Chemistry

(Bachelor of Science)

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.

UW-Green Bay offers three emphases in chemistry. Two emphases are approved by the American Chemical Society and are designed for students who are interested in a career as a practicing chemist at the bachelor's level or who are interested in advancing their education in graduate or professional school. The other emphasis is appropriate for students who are interested in working in a chemistry intensive industry or teaching chemistry at the secondary level.

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 and tomorrow. 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. 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, polymer synthesis and applications, mesoporous material synthesis and applications, computation chemistry, photocatalysis, sensors, environmental chemistry, biochemistry, and molecular biology. A research experience is an excellent way to develop and to showcase your professional skills and can provide a significant advantage when entering the job market and in applying to graduate and professional schools.

The University maintains an excellent collection of modern instrumentation, including: Hewlett-Packard and Varian gas chromatography (GC) systems with a variety of detectors (e.g., MS, ECD, FID, and TCD); 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; 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); Shimadzu UV/visible spectrophotometers; a three-channel Lachat QuikChem 8500 flow injection analyzer (FIA); 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.

A UW-Green Bay Chemistry major provides excellent training for students interested in careers in industry and for students interested in continuing their studies in graduate and professional schools. UW-Green Bay Chemistry majors are sought after by local industries for their strong chemistry skills and problem-solving abilities. Approximately half of the UW-Green Bay Chemistry majors begin their professional careers in industry. Students interested in continuing their studies have been admitted to the top graduate schools in the chemical and health sciences and into professional schools in medicine, dentistry, and veterinary science. UW-Green Bay Chemistry majors have gone on to become university professors, medical doctors and corporate directors.

Area of Emphasis

Students must complete requirements in one of the following areas of emphasis:

- Chemistry (http://catalog.uwgb.edu/archive/2019-2020/undergraduate/programs/chemistry/major/disciplinary-emphasis)
- American Chemical Society Certified in Chemistry (http://catalog.uwgb.edu/archive/2019-2020/undergraduate/programs/chemistry/major/acscertified-emphasis)
- American Chemical Society Certified in Environmental Chemistry (http://catalog.uwgb.edu/archive/2019-2020/undergraduate/programs/chemistry/major/acscertifiedenv-emphasis)
- Chemistry Minor (http://catalog.uwgb.edu/archive/2019-2020/undergraduate/programs/chemistry/minor)

The following are curriculum guides for a four-year Chemistry degree program and is subject to change without notice. Students should consult a Chemistry program advisor to ensure that they have the most accurate and up-to-date information available about a particular four-year degree option.

- Chemistry
  - General Major (http://catalog.uwgb.edu/archive/2019-2020/undergraduate/programs/chemistry/cg/general)
  - ACS Certified Major (http://catalog.uwgb.edu/archive/2019-2020/undergraduate/programs/chemistry/cg/acs-general)
  - ACS Certified Major in Environmental Chemistry (http://catalog.uwgb.edu/archive/2019-2020/undergraduate/programs/chemistry/cg/acs-environmental)

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Debra A Pearson; Associate Professor; Ph.D., University of California - Davis

Julie M Wondergem; Associate Professor; Ph.D., Marquette University

Mandeep Bakshi; Assistant Professor; Ph.D., Panjab University (India)

Georgette Heyrman; Assistant Professor; Ph.D., Northwestern University

Jeremy J Intemann; Assistant Professor; Ph.D., Iowa State University

Breeyawn Lybbert; Assistant Professor; Ph.D., University of California-Los Angeles

Nydia D Villanueva; Senior Lecturer; Ph.D., University of Connecticut

Courses

CHEM 104. Survey of General Chemistry. 4 Credits.
A one-semester introductory course in college Chemistry including an introduction to organic chemistry.

CHEM 105. Survey of Organic and Biochemistry. 3 Credits.
A foundational course in the chemical makeup and metabolic processes of living organisms. Consists of lectures and may also include discussions and demonstrations.

CHEM 106. Survey of General Chemistry Lab. 1 Credit.
Laboratory to accompany CHEM 104.

CHEM 107. Survey of Organic and Biochemistry Lab. 1 Credit.
Laboratory to accompany CHEM 105.

CHEM 108. Survey of General, Organic and Biochemistry. 3 Credits.
Chemistry and measurements; states of matter and changes of state; atoms and elements; ionic and molecular compounds; chemical reactions; solutions; acids, bases and pH; organic nomenclature; introduction to organic functional groups, physical properties and reactions; carbohydrate structure and function; amino acids and protein structure and function; lipid structure and function; nucleic acid structure and function.
P: Math 101 or Math Placement of Math 104 or greater, and Chem 109 or conc enrl.
Spring.

CHEM 109. Survey of General, Organic, and Biochemistry Laboratory. 1 Credit.
Laboratory Course that accompanies Chem 108.
P: Chem 108 or concurrent enrollment
Spring.

CHEM 198. First Year Seminar. 3 Credits.
First Year Seminar, topics vary.
Reserved for New Incoming Freshman.

CHEM 201. Math for Chemistry Discussion: Principles of Chemistry I. 1 Credit.
This discussion course is designed to supplement the concepts presented in CHEM 211/213. Activities will focus on early exposure to math concepts in time for use in CHEM 211/213, deeper explorations of the mathematics and chemistry concepts addressed in these courses, and mathematics and chemistry skills necessary for success in CHEM 211/213.
P: Concurrent enrollment in CHEM 211/213.
Fall Only.

CHEM 202. Math for Chemistry Discussion: Principles of Chemistry II. 1 Credit.
This discussion course is designed to supplement the concepts presented in CHEM 212/214. Activities will focus on early exposure to math concepts in time for use in CHEM 212/214, deeper explorations of the mathematics and chemistry concepts addressed in these courses, and mathematics and chemistry skills necessary for success in CHEM 212/214.
P: Concurrent enrollment in CHEM 212/214.
Spring.

CHEM 207. Laboratory Safety. 1 Credit.
This course examines safety within the science laboratory with emphasis on practical application. Topics include current safety regulations, identification of hazards, chemical labeling and storage, waste management, personal protective equipment, ventilation, spill response, and biosafety.
P: Biology 201 or 203 or Chem 108, 211 or 212 or Hum Biol 204 or conc enr.
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 greater or eq or concurrent enrollment in MATH 104 & 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 299. 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.

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 Chem 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 Chem 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 306. Organic Chemistry Lab I & II. 2 Credits.
Basic laboratory techniques for organic chemistry including commonly used synthetic methods, purification and characterization of reaction products.

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 Chem 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; and Chem 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 201/202 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 201/202 with at least a C grade.
Fall and Spring.

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 and Spring.

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.
Advanced study of the structures of organic compounds, synthetic strategies, and the mechanisms of reactions will be emphasized. Topics will include molecular orbital theory, stereochemistry, linear free energy relationships, isotope effects, and natural and pharmaceutical products, among others.
P: Chem 303 with at least a C grade
Fall Odd.

CHEM 403. Advanced Organic Chemistry Laboratory. 1 Credit.
Synthesis of a natural pharmaceutical product. Learn the modern strategies and techniques involved in multi-step organic synthesis; run reactions, purify products, and use instruments to characterize products.
P: CHEM 305 with a C or better; Chem 207 with a C or better
Fall 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 423. Polymer Chemistry Laboratory. 1 Credit.
Laboratory course to accompany CHEM 420
P: CHEM 420 or conc. enr.
Fall Even.

CHEM 478. Honors in the Major. 3 Credits.
Honors in the Major is designed to recognize student excellence within interdisciplinary and disciplinary academic programs.
P: min 3.50 all cses req for major and min gpa 3.75 all UL cses req for major.
Fall and Spring.

CHEM 495. Research in Chemistry. 1-5 Credits.
Course is repeatable for credit; may be taken 10 times for a total of 10 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. Course is repeatable for credit.
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 in the semester to the registrar for entry on the student's transcript. Course is repeatable for credit.
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.