

# CHEMICAL SCIENCES

## Chemistry

Ward Beecher Science Hall, Room 5053

Youngstown State University

Youngstown, OH 44555

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Dr. Tim R. Wagner, Chair (trwagner@ysu.edu)

The Division of Chemistry within the Department of Chemical and Biological Sciences offers the BS & BA degrees in Chemistry, and the BS degree in Biochemistry. The Division also has an active MS program, offering both thesis and non-thesis options. Our 4 + 1 program gives students the option of completing the Bachelors and Masters Programs in five years.

The division is exceptionally well-equipped in research instrumentation, and offers a rich, hands-on 'learning through research' experience for its students. State-of-the-art laboratory facilities include NMR, X-ray diffraction (powder and single crystal), electron microscopy (scanning & transmission), and a variety of analytical instrumentation. As part of the College of STEM, the division also participates in the YSU Ph.D. program in Materials Science and Engineering.

Our BS Chemistry program is accredited by the American Chemical Society (ACS), one of the largest scientific societies in the world. Students completing an accredited program are considered to be especially well-trained for the chemistry profession, thus the BS degree is recommended for those students who plan to make a career in industrial chemistry or pursue a graduate degree in chemistry. The BA degree is recommended for those who plan to go into a medical, pharmacy, or dental field and for those who plan to enter business or secondary education careers related to chemistry. The BS Biochemistry degree integrates the chemical and biological sciences for students interested in developing a deep understanding of the molecular and chemical processes of living organisms. Students completing this program will be especially well-prepared for further studies in medicine or graduate school programs in biochemistry, or for related careers in the chemical industry.

Each student majoring in chemistry or biochemistry will be assigned a STEM advisor, who will discuss the overall curriculum necessary for your degree program and will assist you in the preparation of a suitable course sequence and choice of a minor or minors if applicable.

For further information, click on the tabs above or visit the Chemistry (<http://chemistry.yosu.edu/>) home page.

### Chair

**Timothy R. Wagner**, Ph.D., Professor, Chair

### Professor

**Ali Abbaspourtamijani**, Ph.D., Assistant Professor

**Ganesaratnam K. Balendiran**, Ph.D., Professor

**Susan Citrak**, Ph.D., Assistant Professor

**Douglas T. Genna**, Ph.D., Professor

**Allen D. Hunter**, Ph.D., Professor

**John A. Jackson**, Ph.D., Professor

**Brian D. Leskiw**, Ph.D., Professor

**Clovis Linkous**, Ph.D., Professor

**Peter Norris**, Ph.D., Professor

**Michael A. Serra**, Ph.D., Associate Professor

**Josef B. Simeonsson**, Ph.D., Professor

**Wim F.A. Steelant**, Ph.D., Professor

**Nina V. Stourman**, Ph.D., Professor

### Lecturer

**Jennifer R. Decker**, Ph.D., Lecturer

**Janelle Russell**, M.S., Senior Lecturer

## Majors

- BS in Chemistry (<http://catalog.yosu.edu/undergraduate/colleges-programs/college-science-technology-engineering-mathematics/department-chemistry/bs-chemistry/>)
- BS in Chemistry 4+1 Track (<http://catalog.yosu.edu/undergraduate/colleges-programs/college-science-technology-engineering-mathematics/department-chemistry/chemistry-four-plus-one-ms-chemistry-track/>)
- BA in Chemistry (<http://catalog.yosu.edu/undergraduate/colleges-programs/college-science-technology-engineering-mathematics/department-chemistry/ba-chemistry/>)
- BA in Chemistry 4+1 Track (<http://catalog.yosu.edu/undergraduate/colleges-programs/college-science-technology-engineering-mathematics/department-chemistry/ba-chemistry-four-plus-one-ms-chemistry-track/>)
- BS in Biochemistry (<http://catalog.yosu.edu/undergraduate/colleges-programs/college-science-technology-engineering-mathematics/department-chemistry/biochemistry-major/#newitemtext>)
- BS in Biochemistry 4+1 Track (<http://catalog.yosu.edu/undergraduate/colleges-programs/college-science-technology-engineering-mathematics/department-chemistry/biochemistry-four-plus-one-ms-chemistry-track/>)
- BS in Biochemistry, BaccMed Track (<http://catalog.yosu.edu/undergraduate/colleges-programs/college-science-technology-engineering-mathematics/department-chemistry/biochemistry-baccmed-track-major/>)

## Minors

- Chemistry Minor (<http://catalog.yosu.edu/undergraduate/colleges-programs/college-science-technology-engineering-mathematics/department-chemistry/chemistry-minor/>)

### CHEM 1500 Chemistry in Modern Living 3 s.h.

Introduction to basic chemical concepts, the scientific method, and the impact of chemistry on human life and society. Examples may include water treatment, air quality, plastics, drugs, cosmetics, energy resources, food, and the chemical basis of life. Not intended for Chemistry majors.

**Gen Ed:** Natural Science.

### CHEM 1500L Chemistry in Modern Living Laboratory 1 s.h.

Introduction to basic laboratory techniques designed to supplement CHEM 1500. Three hours per week. Concurrent with: CHEM 1500.

### CHEM 1501 An Introduction to Chemistry 3 s.h.

Metric units, dimensional analysis, chemical nomenclature, the mole concept, chemical stoichiometry. Emphasis on problem solving and the mathematics required for success in the study of chemistry. For students without high school chemistry and others needing preparation for CHEM 1510 or CHEM 1515. Three hours lecture, no laboratory.

**Prereq.:** "C" or better in MATH 1510 or Level 20 on the MPT or one unit each of high school algebra and geometry.

**CHEM 1504 Introductory Applied Chemistry for Water/Wastewater Treatment 3 s.h.**

This course presents the basic chemistry and treatment methodologies used in drinking water and wastewater operations. The course is a comprehensive water chemistry course and includes fundamentals of atomic structure, dilution calculations, wastewater chemistry, coagulation, softening and BOD, and chlorination, DBP and corrosion control.

**Prereq.:** none.

**CHEM 1510 Chemistry for the Allied Health Sciences 4 s.h.**

An overview of general, organic, and biochemistry. General chemistry introduces basic principles of chemistry. Organic chemistry examines the physical and chemical properties of molecules based on their functional groups. Biochemistry applies these chemistry concepts to the living organism. Intended for majors in allied health and other applied sciences. Three hours lecture, three hours laboratory.

**Prereq.:** "C" or better CHEM 1501 or equivalent, Level 20 or better on the MPT.

**Gen Ed:** Natural Science.

**CHEM 1510L Chemistry for the Allied Health Sciences Laboratory 0 s.h.**

Laboratory for the allied health chemistry course. Concurrent: CHEM 1510.

**CHEM 1510R Chemistry for the Allied Health Sciences Recitation 1 s.h.**

Discussion and problem solving exercises to complement and enhance study in CHEM 1510. Concurrent: CHEM 1510.

**CHEM 1515 General Chemistry 1 3 s.h.**

An introduction to the fundamental principles of chemistry, including measurement and calculation; chemical stoichiometry; the properties of gases; atomic and molecular structure; bonding; thermochemistry; and periodic properties. Intended for majors in the natural sciences and engineering. Three hours lecture.

**Prereq.:** "C" or better in CHEM 1501 or equivalent; "C" or better in MATH 1513 or "C" or better in MATH 1510.

**Coreq.:** CHEM 1515L; CHEM 1515R if major or repeating CHEM 1515.

**Gen Ed:** Natural Science.

**CHEM 1515L General Chemistry 1 Laboratory 1 s.h.**

Quantitative experiments focusing on topics covered in CHEM 1515 lectures. Three hours lab.

**Prereq.:** "C" or better in CHEM 1501 or equivalent; "C" or better in MATH 1513 or "C" or better in MATH 1510.

**Coreq.:** CHEM 1515.

**CHEM 1515R Recitation for General Chemistry 1 1 s.h.**

Discussion and problem solving based on current material in CHEM 1515. Required for chemistry majors or for those repeating CHEM 1515. Concurrent with: CHEM 1515.

**CHEM 1516 General Chemistry 2 3 s.h.**

A continuation of the study of the principles of chemistry, including solution properties; acids and bases; chemical equilibrium; thermodynamics; reaction kinetics; and electrochemistry. Intended for majors in the natural sciences and engineering. Three hours lecture.

**Prereq.:** "C" or better in CHEM 1515 and "C" or better in CHEM 1515L.

**Coreq.:** CHEM 1516L; CHEM 1516R if major or repeating CHEM 1516.

**Gen Ed:** Natural Science.

**CHEM 1516L General Chemistry 2 Laboratory 1 s.h.**

Quantitative experiments focusing on topics covered in CHEM 1516 lectures. Three hours lab.

**Prereq.:** "C" or better in CHEM 1515L; "C" or better in CHEM 1515.

**Coreq.:** CHEM 1516.

**CHEM 1516R Recitation for General Chemistry 2 1 s.h.**

Discussion and problem solving based on current material in CHEM 1516. Required for chemistry majors or for those repeating CHEM 1516. Concurrent with: CHEM 1516.

**CHEM 1520 Allied Health Chemistry for Online Programs 3 s.h.**

An overview of general, organic, and biochemistry. General chemistry introduces basic principles of chemistry. Organic chemistry examines the physical and chemical properties of molecules based on their functional groups. Biochemistry applies these chemistry concepts to the living organism. Intended for students in the accelerated RN to BSN program.

**Gen Ed:** Natural Science.

**CHEM 2604 Quantitative Analysis 5 s.h.**

Chemical equilibrium, stoichiometry, theory of errors, and volumetric and gravimetric procedures as applied to quantitative determinations. Introduction to electroanalytical, chromatographic and spectrophotometric methods. Emphasis on development of technique. Three hours lecture, six hours lab.

**Prereq.:** CHEM 1516.

**CHEM 2604L Quantitative Analysis Laboratory 0 s.h.**

Quantitative Analysis Laboratory.

**CHEM 2650 Introduction to Undergraduate Research 1-2 s.h.**

Introduction to the methods of chemical research under the direction of a faculty member. May include literature search and analysis, instructional laboratory development, and/or original basic or applied research. May be repeated to a maximum of 4 s.h.

**Prereq. or Coreq.:** CHEM 1516 and approval of department chairperson.

**CHEM 3719 Organic Chemistry 1 3 s.h.**

Organic compounds, names, structures, reactions, and mechanisms. Three hours lecture.

**Prereq.:** "C" or better in CHEM 1516 and "C" or better in CHEM 1516L.

**Coreq.:** CHEM 3719L.

**CHEM 3719L Organic Chemistry 1 Laboratory 1 s.h.**

Typical techniques, preparations, and procedures of analysis of organic compounds. Three hours lab.

**Prereq.:** "C" or better in CHEM 1516 and "C" or better in CHEM 1516L.

**Coreq.:** CHEM 3719.

**CHEM 3719R Organic Chemistry Recitation 1 1 s.h.**

An introduction to the preparation and analysis of organic compounds. Discussion of CHEM 3719 material and approaches to problem solving. Required for chemistry majors. Concurrent with: CHEM 3719.

**CHEM 3720 Organic Chemistry 2 3 s.h.**

Organic compounds, names, structures, spectroscopic properties, reactions, and mechanisms. Three hours lecture.

**Prereq.:** "C" or better in CHEM 3719 and "C" or better in CHEM 3719L.

**Coreq.:** CHEM 3720L.

**CHEM 3720L Organic Chemistry 2 Laboratory 1 s.h.**

Typical techniques, preparations, and procedures of spectroscopic analysis of organic compounds. Three hours lab.

**Prereq.:** "C" or better in CHEM 3719 and "C" or better in CHEM 3719L.

**Coreq.:** CHEM 3720.

**CHEM 3720R Organic Chemistry Recitation 2 1 s.h.**

An introduction to the preparation and analysis of organic compounds. Discussion of CHEM 3720 material and approaches to problem solving. Required for chemistry majors. Concurrent with: CHEM 3720.

**CHEM 3729 Inorganic Chemistry 3 s.h.**

Fundamental principles underlying the structure, bonding, and properties of the elements and molecular, solid state, and coordination compounds.

**Prereq. or Coreq.:** CHEM 3739.

**CHEM 3739 Physical Chemistry 1 3 s.h.**

Principles and applications of thermodynamics and kinetics to chemical systems.

**Prereq.:** "C" or better in CHEM 3720, PHYS 2610, MATH 1572.

**CHEM 3739L Physical Chemistry 1 Laboratory 1 s.h.**

Quantitative thermodynamic and kinetic measurements of chemical systems.

**Prereq. or Coreq.:** CHEM 3739.

**CHEM 3740 Physical Chemistry 2 3 s.h.**

Principles and applications of quantum mechanics and statistical thermodynamics to chemical systems. Three hours lecture.

**Prereq.:** "C" or better in CHEM 3739; PHYS 2611, MATH 2673.

**CHEM 3740L Physical Chemistry 2 Laboratory 1 s.h.**

Spectroscopy and computational measurements of chemical systems.

**Prereq. or Coreq.:** CHEM 3740.

**CHEM 3761 Introduction to Polymer Chemistry 1 s.h.**

Survey of polymer chemistry for representative classes of organic polymers, their preparation, characterization, and structure-property relationships.

**Prereq.:** CHEM 3720.

**CHEM 3764 Chemical Toxicology 3 s.h.**

Introduction to the basic principles of toxicology; disposition of toxic agents, focus on the effect that chemical structure has on biotransformation and the mechanism of action of chemicals on living organisms. **Prereq.:** CHEM 3720.

**CHEM 3785 Biochemistry 1 3 s.h.**

Structure and function of proteins, nucleic acids, and carbohydrates. Includes techniques of protein purification and analysis, the study of enzyme catalysis and kinetics. Study of the organization and regulation of metabolic pathways: glycolysis, the citric acid cycle, and oxidative phosphorylation.

**Prereq.:** "C" or better in CHEM 3720.

**CHEM 3785L Biochemistry Laboratory 1 s.h.**

Analysis and separation techniques of biochemistry. Three hours lab-discussion.

**Prereq. or Coreq.:** CHEM 3785.

**CHEM 3786 Biochemistry 2 3 s.h.**

Continues the study of the organization and regulation of metabolic pathways: glycogen metabolism, the pentose phosphate pathway, amino acid, lipid, and nucleic acid metabolism. Biochemical information pathways including replication, transcription, and translation followed by the regulation of gene expression.

**Prereq.:** "C" or better in CHEM 3785.

**CHEM 3790 Undergraduate Seminar 1 s.h.**

Students participate in departmental seminars and present a seminar to the class. May be repeated once.

**Prereq. or Coreq.:** CHEM 2604 and CHEM 3720.

**CHEM 4850 Chemistry Research 1 s.h.**

Research planning, design, and execution including literature survey techniques, proposal writing, and critical scientific analysis. The student gives an oral presentation of a research proposal for CHEM 4850L, or on another topic as approved by the instructor.

**Prereq.:** CHEM 2604 or CHEM 3719 and approval of department chairperson.

**Gen Ed:** Capstone.

**CHEM 4851 Chemistry Research Project 2-3 s.h.**

Research participation under the direction of a faculty member. The student prepares an acceptable written report on the completed project. May be repeated to a maximum of 5 semester hours.

**Prereq.:** Approval of department chairperson.

**CHEM 4860 Regulatory Aspects of Industrial Chemistry 2 s.h.**

Roles and responsibilities of industrial chemists. Industrial hygiene and safety. Industrial chemical processes, their waste products, their environmental effects, and the treatment of pollutants. Governmental regulations relating to waste disposal, product safety, occupational safety, resource conservation, environmental protection, and problems of awareness and compliance.

**Prereq.:** CHEM 3720.

**CHEM 4891 Special Topics 1-3 s.h.**

Topics selected by the faculty from fields of current research interest or of special emphasis. May be repeated with different topics.

**CHEM 4891J Special Topic in Microbial Pathogenesis 1-3 s.h.**

Special Topic in Microbial Pathogenesis Core principles, concepts, and mechanisms by which microbial pathogens interact with the host cell. Three hours lecture.

**Prereq.:** BIOL 3702

**CHEM 5804 Chemical Instrumentation 4 s.h.**

The theoretical foundations of instrumental procedures and the use of instruments in analytical work. Two hours lecture, six hours lab.

**Prereq.:** CHEM 3739.

**CHEM 5804L Chemical Instrumentation Laboratory 0 s.h.**

Chemical Instrumentation Laboratory.

**CHEM 5821 Intermediate Organic Chemistry 3 s.h.**

An intermediate treatment of organic chemistry building on the principles introduced at the sophomore level. Emphasis on curved arrow notation in mechanism and the planning of organic syntheses. Structural analysis of organic compounds using NMR, IR and MS and the application of structural knowledge to questions of mechanism.

**Prereq.:** CHEM 3720.

**CHEM 5822 Advanced Organic Laboratory 4 s.h.**

An advanced approach to the applications of organic chemistry in the laboratory. Synthesis and purification of organic molecules using modern techniques, structure elucidation using spectroscopic techniques. Lecture discussion includes use of instrumentation, planning of practical syntheses, use of the primary chemical literature and safety in the laboratory. Two hours lecture, six hours lab.

**Prereq.:** CHEM 3720.

**CHEM 5822L Advanced Organic Laboratory 0 s.h.**

Advanced Organic Laboratory.

**CHEM 5830 Intermediate Inorganic Chemistry 2 s.h.**

Reactions and descriptive chemistry of transition metal, organometallic, and main-group compounds.

**Prereq.:** CHEM 3729, CHEM 3740 (may be concurrent).

**CHEM 5831L Inorganic Chemistry Laboratory 2 s.h.**

Preparation of typical inorganic compounds and their characterization. Six hours lab-discussion.

**Prereq. or Coreq.:** CHEM 3729 and CHEM 3739.

**CHEM 5832 Solid State Structural Methods 3 s.h.**

The determination of structures of biological, organic, and inorganic materials in the solid state. Introduction to the crystalline state, defects, diffraction of waves, powder and single crystal diffraction methods of neutron and x-ray analysis, electron microscopy, and solid state NMR. Two hours lecture, three hours lab.

**Prereq.:** CHEM 3729.

**CHEM 5832L Solid State Structural Methods Laboratory 0 s.h.**

Solid State Structural Methods Laboratory.

**CHEM 5861 Polymer Science 1: Polymer Chemistry and Plastics 3 s.h.**

Preparation, characterization, structure-property relationships, morphology, and uses of the major commercial polymers. Two hours lecture, three hours lab.

**Prereq.:** CHEM 3739.

**CHEM 5876 Enzyme Analysis 2 s.h.**

Advanced biochemistry laboratory focusing on the methods of enzyme purification and characterization. One hour lecture, two hours lab.

**Prereq.:** CHEM 3785 or equivalent and CHEM 3785L or equivalent.