Chemistry

Disciplinary Major or Minor (http://catalog.uwgb.edu/archive/2014-2015/undergraduate/planning/disciplinary-majors-minors)
(Bachelor of Science)

Professor – Michael Zorn
Associate Professors – Franklin Chen, Warren V. Johnson, John M. Lyon (chair), Michael J. McIntire, Debra Pearson, Julie M. Wondergem
Assistant Professor – Jeremy Intemann
Lecturer – Nydia Villanueva

Chemists have made significant contributions to the improvement of the quality of our lives. They have played a vital role in the advancement of so many fields that it is hard to think of an area where the contributions of chemists have not been important. The challenges of today and tomorrow will continue to rely upon well-trained and creative chemists for their solutions.

The UW-Green Bay Chemistry program is an integrated progression of lecture and laboratory instruction that is designed to provide students with the skills needed by chemists today. These skills include a solid understanding of chemical principles, hands-on training in the use of modern instrumentation, experience in the design of experiments and the ability to analyze data and present results. Students are encouraged to refine these skills by engaging in research. The majority of UW-Green Bay Chemistry majors have opportunities to work as research assistants on faculty projects, or to conduct their own independent projects. UW-Green Bay faculty are active in research on chemical catalysis, sol-gel chemistry, natural product synthesis, alternative and renewable energy, chemistry of ultrasound, polymeric surfactant synthesis and application, mesoporous material synthesis and application, chemistry of colors (computation), photocatalysis, sensors, environmental chemistry, biochemistry, and molecular biology. Experience in research is very important when entering the job market and in applying to graduate and professional schools.

The University maintains an excellent collection of modern instrumentation, including: several Hewlett-Packard and Varian gas chromatography (GC) systems with a variety of detectors (e.g., MS, ECD, FID, and TCD); several Shimadzu high performance liquid chromatography (HPLC) systems; a Dionex ion chromatograph (IC); a TESCAN scanning electron microscope (SEM) with an energy dispersive x-ray detector for elemental analysis; an Anasazi nuclear magnetic resonance (NMR) spectrometer; a Nicolet Fourier Transform Infrared (FTIR) spectrometer; a Varian inductively coupled plasma atomic emission spectrometer (ICP AES); a Perkin Elmer luminescence spectrometer (LS); several Shimadzu UV/visible spectrophotometers; a three-channel Lachat QuikChem 8500 flow injection analyzer (FIA) capable of measuring nitrate/nitrite, ammonia, orthophosphate, and total Kjeldahl nitrogen, with 46 slot block digester; a Shimadzu total organic carbon (TOC) analyzer; a Suprex supercritical fluid extractor (SFE); and gamma-ray and liquid scintillation counters. Students gain hands-on experience with these instruments during advanced coursework and in research projects.

Students who want to add depth to their programs may pursue an American Chemical Society (ACS)-certified major in either Chemistry or Environmental Chemistry. Students who complete these majors are registered with the ACS and have the certification recorded on their official University credentials.

Chemistry majors must combine their studies with an interdisciplinary major or minor. A Chemistry major combined with a minor in Human Biology is excellent training for students aiming for professional schools in the health sciences, medicine, dentistry, and veterinary medicine. Environmental Science would be an appropriate interdisciplinary minor for students planning careers as chemists or in environmental studies, or pursuing graduate studies in chemistry. About half of UW-Green Bay Chemistry majors continue their studies in graduate or professional schools.

Students seeking information on teacher certification should contact the Education Office.

This disciplinary major also requires:

Completion of an interdisciplinary major or minor (http://catalog.uwgb.edu/archive/2014-2015/undergraduate/planning/interdisciplinary-majors-minors)

Completion of one of the following areas of emphasis:

- Chemistry Emphasis (http://catalog.uwgb.edu/archive/2014-2015/undergraduate/programs/chemistry/major/disciplinary-emphasis)
- American Chemical Society Certified in Chemistry Emphasis (http://catalog.uwgb.edu/archive/2014-2015/undergraduate/programs/chemistry/major/acscertified-emphasis)
- American Chemical Society Certified in Environmental Chemistry (http://catalog.uwgb.edu/archive/2014-2015/undergraduate/programs/chemistry/major/acscertifiedenv-emphasis) Emphasis

This disciplinary minor also requires:

Completion of an interdisciplinary major (http://catalog.uwgb.edu/archive/2014-2015/undergraduate/planning/interdisciplinary-majors-minors)

- Chemistry Minor (http://catalog.uwgb.edu/archive/2014-2015/undergraduate/programs/chemistry/minor)

Courses

CHEM 108. General Chemistry. 4 Credits.
Survey of basic concepts of matter: its measurement, properties and states; atomic structure and chemical bonding; solutions; acid-base theories, introduction to organic chemistry and biochemistry.
P: Math 101 or Math Placement of Math 104 or greater, and Chem 109 or conc enrl.
Fall and Spring.

CHEM 109. General Chemistry Laboratory. 1 Credit.
Laboratory Course that accompanies Chem 108.
P: Chem 108 or concurrent enrollment
Fall and Spring.

CHEM 211. Principles of Chemistry I. 4 Credits.
Chemistry and measurement; atoms, molecules, and ions; chemical formulas, equations, and reactions; gaseous state; thermochemistry; quantum theory of the atom; electron configurations and periodicity; ionic and covalent bonding; molecular geometry and chemical bonding; and states of matter; liquids and solids.
P: Math 104 or eq or concurrent enrollment & Chem 213 or concurrent enrollment. Can't repeat until open enrollment begins.
Fall and Spring.

CHEM 212. Principles of Chemistry II. 4 Credits.
Solutions; kinetics; chemical equilibrium; acids and bases; acid-base equilibrium, solubility and complex ion formation; thermodynamics and equilibrium; electrochemistry; and nuclear chemistry.
P: Math 104 with at least a C grade or Math Placement of Math 202 or greater; and Chem 211 and 213 with at least a C grade; and conc enr in Chem 214.
Fall and Spring.

CHEM 213. Principles of Chemistry I Laboratory. 1 Credit.
Laboratory Course that accompanies Chem 211.
P: Chem 211 or concurrent enrollment
Fall and Spring.

CHEM 214. Principles of Chemistry II Laboratory. 1 Credit.
Laboratory Course that accompanies Chem 212
P: Chem 212 or concurrent enrollment
Fall and Spring.

CHEM 283F. Exploring Chemistry. 3 Credits.
Students who successfully complete this course will understand basic chemical principles as they relate to the world around them. This class explores the relationships between chemistry and energy, food, medicine, water, the environment and others. While no previous knowledge of chemistry is required, this course does involve the use of chemical formulas and basic math as algebra and scientific notation. This course is taught online and is intended for non-science majors.

CHEM 299. Travel Course. 1-4 Credits.
Travel courses are conducted to various parts of the world and are led by one or more faculty members. May be repeated to different locations.
P: cons of instr & prior trip arr & financial deposit.

CHEM 300. Bio-Organic Chemistry. 3 Credits.
Those aspects of the field pertinent to students entering the biologically related disciplines: Basic organic chemistry, natural products and molecules important to biological systems. Full credit not given for both Chem 300 and Chem 302 or Chem 303.
P: Chem 212 & 214 with at least a C grade or Chem 108 & 109 with at least a C grade.
Spring.

CHEM 301. Bio-Organic Chemistry Laboratory. 1 Credit.
Optional laboratory course to accompany Chem 300. Credit not granted for both Chem 301 and 304.
P: Chem 300 or conc enr; and Env Sci 207 or conc enr or Hum Biol 207 or conc enr.
Spring.

CHEM 302. Organic Chemistry I. 3 Credits.
The chemistry of carbon compounds: structure, reactions, synthesis, stereochemistry, reaction mechanisms, spectroscopy, nomenclature and physical properties of both aliphatic and aromatic compounds; covers all common functional groups and natural products. Full credit will not be awarded for both Chem 300 and 302 or 303.
P: Chem 212 and 214 with at least a C grade.
Fall and Spring.

CHEM 303. Organic Chemistry II. 3 Credits.
The chemistry of carbon compounds: structure, reactions, synthesis, stereochemistry, reaction mechanisms, spectroscopy, nomenclature and physical properties of both aliphatic and aromatic compounds; covers all common functional groups and natural products. Full credit will not be awarded for both Chem 303 and 300.
P: Chem 302 with at least a C grade.
Fall and Spring.

CHEM 304. Organic Chemistry Laboratory I. 1 Credit.
Basic and intermediate synthesis, basic and intermediate instrumental techniques in organic chemistry. Credit will not be granted for both Chem 304 and 301.
P: Chem 212 and 214 with at least a C grade; and Chem 302 with at least a C grade or conc enr.; and Env Sci 207 or conc enr or Hum Biol 207 or conc enr.
Fall and Spring.

CHEM 305. Organic Chemistry Laboratory II. 1 Credit.
Basic and intermediate synthesis, basic and intermediate instrumental techniques in organic chemistry.
P: Chem 303 or conc enr; and Chem 304 with at least a C grade; and Env Sci 207 or conc enr or Hum Biol 207 or conc enr.
Fall and Spring.

CHEM 311. Analytical Chemistry. 4 Credits.
Theory and practice of chemical analysis. Statistics; gravemetric analysis; acid-base chemistry; precipitation, complexometric and redox tetrations; electrochemistry; spectrophotometry; atomic absorption; emission methods; separation methods (gas/liquid chromatography).
P: Chem 212 and 214 with at least a C grade; and Env Sci 207 or conc enr or Hum Biol 207 or conc enr.
Spring.

CHEM 320. Thermodynamics and Kinetics. 3 Credits.
Temperature, heat and work, thermodynamic properties of gases, solids and solutions; homogeneous and heterogeneous equilibria; thermodynamics of electrochemical cells; statistical thermodynamics; calculation of thermodynamic properties; chemical kinetics.
P: Chem 212 and 214 with at least a C grade and Physics 202 with at least a C grade and Math 203 with at least a C grade.
Fall Only.

CHEM 321. Structure of Matter. 3 Credits.
Integrated approach to the concepts of physical chemistry and modern physics: introduction to quantum theory, symmetry, atomic and molecular structure, spectroscopy, X-rays, properties of gases, liquids and solids.
P: Chem 212 and 214 with at least a C grade and Physics 202 with at least a C grade and Math 203 with at least a C grade.
Spring.

CHEM 322. Thermodynamics and Kinetics Laboratory. 1 Credit.
Laboratory course to accompany Chem 320.
P: Chem 320 or conc enr or Physics 320 or conc enr.; and Env Sci 207 or conc enr or Hum Biol 207 or conc enr.
Fall Only.

CHEM 323. Structure of Matter Laboratory. 1 Credit.
Laboratory course to accompany Chem 321.
P: Chem 321 or conc enr or Physics 321 or conc enr.; and Env Sci 207 or conc enr or Hum Biol 207 or conc enr.
Spring.

CHEM 330. Biochemistry. 3 Credits.
Nature and function of the important constituents of living matter, their biosynthesis and degradation; energy transformation, protein synthesis and metabolic control.
P: Chem 303 with at least a C grade (or concurrent enrollment) and Biology 202 with at least a C grade; or Chem 300 with at least a C grade and 301 with at least a C grade and Biology 202 with at least a C grade.
Fall Only.

CHEM 331. Biochemistry Laboratory. 1 Credit.
Laboratory course to accompany Chem 330.
P: Chem 330 or conc enr.; and Env Sci 207 or conc enr or Hum Biol 207 or conc enr.
Fall Only.

CHEM 355. Chemistry in the World. 3 Credits.
Focuses on chemistry of modern issues: air pollution, atmospheric ozone, global warming, energy utilization, water as a natural resource, acid rain, and nuclear energy.
P: Math 101.

CHEM 402. Advanced Organic Chemistry. 3 Credits.
Physical organic approach to chemistry; reaction mechanisms, molecular orbital theory, conservation of orbital symmetry, aromaticity, stereochemistry, linear free energy relationships, isotopes effects, pericyclic reactions, photochemistry, natural products and advanced topics in molecular spectroscopy.
P: Chem 303 with at least a C grade; REC: Chem 321.
Fall Odd.

CHEM 403. Advanced Organic Chemistry Laboratory. 1 Credit.
Laboratory course to accompany Chem 402; advanced molecular spectroscopy, organic qualitative analysis, physical organic chemistry experiments.
P: Chem 402 or conc enr.; and Env Sci 207 or conc enr or Hum Biol 207 or conc enr.
Fall Odd.

CHEM 407. Molecular Biology. 3 Credits.
Molecular approaches to biological problems, emphasizing study of informational macro molecules. Topics include replication, control, expression, organization, and manipulation of genes; RNA processing; protein processing; transposons; oncogenies, growth factors; genetic control of development and the immune system.
P: Biology 303 with at least a C grade or Chem 330 with at least a C grade; REC: Chem 300 or 303.
Spring Odd.

CHEM 408. Molecular Biology Laboratory. 1 Credit.
Molecular biology of nucleic acids and the techniques that form the basis of biotechnology. Topics include electrophoresis, restriction mapping, hybridization, plasmid analysis, and DNA cloning (recombinant DNA library construction, screening, and mapping).
P: Biology 407 or conc enr or Chem 407 or conc enr; and Env Sci 207 or conc enr of Hum Biol 207 or conc enr. REC: Chem 301 or 305.
Spring Odd.

CHEM 410. Inorganic Chemistry. 3 Credits.
Survey of the elements including coordination and organometallic compounds. Modern bonding theories, group theory and periodic properties extended and applied to chemical systems and reactions. General acid-base theory and non-aqueous solvent systems.
P: Chem 212 and Chem 302 with at least a C grade; REC: Chem 303.
Spring Odd.

CHEM 411. Inorganic Chemistry Laboratory. 1 Credit.
Laboratory course to accompany Chem 410.
P: Chem 410 or conc enr.; Chem 304 with at least a C grade; Env Sci 207 or conc enr of Hum Biol 207 or conc enr.; REC: Chem 305
Spring Odd.

CHEM 413. Instrumental Analysis. 4 Credits.
Theory and practice of analysis by instrumental methods, including methods based on absorption and emission of radiation, electroanalytic methods, chromatographic methods and surface analysis methods.
P: Chem 311 with at least a C grade; and Env Sci 207 or conc enr or Hum Biol 207 or conc enr. REC: Chem 303.
Fall Only.

CHEM 417. Nuclear Physics and Radiochemistry. 3 Credits.
Properties and reactions of atomic nuclei; application of the properties of radioactive nuclei to the solution of chemical, physical, biological and environmental problems.
P: Chem 212 and 214 with at least a C grade and Physics 202 with at least a C grade: REC: Chem 321.
Fall Odd.

CHEM 420. Polymer Chemistry. 3 Credits.
An introduction to the synthesis, characterizations, and properties of industrial polymers.
P: Chem 300 or 303 or 321 or Physics 321.
Fall Even.

CHEM 434. Environmental Chemistry. 3 Credits.
Physical, chemical, and biological processes affecting the composition of air and water. Chemical reactions in polluted, and unpolluted environments; dispersal processes and methods of control for various pollutants.
P: Chem 311 with at least a C grade and 300 with at least a C grade; or Chem 311 with at least a C grade and 302 with at least a C grade and 303 with at least a C grade.
Fall Only.

CHEM 435. Environmental Chemistry Laboratory. 1 Credit.
Basic measurement techniques used by environmental scientists to evaluate air and water quality; field methods, continuous monitoring techniques, and in-laboratory analysis techniques. Experiments demonstrate reaction kinetics, stoichiometry, thermodynamics instrumentation, and wet chemical methods.
P: Chem 434 with at least a C grade or conc enr, or Env Sci 434 or conc enr, or Chem 311; and Env Sci 207 or conc enr of Hum Biol 207 or conc enr.
Fall Only.

CHEM 478. Honors in the Major. 3 Credits.
P: min 3.50 all cses req for major and min gpa 3.75 all UL cses req for major. (F,S)
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Fall and Spring.

CHEM 495. Research in Chemistry. 1-5 Credits.
P: Chem 413.
Fall and Spring.

CHEM 497. Internship. 1-12 Credits.
Supervised practical experience in an organization or activity appropriate to a student's career and educational interests. Internships are supervised by faculty members and require periodic student/faculty meetings.
P: jr st.
Fall and Spring.

CHEM 498. Independent Study. 1-4 Credits.
Independent study is offered on an individual basis at the student's request and consists of a program of learning activities planned in consultation with a faculty member. A student wishing to study or conduct research in an area not represented in available scheduled courses should develop a preliminary proposal and seek the sponsorship of a faculty member. The student's advisor can direct him or her to instructors with appropriate interests. A written report or equivalent is required for evaluation, and a short title describing the program must be sent early inthe semester to the registrar for entry on the student's transcript.
P: fr or so st with cum gpa > or = 2.50; or jr or sr st with cum gpa > or = 2.00.
Fall and Spring.

CHEM 499. Travel Course. 1-6 Credits.
Travel courses are conducted to various parts of the world and are led by one or more faculty members. May be repeated to different locations.
P: cons of instr & prior trip arr & financial deposit.