# OSU Chemistry and Biochemistry Research Interests

| Bioinorganic | Biophysics | Catalysis | Chemical Synthesis | Chemical/Materials Characterization | Data/Chemical/Analytics | Energy | Environmental | Healthcare Applications |
|---|---|---|---|---|---|---|---|---|
| Cowan | Cowan | Baker | Allen | Badu-Tawiah | Hadad | Baker | Allen | Badu-Tawiah |
| Shafaat | Dalbey | Co | Badjic | Baker | Hummon | Co | Co | Bong |
| Zhang | Foster | Cowan | Bong | Bruschweiler | Kankia | Cowan | Coe | Bruschweiler |
| | Jaroniec | Goldberger | Dogan Ekici | Co | Musier-Forsyth | Dutta | Dutta | Coe |
| | Kankia | Gopalan | Forsyth | Coe | Schultz | Goldberger | Forsyth | Cowan |
| | Kohler | Hadad | Goldberger | Dutta | | Grandinetti | Hadad | Dalbey |
| | Kudryashov | McGrier | Hadad | Forsyth | | Hadad | McGrier | Dogan Ekici |
| | Lindert | Nagib | Hamilton | Grandinetti | | Kohler | Wyslouzil | Dutta |
| | Musier-Forsyth | RajanBabu | Nagib | Hadad | | McGrier | | Goldberger |
| | Schultz | Schultz | Parquette | Hummon | | Sevov | | Hummon |
| | Shafaat | Sevov | RajanBabu | Jaroniec | | Shafaat | | Kohler |
| | Singer | Shafaat | Sevov | Kankia | | Turro | | Magliery |
| | Sotomayor | Thomas | Thomas | Kohler | | Wu, Y | | Olesik |
| | Wysocki | Turro | Wade | McGrier | | Zhang | | Parquette |
| | Zhong | Wade | Wu, Y | Olesik | | | | Pei |
| | | Wu, Y | Zhang | Schultz | | | | Schultz |
| | | Zhang | | Thomas | | | | Turro |
| | | | | Wade | | | | Wu, Z |
| | | | | | | | | Yoder |

# OSU Chemistry and Biochemistry Research Interests (continued)

| Materials | Molecular/Structural Biology | Nucleic Acids/RNA Biology | Polymers | Separation Science | Spectroscopy | Surface Science | Theory/Modelling |
|---|---|---|---|---|---|---|---|
| Baker | Cowan | Cowan | Kankia | Olesik | Allen | Allen | Hadad |
| Co | Dalbey | Foster | Kohler | | Baker | Baker | Herbert |
| Dutta | Foster | Gopalan | McGrier | | Bruschweiler | Co | Lindert |
| Goldberger | Gopalan | Jackman | Olesik | | Co | Dutta | Singer |
| Grandinetti | Hadad | Kankia | Wyzgoski | | Coe | Schultz | Sokolov |
| Kohler | Kankia | Kohler | | | Cowan | Wyslouzil | Sotomayor |
| McGrier | Magliery | Musier-Forsyth | | | Foster | | Thomas |
| Parquette | Musier-Forsyth | Nakanishi | | | Grandinetti | | Yoder |
| Schultz | Ottesen | | | | Gustafson | | Zhang |
| Singer | Pei | | | | Hadad | | |
| Wade | Schultz | | | | Jaroniec | | |
| Woodward | Wysocki | | | | Kankia | | |
| Wu, Y | Zhong | | | | Kohler | | |
| Zhang | | | | | Musier-Forsyth | | |
| | | | | | Schultz | | |
| | | | | | Shafaat | | |
| | | | | | Thomas | | |
| | | | | | Turro | | |
| | | | | | Wyzgoski | | |
| | | | | | Zhang | | |
| | | | | | Zhong | | |

# Chemistry and Biochemistry Faculty

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|  | **Heather Allen** | Atmospheric aerosols, pulmonary surfactant, and interfacial electric fields are investigated by surface spectroscopy and imaging methods to reveal the driving forces of molecular organization that then impact atmospheric chemistry and lung function. Advanced surface spectroscopic methods are also being developed. |
|  | **Jovica Badjic** | My group focuses on developing novel synthetic hosts for trapping molecules and promoting chemical reactions. |
|  | **Abraham Badu-Tawiah** | Challenges in chemical detection; new mass spectrometry methods; diagnosis of disease, detection of illicit drugs, and discovery of biomarkers. Novel analytical platforms that enable the use of charged micro-droplets as reaction vessels. Top-down proteomics. |
|  | **Robert Baker** | Ultrafast X-ray spectroscopy, Catalysis for energy conversion and storage, CO2 reduction, Water oxidation, Interfacial charge transfer, Nanoparticle catalysis. |
|  | **Dennis Bong** | Designed molecular recognition, peptide and nucleic acid folding triggers, Bifacial peptide nucleic acid, organic and polymer synthesis, delivery. |
|  | **Rafael Bruschweiler** | Our research program focuses on protein dynamics (enzymes, regulatory and intrinsically disordered proteins) in relationship to function using NMR and long MD simulations. It also covers Metabolomics of complex biological samples to uncover the metabolic response to health and disease. |
|  | **Anne Co** | Electrochemistry. Electrocatalysis. Materials for energy storage. Kinetics and Mechanism. Surface and interfaces. In-situ methods for real-time measurements of electrochemical processes. |
|  | **James Coe** | The Coe Group develops applications of plasmonics, records infrared spectra of single inhalable dust particles, and is developing an infrared probe for detecting cancer. |

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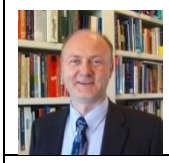
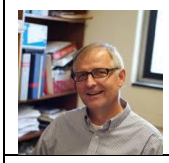
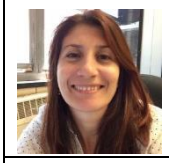
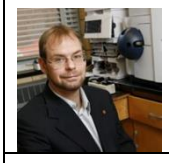
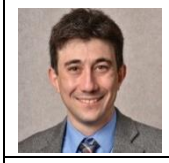
|  | **James Cowan** | Bioinorganic chemistry; RNA; cellular iron and iron proteins; catalytic metallodrugs; metallobiochemistry; neurochemistry |
|  | **Ross Dalbey** | Membrane protein folding, insertion and assembly; structure and function; proteases involved in quality control and secretion. |
|  | **Özlem Doğan Ekici** | The main focus of my research is to develop novel inhibitors for proteases. Currently, we are working on the design, synthesis, and evaluation of new classes of inhibitors for the constitutive and immunoproteasomes for the treatments of certain cancers, inflammatory disorders, and autoimmune diseases. |
|  | **Prabir Dutta** | Microporous materials synthesis; photochemistry in microporous materials; harsh environment sensors; toxicity of mineral fibers |
|  | **Craig Forsyth** | Synthesis of complex, biologically active organic molecules based upon natural product templates; enabling synthetic methods; selective protein serine-threonine inhibition; mechanism of action of the phorboxazole, thyrsiferyl, and apratoxin natural products |
|  | **Mark Foster** | Structure and dynamics of macromolecules (proteins, DNA, RNA); gene regulation, protein-protein interactions, molecular recognition, allostery, NMR spectroscopy. |
|  | **Joshua Goldberger** | We design new materials for next-generation electronics and devices, catalysis, and medical diagnostics and therapeutics. Our lab is multidisciplinary, combining synthetic organic, inorganic, and solid-state chemistry, with insight and measurements from the condensed-matter physics, materials science, and biomedical communities. |
|  | **Venkat Gopalan** | We use RNase P, a catalytic ribonucleoprotein (RNP), as an experimental model to understand how proteins modulate RNA structure and function. We also explore whether the metabolic capability to utilize fructose-asparagine may be exploited to design narrow-spectrum anti-Salmonella therapeutics. |
|  | **Philip Grandinetti** | Our research interests focus on the use of magnetic resonance to probe dynamics and structure in non-crystalline solids and energy-related materials. Motivated by the challenges of such difficult-to-characterize materials we have developed numerous magnetic resonance methodologies, theories, and analyses over the years. |

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|  | **Terry Gustafson** | The primary focus of our research efforts is the elucidation of the structure and dynamics of photo-generated transient species. We use a variety of time-resolved spectroscopies to probe energy and electron transfer in chemical and biological systems. |
|  | **Christopher Hadad** | Biochemical applications in which organic transformations occur in an enzyme's active site; reactive oxygen species and reactive intermediates in biochemical, atmospheric (environmental) and combustion environments; catalysts for improved conversion of chemical feedstocks |
|  | **Ewan John Mcgregg Hamilton** | My primary interests have been in main group chemistry, to this point mostly studying the synthetic and structural aspects of boron compounds, ranging from monoboron species to clusters and non-oxide ceramic materials. |
|  | **John Herbert** | Electronic structure theory and molecular quantum mechanics, especially for condensed-phase systems and excited states; development of quantum chemistry software. |
|  | **Amanda Hummon** | Mass spectrometry and proteomics. |
|  | **Jane Jackman** | The Jackman lab uses enzyme kinetics, model organism genetics, and RNA biochemistry to uncover the molecular mechanisms and biological functions of tRNA processing and modification enzymes that catalyze critical reactions in biology. |
|  | **Christopher Jaroniec** | Biophysical chemistry, Nuclear Magnetic Resonance spectroscopy, protein structure and dynamics, protein folding and misfolding, amyloids, chromatin. |
|  | **Besik Kankia** | The Kankia group employs DNA quadruplexes in various biotechnological applications: (i) quadruplex priming amplification for isothermal amplification of DNA; (ii) quadruplex-and-$Mg^{2+}$ noncovalent interaction as a new class of capture molecules with major advantages over streptavidin-biotin system; and (iii) DNA quadruplex as a structural and recognition element of static and dynamic nanotechnologies. |
|  | **Bern Kohler** | We investigate the photophysical and photochemical dynamics of excited electronic states in solution and in solid nanomaterials. Molecular excited states are prepared ‘instantly’ with femtosecond laser pulses and interrogated as a function of time using electronic and vibrational spectroscopy. In analogy to microscopy, which provides access to miniscule spatial dimensions, femtosecond laser spectroscopy reveals the temporal evolution of the microscopic world. |

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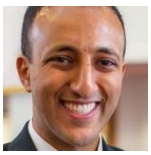
|  | **Dmitri Kudryashov** | Kudryashov's lab focuses on both fundamental and applied research in the following areas: 1) developing innovative cancer-targeting drugs of high potency and selectivity; 2) investigating the role of cytoskeleton proteins in invasive activity of immune and cancer cells; 3) investigating molecular and cellular mechanisms of bacterial protein toxins; 3) exploring molecular mechanisms of toxin inactivation by immune peptides. |
|  | **Steffen Lindert** | Research in the lab focuses on the development and application of computational techniques for modeling biological systems, with the goal of gaining a deeper understanding of biomolecular processes, predicting protein structure de novo with the use of sparse experimental data, and discovering new drugs. |
|  | **Thomas Magliery** | Combinatorial and statistical approaches to protein stability, structure and function; protein engineering for therapeutic purposes. |
|  | **Psaras McGrier** | Research in the McGrier group focuses on utilizing novel synthetic methods to create functional porous and polymeric materials that can be useful for environmental safety, device applications, and clean energy technologies. |
|  | **Karin Musier-Forsyth** | RNA-protein interactions critical for assembly of HIV-1 and other retroviruses; Quality control mechanisms of aminoacyl-tRNA synthetases and related *trans*-editing enzymes; Role of aminoacyl-tRNA synthetases in human health and disease mechanisms. |
|  | **David Nagib** | Developing multi-faceted approaches for selective C-H and C-O activation, using combinations of radical (1e-) and closed shell (2e-) processes. |
|  | **Kotaro Nakanishi** | Humans use more than 2,000 microRNAs to regulate gene expression. Due to the significance, their dysregulation causes neurological diseases and cancers. We take a combinatorial approach, biochemistry, molecular biology, cell biology, and structural biology, to elucidate the molecular mechanisms of the gene expression. |
|  | **Susan Olesik** | Our research involves new materials to enhance analytical separation science. Recent areas of research include studies of biologically relevant compounds and improvements in chromatographic efficiency and ionization efficiency in surface assisted laser desorption ionization (SALDI) using nanoparticle and nanofiber arrays and devices. |

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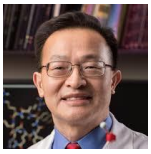
|  | **Jennifer Ottesen** | Peptide and protein chemistry, chemical ligation, chromatin modifications, synthetic proteins in the cell |
|  | **Jon Parquette** | Our research revolves around the theme of organic nanotechnology. We focus on the synthesis and assembly of organic nanomaterials that function as catalysts, optoelectronics, biomedical materials and drug delivery vectors. |
|  | **Dehua Pei** | Design of protein-protein interaction inhibitors as chemical probes and therapeutics; Discovery and mechanism of novel cell-penetrating molecules for intracellular delivery of biologics; Cell entry mechanisms of bacterial toxins and viruses; Engineering of cell-permeable proteins. |
|  | **T.V. RajanBabu** | Major areas of our research are in the development new catalytic enantioselective methods for C-C, C-H and C-N bond formations using readily available organic precursors and catalysts, and, applications of the newly developed methods for the synthesis of biologically relevant molecules. |
|  | **Zachary Schultz** | Research in the Schultz Lab, focuses on developing chemical measurement tools relevant to biomedical diagnostics and materials characterization. We are investigating questions in metabolomics, protein receptor signaling, and active plasmonics. |
|  | **Christo Sevov** | Our research targets the development of new strategies for safe, sustainable, and scalable organic synthesis and energy storage that exist at the interface of homogeneous catalysis and electrochemistry. |
|  | **Hannah Shafaat** | Combining metalloprotein engineering, spectroscopy, inorganic chemistry, electro- and photochemistry, and computational methods to investigate mechanisms of bioinorganic systems with relevance to energy conversion and disease. |
|  | **Sherwin Singer** | Our group develops theory for condensed phases: liquids, solids, and aerosol droplets. Recent interest, which relates to nanotechnology, explores how electric fields can direct fluid flow in small channels. We have also developed a successful theory for transitions among the many phases of ice. Our interests also extend to the properties of amyloid fibrils. |

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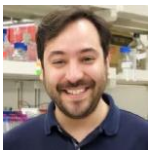
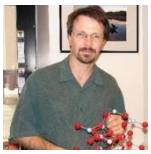
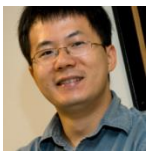
|  | **Alexander Sokolov** | Research in the Sokolov group aims to develop new theoretical methods for the simulations of light-induced and non-equilibrium processes in chemical systems with complex electronic structure. |
|  | **Marcos Sotomayor** | Mechanotransduction; Mechanosensitive Ion Channels; Elasticity of Modular Proteins; Adhesion Molecules in Neural Circuits and Cancer, Theoretical Modeling; Molecular Dynamics Simulations; X-ray Crystallography & Structural Biology; Molecular Biophysics |
|  | **Christine Thomas** | Synthetic inorganic and organometallic chemistry; design of sustainable catalysts featuring metal-metal bonds and non-innocent ligand platforms; spectroscopic and computational studies of inorganic and organometallic complexes. |
|  | **Claudia Turro** | The use of light to initiate chemical reactions with applications in solar energy conversion and to release therapeutic agents; understanding the fundamental processes that take place after molecules absorb a photon using ultrafast spectroscopy. |
|  | **Casey Wade** | Synthetic inorganic and organometallic chemistry; synthesis and applications of metal-organic frameworks; design and study of new homogeneous and heterogeneous catalysts; |
|  | **Patrick Woodward** | Our research efforts seek to understand existing functional materials and discover new ones. We are currently developing nontoxic, solution processable materials for use solar cells and LEDs. We are also striving to understand the magnetism of oxides containing 5d transition metal ions. |
|  | **Yiying Wu** | Wu group has been working at the interface of synthetic molecular chemistry, solid state materials chemistry, and (photo) electrochemistry. Our current focuses are dye-sensitized solar cells, metal-air batteries, and (photo) electrocatalysts for solar fuels. We utilize knowledge, concepts and techniques from chemistry, physics, materials science and engineering to create new materials, explore new sciences, and enable new applications. |
|  | **Zhengrong Wu** | Characterization of macromolecules by means of modern NMR spectroscopy; dynamic studies of macromolecules for understanding their functional mechanism; drug development based on structural studies of drug-target complexes. |

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|  | **Barbara Wyslouzil** | Our focus is aerosol science: experiments and simulations that investigate the formation, growth and structure of nanodroplets, as well as phase transitions that occur within nanodrops. We also explore biomedical applications of aerosol science. |
|  | **Vicki Wysocki** | Structural Biology; Mass Spectrometry; Protein Structure and Folding |
|  | **Faith Wyzgoski** | Dr. Wyzgoski specializes in studies of nuclear magnetic resonance (NMR) at high field to identify and quantify chemopreventive components in black raspberries. She is also involved with advanced NMR studies of synthetic polymers and is currently working collaboratively with DuPont on fluoropolymer NMR analysis. |
|  | **Ryan J. Yoder** | Dr. Yoder's current research involves molecular docking studies examining the interaction of potential therapeutics with acetylcholinesterase (AChE) and modeling of the spectroscopic principles of potential aqueous fluoride, chloride, and bromide probes. |
|  | **Shiyu Zhang** | Biomimetic catalysts, Homogeneous catalysts for solar-to-fuel conversion, Organic radical batteries, Methane oxidation, Halogen photoelimination, Electrochemical energy storage. |
|  | **Dongping Zhong** | Femtobiology, Biomolecular Recognition, Ultrafast Protein/Enzyme Dynamics, Four Dimensional (4D) Electron Diffraction and Microscopy for Biology |