

Department of CHEMISTRY

<http://www.chem.utk.edu>

Craig E. Barnes, Interim Head

Charles S. Feigerle, Graduate Liaison

Professors

Adcock, J.L., PhD Texas
 Baker, D.C., PhD Ohio State
 Barnes, C.E., PhD Stanford
 Bartmess, J.E., PhD Northwestern
 Compton, R.N., PhD Tennessee
 Cook, K.D., PhD Wisconsin
 Dunning, Jr., T.H., (Distinguished Scientist, Science Alliance
 Center of Excellence), PhD California Institute of Technology
 Feigerle, C.S., PhD Colorado
 Guiochon, G.A. (Distinguished Scientist, Science Alliance
 Center of Excellence), PhD Université de Paris (France)

Kabalka, G.W. (Robert H. Cole Professor, Alumni Distinguished Service Professor), PhD	Purdue
Kovac, J.D., PhD	Yale
Larese, J.Z., PhD	Wesleyan
Magid, L.J., PhD	Tennessee
Magid, R.M., PhD	Yale
Mays, J.W., (Distinguished Scientist, Science Alliance Center of Excellence), PhD	Akron
Pagni, R.M., PhD	Wisconsin
Schweitzer G.K. (Alumni Distinguished Service Professor), PhD	Illinois
Sepaniak, M.J., PhD	Iowa State
Williams, T.F. (Alumni Distinguished Service Professor), PhD	London (UK)
Woods, III, C., PhD	North Carolina State
Wunderlich, B. (Distinguished Scientist), PhD	Northwestern
Xue, Z., PhD	UCLA

Associate Professors

Dadmun, M.D., PhD	Massachusetts
Gilman, S.D., PhD	Penn State
Hinde, R.J., PhD	Chicago
Musfeldt, J.L., PhD	Florida
Schell, F.M., PhD	Indiana

Assistant Professors

Turner, J.F.C., PhD	Oxford (UK)
Young, D.G.J., PhD	Ohio State
Zhang, X., PhD	Pennsylvania
Zhao, B., PhD	Akron

MAJOR

Chemistry	MS, PhD
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DEGREES

The faculty of the Department of Chemistry at the University of Tennessee, Knoxville, seek to prepare their students to join the international ranks of professional chemists in fundamental areas of chemistry as well as cross-disciplinary sciences in which chemical expertise plays a critical role in the development of new knowledge and technologies. Students planning to major in chemistry for the master's or doctoral degree will ordinarily have attained a satisfactory record in the traditional areas of chemistry. The department, however, recognizes that modern chemistry transcends traditional disciplinary divisions. Therefore, it encourages students with undergraduate majors in chemical engineering, the biological sciences, physics, mathematics, computer science, or other fields to apply for admission to our program.

ADMISSION

Admission to the graduate program and a student's course of study in graduate school are decided on a case-by-case basis, taking into consideration an applicant's undergraduate record (traditionally including one year, each, of general, analytical, organic, and physical chemistry, and one-half year of inorganic chemistry), performance on national graduate school tests, and departmental diagnostic exams. All applicants are required to take the general Graduate Record Examination.

MASTER OF SCIENCE

Chemistry Major

CONCENTRATIONS

The department offers concentrations in six areas for the MS: analytical chemistry, environmental chemistry, inorganic chemistry, organic chemistry, polymer chemistry, and physical chemistry.

REQUIREMENTS

The requirements for the MS with a major in chemistry consist of the satisfactory completion of:

- Research and a thesis to give 6 to 12 hours of graduate credit in Chemistry 500.
- Participation in seminar (Chemistry 501) during the entire period of graduate study, including the presentation of at least one seminar. (No more than 2 hours may be applied to the course requirements.)
- Prescribed courses based on performance on diagnostic examinations.
- Sufficient graduate course work in chemistry (at the 400 level or above) and/or a related field to make an overall total of 30 hours, including one of the following sequences: 510-511-512, three of 530-531-532-533, 550-551-552, 570-572-573 and 590-594-595. At least 14 hours of this graduate coursework must be at the 500 level or above.
- A final oral examination.

DOCTOR OF PHILOSOPHY

Chemistry Major

CONCENTRATIONS

The department offers concentrations in eight areas for the PhD with a major in chemistry: analytical chemistry, chemical physics (in cooperation with the Department of Physics), environmental chemistry, inorganic chemistry, organic chemistry, physical chemistry, polymer chemistry, and theoretical chemistry.

REQUIREMENTS

The requirements for the PhD in chemistry (except for the chemical physics concentration) consist of the satisfactory completion of:

1. Research and a dissertation to give at least 24 hours of graduate credit in Chemistry 600. Registration must be continuous from the beginning of research.
2. Participation in seminar (Chemistry 501) during the entire period of graduate study, including the presentation of at least one seminar.
3. Prescribed courses based on performance on diagnostic examinations.
4. Completion of the comprehensive examination series and defense of an original research proposal to give 2 hours of credit in Chemistry 601.
5. Eighteen additional hours in courses at the 500 level or above including at least one course above 601 and one of the following sequences: 510-511-512, 530-531-532-533, 550-551-552-553-554, 570-571-572-573 and 590-594-595.
6. A final oral examination.

The PhD program with a concentration in chemical physics is conducted jointly with the Department of Physics. Requirements depend on the choice of the major department. Chemistry departmental requirements include passing the above degree requirements in chemistry with concentration in physical

chemistry plus six additional hours in physics at the 500 level or above. Three of the additional physics hours can be used to satisfy the 18 hours requirement in item 5.

GRADUATE COURSES

Chemistry (235)

430 Advanced Inorganic Chemistry (3) Atomic and molecular structure, bonding theories, descriptive chemistry of elements, kinetics and mechanism of inorganic reactions, applications of modern techniques for characterization, coordination and organometallic chemistry. Prereq: 230.

450 Advanced Organic Chemistry (3) Modern organic reactions of mechanistic, synthetic, and theoretical interest. Current trends. Prereq: 360.

471-481 Biophysical Chemistry (3,3) (*Same as Biochemistry and Cellular and Molecular Biology 471-481.*)

473-483 Physical Chemistry (3, 3) Students may not receive credit for both 471 and 473 nor for both 481 and 483. 473 - Properties of gases; first, second and third laws of thermodynamics; chemical equilibria; simple phase equilibria; properties of solutions. 483 - Introduction to statistical thermodynamics; kinetics of chemical reactions; introduction to quantum mechanics and applications to electronic structure of atoms and molecules; molecular spectroscopy. Prereq: 130 or 138; Physics 136 or 138 or 222 or 231; and Mathematics 241, 247.

479-489 Physical Chemistry Laboratory (2,2) Experiments on topics discussed in 471-481 or 473-483. 1 lab. Prereq/Coreq: Corresponding courses 471 or 473 for 479 and 481 or 483 for 489.

500 Thesis (1-15) P/NP only.

501 Chemistry Seminar (1) Lectures and discussion on current research. May be repeated. Continuous registration required for resident graduate students. Satisfactory/No Credit grading only.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

505 Special Problems (3) Specially assigned theoretical or experimental work on problems not covered in other courses. Prereq: Consent of department. May be repeated. Maximum 6 hours Satisfactory/No Credit grading only.

510 Analytical Spectrometry (3) Principles and practice of optical and mass spectrometric techniques in quantitative chemical analysis. Required background: Two semesters of physical chemistry.

511 Analytical Separations (3) Principles and practice of chemical separations based on extraction, chromatographic, and electrophoretic phenomena. Required background: Two semesters of physical chemistry.

512 Electroanalytical Chemistry (3) Fundamentals of electrode processes; principles and practice of electroanalytical techniques in quantitative chemical analysis and applied to study of chemical systems. Required background: Two semesters of physical chemistry.

530 Chemical Bonding (3) Wave mechanical atom, group theory, quantum approach to molecular orbital theory, covalent, ionic, and metallic bonding, ligand field theories, solid state. Required background: One semester of inorganic chemistry.

531 Characteristics of Inorganic Compounds (3) Descriptive chemistry of elements; structure, reactions, kinetics, mechanisms, equilibria, and spectra of coordination, organometallic, bioinorganic compounds. Required background: One semester of inorganic chemistry.

532 Experimental Methods of Inorganic Chemistry (3) Electronic, infrared, Raman, microwave, NMR, ESR, nuclear quadrupole, Mossbauer, mass, and photoelectron spectroscopies for characterization of inorganic compounds. Required background: One semester of inorganic chemistry.

533 Chemistry of the Transition Metals (3) Theoretical and experimental foundations of modern coordination, organometallic, and bio-inorganic chemistry of transition metals; transition metal mediated catalysis, materials chemistry, isolobal theory, kinetics and mechanism of reactions of transition metals, and applications in organic synthesis. Required background: One semester of inorganic chemistry.

550 Structure and Reactivity in Organic Chemistry (3) Structure and bonding in organic compounds; molecular orbital theory, stereochemistry, conformational analysis, and molecular mechanics; substituent effects on acidity and reactivity; introduction to reaction mechanisms. Required background: Two semesters of organic chemistry.

551 Organic Reactions (3) Organic transformations of use in synthesis; carbonyl chemistry and carbon-carbon bond formation; stereochemistry and regiochemistry of synthetic processes. Prereq: 550.

552 Organic Reaction Mechanisms (3) Techniques and principles in study of organic reaction mechanisms; applications and interpretations in polar, radical, and pericyclic reactions; reactive intermediates. Prereq: 550.

553 Spectroscopic Characterization of Organic Compounds (2) Organic structure elucidation using spectroscopic methods: nuclear magnetic resonance, infrared, ultraviolet and mass spectrometry. Required background: Two semesters of organic chemistry.

554 Organic Spectroscopy Laboratory (1) Use of IR, UV, MS and multinuclear FTNMR spectrometers. Development of problem-solving ability in area of spectroscopic characterization of organic molecules. Prereq: 360 or equivalent. Coreq: 553.

570 Quantum Chemistry and Spectroscopy (3) Basic principles of quantum mechanics and their applications to molecular orbital theory, molecular structure, and spectroscopy; introduction to group theory. Required background: Two semesters of physical chemistry.

571 Advanced Quantum Chemistry and Spectroscopy (3) Prereq: 570 or consent of instructor.

572 Thermodynamics and Statistical Mechanics (3) Macroscopic and microscopic description of equilibrium systems. Basic principles of thermodynamics and statistical mechanics, and application to selected chemical systems. Required background: Two semesters of physical chemistry.

573 Chemical Kinetics and Transport (3) Time-dependent phenomena in chemistry: chemical kinetics, chemical dynamics, transport theory. Required background: Two semesters of physical chemistry.

590 Polymer Chemistry (3) Fundamentals of polymer synthesis and characterization through application of organic and physical chemical principles. Required background: Two semesters each of organic and physical chemistry.

594 Organic Chemistry of Polymers (3) Synthesis of monomers; mechanism, stereochemistry, sequence distribution, and kinetics of polymerizations. Formation of block, graft, and network polymers. Reactions on polymers. Prereq: 590 or equivalent.

595 Physical Chemistry of Polymers (3) Conformation of macromolecules, solution and bulk properties, rubber elasticity, kinetics of polymerization, polymer thermodynamics. Prereq: 590 or equivalent.

600 Doctoral Research and Dissertation (3-15) P/NP only.

601 Chemistry Research Proposal (2) Preparation and oral defense of original written research proposal based on thorough survey of chemical literature. Prereq: Consent of department head. Satisfactory/No Credit grading only.

610 Selected Topics in Analytical Chemistry (3) Topics of current significance. Prereq: 510, 511, 512 or consent of instructor. May be repeated. Maximum 12 hours.

630 Selected Topics in Inorganic Chemistry (3) Topics of current significance. Prereq: 530, 531, 532 or consent of instructor. May be repeated. Maximum 12 hours.

650 Selected Topics in Organic Chemistry (3) Topics of current significance. Prereq: Two of 550, 551, 552 or consent of instructor. May be repeated. Maximum 12 hours.

670 Selected Topics in Physical Chemistry (3) Topics of current significance. Prereq: 570, 572, 573 or consent of instructor. May be repeated. Maximum 12 hours.

690 Selected Topics in Polymer Chemistry (3) Topics of current significance. Prereq: Consent of instructor. May be repeated. Maximum 12 hours.

691 Selected Topics in Thermal Analysis of Polymeric Materials (3) Topics of current significance. Prereq: Consent of instructor. May be repeated. Maximum 9 hours. Maximum 3 hours may be applied toward degree in chemistry.