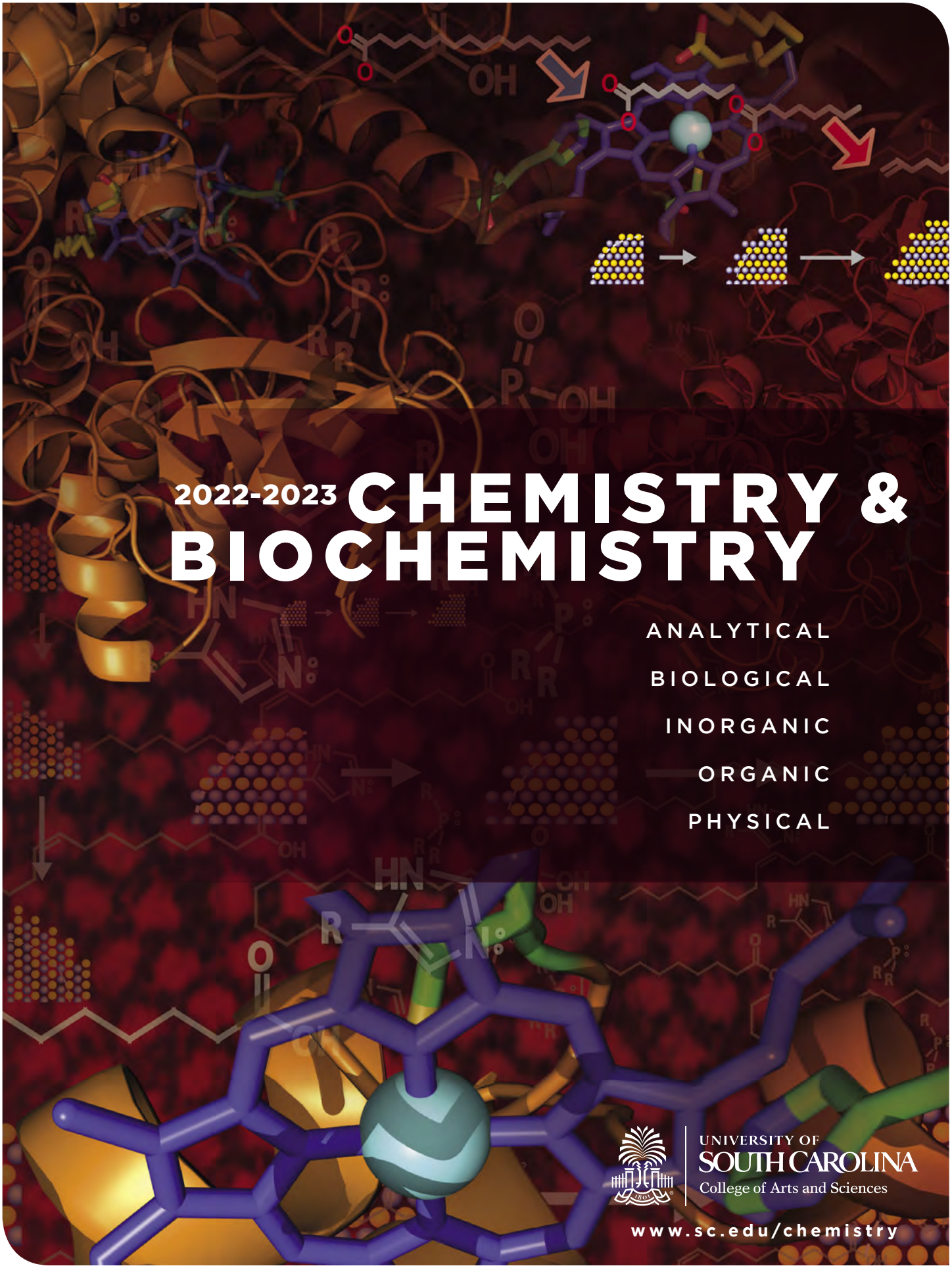


2022-2023 CHEMISTRY & BIOCHEMISTRY

ANALYTICAL

BIOLOGICAL

INORGANIC

ORGANIC

PHYSICAL

UNIVERSITY OF SOUTH CAROLINA
College of Arts and Sciences

www.sc.edu/chemistry

College of Arts and Sciences
Department of Chemistry and Biochemistry
University of South Carolina

Graduate Studies in **Chemistry & Biochemistry** Frequently Asked Questions

What is the yearly stipend for graduate students in your program?

The stipend for the 2022-2023 academic year is $26,000.

Do I pay my own tuition?

No, the department will cover your tuition.

How long is a typical Ph.D. program?

The department average is 4.7 years to complete the program.

Do you have a joint MD/PhD program?

No.

Do you have a masters program?

We only admit students interested in completing a Ph.D. because it is the degree most desired by employers.

Do you have forensic or environmental chemistry programs?

Forensic and environmental chemistry are not separate programs, but we do have clusters of faculty involved in each area.

What is your policy for transfer students entering the Ph.D. program (with or without a M.S. degree)?

Once a transfer student chooses an advisor, the advisor can determine whether courses taken elsewhere may be transferred. Until an advisor is chosen, transfer students follow the same program as other entering students.

Do you have an REU program?

No, but we do offer fellowships to entering graduate students during the summer before they enter our graduate program.

Do you have any connection to biomedical sciences or the USC School of Medicine?

We have a strong biochemistry/molecular biology division that is involved in biomedical research, which includes collaborations with research groups at the USC School of Medicine. Some of our faculty also participate in the Integrated Biomedical Sciences program that allows students to choose a research group from a variety of research labs in colleges and schools across USC.

When and how do students join research groups?

Students choose research advisors at the end of the first semester, after seeing brief seminars from all faculty and participating in a faculty interview process.

What is a typical group size?

The department average is just over 4 students per group.

What type of housing is available in Columbia, SC?

There is some on-campus housing for graduate students, but most students find housing within 15 minutes of campus in single or shared apartments and houses.

How do I apply?

Application is free. You can start with 2-3 recommenders, unofficial transcripts and GRE scores (TOEFL if international).
Visit **www.sc.edu/chemistry** >> **Apply**.

Other questions?

Email **chemgrad@mailbox.sc.edu** or call 800-868-7588

College of Arts and Sciences
Department of Chemistry and Biochemistry
University of South Carolina

Graduate Studies in **Analytical and Environmental Chemistry**

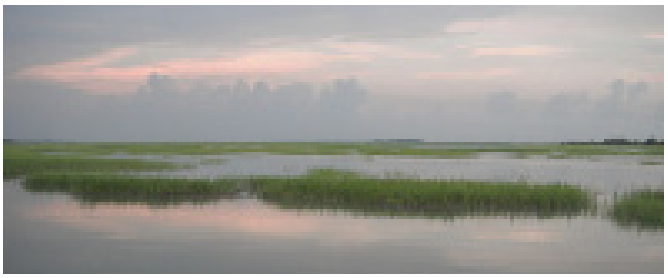
- Top 40 chemistry/biochemistry PhD program*
- Top 25 in chemistry/biochemistry research activity*
- High faculty-to-student ratio promotes personal mentoring and instruction
- All students financially supported by teaching or research appointments
- Fellowships and awards for outstanding teaching and research
- Located in Columbia, SC - rated one of 10 Best College Towns#
- Within 2-hour drive of SC beaches and Blue Ridge Mountains

*National Research Council

#Livability.com

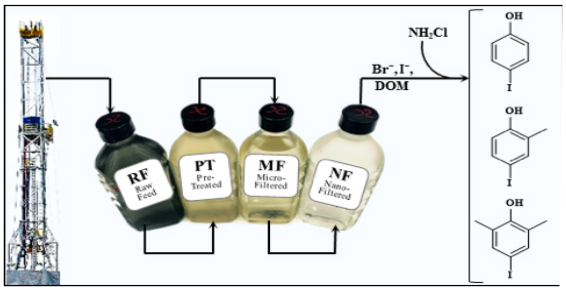
John Ferry

My group studies how natural and technological processes can work to remove trace organic chemicals from the environment. The role of sunlight and surfaces are particularly important in our research.



Susan Richardson

We study disinfection by-products and other emerging environmental contaminants in water to solve important human health and environmental issues. We use GC/MS and LC/MS to identify unknown contaminants and quantify toxicologically important ones.



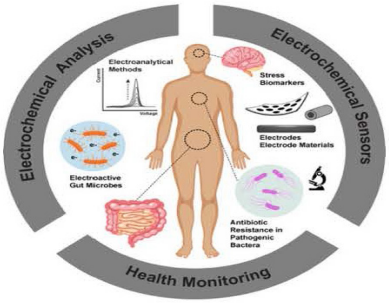
Timothy Shaw

The analytical/environmental chemistry laboratory combines analytical method development with environmental applications such as transport and cycling of trace elements associated with hydrothermal vents, seawater and submarine ground waters.

www.sc.edu/chemistry

Olja Simoska

Our group seeks to establish electrochemical platforms for quantitatively studying of processes in envirments relevant to human health. We investigate important questions at the chemistry-biology interface, including dynamic responses of stress-related biomarkers, mechanisms of antibiotic-resistant bacteria, and electron transfer in gut microbes.



For additional information, please contact:

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Department of Chemistry and Biochemistry
University of South Carolina
631 Sumter Street, Columbia, SC 29208

Email: **chemgrad@mailbox.sc.edu**
Phone: **800-868-7588**
Web: **www.sc.edu/chemistry**

Arts and Sciences

College of Arts and Sciences
Department of Chemistry and Biochemistry
University of South Carolina

Graduate Studies in **Biochemistry & Molecular Biology**

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- Top 25 in chemistry/biochemistry research activity*
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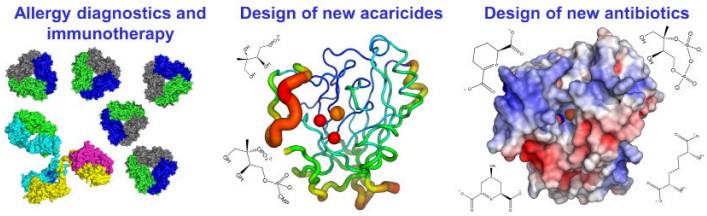
#Livability.com

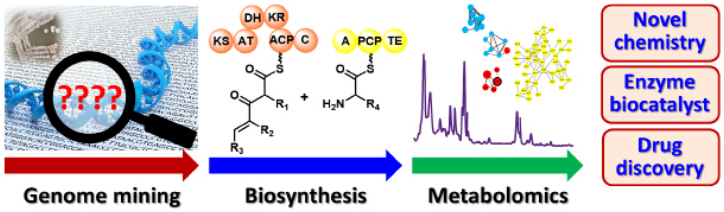
Maksymilian Chruszcz

We specialize in protein chemistry and structural biology, focusing on the analysis of allergens to determine the molecular basis of allergic diseases. Moreover, we study proteins that are targets for the development of antibiotics and pesticides.



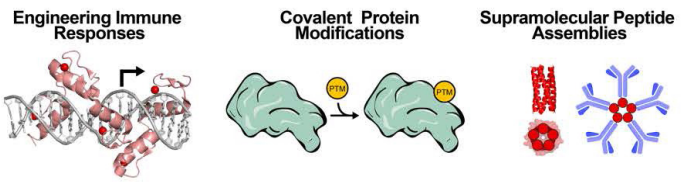
Jie Li

We focus on drug discovery and enzyme biocatalyst development using microbial genome mining and biosynthesis. Our interdisciplinary approach includes organic chemistry, natural products chemistry, biochemistry, metabolomics, genetic engineering, and synthetic biology.



Nicholas Truex

We will develop chemical tools for studying immune pathways and directing their function. We wll achieve these goals by developing engineering papetides, proteins, and small molecules for advancing cancer-and pathogen-targeting immunotherapies.



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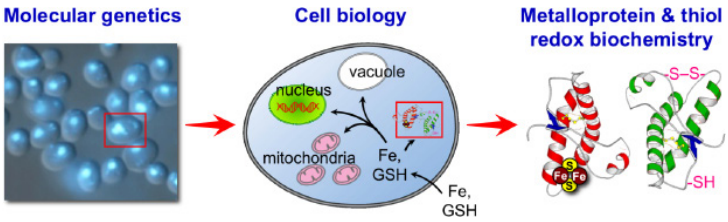
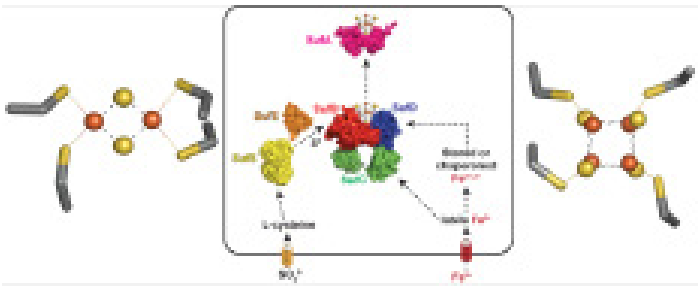
Caryn Outten

We study how cells regulate the essential metal iron and control thiol-disulfide balance using yeast as a model system. We employ a multidisciplinary approach that includes protein biochemistry, molecular genetics, and cell biology.



F. Wayne Outten

We study the homeostasis and metabolism of essential metals like copper, iron and zinc, with the goals of disrupting metal metabolism in bacteria during infection and correcting defects in human metal metabolism that lead to disease.



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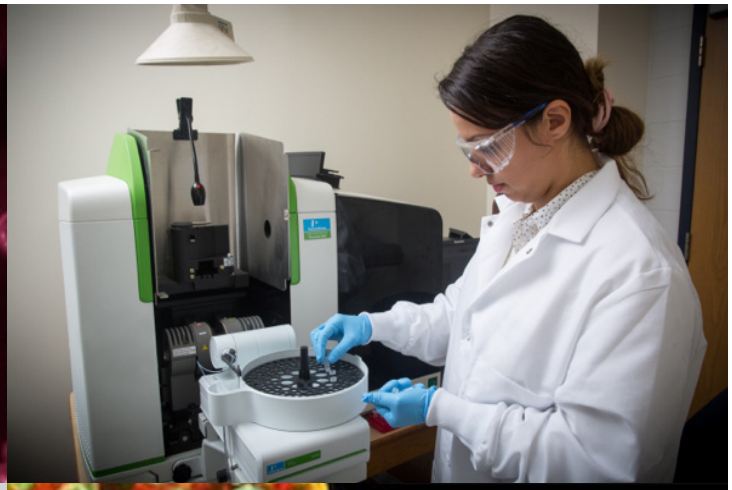

UofSC Arts and Sciences

College of Arts and Sciences
Department of Chemistry and Biochemistry
University of South Carolina

Graduate Studies in **Inorganic and Materials Chemistry**

- Top 40 chemistry/biochemistry PhD program*
- Top 25 in chemistry/biochemistry research activity*
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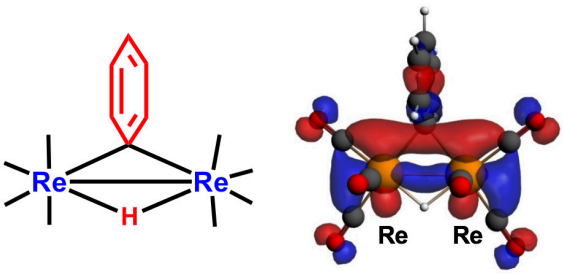
*National Research Council
#Livability.com

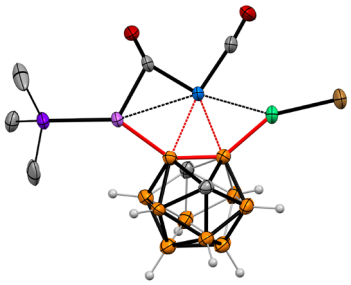
Richard Adams

Our research is focused on the organometallic chemistry of polynuclear metal complexes for the activation of C-H bonds and for the formation of catalysts for the selective oxidation of hydrocarbons to higher-value organic compounds.



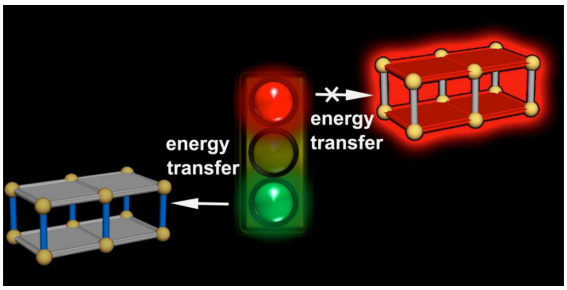
Dmitry Peryshkov

We design and make new molecular catalysts for activation of important substrates such as dihydrogen, carbon dioxide, and unsaturated organic compounds. Our focus is on renewable energy, catalysis, inorganic, and organometallic chemistry.



Natalia Shustova

We design photoswitches, artificial biomimetic systems, and materials for sustainable energy conversion based on porous graphitic frameworks.

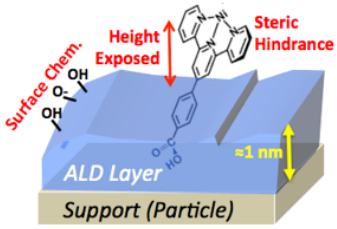


www.sc.edu/chemistry

Aaron Vannucci

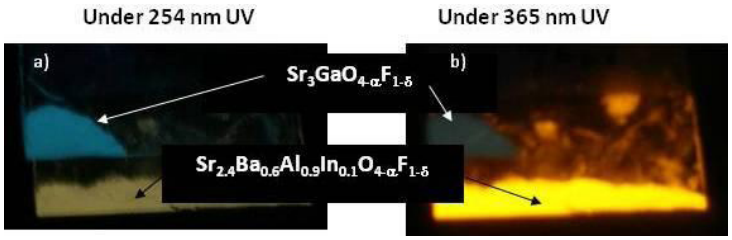
We design methodologies for sustainable catalysis that cross the divide between homogeneous and heterogeneous catalysis. Our interests include photoredox cross-coupling, lignin biomass conversions, and photoelectrochemical production of renewable fuels.

Hybrid Heterogeneous Catalyst



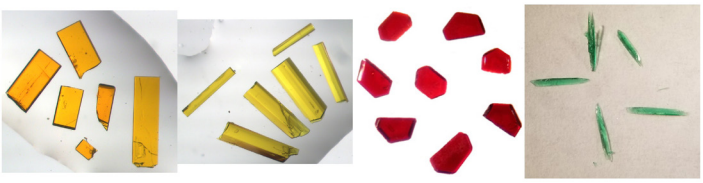
Thomas Vogt

We make novel metal oxides and nanoparticles and determine their atomic structures using electron, X-ray, and neutron scattering and explore their unique electrical, magnetic, dielectric, optical and photocatalytic properties.



Hans-Conrad zur Loye

We investigate the crystal growth of new materials, including new scintillating and luminescing oxides and fluorides, and new uranium and thorium containing structures. For the latter, we synthesize new hierarchical wasteform materials for the effective immobilization of nuclear waste.



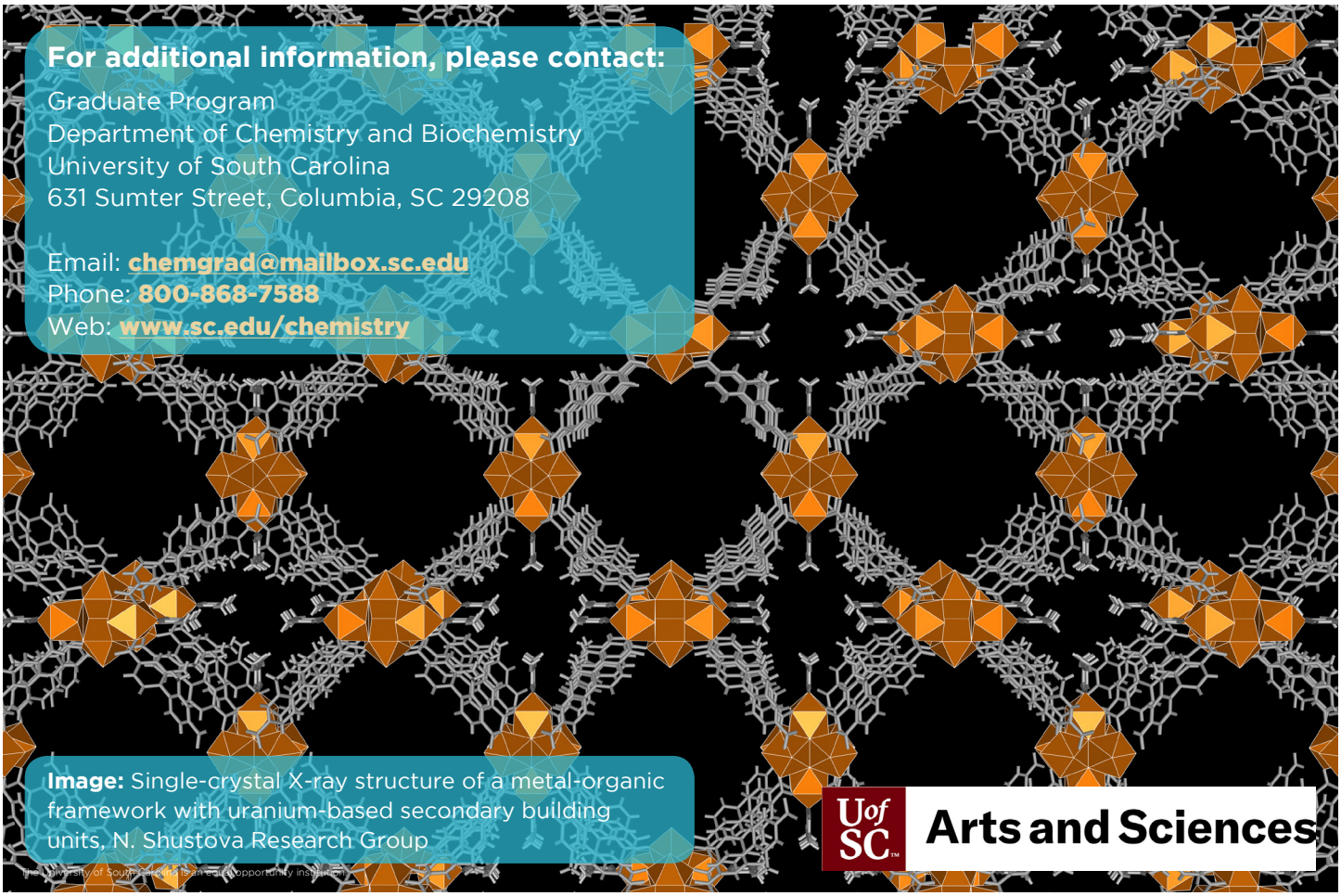


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Image: Single-crystal X-ray structure of a metal-organic framework with uranium-based secondary building units, N. Shustova Research Group

Arts and Sciences

College of Arts and Sciences
Department of Chemistry and Biochemistry
University of South Carolina

Graduate Studies in **Organic and Polymer Chemistry**

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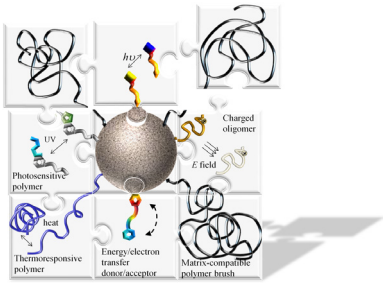
*National Research Council

#Livability.com

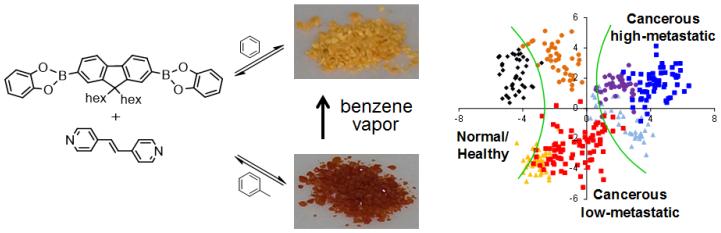
Brian Benicewicz

We design and synthesize new functional polymers to study structure-property relationships in polymer nanocomposites and fuel cell-membrane applications.



John Lavigne

Our research is centered on supramolecular organic and organometallic chemistries. More specifically, we are using boronic acids to assemble new polymeric networks, and conjugated polymers as sensors in biological assays.



Jie Li

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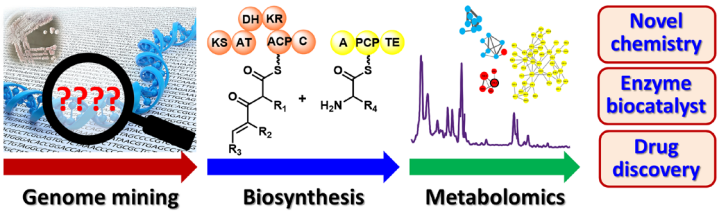
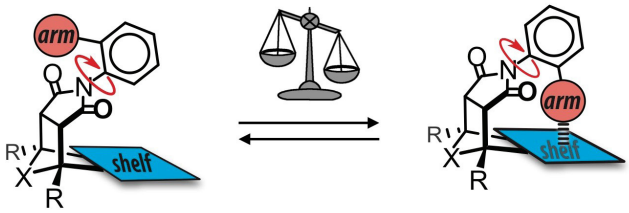


Ken Shimizu

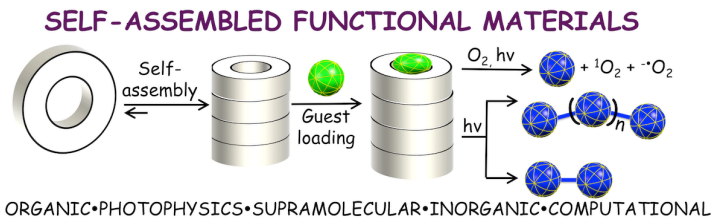
We make molecular devices such as molecular rotors, switches, and balances to measure weak non-covalent interactions. We also make molecularly-imprinted polymers for sensing and separation applications.



www.sc.edu/chemistry

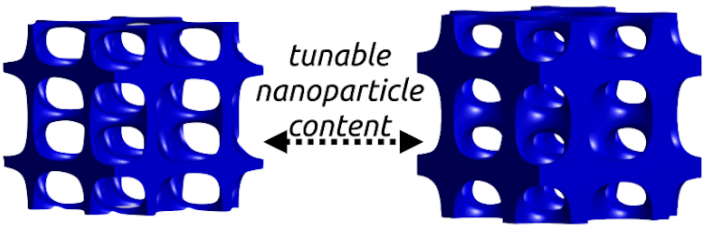
Linda Shimizu

We are interested in developing macrocycles that self-assemble in high fidelity to give porous functional materials. These porous molecular crystals can bind guests and facilitate their subsequent photooxidations, polymerizations or photodimerizations.



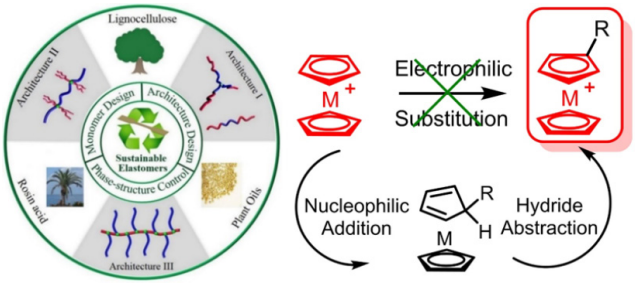
Morgan Stefik

We are developing new polymer-based methods to control the fabrication of advanced nanomaterials. The novel material chemistries we develop are taken from concept through to functioning devices such as fuel cells, batteries, supercapacitors, photovoltaics, and solar fuels.



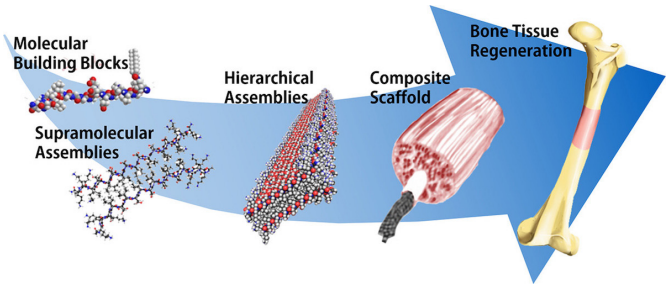
Chuanbing Tang

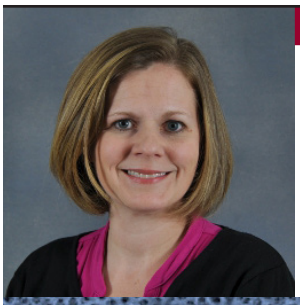
Our research is focused on designing novel macromolecular topologies and compositions for sustainable bio-based polymers and biomaterials from natural resources, metal-containing polymers, as well as advanced polymeric materials for biomedical and energy applications.



Qian Wang

Our research is focused on bioconjugation chemistry and biomaterials development. We are exploring novel synthetic and biological methods in order to create materials and functionalities at the nanometer scale.





Sheryl Wiskur

Our research focuses on synthetic organic methodology and mechanistic investigations. When developing new reactions, we also want to thoroughly understand what is happening in the reaction and what intermolecular forces control selectivity.

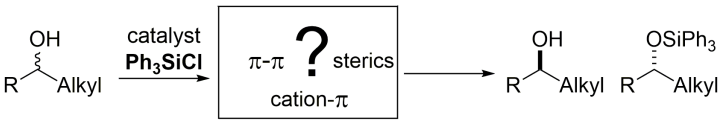


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Image: Scanning electron microscopy image of porous Nb_2O_5 films templated from block copolymer micelles, M. Stefik Research Group

UofSC Arts and Sciences

College of Arts and Sciences
Department of Chemistry and Biochemistry
University of South Carolina

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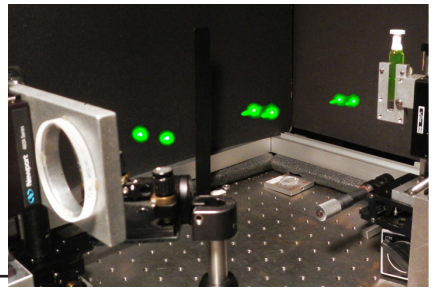
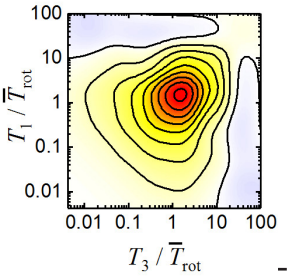
*National Research Council #Livability.com

Mark Berg

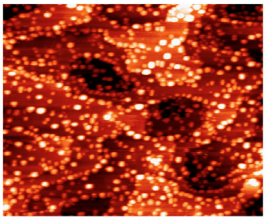
Molecular dynamics are studied in complex materials: polymers, biomolecules, nanoparticles, supercooled liquids, and so on. Both ultrafast (10^{-13}–10^{-9} s) laser experiments and theory are being extended to multiple time dimensions to attack these problems.

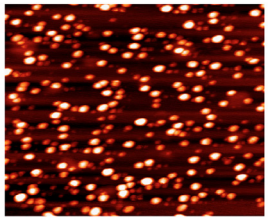




Donna Chen

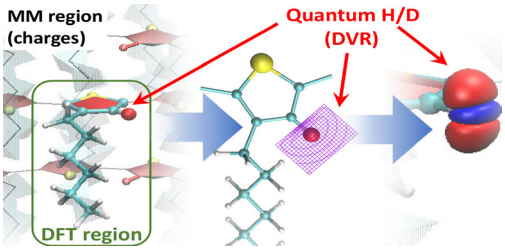
We are investigating reactions at surfaces on the atomic level in order to develop superior heterogeneous catalysts. Fundamental studies of catalytic reactions on supported metal nanoparticles elucidate the role of structure and composition on chemical activity.





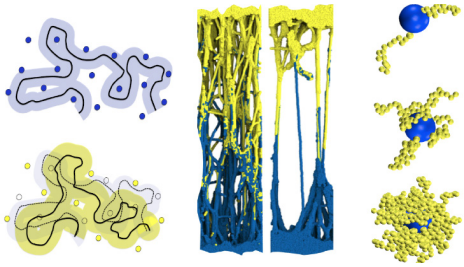
Sophya Garashchuk

We develop molecular dynamics methods with quantum corrections for the nuclei, which influence properties and reactivity of complex molecular systems. Applications range from enzymatic reactions to isotope effects on crystallinity and other properties of materials.



Ting Ge

We use molecular simulation and theory to study polymer structure, rheology, and mechanics as well as polymer nanocomposites and nanoscale transport.



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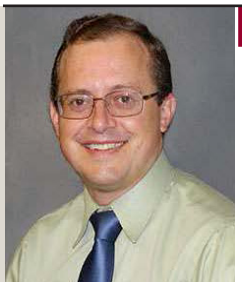
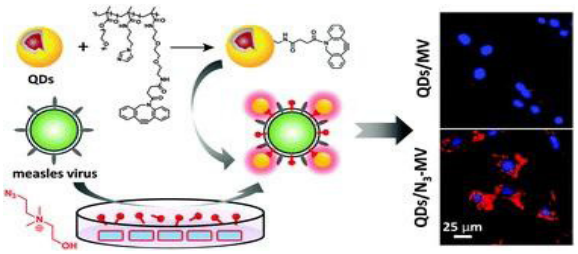


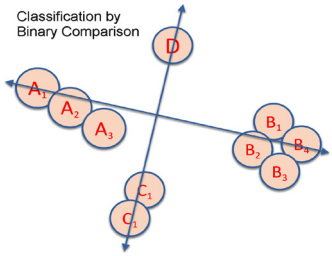
Andrew Greytak

We use microscopy, spectroscopy and electronic transport measurements to explore the role of the surface in dictating the properties of semiconductor nanowires and colloidal nanocrystals. We are also interested in applications of nanomaterials in energy production and fluorescence imaging.



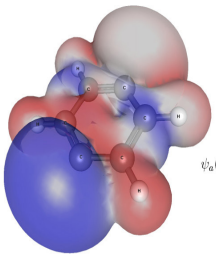
Michael Myrick

We are using a form of factorial optics to identify single phytoplankton cells in mixtures for ocean science applications including global carbon cycling, harmful algal bloom warning and ocean chemical sensing. We develop and test optical instruments performing chemometric analyses.



Vitaly Rassolov

Our lab develops and applies new electronic structure models based on electron pairs, especially useful for transition metal complexes and bond breaking. We also work on the nuclear dynamics of protons in complex systems.



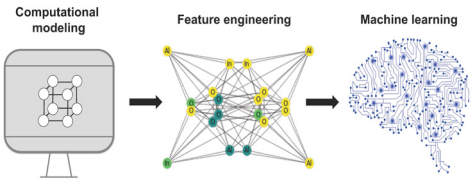
$$\psi_a(\mathbf{r}_1,\mathbf{r}_2) = \sum_{k\in A} \frac{D_1^A}{\sqrt{2}}[\phi_k(\mathbf{r}_1)\bar{\phi}_k(\mathbf{r}_2) - \phi_k(\mathbf{r}_2)\bar{\phi}_k(\mathbf{r}_1)]$$

$$\phi_k(\mathbf{r}_1) = \sum_\lambda C_\lambda^k \chi_\lambda(\mathbf{r}_1)$$

$$\bar{\phi}_k(\mathbf{r}_1) = \sum_\lambda \bar{C}_\lambda^k \chi_\lambda(\mathbf{r}_1)$$

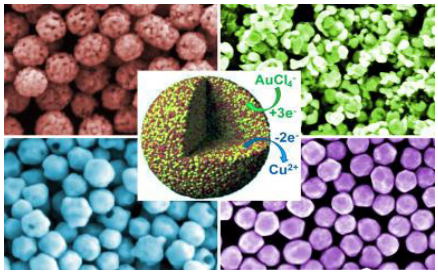
Chris Sutton

Our research is focused on combining electronic-structure calculations and machine learning methods for materials design and discovery, with a particular focus on identifying where and why the predictions can be trusted (i.e., its "domain of applicability").



Hui Wang

We use novel physical chemistry approaches, specifically spectroscopies and microscopies, to develop quantitative understanding of novel nanophotonic materials systems and conformationally dynamic biomolecules.



For additional information, please contact:

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Image: Fluorescence microscopy image of CdS semiconductor nanowires, A. Greytak Research

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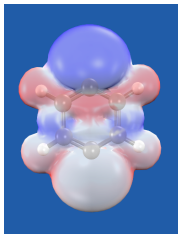
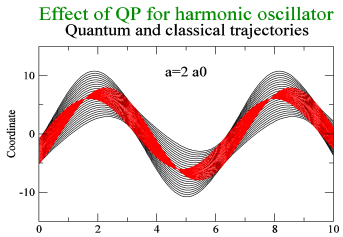
Vitaly Rassolov

We study quantum effects in chemistry that range from strongly correlated molecular systems, for which the standard Density Functional Theory electronic structure models fail, to semiclassical effects of nuclear motion. Two complementary theoretical approaches are developed in the group.



Reactive singlet geminal of para-benzyne



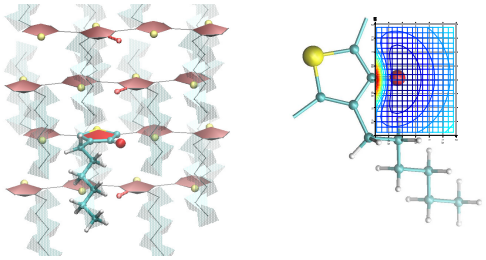
Comparison of classical (without the Quantum Potential, QP) and quantum dynamics

Sophya Garashchuk

We study dynamics and properties of complex molecular systems, often in collaboration with experimental groups, and develop theoretical and computational approaches which incorporate the nuclear quantum effects into the classical-like framework of molecular dynamics.

H/D isotope effect in a polymeric crystal

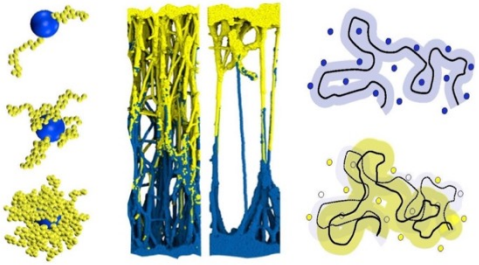
QM/MM structure quantum/classical dynamics



Ting Ge

The group perform computational and theoretical research in polymer physics. The goal is to understand the conformations and dynamics of polymers on the microscopic level and the connections to macroscopic material properties, such as the mechanical and rheological responses.

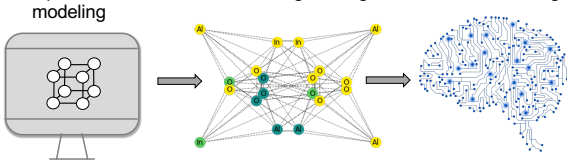
Polymer-tethered Nanoparticles **Mechanical Failure at Polymer Interfaces** **Rheology of Ring Polymers**



Christopher Sutton

Our research combines first-principles theory and machine learning methods for the design and discovery of new materials for energy production and storage applications. A particular focus of our research is identifying regions of low errors/uncertainties in our predictions (i.e., their “domain of applicability”).

Computational modeling Feature engineering Machine learning



- ❑ Top 25 in chemistry/biochemistry research activity ranked by *National Research Council*
- ❑ High faculty-to-student ratio promotes personal mentoring and instruction
- ❑ UofSC flagship cluster *Hyperion* consists of 407 computing, GPU, and Big Data Nodes
- ❑ Fellowships and awards for outstanding teaching and research
- ❑ Located in Columbia, SC – rated one of 10 Best College Towns by *Livability.com*
- ❑ Within 2-hour drive of SC beaches and Blue Ridge Mountains