTG F214X; must be a chemistry major.**Lecture + Lab + Other:** 1 + 6 + 0**Grading System:** Letter Grades with option of Plus/Minus**CHEM F321 Organic Chemistry I (n)**

4 Credits

Offered Fall

A systematic study of the more important functional groups of carbon compounds, including their mechanisms of reaction, methods of synthesis, and physical and spectroscopic properties. Lab portion will include an introduction to synthetic techniques and spectroscopy.

Prerequisites: CHEM F106X.**Lecture + Lab + Other:** 3 + 3 + 0**Grading System:** Letter Grades with option of Plus/Minus**CHEM F325 Organic Chemistry II (n)**

4 Credits

Offered Spring

A systematic study of the more important functional groups of carbon compounds, including their mechanisms of reaction, methods of synthesis and physical and spectroscopic properties. Lab portion will include synthesis and characterization by spectroscopy.

Prerequisites: CHEM F321.**Lecture + Lab + Other:** 3 + 3 + 0**Grading System:** Letter Grades with option of Plus/Minus**CHEM F331 Physical Chemistry I (n)**

4 Credits

Offered Fall

Principles of thermodynamics and kinetics with applications to phase equilibria, solutions, chemical equilibrium and electrochemistry. Course teaches these concepts using both lecture and laboratory instruction.

Prerequisites: CHEM F106X; MATH F252X; PHYS F124X or PHYS F212X.**Lecture + Lab + Other:** 3 + 3 + 0**Grading System:** Letter Grades with option of Plus/Minus**CHEM F332 Physical Chemistry II (n)**

4 Credits

Offered Spring

Atomic and molecular structure, and spectroscopy, and statistical mechanics. Course teaches these concepts using both lecture and laboratory instruction.

Prerequisites: CHEM F331; MATH F252X.**Lecture + Lab + Other:** 3 + 3 + 0**Grading System:** Letter Grades with option of Plus/Minus

CHEM F360 Cell and Molecular Biology (n)

3 Credits

Offered Fall and Spring

An introduction to the structure and function of cells. Topics include: the structure and function of cellular components, including proteins, membranes and organelles; understanding how cells communicate; and how information is processed in the cell via DNA replication, transcription and translation.

Prerequisites: BIOL F260; CHEM F105X; CHEM F106X (may be taken concurrently).

Cross-listed with BIOL F360.

Special Notes: Taught asynchronously online in fall, face to face in spring.

Lecture + Lab + Other: 3 + 0 + 0

Grading System: Letter Grades with option of Plus/Minus

CHEM F402 Inorganic Chemistry (n)

3 Credits

Offered Fall

Symmetry and group theory, molecular orbital theory, solid state chemistry, acids and bases, redox reactions, non-aqueous solvents, descriptive chemistry of some main group elements.

Prerequisites: CHEM F202; CHEM F325.

Lecture + Lab + Other: 1 + 6 + 0

Grading System: Letter Grades with option of Plus/Minus

CHEM F403 Biological Inorganic Chemistry

3 Credits

Offered Fall

Survey of structure, functions, and chemical properties of natural metalloproteins and metalloenzymes, roles of metalloproteins in nucleic acid formation and replication, metal-based medicines.

Prerequisites: CHEM F202; CHEM F449.

Stacked with CHEM F603.

Lecture + Lab + Other: 3 + 0 + 0

Grading System: Letter Grades with option of Plus/Minus

CHEM F406 Atmospheric Chemistry

3 Credits

Offered Spring Odd-numbered Years

Chemistry of the lower atmosphere (troposphere and stratosphere) including photochemistry, kinetics, thermodynamics, box modeling, biogeochemical cycles and measurement techniques for atmospheric pollutants; study of important impacts to the atmosphere which result from anthropogenic emissions of pollutants, including acid rain, the "greenhouse" effect, urban smog and stratospheric ozone depletion.

Prerequisites: CHEM F332.

Stacked with CHEM F606; ATM F606.

Lecture + Lab + Other: 3 + 0 + 0

Grading System: Letter Grades with option of Plus/Minus

CHEM F419 Practical Nuclear Magnetic Resonance

2 Credits

Offered Spring

Students will be trained in the basic operation of NMR instruments. Students will spend much of the class time getting hands-on experience on the NMR with student-driven NMR-based research projects. At the end of the course, students will present their projects to the rest of the class.

Prerequisites: CHEM F321.

Lecture + Lab + Other: 1 + 3 + 0

Grading System: Letter Grades with option of Plus/Minus

CHEM F420 Applications of NMR Spectroscopy

3 Credits

Offered Fall Even-numbered Years

Applications of nuclear magnetic resonance (NMR) spectroscopy in the chemical and biochemical sciences. The course will focus on the implementation and interpretation of NMR experiments for solving research problems. Topics include the basic theory of NMR and one- and two-dimensional techniques.

Prerequisites: CHEM F321.

Stacked with CHEM F620.

Lecture + Lab + Other: 3 + 0 + 0

Grading System: Letter Grades with option of Plus/Minus

CHEM F434 Chemistry Capstone Laboratory (n)

3 Credits

Offered Fall

A capstone laboratory course with three major components: 1) experiments related to concepts learned in physical, analytical and inorganic chemistry courses emphasizing kinetics, spectroscopy and thermodynamics; 2) computer use in problem solving, data analysis and word processing; and 3) technical writing with emphasis on preparation of papers for publication.

Prerequisites: WRTG F111X; WRTG F211X, WRTG F212X, WRTG F213X or WRTG F214X; CHEM F212; CHEM F202; CHEM F332 (may be taken concurrently).

Lecture + Lab + Other: 1 + 6 + 0

Grading System: Letter Grades with option of Plus/Minus

CHEM F449 General Biochemistry: Metabolism

3 Credits

Offered Spring

This course is an introduction to metabolism at the molecular level and covers the molecular structures and classification of the three major macromolecules: carbohydrates, lipids and proteins. Individual metabolic pathways and regulation will be studied, as well as the big picture and how all the pathways are tied together.

Prerequisites: CHEM F321.

Lecture + Lab + Other: 3 + 0 + 0

Grading System: Letter Grades with option of Plus/Minus

CHEM F450 Information Storage and Transfer: Molecules and Pathways

3 Credits

Offered Fall

Focuses on the biochemistry of the two principal macromolecules: nucleic acids and proteins. Topics include: nucleotides metabolism, DNA structure and topology, DNA replication, DNA repair and recombination, cell cycle regulation, RNA transcription and processing. Gene expression, translation and protein metabolism. Biomedical relevance and contemporary techniques will be addressed if appropriate.

Prerequisites: CHEM F321.

Lecture + Lab + Other: 3 + 0 + 0

Grading System: Letter Grades with option of Plus/Minus

CHEM F455 Environmental Toxicology

3 Credits

Offered Fall

Environmental toxicology will focus on the general properties and principles of persistent and/or poisonous (toxic) chemicals commonly encountered in air, water, fish and wildlife. Numerous natural and synthetic chemicals in the environment will be discussed from a global perspective with some bias towards Arctic and sub-Arctic regions.

Prerequisites: CHEM F321 or CHEM F325; BIOL/CHEM F360; COM F131X or COM F141X; WRTG F111X; WRTG F211X, WRTG F212X, WRTG F213X or WRTG F214X.

Cross-listed with BIOL F455.

Stacked with BIOL F656; CHEM F655.

Lecture + Lab + Other: 3 + 0 + 0

Grading System: Letter Grades with option of Plus/Minus

CHEM F466 Advanced Cell and Molecular Laboratory

3 Credits

Offered Spring

Modern molecular biological techniques including protein and nucleic acid gel electrophoresis, western blotting, cell fractionation, cellular respiration, enzymology and fluorescence microscopy. Lectures will be supplemented with reading from the primary literature. Student projects in this course may satisfy the capstone project requirements of the biological science degree.

Prerequisites: BIOL F360 or CHEM F360 may be taken concurrently.

Cross-listed with BIOL F466.

Lecture + Lab + Other: 2 + 4 + 0

Grading System: Letter Grades with option of Plus/Minus

CHEM F470 Cellular and Molecular Neuroscience

3 Credits

Offered Spring Odd-numbered Years

The cellular and molecular underpinnings of signaling in the nervous system. Topics include properties of excitable membranes, synaptic transmission, neurological integration, the cellular and molecular basis of learning and memory, and pharmacological treatment of neuronal pathologies.

Prerequisites: Two F300-level courses in BIOL or CHEM; MATH F230X or MATH F251X.

Recommended: MATH F252X.

Stacked with CHEM F670; BIOL F679.

Lecture + Lab + Other: 3 + 0 + 0

Grading System: Letter Grades with option of Plus/Minus

CHEM F474 Neurochemistry

3 Credits

Offered Fall Odd-numbered Years

Covers basic and applied aspects of interneuronal signaling of specific neurotransmitter systems. Lectures will be based on chapters from assigned text as well as recent and historical literature relevant to these topics. Basic concepts introduced in lectures will be applied through guided discussion of original research papers.

Prerequisites: BIOL F115X; CHEM F325; BIOL F417 or CHEM F470 or PSY F335.

Stacked with CHEM F676.

Special Notes: Students will learn to prepare "peer reviews" of selected papers and critically discuss original research.

Lecture + Lab + Other: 3 + 0 + 0

Grading System: Letter Grades with option of Plus/Minus

CHEM F481 Seminar

1 Credit

Offered Fall and Spring

Introduction to the techniques and style of technical oral presentation generally accepted by professional chemists. Class meets two hours/week, the first hour in closed session, the second, open to the public. Seminar attendance and participation in observing and critiquing presentations by graduate students, chemistry faculty and their peers is required.

Prerequisites: COM F131X or COM F141X.

Lecture + Lab + Other: 2 + 0 + 0

Grading System: Pass/Fail Grades

CHEM F482 Seminar

2 Credits

Offered Fall and Spring

Introduction to the techniques and style of technical oral presentation generally accepted by professional chemists. Class will meet two hours per week, the first hour in closed session, the second, open to the public. Preparation of a 40 minute presentation to be delivered twice, first, to others in the course.

Prerequisites: CHEM F481; COM F131X or COM F141X.

Lecture + Lab + Other: 2 + 0 + 0

Grading System: Letter Grades with option of Plus/Minus

CHEM F488 Undergraduate Chemistry and Biochemistry Research

2-3 Credits

Offered Fall and Spring

Advanced research topics from outside the usual undergraduate laboratory offerings. The student will be required to make presentations and turn in a final report. Research areas range from atmospheric chemistry to molecular biology. A substantial level of chemistry or biochemistry background is assumed.

Prerequisites: CHEM F434 or CHEM F314.

Lecture + Lab + Other: 0 + 6-9 + 0

Grading System: Letter Grades with option of Plus/Minus

Repeatable for Credit: May be taken 4 times for up to 12 credits

CHEM F498 Research

1-9 Credits

Lecture + Lab + Other: 0 + 0 + 0

Grading System: Letter Grades with option of Plus/Minus

Repeatable for Credit: May be taken unlimited times for up to 99 credits

CHEM F601 Introduction to Atmospheric Sciences

3 Credits

Offered Fall

Fundamentals of atmospheric science. Includes energy and mass conservation, internal energy and entropy, atmospheric water vapor, cloud microphysics, equations of motion, hydrostatics, phase oxidation, heterogeneous chemistry, the ozone layer, fundamentals of biogeochemical cycles, solar and terrestrial radiation and radiative-convective equilibrium. Also includes molecular, cloud and aerosol absorption and scattering.

Prerequisites: Graduate standing.

Cross-listed with ATM F601.

Stacked with ATM F401.

Lecture + Lab + Other: 3 + 0 + 0

Grading System: Letter Grades with option of Plus/Minus

CHEM F603 Biological Inorganic Chemistry

3 Credits

Offered Fall

Survey of structure, functions, and chemical properties of natural metalloproteins and metalloenzymes, roles of metalloproteins in nucleic acid formation and replication, metal-based medicines.

Stacked with CHEM F403.

Lecture + Lab + Other: 3 + 0 + 0

Grading System: Letter Grades with option of Plus/Minus

CHEM F605 Aquatic Chemistry

3 Credits

Offered As Demand Warrants

Chemistry of aquatic systems, including the development of equilibrium and kinetic models to understanding the speciation, transformation and partitioning of inorganic chemical species in aqueous systems. Emphasis is on the study of acid-base chemistry, complexation, precipitation-dissolution and reduction-oxidation reactions.

Prerequisites: Graduate standing.

Cross-listed with ENVE F641.

Lecture + Lab + Other: 3 + 0 + 0

Grading System: Letter Grades with option of Plus/Minus

CHEM F606 Atmospheric Chemistry

3 Credits

Offered Spring Odd-numbered Years

Chemistry of the lower atmosphere (troposphere and stratosphere) including photochemistry, kinetics, thermodynamics, box modeling, biogeochemical cycles and measurement techniques for atmospheric pollutants; study of important impacts to the atmosphere which result from anthropogenic emissions of pollutants, including acid rain, the "greenhouse" effect, urban smog and stratospheric ozone depletion.

Prerequisites: ATM F601.

Cross-listed with ATM F606.

Stacked with CHEM F406.

Lecture + Lab + Other: 3 + 0 + 0

Grading System: Letter Grades with option of Plus/Minus

CHEM F609 Aqueous and Environmental Geochemistry

3 Credits

Offered Spring Odd-numbered Years

Chemistry of aquatic and terrestrial environments, including thermodynamic, kinetic and structural principles applied to aqueous geochemical systems. Emphasis on aqueous speciation and heterogeneous interactions (e.g., dissolution/precipitation and sorption) involved in the partitioning, transformation and transport of chemical species in the environment.

Prerequisites: CHEM F331 or Graduate standing.

Cross-listed with GEOS F633.

Lecture + Lab + Other: 3 + 0 + 0

Grading System: Letter Grades with option of Plus/Minus

CHEM F620 Applications of NMR Spectroscopy

3 Credits

Offered Fall Even-numbered Years

Applications of nuclear magnetic resonance (NMR) spectroscopy in the chemical and biochemical sciences. The course will focus on the implementation and interpretation of NMR experiments for solving research problems. Topics include the basic theory of NMR and one- and two-dimensional techniques.

Prerequisites: Graduate standing.

Stacked with CHEM F420.

Lecture + Lab + Other: 3 + 0 + 0

Grading System: Letter Grades with option of Plus/Minus

CHEM F631 Environmental Fate and Transport

3 Credits

Offered Spring Even-numbered Years

Examination of the physical properties that govern the behavior, fate and transport of contaminants released into the environment. Topics include air-water partitioning and exchange, organic solvent-water partitioning, diffusion, sorption, chemical and biological transformation reactions, and modeling concepts.

Cross-listed with ATM F631.

Lecture + Lab + Other: 3 + 0 + 0

Grading System: Letter Grades with option of Plus/Minus

CHEM F632 Molecular Spectroscopy

3 Credits

Offered Fall Odd-numbered Years

Application of quantum mechanics to molecular bonding and spectroscopy. Topics include: applications of lasers to probe chemical reactivity, photochemistry and the detection of trace compounds in mixtures. Variable content. May be repeated for credit.

Prerequisites: CHEM F332.

Lecture + Lab + Other: 3 + 0 + 0

Grading System: Letter Grades with option of Plus/Minus

CHEM F654 Protein Structure and Function

3 Credits

Offered Spring Even-numbered Years

Contemporary topics in peptide and protein biochemistry. Topics include peptide synthesis, protein modification, comparative aspects of structure, protein engineering, enzyme and receptor function as well as molecular modeling.

Prerequisite: CHEM F449.

Lecture + Lab + Other: 3 + 0 + 0

Grading System: Letter Grades with option of Plus/Minus

CHEM F655 Environmental Toxicology

3 Credits

Offered Fall

Environmental toxicology will focus on the general properties and principles of persistent and/or poisonous (toxic) chemicals commonly encountered in air, water, fish and wildlife. Numerous natural and synthetic chemicals in the environment will be discussed from a global perspective with some bias towards Arctic and sub-Arctic regions.

Prerequisites: CHEM F449 or one semester each of organic chemistry and cell or molecular biology.

Cross-listed with BIOL F656.

Stacked with BIOL F455; CHEM F455.

Lecture + Lab + Other: 3 + 0 + 0

Grading System: Letter Grades with option of Plus/Minus

CHEM F657 Molecular Foundations of Gene Expression

3 Credits

Offered Spring Even-numbered Years

The molecular regulation of gene expression in prokaryotes and eukaryotes in the context of development and disease. Major topics include: protein/DNA interactions, structure-function relations of transcription factors, signal transduction, control of transcription and translation, chromatin structure and DNA replication.

Prerequisites: CHEM F449; CHEM F450.

Lecture + Lab + Other: 3 + 0 + 0

Grading System: Letter Grades with option of Plus/Minus

CHEM F660 Chemical Oceanography

3 Credits

Offered Spring

An integrated study of the chemical, biological, geological and physical processes that control the chemical composition of seawater. Boundary interactions with the atmosphere and lithosphere, biogeochemical cycles and tracers of these complex cycles are examined. The marine chemistry of inorganic carbon is considered in detail.

Prerequisites: Graduate standing.**Cross-listed with** OCN F660.**Stacked with** OCN F460.**Lecture + Lab + Other:** 3 + 0 + 0**Grading System:** Letter Grades with option of Plus/Minus**CHEM F666 Scientific Teaching**

2 Credits

Offered Spring Even-numbered Years

This course explores methods for teaching science at the university level. Emphasis is placed on methods of course design, instructional techniques, assessment, and course management that have been shown by research to improve student learning. This course is intended for graduate students who have an interest in science teaching.

Prerequisites: Graduate standing.**Lecture + Lab + Other:** 2 + 0 + 0**Grading System:** Letter Grades with option of Plus/Minus**CHEM F670 Cellular and Molecular Neuroscience**

3 Credits

Offered Spring Odd-numbered Years

The cellular and molecular underpinnings of signaling in the nervous system. Topics include properties of excitable membranes, synaptic transmission, neurological integration, the cellular and molecular basis of learning and memory, and pharmacological treatment of neuronal pathologies.

Prerequisites: Two F300-level courses in BIOL or CHEM; MATH F230X or MATH F251X.**Recommended:** MATH F252X.**Cross-listed with** BIOL F679.**Stacked with** CHEM F470.**Lecture + Lab + Other:** 3 + 0 + 0**Grading System:** Letter Grades with option of Plus/Minus**CHEM F671 Receptor Pharmacology**

3 Credits

Offered Fall Even-numbered Years

Covers basic drug/receptor theory to train students to assess affinity and efficacy of receptor ligands, interpret functional assays and binding results, and critically evaluate original research regarding receptor pharmacology with an emphasis on ligand-gated ion channels and G-protein coupled receptors.

Prerequisites: Upper-division or graduate biochemistry or neurochemistry course.**Recommended:** BIOL F417.**Lecture + Lab + Other:** 3 + 0 + 0**Grading System:** Letter Grades with option of Plus/Minus**CHEM F674 Membrane Biochemistry and Biophysics**

3 Credits

Offered Fall Even-numbered Years

Basic biophysical and molecular processes associated with membrane-mediated events in the context of cellular physiology. Major topics includes biochemical and biophysical characteristics of membrane lipids; structure-function relation of membrane proteins; protein trafficking/targeting; vesicle transport and membrane fusion/exocytosis; the nature of membrane excitability; and the role of membrane in bioenergetics.

Prerequisites: CHEM F449; CHEM F450.**Lecture + Lab + Other:** 3 + 0 + 0**Grading System:** Letter Grades with option of Plus/Minus**CHEM F675 Cellular Signaling**

3 Credits

Offered Spring Odd-numbered Years

Cellular signaling is vitally important in complex biomolecular systems, development, physiology, and pathology and thus constitutes a major topic in modern medical and pharmacological research. This course concentrates on cellular signal transduction and regulation in higher mammals. Major topics include G-proteins, protein kinases, signaling molecules, lipid mediators, and adaptor proteins.

Prerequisites: Upper division or graduate biochemistry or neurochemistry course.**Lecture + Lab + Other:** 3 + 0 + 0**Grading System:** Letter Grades with option of Plus/Minus**CHEM F676 Neurochemistry**

3 Credits

Offered Fall Odd-numbered Years

Covers basic and applied aspects of interneuronal signaling of specific neurotransmitter systems. Lectures will be based on chapters from assigned text as well as recent and historical literature relevant to these topics. Basic concepts introduced in lectures will be applied through guided discussion of original research papers.

Prerequisites: BIOL F115X; CHEM F325; BIOL F417 or CHEM F470 or PSY F335.**Stacked with** CHEM F474.**Special Notes:** Students will learn to prepare "peer reviews" of selected papers and critically discuss original research.**Lecture + Lab + Other:** 3 + 0 + 0**Grading System:** Letter Grades with option of Plus/Minus**CHEM F686 Chemical Research Mentoring**

2 Credits

Offered As Demand Warrants

This course provides graduate students the opportunity to mentor undergraduates in chemical research within a structured environment, from developing a research idea to executing a small research project. The focus of this course is to refine mentoring skills that contribute to the professional development of maturing chemical professionals.

Prerequisites: Graduate standing in a scientific discipline.**Lecture + Lab + Other:** 1 + 3 + 0**Grading System:** Letter Grades with option of Plus/Minus**Repeatable for Credit:** May be taken 2 times for up to 4 credits**CHEM F688 Biochemical and Molecular Biology Seminar**

1 Credit

Offered Fall and Spring

A seminar on various topics related to biochemistry and molecular biology including discussions of recent literature and research results.

Lecture + Lab + Other: 1 + 0 + 0**Grading System:** Letter Grades with option of Plus/Minus

CHEM F691 Research Presentation Techniques

1 Credit

Offered Fall

Review of recent research in chemistry to expose students to recent findings, methodologies and concepts in a broad range of chemistry and related disciplines. How to present and defend research proposals. Course may be repeated for credit.

Lecture + Lab + Other: 1 + 0 + 0**Grading System:** Letter Grades with option of Plus/Minus**Repeatable for Credit:** May be taken 3 times for up to 3 credits**CHEM F692 Seminar**

1-6 Credits

Lecture + Lab + Other: 1-6 + 0 + 0**Grading System:** Letter Grades with option of Plus/Minus**Repeatable for Credit:** May be taken unlimited times for up to 99 credits**CHEM F698 Non-thesis Research/Project**

1-9 Credits

Lecture + Lab + Other: 0 + 1-9 + 0**Grading System:** Pass/Fail Grades**Repeatable for Credit:** May be taken unlimited times for up to 99 credits**CHEM F699 Thesis**

1-12 Credits

Offered Fall, Spring and Summer

Lecture + Lab + Other: 0 + 0 + 0**Grading System:** Pass/Fail Grades**Repeatable for Credit:** May be taken unlimited times for up to 99 credits