Chemistry Research at the University of Tennessee

Thank you for your interest in the research programs in the Department of Chemistry at the University of Tennessee’s main campus at Knoxville.

We are proud of our long-standing tradition of excellence in chemical research and education. Our more than 30 faculty members pursue research at the leading edges of modern chemistry, whether in the traditional divisional areas listed below or in such exciting new interdisciplinary fields as materials chemistry, environmental chemistry, and computational chemistry. We enjoy a close relationship with nearby Oak Ridge National Laboratory, a multiprogram Department of Energy research facility operated jointly by the university and Battelle Memorial Institute. Our students and faculty benefit from ready access to the laboratory’s research facilities, which complement our already impressive in-house research instrumentation.

Our students and faculty have been recognized nationally and internationally for their research and teaching achievements. Three faculty members are fellows of the American Association for the Advancement of Science. Several others have received National Science Foundation CAREER awards, which are given to young faculty members who exhibit outstanding promise for future excellence in research and education. In recent years, three of our graduate students have won National Science Foundation predoctoral fellowships, and one of our students was among 36 graduate students from the U.S. chosen to attend the 50th anniversary annual meeting of Nobel Prize winners in Lindau, Germany.

This brochure describes the research programs of our individual faculty members. Each faculty member has a page on our departmental Web site (www.chem.utk.edu) that outlines her or his research in greater detail and lists several recent publications from her or his research group. We invite you to use this booklet and the Web site to learn more about our tradition of excellence in chemical research.

DEPARTMENTAL DIVISIONS

The ANALYTICAL CHEMISTRY DIVISION is a dynamic faculty–student alliance whose research includes most major areas of analytical chemistry: mass spectrometry, separations, electrochemistry, chemometrics, and spectroscopy. Research results are applied to solve problems in such scientific arenas as process industrial chemistry, biochemical science, and environmental science. In addition to the core faculty in the analytical division, a number of other members of the chemistry faculty and adjunct faculty from ORNL have research projects in analytical chemistry.

The INORGANIC CHEMISTRY DIVISION is organized into research groups that investigate most areas of the field. The university’s facilities, coupled with the internationally known scientific community and complementary resources at ORNL, provide students in inorganic chemistry at UT exceptional opportunities in their graduate research programs. UT’s inorganic chemistry students have conducted their graduate research in the laboratories of ORNL scientists in such cutting-edge fields as materials chemistry and nuclear medicine. The division has recently received major national recognition for its contributions to the field, and that favorable notice is likely to continue: the now-under-construction Spallation Neutron Source at ORNL will bring one of the world’s finest neutron science facilities within commuting distance and offer UT students and faculty members powerful new research techniques.

The ORGANIC CHEMISTRY DIVISION is its diversity of research interests. The expertise of this group encompasses virtually all aspects of modern organic chemistry. Mutually beneficial collaborations with other University of Tennessee academic units and with colleagues at a number of national laboratories (ORNL, BNL, and LANL) greatly enrich the research opportunities for organic chemistry students. Research projects range from total synthesis and medicinal chemistry to new reaction development to fundamental physical–organic studies. Many of them address important aspects of environmental, materials, and life-science goals. Members of the highly regarded organic faculty are active in a number of national and international societies and serve on journal editorial boards.

A major strength of the ORGANIC CHEMISTRY DIVISION at the University of Tennessee covers both basic molecular science and its application to challenging problems. Fundamental studies of chemical structure, dynamics, and reactivity produce results that are then applied to the synthesis of new materials, the development of new sources of energy, and the protection of the environment. Some of the division’s major focuses are molecular spectroscopy, materials chemistry, surface science, polymer science, quantum chemistry, and free-radical chemistry.

Research in the PHYSICAL CHEMISTRY DIVISION at the University of Tennessee addresses the full spectrum of issues in the field, with activities ranging from synthesis to the study of the properties of materials. Making good use of the small-angle X-ray and neutron-scattering facilities at ORNL, polymer chemistry researchers investigate such areas as anionic polymerization, liquid crystalline polymers, colloidal systems, thermodynamics and properties of polymer solutions, blends, and nanocomposites, synthesis of linear and branched polymers and copolymers of controlled structure, Monte Carlo simulations, and the solid state of linear macromolecules.

POLYMER CHEMISTRY DIVISION research at UT addresses the full spectrum of issues in the field, with activities ranging from synthesis to the study of the properties of materials. Making good use of the small-angle X-ray and neutron-scattering facilities at ORNL, polymer chemistry researchers investigate such areas as anionic polymerization, liquid crystalline polymers, colloidal systems, thermodynamics and properties of polymer solutions, blends, and nanocomposites, synthesis of linear and branched polymers and copolymers of controlled structure, Monte Carlo simulations, and the solid state of linear macromolecules.
**CROSS-DISCIPLINARY RESEARCH**

**CHEMICAL PHYSICS**
Chemical physics is an exciting area of molecular science that bridges the traditional fields of chemistry and physics. Because of its interdisciplinary character, this broad field includes such widely varying topics as

- atomic and molecular spectroscopy,
- the structure and dynamics of weakly bound complexes,
- nanostructured functional materials, and
- surface chemistry and catalysis.

Chemical physicists attempt to understand the fundamental properties of molecular systems by using a variety of experimental and theoretical techniques from a number of disciplines to solve the complex, multifaceted problems encountered during their investigations.

**Faculty members with research interests in chemical physics:**
- R. N. Compton (physical)
- M. D. Dadmun (polymer)
- C. S. Feigerle (physical)
- G. A. Guiochon (analytical)
- R. J. Harrison (physical)
- R. J. Hinde (physical)
- I. Z. Larese (physical)
- L. J. Magid (organic)
- J. L. Musfeldt (physical)
- R. M. Pagni (organic)
- J. L. Adcock (inorganic)
- C. E. Barnes (inorganic)
- J. E. Bartmess (organic)
- R. N. Compton (physical)
- K. D. Cook (analytical)
- G. A. Guiochon (analytical)
- Y. Lee (analytical)
- G. W. Kabalka (organic)
- F. M. Schell (organic)
- M. J. Sepaniak (analytical)
- X. P. Zhang (inorganic)

**ENVIRONMENTAL CHEMISTRY**
One of the most critical challenges facing all scientists today is restoring the health of the environment by removing toxic substances while preventing the introduction of additional pollutants. Research groups at UT have launched important initiatives in applying chemistry to problems facing the environment, such as

- Developing new methods for the analysis of biological markers of exposure to toxins
- Developing remote sensors to detect natural and manmade toxins and to monitor the remediation of contaminated areas

**Faculty members with research interests in environmental chemistry:**
- J. L. Adcock (inorganic)
- C. E. Barnes (inorganic)
- J. E. Bartmess (organic)
- R. N. Compton (physical)
- K. D. Cook (analytical)
- R. J. Hinde (physical)
- J. Z. Larese (physical)
- Y. Lee (analytical)
- R. M. Pagni (organic)
- M. J. Sepaniak (analytical)
- J. F. Turner (inorganic)
- F. Vogt (analytical)
- Z. B. Xue (inorganic)

**MATERIALS CHEMISTRY**
Most aspects of human life have been heavily impacted by the materials available for people’s use. A fundamental desire for improvements in materials transcends cultures and civilizations and has accelerated in modern times, giving rise both to new commodity materials and to high-performance designer materials for highly specialized uses.

UT chemistry faculty members are at the forefront of modern materials work, investigating the basic building blocks of materials—atoms, molecules, crystals, and amorphous solids. Our research spans all major elements of materials science and includes new materials design and synthesis, composition/structure/properties work, and processing and device issues. Our watchword is performance as we pursue the ultimate goal of molecular-level control of materials.

Materials chemistry at UT is extraordinarily diverse, with rich interdisciplinary opportunities in
every research group:
• Studies of inorganic materials include functionalized sol-gels, ceramics, zeolites, layered magnetic oxides, nanotubes, and molecule-based magnets. Work also focuses on the environmental, sensor, electronic, and superconducting application of these materials.
• Novel approaches have also been developed to prepare, modify, and investigate organic materials. Ongoing efforts focus on fullerenes, carbon nanotubes, polymer blends, diamond films, organic molecular superconductors, and supramolecular assemblies.
• Our close collaborations with ORNL enhance many of these on-campus efforts. For instance, neutron-scattering facilities support the study of surfactant and micelle structure and dynamics, as well as surface science.

Faculty members studying materials chemistry:
J. L. Adcock (inorganic)
C. E. Barnes (inorganic)
R. N. Compton (physical)
K. D. Cook (analytical)
M. D. Dadmun (polymer)
C. S. Feigerle (physical)
R. J. Hinde (physical)
J. Z. Larese (physical)
L. J. Magid (organic)
J. W. Mays (polymer)
J. Z. Larese (physical)
R. J. Hinde (physical)
C. E. Barnes (inorganic)
D. C. Baker (organic)
X. P. Zhang (inorganic)
Z. B. Xue (inorganic)
F. A. Williams (physical)
J. L. Musfeldt (physical)
J. F. Turner (inorganic)
M. D. Best (organic)
F. M. Schell (organic)
J. F. Turner (inorganic)
G. W. Kabalka (organic)
J. W. Mays (polymer)
J. Z. Larese (physical)
F. M. Schell (organic)
J. F. Turner (inorganic)
Z. B. Xue (inorganic)
B. Zhao (polymer)

NEUTRON SCIENCES
Neutron scattering is one of the most powerful techniques for studying the structure and dynamics of condensed matter. With wavelengths that are similar to interatomic spacings in materials and energies that span the conventional chemical energy scale—from ligand field transitions to the energies associated with molecular rotation on surfaces and quantum tunneling—thermal neutrons are uniquely robust multipurpose tools. They interact with either with the isotopes present in the sample or with unpaired spin density, and their lack of charge gives them great depths of penetration.

Several members of our chemistry faculty use neutrons as research tools in projects focusing on:
• polymer dynamics and structure,
• crystallography,
• molecular assemblies (micelles, for example),
• zeolites and other porous materials, and
• the dynamics of surface-adsorbed gases.

Our close collaboration with nearby Oak Ridge National Laboratory allows joint and adjunct faculty members to use the facilities of both institutions to perform neutron-scattering research. In fact, the ORNL connection will soon make the UT Chemistry Department the best arena for such research by virtue of unmatched access to facilities. ORNL now features the upgraded High Flux Isotope Reactor, which provides some of the world’s best cold neutron beams and serves as a highly competitive reactor source for small-angle neutron scattering, magnetic studies, and crystallography. Currently under construction at ORNL is the world’s most powerful accelerator-based pulsed neutron source, the Spallation Neutron Source, expected to be on line in 2006.

Faculty members with research interests involving neutron scattering:
C. E. Barnes (inorganic)
R. N. Compton (physical)
M. D. Dadmun (polymer)
R. J. Hinde (physical)
J. Z. Larese (physical)
L. J. Magid (organic)
J. F. Turner (inorganic)

SYNTHESIS
Tailoring molecules for specific purposes is an escalating challenge to modern chemistry. At UT, synthesis contributions to biomedicine, materials science, and environmental quality have high priority. Our synthesis students master cutting-edge tools and techniques to develop new synthesis methods, apply state-of-the-art spectroscopic techniques, and exploit sophisticated computational methods to resolve problems. Goals of the synthesis groups at UT have included the elaboration of natural products, catalysts, polymers, and pharmaceuticals.

Some of our synthesis results:
• New kinds of reactions
• Compounds active against HIV
• A therapeutic agent used to destroy tumors
• Bifunctional polymer reagents
• New silicate-based sorbents that exhibit enhanced ion recognition to help remove toxic metal ions from aqueous waste streams

Faculty members pursuing research in synthesis:
D. C. Baker (organic)
C. E. Barnes (inorganic)
M. D. Best (organic)
G. W. Kabalka (organic)
J. Z. Larese (physical)
J. W. Mays (polymer)
F. M. Schell (organic)
J. F. Turner (inorganic)
Z. B. Xue (inorganic)
X. P. Zhang (inorganic)
B. Zhao (polymer)

THEORETICAL & COMPUTATIONAL CHEMISTRY
Inexpensive high-speed desktop computers linked in powerful parallel clusters have revolutionized computational and theoretical chemistry. This dramatic increase in available computing power, coupled with advances in algorithms and numerical methods, has enabled computer simulations of molecular behavior and chemical processes that have rapidly advanced theory and application.

Members of our theoretical and computational chemistry faculty are engaged in developing new algorithms and codes to attack ever larger and more complex problems, and they continue to refine the formal theoretical base of modern computational chemistry methods. Students in our department can access both a network of Linux machines within the department and high-end parallel computers jointly operated by the university and Oak Ridge National Laboratory.

Primary focus areas:
• Ab initio quantum chemical calculations
• Studies of chemical reaction dynamics
• Investigations of highly quantum cryogenic fluids and solids
• Simulations of polymer structure and dynamics
• Studies of molecules adsorbed on surfaces

Recent research projects:
• Chemical processes occurring in the earth’s atmosphere and the atmospheres of other planetary bodies
• Structure of glassy condensed phases
• Dynamics of molecules embedded in superfluid helium droplets or in cryogenic matrices
• Dynamics of polymer chains near solid surfaces or near polymer–polymer interfaces
• Electronic structure and vibrational dynamics of adsorbates on surfaces

Faculty members involved in theoretical and computational chemistry:
J. E. Bartmess (organic)
B. E. Bursten (inorganic)
M. D. Dadmun (polymer)
G. A. Guiochon (analytical)
R. J. Harrison (physical)
R. J. Hinde (physical)
J. D. Kovac (physical)
J. Z. Larese (physical)
**Faculty**

**Jamie L. Adcock (1974)**
**Professor:** Elemental fluorine chemistry, environmental chemistry  
(865) 974-3391; adcock@utk.edu  
- B.Sc. in chemistry, University of Texas—Austin (1966)  
- Ph.D. in chemistry, University of Texas—Austin (1971)  

Dr. Adcock’s research interests include synthetic chemistry using elemental fluorine, development of molecules having device-element properties, and investigation of novel cage systems, especially fluorinated cages.

**Ziegler Professor:** Chemistry of carbohydrates and heterocyclic compounds, medicinal chemistry, design of novel antiviral and anticancer agents  
(865) 974-1066; dbaker@utk.edu  
- B.S. in chemistry, University of Tennessee (1969)  
- Ph.D. in organic chemistry, Ohio State University (1973)  
- Editor, Carbohydrate Research  

**David C. Baker (1990)**
**Ziegler Professor:** Chemistry of carbohydrates and heterocyclic compounds, medicinal chemistry, design of novel antiviral and anticancer agents  
(865) 974-1066; dbaker@utk.edu  
- B.S. in chemistry, University of Tennessee (1969)  
- Ph.D. in organic chemistry, Ohio State University (1973)  
- Editor, Carbohydrate Research  

Dr. Baker’s research is in the design, synthesis, and evaluation of carbohydrate and heterocyclic compounds of interest in the chemotherapy of cancer and viral diseases. Emphasis is on design via molecular modeling strategies and development of synthetic approaches to complex organic compounds. Structural analysis is carried out via NMR spectroscopy and mass spectrometry. New initiatives include the development of active anti-HIV agents and cell-surface carbohydrate chemistry aimed toward limiting cancer metastasis.

**Craig E. Barnes (1984)**
**Professor and Head:** Inorganic and organometallic chemistry, catalysis, materials chemistry  
(865) 974-3446; cebarnes@utk.edu  
- B.S. in chemistry, Harvey Mudd College (1977)  
- Ph.D. in chemistry, Stanford University (1982)  

Dr. Barnes’s research interests focus on synthetic inorganic, organometallic, and materials chemistry. Current research directions include the development of replacement catalysts for methylalumoxane (MAO) and the design and synthesis of selective metal ion sorbents for application in environmental remediation efforts.

**John E. Bartmess (1984)**
**Professor:** Physical organic chemistry, gas phase chemistry  
(865) 974-6578; jbartmess@utk.edu  
- B.A. in chemistry, Rice University (1970)  
- Ph.D. in organic chemistry, Northwestern University (1975)  

Dr. Bartmess’s interests involve physical organic chemistry, with a focus on thermochemistry and solvation phenomena. By investigating familiar solution-phase reactions in the gas phase, it can be shown that the solvent plays a major role in determining the mechanism of those involving ions as reactants. This has been carried out using an interactive combination of mass spectrometry and computational chemistry. In addition, solution calorimetry, previously used as an additional tool, is now being extended into investigations of “green” chemistry dealing with solvation of molecules by ionic liquids.

**Michael D. Best (2005)**
**Assistant Professor:** Bio-organic, supramolecular, and medicinal chemistry  
(865) 974-8658; mdbest@utk.edu  
- B.S. in chemistry, Boston College (1997)  
- Ph.D. in chemistry, University of Texas—Austin (2002)  

Dr. Best’s research focuses on the design and synthesis of molecules that can be used to probe and perturb biological systems. Major emphasis is placed on developing a microscopic understanding of the mechanism by which species such as proteins and viruses bind to cell surfaces. Another focus of the group involves the development of molecular sensors for specific detection of target analytes.

**Bruce E. Bursten (2005)**
**Distinguished Professor and Dean:** Actinide chemistry, dinuclear organometallic complexes, quantum chemistry  
(865) 974-4377; bbursten@utk.edu  
- B.S. in chemistry, University of Chicago (1974)  
- Ph.D. in chemistry, University of Wisconsin (1978)  
- NSF Postdoctoral Fellow  

Dr. Bursten’s group uses quantum chemical methods to explore aspects of inorganic chemistry. In particular, his group attempts to correlate theoretical electronic structure calculations with the structure, bonding, reactivity, and dynamics of large metal-containing systems. Systems of particular interest are organometallic and coordination complexes of the transition metal and actinide elements, dinuclear organometallic complexes, and systems with multiple bonds between metal atoms. The ultimate goal of these studies is to expand our understanding of metal-containing systems, especially those that are experimentally relevant.

**Robert N. Compton (1986)**
**Ziegler Professor:** Physics, materials, laser spectroscopy, chemistry  
(865) 974-9513; rcompton@utk.edu  
- B.S. in physics, Berea College (1960)  
- Ph.D. in physics, University of Tennessee (1965)  
- J. W. Beams Award, American Physical Society  
- W. Meggers Award, Optical Society of America  

Dr. Compton’s experimental research is in multiphoton ionization, photoelectron spectroscopy, nonlinear optics, laser spectroscopy, negative ions, and clusters. Fundamental studies are conducted in the physics of clusters, particularly fulleranes and fullerenes derivatives. Recent interests involve chirality in nature and the origins of homochirality in biomolecules.

**Kelsey D. Cook (1984)**
**Professor:** Mass spectrometry, polymer chemistry, process analysis  
(865) 974-8019; kcook@utk.edu  
- B.A. in chemistry, Colorado College (1974)  
- Ph.D. in chemistry, University of Wisconsin (1978)  
- Associate editor, Journal of the American Society for Mass Spectrometry  

Dr. Cook’s research interests are in analytical and polymer chemistry. He directs the UT Measurement and Control Engineering Center. His research focuses on mass spectrometry, including fundamental studies of ionization mechanisms and applications in industrial and enzymatic reaction (process) monitoring and characterization of synthetic and biopolymers. He is a member of a multidisciplinary team using H/D exchange and other methods for characterization of the fibrils associated with Alzheimer’s and other amyloidogenic diseases.
The research in Dr. Dadmun’s group examines methods by which the properties of polymer mixtures can be optimized by the selective migration of a polymeric additive to the surface or by control of morphology or dispersion size. For instance, the dispersion of nanoscale particles in a polymer matrix can produce novel nanostructured materials with unique and controllable properties.

This group is clarifying how control of the polymer structure can be used to create nanoscale dispersions efficiently and reproducibly, which can then lead to nonlinear enhancement of material properties. They have also developed techniques they use to characterize the impact of polymer architecture on the dynamics of a surface segregation process, their final surface structure and functionality, and the material properties of a surface-modified polymeric material. Thus, the research program is designed to provide specific fundamental information to enable the design and production of multicomponent polymeric materials with such properties as self-healing chemical and flame resistance, exceptional impact strength, and dimensional stability.

Charles S. Feigerle (1985)
Professor: Experimental physical chemistry, materials, laser chemistry
(865) 974-2129; feigerle@utk.edu
• B.S. in chemistry, University of Illinois at Chicago (1977)
• Ph.D. in chemical physics, University of Colorado (1983)

Dr. Feigerle’s research interests are in the physical chemistry of thin films and nanoscale clusters. These represent advanced and emerging materials with applications in coatings, electronics and optoelectronics, sensor technology, and catalysis. Examples are chemical vapor deposition of diamond, monolayer metal films on metal oxides (mixed metal catalysts), and the reactivity of gas phase nanoscale metal clusters.

Georges A. Guiochon (1987)
UT/ORNL Distinguished Scientist: Separations, chemistry, theoretical chemistry
(865) 974-0733; guiochon@utk.edu
• Degree of Ingénieur, École Polytechnique, France (1953)
• Ph.D. in chemistry, L’Université de Paris, France (1958)
• ACS Award in Separations Science and Technology
• ACS Award in Chromatography

Dr. Guiochon’s research interests include all aspects of gas and liquid chromatography, theory, instrumentation and applications, and the problems of physical chemistry related to chromatography. His current activities deal with preparative chromatography and the consolidation of chromatographic columns.

Robert J. Harrison (2002)
UT/ORNL Research Professor: Theoretical and computational chemistry
(865) 241-3937; robert.harrison@utk.edu
• IEEE Sydney Fernbach Award

Dr. Harrison’s research group is developing reliable, accurate, and efficient methods for computing molecular electronic structure, from which essentially all chemistry may be predicted. This activity encompasses developing new theoretical models for electron correlation, response theory for modeling excited states, implementations for massively parallel computers, and application to systems of chemical interest. The group’s work reflects the inherently multidisciplinary nature of modern chemistry, which is closely intertwined with such disciplines as material science and physics. Also required are new mathematical and computer science techniques for fully predictive simulations of large systems.

George W. Kabalka (1970)
Cole Professor: Boron chemistry, medicinal chemistry, radiopharmaceutical chemistry
(865) 974-3260; kabalka@utk.edu
• B.A. in chemistry, University of Michigan (1965)
• Ph.D. in organic chemistry, Purdue University (1970)

Dr. Kabalka’s research is focused on the design, synthesis, and in vivo testing of reagents useful in the detection and treatment of cancer. A primary emphasis is developing new synthetic strategies involving the use of reactive organometallic and organoborane reagents to incorporate isotopes (both radioactive and stable) is emphasized. Current areas of interest: the application of positron emission tomography, magnetic resonance imaging, and boron neutron capture therapy in oncology.

Continued on page 6
Jeffrey D. Kovac (1976)
Professor: Theoretical chemistry, statistical mechanics and thermodynamics, chemical education, history and philosophy of science
(865) 974-3444; jkovac@utk.edu
• B.S. in chemistry, Reed College (1970)
• Ph.D. in chemistry, Yale University (1974)
• Fellow of the American Association for the Advancement of Science
Dr. Kovac’s research interests involve statistical mechanics and thermodynamics of condensed matter, especially computer simulation methods for the study of polymer dynamics and the theory of amorphous solids. He is also involved in chemical education research, including developing student-active learning methods and the teaching of writing, as well as research in the history and philosophy of science.

John Z. Larese (2001)
Professor and UT/ORNL Joint Faculty: Physical chemistry, neutron scattering, materials chemistry
(865) 974-3429; jd@utk.edu
• B.A. in physics, Central Connecticut State University (1977)
• Ph.D. in physics, Wesleyan University (1982)
• Department of Energy Award for Outstanding Scientific Accomplishment
• Department of Energy Award for Sustained Outstanding Research
Dr. Larese’s current research focuses on methods for the synthesis, characterization, and manipulation of novel materials. The Larese group strives to develop a quantitative molecular-level understanding of molecule–molecule and molecule–surface interactions by obtaining detailed information on the structure, dynamics, and chemical activity of surface-adsorbed films using thermodynamic, neutron, and X-ray scattering techniques and computer simulation methods. Opportunities also exist for performing collaborative research at a number of national and international facilities.

Youngmi Lee (2004)
Assistant Professor: Electrochemistry, biocatalytic chemistry, electrochemical microsensors, scanning electrochemical microscopy (865) 974-8898; ylee@ion.chem.utk.edu
• B.S. in chemistry, Ewha Womans University (1994)
• M.S. in analytical chemistry, Ewha Womans University (1996)
• Ph.D. in analytical chemistry, University of Texas—Austin (2001)
The research in Dr. Lee’s group focuses on the development of novel electrochemical microsensors and their applications for biological and biomedical systems. The group seeks to understand the behaviors of physiologically important molecules (e.g., nitric oxide, carbon monoxide, glucose, DNA) connected with the specific characteristics (e.g., cellular damage, shape, location) of various biological living cells. This research includes (1) development of improved electrochemical microsensors that are selective for specific biological molecules and that can perform two or more sensing functions simultaneously, and (2) application of these sensors for imaging living biological tissues and biological cellular membranes chemically, as well as topographically, at the molecular level.

Linda J. (Lee) Magid (1973)
Professor: Physical and physical organic chemistry of complex fluids
(865) 974-4228; imagid@utk.edu
• B.A. in chemistry, Rice University (1969)
• Ph.D. in chemistry, University of Tennessee (1973)
• Fellow of the American Association for the Advancement of Science
• Acting Director, UT/ORNL Joint Institute for Neutron Sciences
Dr. Magid’s research concerns the structure and dynamics of such equilibrium polymers as wormlike micelles formed by surfactant molecules and polyelectrolytes, an example of quenched polymers.
Examples of the techniques used to elucidate microstructure: small-angle scattering of light, neutrons, and X-rays; neutron-spin echo spectroscopy and dynamic light scattering; cryo-TEM/FFEM for direct imaging; rheological measurements; and multinuclear NMR.

Ronald M. Magid (1970)
Professor: Reaction mechanisms
(865) 974-3440; rmagid@utk.edu
• B.S. in chemistry, Yale College (1959)
• Ph.D. in chemistry, Yale University (1963)
Dr. Magid’s research interests are the mechanism and stereochirality of organic reactions. A principal focus in recent years has been on the reaction of allylic halides with nucleophiles and with organometallic reagents. Among the topics studied have been the stereochemistry of the S₂,2’ reaction and the synthesis of allylic halides with high regio- and stereoselectivity.

Jimmy W. Mays (2002)
UT/ORNL Distinguished Scientist: Polymer chemistry
(865) 974-0747; jimmymays@utk.edu
• B.S. in polymer science, University of Southern Mississippi (1979)
• Ph.D. in polymer science, University of Akron (1984)
Research in the Mays group focuses on polymer synthesis, especially the synthesis of novel polymers and copolymers having well-defined architectures. Using these new materials, the group collaborates extensively with physical polymer scientists to develop fundamental understanding of how polymer structure impacts properties and processability.

Janice L. Musfeldt (2000)
Associate Professor: Physical and materials chemistry
(865) 974-3392; musfeldt@novell.chem.utk.edu
• B.S. in chemical engineering, University of Illinois (1987)
• Ph.D. in physical chemistry, University of Florida (1992)
• NSF CAREER Award
Dr. Musfeldt’s research focuses on the spectroscopic properties of novel molecular and low-dimensional electronic and magnetic solids. The group seeks to understand the competition between superconductivity and magnetism, chemical structure–optical property relationships, and the coupling between spin, lattice, and charge degrees of freedom in complex materials using various low-temperature high magnetic field spectroscopies over a wide frequency range. The Musfeldt group has ongoing initiatives in several classes of novel materials: layered and magnetic oxides, inorganic...
nanotubes, molecule-based magnets, organic molecular conductors and superconductors, and fullerene polymers. The group’s strong national laboratory associations (ANL, BNL, NHMFL, and ORNL) and extensive international collaborations (Budapest, Orsay, Poznan) provide a well-rounded experience for students.

Richard M. Pagni (1969)
Professor: Physical and mechanistic organic chemistry, organic and environmental photochemistry, reactions on solid surfaces
(865) 974-3397; rpagni@utk.edu
• B.A. in chemistry, Northwestern University (1963)
• Ph.D. in chemistry, University of Wisconsin (1968)

Dr. Pagni’s current research interests encompass the photochemistry of polycyclic aromatic hydrocarbons in amorphous and crystalline ice, the nature of lithium perchlorate in ether, a widely used catalyst in organic synthesis, and organic reactions on metal oxide surfaces—a topic of relevance in the burgeoning area of environmentally friendly chemistry.

Fred M. Schell (1972)
Associate Professor: Synthesis, natural product chemistry
(865) 974-3141; fschell@utk.edu
• B.S. in pharmacy, University of Cincinnati (1966)
• M.S. in pharmacy, University of Cincinnati (1968)
• Ph.D. in chemistry, Indiana University (1972)

Dr. Schell’s principal interest is developing new synthetic reactions and applying them to the synthesis of physiologically active natural products. Isolation and structure elucidation of bioactive materials constitutes a second area of interest.

George K. Schweitzer (1948)
Alumni Distinguished Professor: Lanthanide chemistry, solvent extraction, radiochemistry
(865) 974-3242; gschweitzer@utk.edu
• B.S. in chemistry, Central College (1945)
• Ph.D. in chemistry, University of Illinois (1948)
• Ph.D. in philosophy and history of science, New York University (1961)

Dr. Schweitzer’s research interests include (1) continuous counter-current solvent extraction of rare earths, (2) rare-earth separations by redox and kinetic differentiation, (3) rare-earth analyses at the ppb level, (4) development of rare-earth detectors for gamma radiation, (5) development of equilibrium sources of short-lived radionuclides, (6) recoil separations of radionuclides, and (7) epistemology of science.

Michael J. Sepaniak (1981)
Ziegler Professor: Microscale separations, optical sensing, biological and environmental chemistry
(865) 974-8023; msepaniak@utk.edu
• B.S. in chemistry, Northern Illinois University (1974)
• Ph.D. in chemistry, Iowa State University (1980)

Research in the Sepaniak group focuses on fundamental development of microchemical methods of analysis with the goal of solving analysis problems in the life, environmental, and forensic sciences. Microfluidic separation techniques, laser-based optical detection using fluorimetry and Raman spectrometry, and micro-electro-mechanical sensing are among the approaches employed.

John F. Turner (1999)
Associate Professor: Synthetic inorganic chemistry, neutronic techniques for inorganic chemistry
(865) 974-3141; johnturner@utk.edu
• B.A. (Hons) in chemistry with quantum chemistry, Oxford University, UK (1991)
• D.Phil. in chemistry, Oxford University, U.K. (1995)
• NSF CAREER Award

Dr. Turner’s research interests are centered on two areas. The first is synthesizing molecules that will catalytically transform small molecules such as hydrocarbons and nitrogen oxides into useful or environmentally benign products. The second concentrates on using neutrons, the most powerful probe of dynamics and structure, to characterize molecular systems in solution and in the solid state. These systems are of contemporary chemical interest or are fundamental archetypes for more complex materials.

Frank Vogt (2005)
Assistant Professor: Analytical chemistry, optical sensors, chemical imaging, statistics
(865) 974-3465; fvogt@utk.edu

Dr. Vogt’s research focuses on optical sensing and statistical data analysis. For studies of highly heterogeneous systems, spectroscopic imaging sensors that combine conventional spectroscopy and imaging techniques are developed. These imaging sensors probe samples at thousands of locations in parallel, thus establishing fast and comprehensive analyses.

Furthermore, computational methods that take full advantage of the entire spectroscopic and spatial information are developed. Examples of research topics in this field are determining (time dependent) concentration maps or enhancing chemical classification by studying spatial distributions of spectroscopic information.

Among the applications of spectroscopic imaging are remote pollution monitoring, process analytical chemistry, and studies in the biomedical field.

Ffrancon Williams (1961)
Alumni Distinguished Service Professor: ESR spectroscopy, matrix isolation, radical ion chemistry
(865) 974-3468; ffwilliams@utk.edu
• B.Sc. in chemistry, University College London (1949)
• Ph.D. in chemistry, University of London (1960)
• Guggenheim Fellow

Dr. Williams’s research involves ESR studies of the structure and reactivity of organic radicals and radical ions in solid matrices. Current work is centered on the radical cation rearrangements of strained organic molecules and their interpretation in terms of the admixture of excited-state character introduced by vibronic coupling.
Ziling (Ben) Xue (1992)
Ziegler Professor: Organometallic and inorganic chemistry, materials chemistry, sensors, separations
(865) 974-3443; xue@utk.edu
• B.S. in chemistry, Nanjing University, China (1982)
• Ph.D. in chemistry, University of California—Los Angeles (1989)
• NSF Young Investigator Award
• DuPont Young Professor Award
• Camille Dreyfus Teacher Scholar Award
Dr. Xue’s research interests are synthetic organometallic/inorganic chemistry, mechanistic pathways in the formation of advanced materials, and developing novel materials for sensor, separation, and electronic applications.

X. Peter Zhang (2001)
Assistant Professor: Inorganic and organic chemistry, catalysis, metalloenzyme mimics, materials chemistry, medicinal chemistry
(865) 974-3419; pzhou@utk.edu
• B.S. in chemistry, Anhui Normal University, China (1985)
• M.S. in chemistry, Beijing Normal University, China (1988)
• Ph.D. in chemistry, University of Pennsylvania (1996)
• NIH National Research Service Award
• NSF CAREER Award
Dr. Zhang’s primary research interests are in the interdisciplinary areas of inorganic, organic, and materials chemistry. His research program involves the design and synthesis of new organometallic ligands, the preparation of their transition metal complexes, and the exploration of their applications in catalysis, materials, biomimics, and medicine. Applications include (1) the development of catalytic systems for interesting organic reactions, (2) the synthesis and study of novel transition metal-containing inorganic-organic hybrid materials, (3) the construction of functional models for metalloenzymes that can mediate important chemical transformations, and (4) the pharmaceutical development and medical applications of porphyrins and metalloporphyrins.

Bin Zhao (2002)
Assistant Professor: Polymer chemistry
(865) 974-3399; zhaop@novell.chem.utk.edu
• B.S. in polymer science, University of Science and Technology of China (1992)
• M.S. in polymer science, University of Science and Technology of China (1995)
• Ph.D. in polymer science, University of Akron (2000)
Dr. Zhao’s research programs are intended to explore the opportunities in the interdisciplinary areas of polymer science, surface science, and microfabrication. Two research directions, polymer brushes and microfluidics, are of primary interest. Some objectives of this research are to synthesize novel polymer brushes, to investigate their behavior in response to environmental changes, and to seek their applications in the emerging fields such as nanoscience.

The so-called “grafting from self-assembled monolayers” approach and controlled/living polymerization techniques will be employed to prepare polymer brushes. Research objectives in the microfluidics field are to manipulate liquid flow inside microchannels and to fabricate novel microfluidic devices by taking advantage of surface effects in submillimeter scales. This research brings chemistry and microfabrication together, providing a great opportunity to those who are interested in exploring new territory in science and technology.

ADJUNCT FACULTY

David B. Beach, adjunct professor
Ph.D., University of California—Berkeley, 1985
Inorganic chemistry
Synthesis and characterization of electroceramic thin-films using sol-gel and MOCVD

Michelle V. Buchanan, adjunct professor
Ph.D., University of Wisconsin—Madison, 1978
Analytical chemistry
Mass spectrometry; gas phase ion processes for structure determination; trapped ion techniques (Fourier transform ion cyclotron resonance and rf quadrupolar ion trap MS); biomolecule analysis; trace detection of compounds in environmental and physiological samples

Paul D. Butler, adjunct assistant professor
Ph.D., University of Tennessee, 1991
Polymer chemistry
Structural and dynamical characterization of colloidal systems

Sheng Dai, adjunct associate professor
Ph.D., University of Tennessee, 1990
Inorganic chemistry
Chemistry of actinides and fission products, laser spectroscopy, sol-gel chemistry, fiberoptic instrumentation, chemical sensors, and molten salt chemistry

Donald Noid, adjunct professor
Ph.D., University of Illinois, 1976
Physical chemistry
Physical chemistry of polymers and polymer powders; theoretical aspects of molecular and polymer spectroscopy and energy transfer processes; chemical kinetics; laser chemistry; molecular modeling, applications of neural networks to chemistry; nanotechnology; classical and quantum chaos

Tuan Vo-Dinh, adjunct professor
Ph.D., Swiss Federal Institute of Technology, Zurich, 1975
Biophysical chemistry
Analytical spectroscopy and chemical sensors

Ronald Wetzel, adjunct professor
Ph.D., University of California—Berkeley, 1973
Protein chemistry and biochemistry
The role of amyloid formation in human disease; structure and assembly of amyloid fibrils; inhibitors of amyloid formation; protein stability and protein aggregation