Berkeley Emerging Research Scholars (BERS):

Laboratory Research Experience Program

July 02 - August 10, 2018

About the Program

Through Dean Douglas S. Clark and the College of Chemistry, Professor Omar M. Yaghi, Professor Peidong Yang, and Mr. Kyle E. Cordova have designed a laboratory research experience program, in which participating scholars are exposed to graduate student level research. This is a laboratory-intensive program that seeks to prepare highly qualified emerging scholars for doctoral studies. Through this program, you will learn to think independently, process advanced concepts and apply theory, effectively communicate and substantiate your ideas to others, and build group dynamic skills while being mentored through the research modules.

The BERS: Laboratory Research Experience Program distinguishes itself from other research-based programs in the following aspects:

Brought to you by the TOP RANKED chemistry program in the world. The Laboratory Research Experience Program is administered and delivered by the College of Chemistry at UC Berkeley and is taught by its own globally ranked faculty.

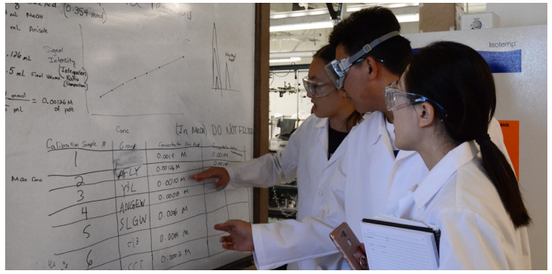
Training in ACTION. As a participating scholar, you will gain hands-on practical experience on advanced techniques, including, but not limited to, X-ray diffraction, electron microscopy (SEM and TEM), photoluminescence microscopy, gas adsorption, and nuclear magnetic resonance spectroscopy.

Combines general knowledge with cutting edge research. Participating scholars will perform cutting edge research that parallels the research that is done at UC Berkeley and at the Lawrence Berkeley National Laboratory.

Provides invaluable insight into graduate school life at UC Berkeley. The program is designed to mirror life in graduate school - everything from experimental design to collaborative experimentation. Participating scholars will also attend weekly seminars provided by UC Berkeley faculty and mingle with current UC Berkeley students to solicit their advice on the graduate school application process and to get a better sense of graduate school life.

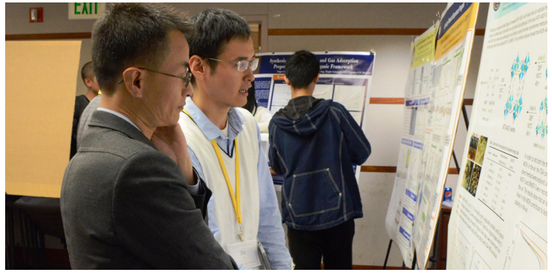
Continuous interaction with Berkeley professors and students. Continuous interactions will better inform UC Berkeley professors and mentors when writing recommendation letters.

Program Highlights



Gain Research Experience

In UC Berkeley's world class laboratories, you will gain hands-on, practical experience in performing cutting edge research. You will be trained like a professional chemist and will utilize state-of-the-art instrumentation.

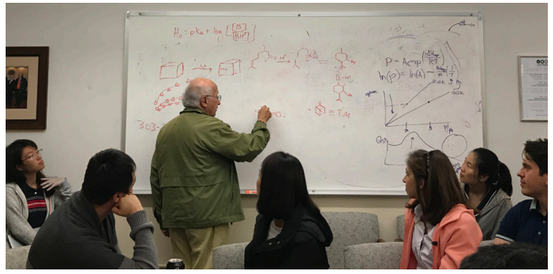


BERS Symposium

At the culmination of the research experience, you will present your work at the Berkley Emerging Research Scholars Symposium. The entire College of Chemistry is invited to attend; in which you will showcase the skills you acquired.

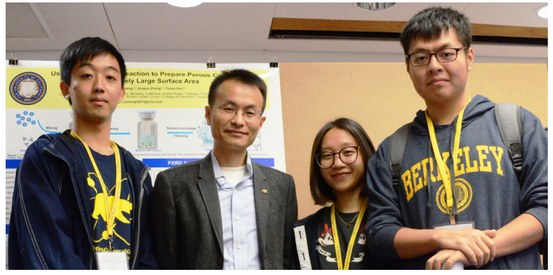
Weekly Seminars from Distinguished Scholars

Weekly seminars from distinguished UC Berkeley professors will allow you to engage in scientific discussions and learn more about the research being conducted on campus. Lunch outings after the seminars provide you with the opportunity to foster a relationship with these professors.



Build your Professional Network

Successful completion of the program will earn you a certificate signed by the Dean of the College of Chemistry. Additionally, through building strong relationships with UC Berkeley professors, you will earn letters of recommendation for your graduate school application.



Participating Faculty

Omar M. Yaghi

James and Neeltje Tretter Chair Professor of Chemistry

Pioneer in the science of building chemical structures from molecular building blocks; a field referred to as reticular chemistry.

Peidong Yang

S. K. Angela Chan Distinguished Professor of Energy; MacArthur Genius Award Recipient

Researches materials chemistry, inorganic chemistry; specifically, low-dimensional nanoscopic building blocks to assemble complex architectures with novel electronic and photonic properties.

Ting Xu

Associate Professor of Chemistry & Materials Science and Engineering

Research aims to generate hierarchical functional soft materials using synthetic polymers, peptides and proteins, small organic molecules and nanoparticles as building blocks and focuses on the fundamental understanding of the physics behind assembling these nanostructured materials.

F. Dean Toste

Professor of Chemistry

Organic and organometallic chemistry are employed in the development of new synthetic methods, enantioselective catalysts and strategies for the synthesis of natural products.

Kristin Ceder-Persson

Assistant Professor, Department of Materials Science and Engineering

Studies the physics and chemistry of materials using atomistic computational methods and high-performance computing technology. These materials can be applied toward developing new energy technologies, including battery electrode materials, electrolytes, photocatalysts, and thermoelectrics.

Jeffrey A. Reimer

Warren and Katharine Schlinger Distinguished Professor in Chemical Engineering; C. Judson King Professor of Chemical and Biomolecular Engineering

Researches materials chemistry, applied spectroscopy, alternative energy, including a diverse array of contributions in expanding and applying spectroscopy for materials research.

Kristie A. Boering

Professor of Earth and Planetary Science; Lieselotte and David Templeton Professor of Chemistry

Research lies in atmospheric chemistry and transport. Specifically, the chemistry and mass transport in Earth's and extraterrestrial atmospheres are studied through kinetics and photochemistry experiments.

Laboratory Research Experience Curriculum

Week 1: Covalent Chemistry Beyond the Molecule: Introduction to Reticular Chemistry

- Computational modeling of extended structures
- Solid-state covalent organic framework synthesis
- Powder X-ray diffraction and structure solution
- Surface area and pore size distribution
- Spectroscopy characterization techniques (nuclear magnetic resonance and FT-IR) and thermal gravimetric analysis

Week 2: Hydrophobic Zeolitic Imidazolate Frameworks for Selective CO_2 Capture

- Hands-on use of single crystal X-ray diffraction for structure solution
- CO_2 and N_2 gas adsorption + H_2O adsorption isotherms
- Heat of adsorption and gas pair selectivity analysis
- Analyzing the selective capture of CO_2 via breakthrough experiments

Week 3: Superacidity in Metal-Organic Frameworks: Applications toward Heterogeneous Catalysis

- 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

Week 4: Emerging Inorganic Halide Perovskite Nanostructures

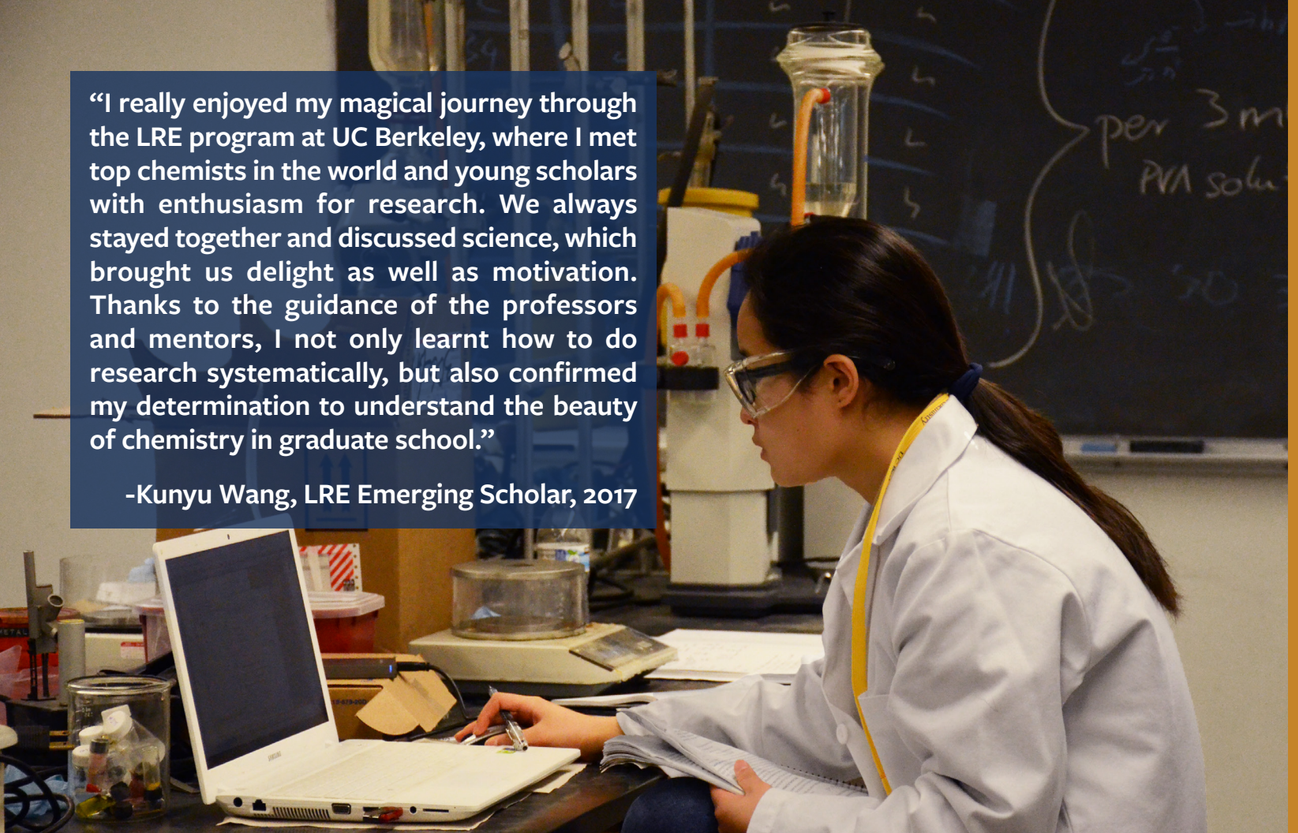
- Synthesis of all inorganic halide perovskite nanostructures
- Hands-on use of solution-phase synthetic methodology structural techniques, including powder X-ray diffraction and scanning electron microscopy
- 'Bright Light Emitting Nanostructures': Hands-on use of photoluminescence microscopy and UV-Vis absorption spectroscopy

Week 5: Ultrathin Silver Nanowires for High-Performance Transparent Conductors

- Synthesis of ultrathin silver nanowires
- Hands-on use of powder X-ray diffraction, scanning electron microscopy, transmission electron microscopy, and post-treatment for conductivity enhancement
- 'Nanowires as Transparent Conductors': Fabrication and performance characterization of silver nanowire transparent conductors

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)
- Poster presentation at the Berkeley Emerging Research Scholar Symposium



"I really enjoyed my magical journey through the LRE program at UC Berkeley, where I met top chemists in the world and young scholars with enthusiasm for research. We always stayed together and discussed science, which brought us delight as well as motivation. Thanks to the guidance of the professors and mentors, I not only learnt how to do research systematically, but also confirmed my determination to understand the beauty of chemistry in graduate school."

-Kunyu Wang, LRE Emerging Scholar, 2017

Eligibility

Undergraduate students (sophomore, junior, or senior standing) from the US and abroad are encouraged to apply and participate in the program. Those accepted must have taken both general and organic chemistry (with accompanying laboratory classes). Successful applicants will be among the top 10% of their respective class and must demonstrate fluency in English. Please note that this is a highly selective program.

Course Details

The Laboratory Research Experience Program will take place through the College of Chemistry on the historic UC Berkeley campus. This program is held every summer for a six-week duration.

Program tuition includes all laboratory and course materials, instrument and research facilities use, seminars, daily meal, UC Berkeley "swag", and end-of-the-program research posters.

Admission is rolling, applications will close once 28 scholars are accepted into the program. For more information regarding dates, tuition fees, and application visit our website: **globalscience.berkeley.edu/bers/lre**

Contact Us

For questions about the Laboratory Research Experience Program, please contact us:

General Info. bers-program@berkeley.edu

Kyle E. Cordova kcordova@berkeley.edu

Or visit our website at:
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College of Chemistry
and
Berkeley Global Science Institute

Berkeley
UNIVERSITY OF CALIFORNIA