

# Laboratory Research Experience

Presented by



**Berkeley Global  
Science Institute**

**College of Chemistry**  
UNIVERSITY OF CALIFORNIA, BERKELEY

## Laboratory Research Experience Curriculum

### *Week 1: Investigation of Superacidity using Metal-Organic Frameworks with Applications in Catalytic Organic Transformations*

- Superacidity and acid-base chemistry
- ‘Crystals as Molecules’: Post-synthetic modification
- Inert atmosphere synthetic techniques
- Hammett indicator analysis
- Heterogeneous catalysis for petrochemical refining
- Mass spectrometry characterization techniques
- **Distinguished Scholar Seminar: Professor Kristie Boering**

### *Week 2: Fabrication, Characterization, and Modification of Next Generation Batteries*

- Fabrication of next generation batteries
- Hands-on use of electrochemical workstation and battery analyzer
- Developing new strategies to improve battery performance
- **Distinguished Scholar Seminar: Professor F. Dean Toste**

### *Week 3: Harvesting Water from Air*

- Synthesis of different metal-organic frameworks for water sorption on larger scales
- Characterization of the respective materials (nitrogen sorption, water sorption isotherm, etc.)
- Water harvesting with synthesized materials using Berkeley’s sun
- **Distinguished Scholar Seminar: Professor Omar M. Yaghi**

### *Week 4: Tailoring the Activity and Selectivity of Nanocatalysts Using a Size Tunable Synthesis*

- Colloidal synthesis of varying sized nanoparticles
- Hands-on use of UV-Vis absorption, powder X-ray diffraction, and transmission electron microscopy for structure and size estimation
- Determining nanocatalyst selectivity using nuclear magnetic resonance spectroscopy for products identification and quantification
- Using nano-design to meet an efficiency target in catalysis
- **Distinguished Scholar Seminar: Professor Ting Xu**

### *Week 5: Covalent Chemistry Beyond the Molecule: Covalent Organic Frameworks*

- Computational modeling of extended structures
- Hands-on optimization of solid-state COF synthesis
- Powder X-ray diffraction and structure determination
- Surface area and pore size distribution analysis
- Spectroscopy characterization (NMR and FT-IR) and thermal gravimetric analysis
- **Distinguished Scholar Seminar: Professor Sir Fraser Stoddart, 2016 Nobel Laureate**

## ***Week 6: Effective Communication, Better Science***

- Keys to success in publishing high impact scientific results
- How to effectively communicate your results via oral and poster presentations
- College of Chemistry graduate student shadowing
- Lawrence Berkeley National Laboratory tour (Advanced Light Source and Molecular Foundry)
- UC Berkeley campus tour
- Poster presentation at the Berkeley Emerging Research Scholar Symposium

***Scholars who complete the entirety of the six-week Laboratory Research Experience program will earn a **Certificate of Completion** from UC Berkeley's College of Chemistry signed by Dean Douglas Clark. Scholars will also earn a **letter of recommendation** for their graduate school application written by a College of Chemistry faculty member.***