Indiana University, Bloomington Chemistry Department Faculty

BAKER, LANE, Professor. Ph.D., Texas A&M University, 2001. Electroanalytical and Bioanalytical chemistry, Materials Chemistry and Nanotechnology. The general theme of research is to develop new tools for probing and manipulating biological samples. Designing principles inspired by Mother Nature for the development of new analytical techniques, such as nanopore-based sensors. Especially interested in scanned probe microscopies coupled with electrochemical techniques.

BROWN, KEVIN, Associate Professor. Ph.D., Boston College 2008. Organic Chemistry, Organometallic Chemistry, Enantioselective Catalysis, Total Synthesis, Natural Products. Research in the Brown lab will focus on the invention of new catalysts that will enable the development of new and important chemical transformations for organic synthesis. Inspiration to develop these reactions emanates from the structures of bioactive compounds where an efficient synthesis is needed, but impractical with current state-of-the-art technologies.

CAULTON, KENNETH, Distinguished Professor, PhD University of Wisconsin, 1968. Inorganic and organometallic chemistry related to discovery of new reactions with special reference to refractory bonds, and design of ligands appropriate for their targeted conversions to value-added compounds. Using a broad variety of spectroscopic and structural methods, we focus currently on conversion of CO2 to value-added organic compounds and of nitrate and nitrite, pollutants derived from agricultural ammonia fertilizer which lead to aquatic coastal “dead zones,” into reduced nitrogen compounds which can productively recycle environmental nitrogen. These projects are collaborative with colleagues Zaleski and Smith. A complementary theme uses surface organometallic chemistry to create better single-site heterogeneous catalysts, employing the tools and skills of colleague Steven Tait.

CLEMMER, DAVID E., Professor and Robert & Marjorie Mann Chair. Ph.D., University of Utah, 1992. Analytical chemistry. Structures of macromolecules; complex mixtures; proteomics; drift tube/mass spectrometry. Fundamentals of biopolymer structures, energetics, and the step by step motions that connect different favored geometries. Such studies are important for understanding biopolymer folding and assembly. Development of advanced mass-spectrometry based instrumentation for determining structure and analyzing highly-complex molecular mixtures.

COOK, SILAS, Associate Professor. Ph.D., Columbia University, New York, 2006. Organic Chemistry, Bioorganic Chemistry, Organometallic Chemistry, Asymmetric Catalysis and Supramolecular Chemistry. The research focuses on the creation of biologically relevant small molecules through the synthesis of natural and unnatural molecules with the potential to illuminate living systems. To ease the burden of small-molecule synthesis, new strategies and catalysts are under development that can yield novel tools for chemists and biologists alike.

DANN III, CHARLES E., Associate Professor. Ph.D., Johns Hopkins University School of Medicine, 2001. Biochemistry, biophysics, enzymology, proteomics, and X-ray crystallography. The primary focus of our research is to use analytical, biochemical, and biophysical methods to probe the structure and mechanism of proteins with implications in cancer and inflammatory disease.

DE SOUZA, ROMUALDO T., Provost Professor. Ph.D., University of Rochester, 1987. Nuclear chemistry. Investigation of nuclear fusion and fission; nuclear equation of state studies, particularly the density dependence of the asymmetry term; bulk properties of nuclear matter; multifragmentation of highly excited nuclear systems; Resonant spectroscopy of weakly bound nuclei; synthesis and study of new proton-rich and neutron-rich nuclei. Development of state-of-the-art instrumentation and electronics for imaging studies

DOUGLAS, TREVOR, Earl Blough Professor, PhD., Cornell University, 1991. Biomimetic Materials and Inorganic Chemistry. Understanding the supramolecular architecture of viruses and developing them as platforms for synthetic manipulation with applications in catalysis and medicine. Biomineralization of inorganic solids using protein and polymer interfaces to direct mineral nucleation and growth.

DRAGNEA, BOGDAN G., Professor. Provost Professor. Ph.D., University of Paris at Orsay, 1997. Broad interests in the physical chemistry of self-organizing materials. Emergence of collective properties in nanoparticle systems organized by non-covalent interactions. Experimental models of virus self-assembly. Virus-enabled biophotonic applications. Nanoparticle-induced phase transitions. Development of time-resolved optical probing and control analytical methods. Tools and techniques: various microscopies including single particle tracking, photothermal imaging, correlation and pump-probe laser spectroscopy, atomic force nano indentation, cryo-em microscopy, molecular dynamics simulations.

FLOOD, AMAR H., Professor, Ph.D., Otago University (New Zealand), 2001, Postdoc UCLA. Synthesis, organic chemistry, and self-assembly of molecules and supramolecular materials by design. Recognition, sensing and manipulation of ions in fundamental and applied areas of chemistry from environmental remediation to anti-corrosion. Creation of the brightest fluorescent nanostructures with applications in optical materials.

GERDT, J.P., Assistant Professor. Ph.D., University of Wisconsin–Madison, 2014. Chemical Biology. Research in the Gerdt lab focuses on elucidating the molecular mechanisms of interspecies microbial interactions. We employ chromatography, mass spectrometry, and NMR to identify new interkingdom signaling molecules, and then we utilize biochemical, chemical biology, and genetic tools to identify their mechanisms of action.

GIEDROC, DAVID P., Lilly Chemistry Alumni Professor, Ph.D., Vanderbilt University, 1984. Structural and chemical biology of infectious disease. Bioinorganic chemistry of transition metal homeostasis (metallostasis) in bacterial pathogens; metal sensor proteins and allostery; bacterial hydrogen sulfide homeostasis; biomolecular NMR spectroscopy.

IYENGAR, SRINIVASAN, Associate Professor, Ph.D., University of Houston, 1998. Theoretical Chemistry and Chemical Physics, Development of computational methods for simultaneous treatment of electrons and nuclei, Treatment of fundamental hydrogen bonded systems of importance in the earth's atmosphere and also in energy research, Computational enzymology, New computational methods for molecular electronics, Hybrid QM/MM and QM/QM techniques, Numerical analysis and scientific computing, Quantum information, quantum computing and quantum simulation.

JACOBSON, STEPHEN C., Professor and Dorothy & Edward Bair Chair in Chemistry, Ph.D., Univ. of Tennessee, 1992. Analytical Chemistry. Our research efforts are directed toward miniaturization of analytical instrumentation with an emphasis on micro- and nanofluidic devices. We are actively working in the areas of microfluidic separations, nanofluidic transport, cancer screening, virus sensing and assembly, and bacterial development and aging.

JARROLD, CAROLINE CHICK, Class of 1948 Herman B Wells Endowed Professor, Ph.D., University of California, Berkeley, 1994. Physical chemistry, chemical physics, Inorganic chemistry, materials chemistry. Broad experimental skill sets and fundamental chemical and physical insights are acquired when we apply mass spectrometry, anion photodetachment techniques and computational chemistry to a range of systems with relevance in atmospheric chemistry, catalysis, inorganic chemistry, and exotic lanthanide materials.

JARROLD, MARTIN F., Professor and Robert & Marjorie Mann Chair. Ph.D., University of Warwick, 1980. Charge detection mass spectrometry (CDMS) is a novel MS method that can determine accurate molecular weights into the gigadalton regime (i.e., way beyond the mass range of conventional MS). We work on developing CDMS instrumentation and applications of CDMS to a range of interesting problems including viruses, protein complexes, protein aggregation, lipoproteins, micelles, and nanoparticles.

LEWIS, JARED C., Associate Professor, Ph.D., University of California, Berkeley, 2007. We develop new catalysts, including small molecule transition metal catalysts, enzymes, and artificial metalloenzymes, for challenging chemical transformations. Students receive training in organic/organometallic synthesis, enzyme discovery/engineering (genome mining, directed evolution, bioconjugation, high throughput experimentation etc.), and mechanistic studies (kinetics, spectroscopy, computational simulation, etc.).

LI, LIANG-SHI, Associate Professor. Ph.D., University of California-Berkeley, 2003. Organic, inorganic nanomaterials. We synthesize carbon-based nanomaterials and study their properties for artificial photosynthesis, chemical catalysis, environment remediation, and cancer therapy.

OAKLEY, MARTHA G., Professor. Ph.D., California Institute of Technology, 1994. Biochemistry. Structure, function and interactions of proteins involved in the maintenance of chromosomes during cell proliferation; bacterial chromosome segregation; coiled coils; macromolecular machines.

ORTOLEVA, PETER J., Distinguished Professor, Director, Center for Theoretical and Computational Nanoscience. Ph.D., Cornell University, 1970. Theoretical and physical chemistry. Statistical mechanics, multiscale theory and computation, theoretical nanoscience, virus modeling, self-assembly and pattern formation, kinetics of phase transitions, vaccine discovery.

PETERS, DENNIS G., Herman T. Briscoe Professor, Ph.D., Harvard University, 1962. Analytical chemistry. Electroanalytical chemistry; mechanistic and synthetic aspects of organic electrochemical processes; electrocatalysis; chemically modified and polymer-coated electrodes; transition-metal mediated redox processes; environmental electrochemistry.

POHL, NICOLA L., Professor and Joan & Marvin Carmack Chair. Ph.D., University of Wisconsin – Madison, 1997. Analytical and synthetic organic chemistry, chemical biology. Development of synthetic methods for solution and automated synthesis of biomolecules, especially carbohydrates and peptides, in batch and flow. Internet-of-Things-based automation development, including low-cost analytical sensors and computation. Design of reagents and tools for mass-spectrometry-based and other biological assays. Design and synthesis of materials such as vaccines and vaccine adjuvants to control immune responses.

RAGHAVACHARI, KRISHNAN, Distinguished Professor. Ph.D., Carnegie-Mellon University, 1981. Computational Quantum Chemistry. New methods in electronic structure theory; Fragment-based methods for large molecules; Quantum structure-based drug design; Accurate models for theoretical thermochemistry; Electronic structures and properties of molecules and materials; Nanographene-based materials for catalytic applications; Spectroscopy and chemical reactions on semiconductor surfaces; Computational investigations of complex materials and nanotechnology; Electronic structures and chemical reactions of metal oxide clusters.

RAFF, JONATHAN, Associate Professor, PhD Indiana University, 2007. Environmental, Analytical and Physical Chemistry. Specific focus on mechanisms of chemical and biochemical transformations of nitrogen in the atmosphere and on terrestrial/aqueous surfaces in laboratory and field settings, in order to understand factors that control rates of atmosphere-surface exchange and pollution degradation. Central to the group's approach is the use of cutting-edge spectroscopic and mass spectrometry techniques to measure trace gases and intermediates under environmental conditions.

REILLY, JAMES P., Professor. Ph.D., University of California, Berkeley, 1977. Physical and bioanalytical chemistry. Protein-protein interactions studied using novel chemical labeling, cross-linking and biomolecular mass spectrometric methods. Photofragmentation of peptide ions and its application to peptide sequencing and protein identification.

SCHLEBACH, JONATHAN, Assistant Professor. Ph.D., Purdue University, 2012. Chemical Biology and Biophysical Chemistry. Research is focused on the mechanisms of integral membrane protein folding and misfolding in the cell, and how this relates to the molecular basis of disease. Ongoing efforts also include the development of new techniques to address current challenges in precision medicine.

SKRABALAK, SARA, James H. Rudy Professor. Ph.D., University of Illinois at Urbana – Champaign, 2007. Materials Chemistry, Inorganic Chemistry, Nanotechnology, Catalysis. The overall research goals are to (1) develop chemical and engineering ways of controlling the shape, size, and architecture of inorganic solids, (2) study their structure/function relationships, and (3) apply these materials to energy, catalytic, environmental, and security applications.

SMITH, JEREMY M., Professor. Ph.D., University of the Witwatersrand (South Africa) 1996. Synthetic and mechanistic inorganic chemistry, energy and environmentally-relevant catalysis. Synthesis, characterization and reactivity of metal-ligand multiple bonds, magnetic properties of paramagnetic complexes, nitrogen cycle electrocatalysis.

SNADDON, THOMAS N., Assistant Professor. Ph.D., University of Leeds, UK, 2008. Organic Chemistry, Enantioselective Catalysis, Stereochemistry, Natural Product Synthesis, Biological Probes. Research is primarily directed toward the development and application of new catalysis-based methods for carbon–carbon and carbon–heteroatom bond formation. These methods are applied to the syntheses of stereochemically complex natural products and analogues, which display medicinally significant biological activity.

STEVENS, PHILIP S., James H. Rudy Professor. Ph.D., Harvard University, 1990. Atmospheric chemistry. Chemical kinetics and mechanisms of atmospheric reactions; in-situ measurements of free-radicals in the atmosphere.

TAIT, STEVEN L., Professor. Ph.D., University of Washington, 2005. Surface Chemistry and Catalysis, Materials Chemistry, Physical Chemistry, Nanomaterials, and Energy. Synthesis, characterization, and reaction activity measurements of single-atom heterogeneous catalysts. Metal-organic complexation at surfaces. Surface analysis, including scanning tunneling microscopy, atomic force microscopy, and surface-sensitive vibrational and photoelectron spectroscopies. Molecular self-assembly at surfaces for highly-ordered organic semiconductor and organic photovoltaic materials.

THIELGES, MEGAN, Associate Professor. Ph.D. The Scripps Research Institute, 2009. Bioanalytical Chemistry, Biophysical Chemistry, Chemical Biology. Multidimensional infrared spectroscopy of biomolecules, protein dynamics and flexibility, disordered proteins, biological molecular recognition, and evolution of protein dynamics

VANNIEUWENHZE, MICHAEL, Standiford H. Cox Professor of Chemistry. Ph.D., Indiana University, 1992. Organic Chemistry, Synthesis, study, and design of antibiotics that inhibit bacterial cell wall biosynthesis; peptidoglycan biosynthesis and bacterial cell morphology; development of HBV capsid-binding probes and assembly-directed antivirals.

WILLIAMS, DAVID R., Professor and Harry G. Day Professor of Chemistry. Ph.D., Massachusetts Institute of Technology, 1976. Organic chemistry. New synthetic methodology and the total synthesis of biologically active natural products.

YE, XINGCHEN, Assistant Professor. Ph.D., University of Pennsylvania, 2012. Materials Chemistry, Physical Chemistry, Nanoscience and Nanotechnology, Catalysis. The research themes of our group are to (1) precision synthesis of colloidal nanomaterials and their integration into mesoscale nano-assemblies, (2) in-situ liquid cell electron microscopy of materials transformations, (3) nanoscale materials for catalysis and device applications.

YU, YAN, Associate Professor. Ph.D., University of Illinois at Urbana-Champaign, 2009. Bioanalytical Chemistry, Chemical Biology, Nanomaterials, Biophysical Chemistry. The overall goals of our research program are to (1) to develop nanomaterials for understanding and controlling immune cell functions, and (2) to understand the environmental impact of nanomaterials. Interdisciplinary approaches include nanomaterial fabrication, biochemical and physical characterization, advanced optical imaging.

ZALESKI, JEFFREY M., Professor. Ph.D., Michigan State University, 1993. Physical-inorganic and bioinorganic chemistry. The design and study of novel pharmaceutical agents based on transition metal complexes is currently one of the frontiers of inorganic chemistry and catalysis. Research being conducted in my group employs various spectroscopic methods to investigate the structure and kinetics of biologically relevant intermediates involved in enzyme and drug-related reaction mechanisms.