



Chemical and Environmental  
Engineering

# VIRTUAL OPEN HOUSE

## Graduate Admissions

**TUESDAY, NOVEMBER 24, 2020**



Apply to CEE!  
Jan. 5<sup>th</sup>



CELEBRATING 30 YEARS  
Marlan and Rosemary Bourns  
College of Engineering





# Tonight's Agenda

**Welcome:** Prof. David Cocker, Chair

**Graduate Admissions:** Prof. Juchen Guo

**Program Overviews**

- ***Materials:*** Prof. Younjin Min
- ***Biotechnology:*** Prof. Ian Wheeldon
- ***MSOL Water Quality:*** Prof. Jinyong Liu
- ***Air Quality Masters:*** Prof. Kelley Barsanti

**Moderated Q&A:** Faculty Panel

**Close**





# Welcome!

Prof. David Cocker, Chair







# Graduate Admissions

Prof. Juchen Guo





# Department of Chemical and Environmental Engineering

## Graduate Open House

Juchen Guo, Associate professor  
Admissions Graduate Advisor



November 24, 2020





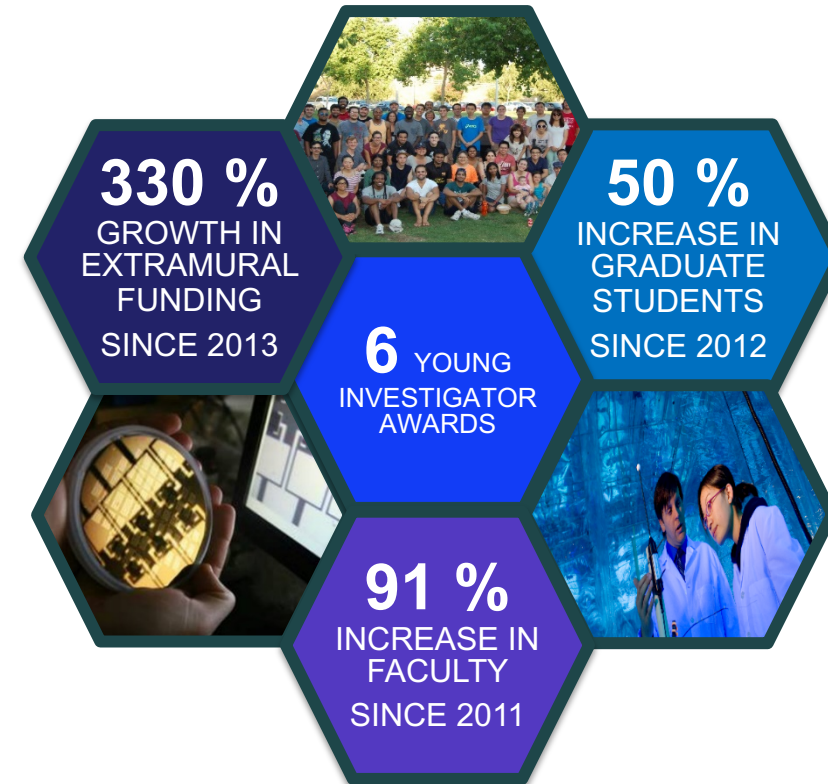
CELEBRATING 30 YEARS

Marlan and Rosemary Bourns  
College of Engineering

## QUICK FACTS

### CHEMICAL AND ENVIRONMENTAL ENGINEERING

- **~400** undergraduate students
- **~100** graduate students
- **21** Full-Time Tenured/Tenure-track faculty
- **~\$600k/per PI** extramural funding





# A Few Things We Are Proud Of...

- Dynamic and highly productive faculty
- Multi-disciplinary research and collaborative projects
- Well supported infrastructure and outstanding laboratory research facilities
- Large graduate program and many research opportunities for undergraduates
- Outstanding colloquium series



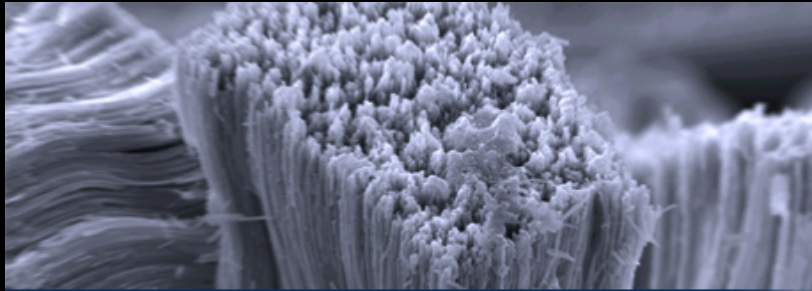
# Graduate Program Overview

- Started in Fall 1999
- Joint Chemical and Environmental Engineering graduate program
- Offering M.Sc. and Ph.D. degrees
- M.S. in Industrial Biotechnology
- 5-year B.Sc. / M.Sc. Degree offered

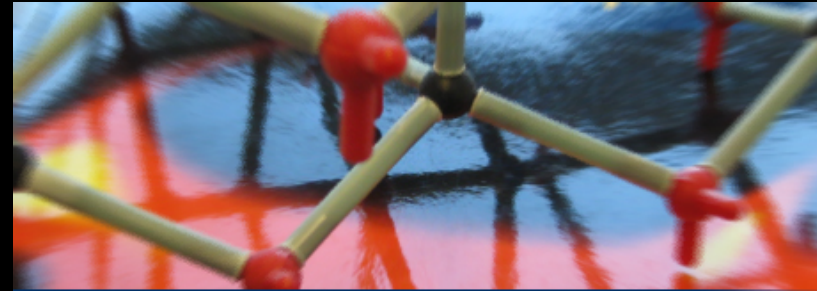




# Research Areas



**ADVANCED MATERIALS AND NANOTECHNOLOGY**



**COMPUTATION AND MOLECULAR MODELING**



**AIR QUALITY SYSTEMS ENGINEERING**



**ENERGY CONVERSION & STORAGE**



**BIOTECHNOLOGY & BIOMOLECULAR ENGINEERING**



**WATER QUALITY SYSTEMS ENGINEERING**

DEPARTMENT OF **CHEMICAL AND ENVIRONMENTAL ENGINEERING**



# Graduate Program Courses

## Core Courses – 16 units

- CEE 200: Advanced Engineering Computation (4 units)
- CEE 202: Transport Phenomena (4 units)
- CEE 204: Advanced Kinetics and Reaction Engineering (4 units)
- CEE 206: Advanced Chemical Engineering Thermodynamics (4 units)

## Plus

Ph.D. – 8 units of regular lecture graduate and/or approved upper division courses

M.S. – A minimum of 20 units of approved coursework

CEE 286: Colloquium in CEE (1 unit)

– Taken every quarter and mandatory for all students

CEE 302: Teaching Practicum (2 units)

# Ph.D. Program

## Preliminary Exam

- A critical evaluation of a published scientific journal article, presented orally, followed by questions from a faculty panel.
- The article will be selected by the faculty panel comprised of faculty from CEE with appropriate expertise in the chosen area of study.
- Pass/fail based on the oral presentation and answers to questions.
- There is a second and final attempt to pass a makeup examination.
- Hold in the third quarter of study

## Advancement to Candidacy Exam

- Committee member nominations due Fall quarter of 2<sup>nd</sup> year
- Qualifying Committee (4 members from CEE, 1 outside member)
- Thesis Proposal – 15 pages, must follow format guidelines
- Oral Presentation

## Dissertation and Final Oral Examination

- Dissertation Committee (3 members)
- Thesis Defense



# Advisor Selection

- Process begins Fall quarter
- Advisor Selection Form will be available online
- Student indicates 3 CEE faculty choices
- Graduate Committee will review Advisor Selection Forms in December and match students with a faculty advisor
- Students will be informed of who their advisor is before Winter break

# Ideal Geographical Location







# Advanced Materials and Nanotechnology

Prof. Younjin Min





# What Chemical Engineers and Material Scientists Do?

- Materials science is one of the broadest and most active areas in [chemical engineering](#).<sup>1</sup>
- It involves the [discovery](#), [evaluation](#), and [manipulation](#) of useful properties in different substances. The outcome is an expanding array of materials that feature unique characteristics used for the development and fabrication of revolutionary new products.
- Achievements of Chemical Engineers in Materials Science - Development of materials with the following properties:<sup>1,2</sup>

Broad  
resistance to  
chemicals



High performance polymeric tubing

Unique optical  
properties

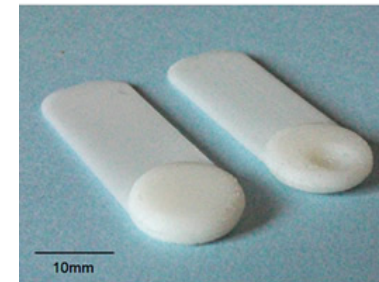


Increased antibacterial,  
antiviral, and antifungal  
capabilities

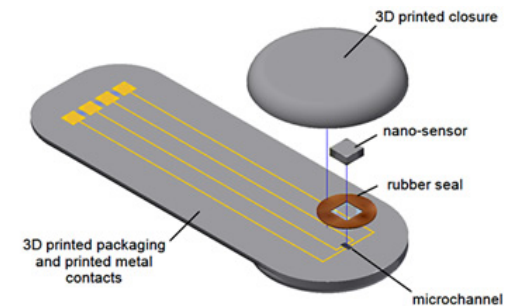


Inhibition of  
*S. aureus* growth

High-precision  
chemical sensing



Nanosensors for Disease Detection



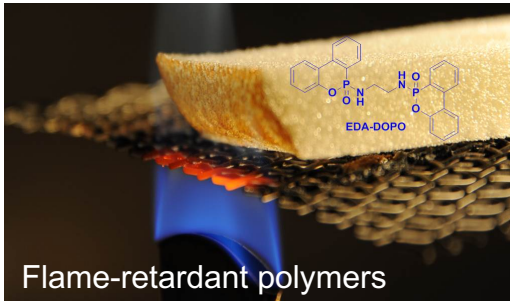
<sup>1</sup><https://www.aiche.org/community>; <sup>2</sup><https://www.webofscience.com/>



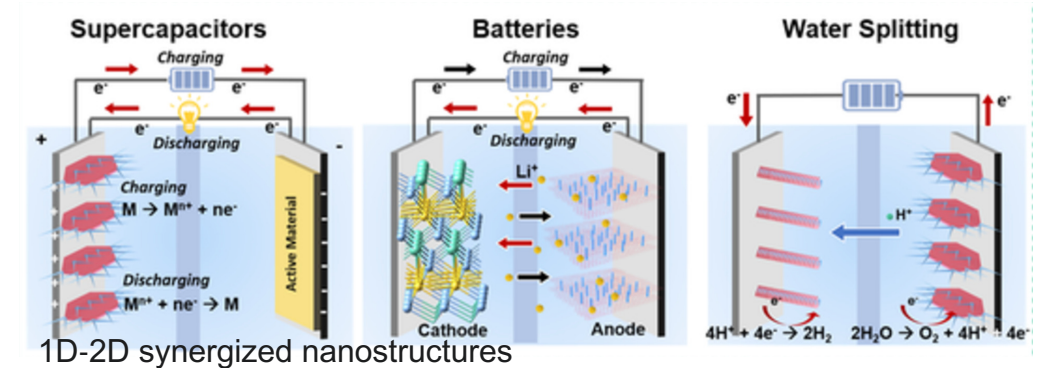
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- Achievements of Chemical Engineers in Materials Science - Development of materials with the following properties:<sup>1,2</sup>

Improved flame retardance



Superior electrochemical energy storage



Functional thermal and electrical insulation, Light weight with high durability, Improved tensile and impact strength, Light weight with high durability, Increased resistance to oxygen, ozone, or ultraviolet-radiation damage, etc.

<sup>1</sup><https://www.aiche.org/community>; <sup>2</sup><https://www.webofscience.com/>

# Department Faculty at UC, Riverside

## - Advanced Materials and Nanotechnology



**Kandis Leslie Abdul-Aziz**

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Sustainable Catalysis  
and Materials



**Juchen Guo**

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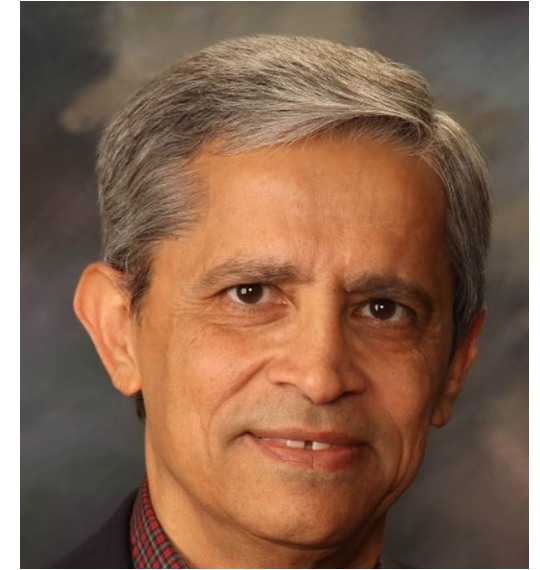
Electrochemical Materials  
and Interfaces



**Younjin Min**

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Interfacial Soft-  
Condensed Matter



**Ashok Mulchandani**

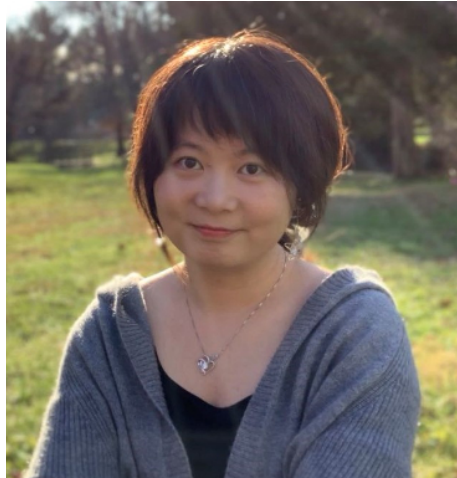
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Nano- and Biotechnology for  
(bio)Analytical Devices,  
(bio)Energy Generation and  
(bio)Remediation  
Technologies



# Department Faculty at UC, Riverside

## - Advanced Materials and Nanotechnology



**Yun Shen**

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Nanomaterials for Air  
Filters and Antibacterial  
Materials



**Bryan M. Wong**

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Nanoscale and  
Mesoscale Energy  
Materials



**Jianzhong Wu**

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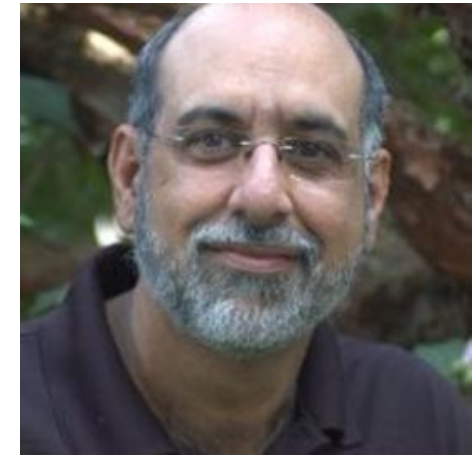
Molecular Theory  
and Modeling of  
Materials



**Ruoxue Yan**

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Nanophotonics,  
Flexible Electronics,  
and  
Nanobiotechnology



**Michael Zachariah**

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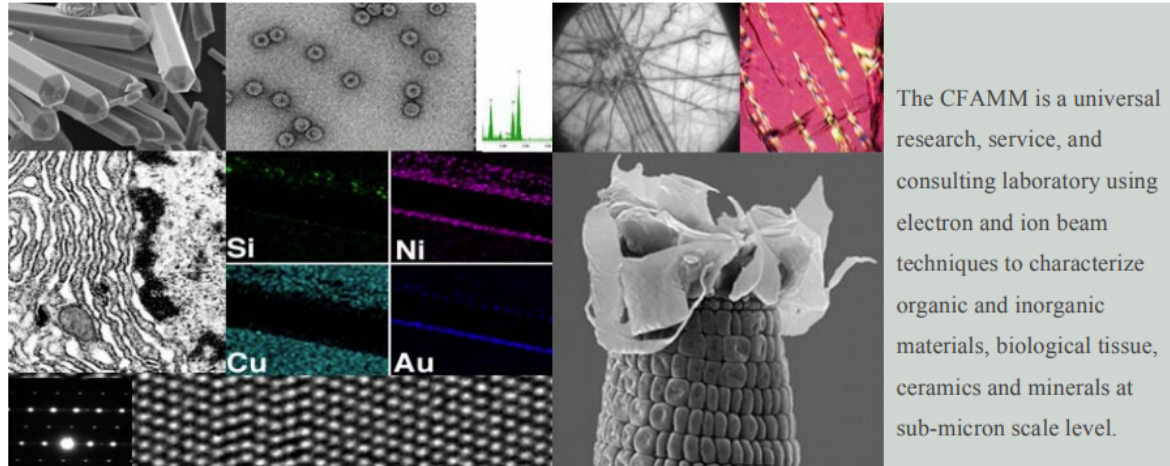
Nanoparticles and  
Nanotechnology for  
Energy and the  
Environment

# Facilities at UC, Riverside

## - Advanced Materials and Nanotechnology

### Central Facility for Advanced Microscopy and Microanalysis

<https://cfamm.ucr.edu/>



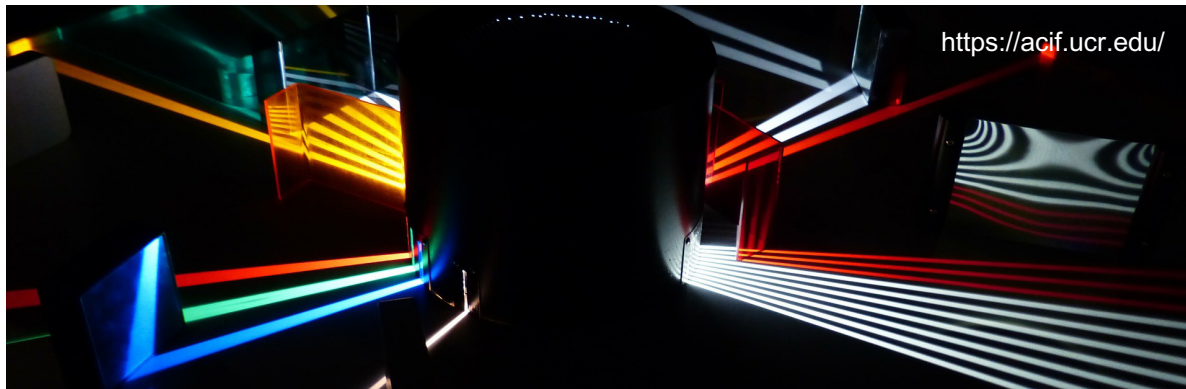
### Nanofabrication Facility

<https://nanofab.ucr.edu/>



### Analytical Chemistry Instrumentation Facility

<https://acif.ucr.edu/>



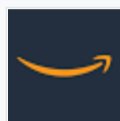
### Microscopy and Imaging Core Facility

<https://microscopycore.ucr.edu/>





# Some Companies Recruiting in These Areas in California



**Quantum Research  
Scientist – Materials &  
Surface Scientist**  
Amazon  
Glendale, CA  
via LinkedIn

🕒 1 day ago 🧳 Full-time



**Principal Material Process  
Engineer**  
Northrop Grumman  
Redondo Beach, CA  
via Clearance Jobs

🕒 3 hours ago 🧳 Full-time



**Materials Engineer**  
Exponent  
Los Angeles, CA  
via ZipRecruiter

🕒 Over 1 month ago 🧳 Full-time



**Materials Engineer -  
Polymers for SpaceX**  
SpaceX  
Hawthorne, CA  
via Talent.com

🕒 10 days ago 🧳 Full-time



**Battery Materials Engineer**  
Apple  
Cupertino, CA  
via LinkedIn

🕒 6 days ago 🧳 Full-time



**Research Assistant**  
DuPont  
Hayward, CA  
via Careers - DuPont

🕒 Over 1 month ago 🧳 Full-time



**Chemical Engineer**  
Agilent Technologies, Inc.  
Folsom, CA  
via Folsom, CA - Geebo

🕒 5 days ago 🧳 Full-time



**Materials Engineer,  
Polymers**  
Tesla  
Fremont, CA  
via Glassdoor

🕒 20 hours ago 🧳 Full-time



**Senior Materials Engineer  
in Richmond, CA**  
Chevron Corporation  
Richmond, CA  
via Richmond, CA - Geebo

🕒 5 days ago 🧳 Full-time



**Chemistry, Chemical  
Engineering, Materials  
Science Intern**  
HP

San Diego, CA  
via Glassdoor

🕒 20 hours ago 🧳 Internship



**Corrosion & Finishes  
Material & Process  
Engineer**

Lockheed Martin  
Palmdale, CA  
via Clearance Jobs

🕒 18 hours ago 🧳 Full-time



**Polymer Technician**  
PPG  
California Hot Springs, CA  
via Lensa

🕒 12 days ago 🧳 Full-time



# Biotechnology Master's

Prof. Ian Wheeldon





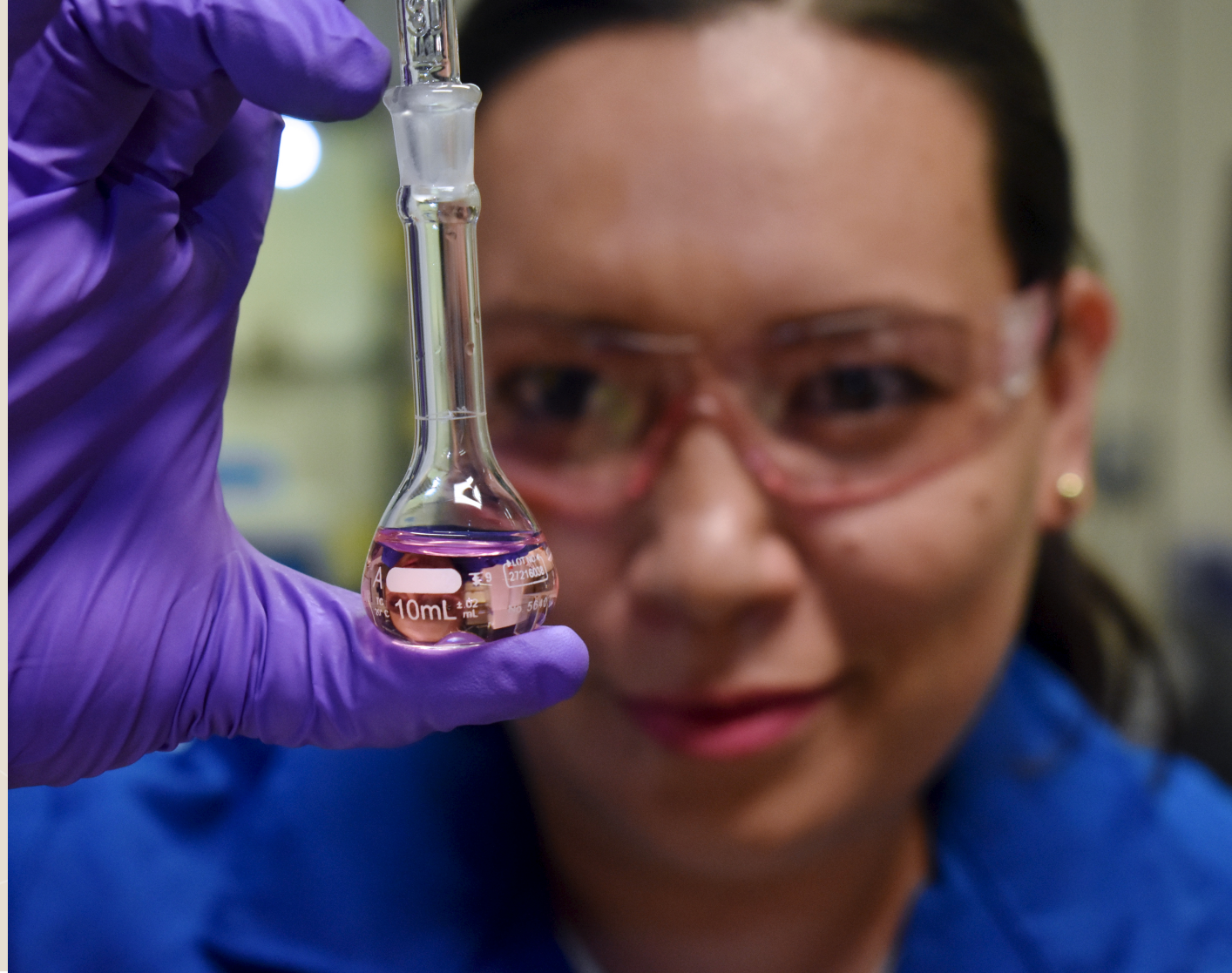
# PROFESSIONAL SCIENCE MASTER'S IN INDUSTRIAL BIOTECHNOLOGY

## NEXT-GEN BIOTECH EDUCATION

- M.S. in as few as 9-12 months
- One of only a few programs training biotech & bio-pharmaceutical skills
- Four focus areas
- Distinguished faculty interaction
- Biotech career prep in research, development, and production

### INNOVATIVE DUAL EDUCATIONAL APPROACH

- Class and lab instruction
- Industrial internships
- Undergraduate mentoring
- Built-in CIB research training



# INDUSTRIAL BIOTECHNOLOGY

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## HEALTH

- **Reduces** rates of infectious disease
- **Minimizes** health risks and side effects through tailored treatments

## FOOD & AGRICULTURE

- **Generates** higher crop yields with fewer inputs
- **Improves food** and crop oil content for cardiovascular health

## BIOFUELS

- **Cuts** greenhouse gas emissions by 52% or more
- **Reduces** fossil fuel dependence

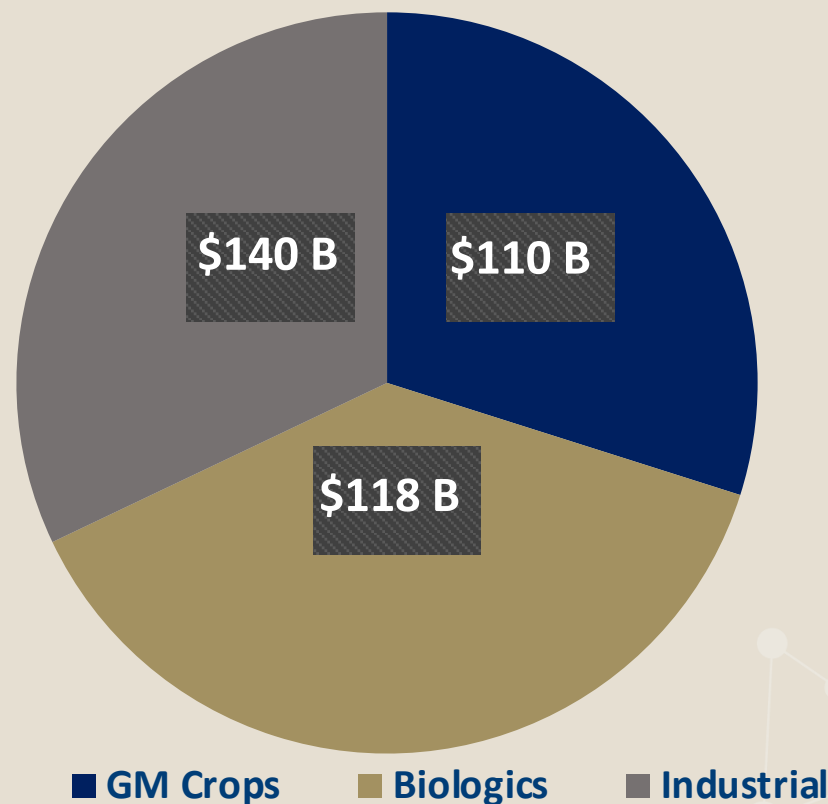
## INDUSTRIAL

- **Lowers** the temperature for cleaning clothes, potentially saving \$4.1B annually
- **Produces** biodegradable plastic alternatives

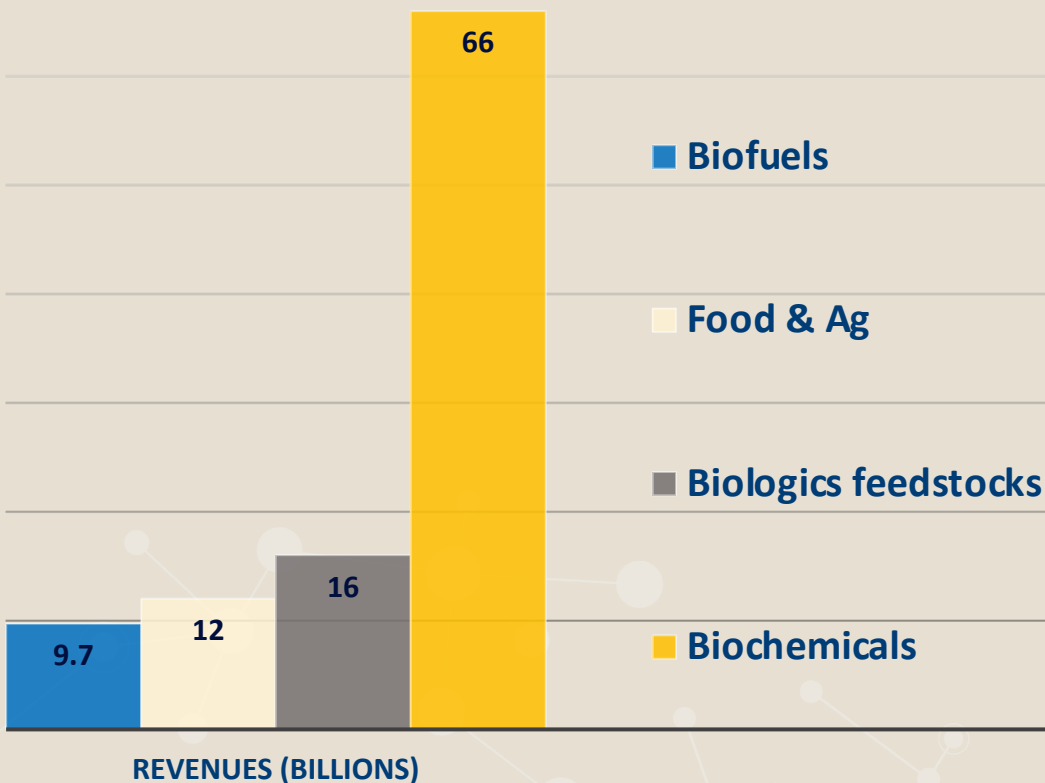


# INDUSTRIAL BIOTECHNOLOGY IS A LARGE AND GROWING SECTOR OF THE US ECONOMY

Biotechnology Revenues (>\$370 Billion)



Industrial Biotech Revenues



# INDUSTRIAL BIOTECHNOLOGY IN CALIFORNIA



## 2020 CALIFORNIA ECONOMIC IMPACT REPORT CALIFORNIA



The State of California  
employs  
**1.4 million**  
people in total jobs  
attributable to the Life  
Science Industry (direct/  
indirect/induced)



**\$4.59 billion**  
in research funding from  
National Institutes of Health  
(NIH) for FY2019



**15,341**  
Life Science  
establishments

<https://www.biocom.org/eir/>



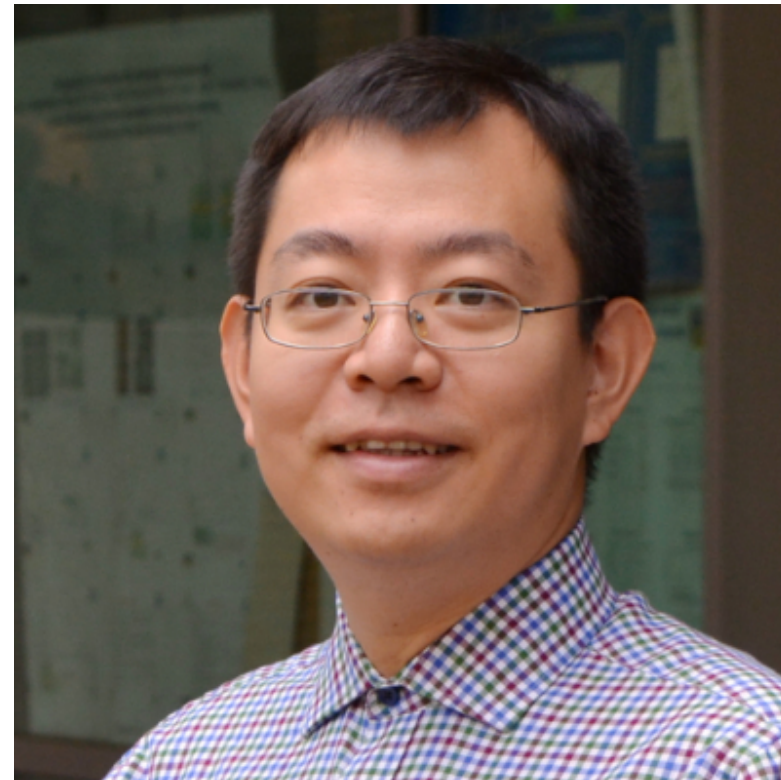
# 1 YEAR MS CURRICULUM IN INDUSTRIAL BIOTECHNOLOGY

Fall Quarter	Winter Quarter	Spring Quarter	Summer Quarter
CHE 124 Biochemical Engineering Principles	CEE 212 Bioseparations	CEE 210 Cell Engineering	CEE 298i Industrial Internship (6-8 weeks)
CHE 124L Biochemical Engineering Lab	CEE 211 Upstream Processes in Biotechnology	CEE 248 Quantitative Analysis of Upstream	
CEE 236 Energy: Production, Uses, Economics, and Sustainability	CEE 238B Bioprocess Design Laboratory II	CEE 238C Bioprocess Design Laboratory III	
CEE 238A Bioprocess Design Laboratory I	CEE 286 CEE Seminar	CEE 286 CEE Seminar	<div>Legend</div> <div>Process design and analysis</div> <div>Core lecture material</div> <div>Wet lab course</div>
CEE 286 CEE Seminar			



# MSOL: Water Quality Systems Engineering

Prof. Jinyong Liu



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# Environmental Engineering Systems (Water)

- Explore the science and engineering principles that are essential to providing clean water and improving the natural environment.
- This specialization incorporates elements of water treatment and chemistry, covering topics such as water systems fundamentals, physical and chemical processes, biological treatment, and advanced technologies.



# Environmental Engineering Systems (Water)

Course Prefix	Course Name	Credit Hours
ENGR 200	Engineering in the Global Environment	4
ENGR 201	Technology Innovation and Strategy for Engineers	4
ENGR 202	Introduction to Systems Engineering	4
ENGR 203	Principles of Engineering Management	4

CEE 241	Water Chemistry in Natural and Engineered Systems	4
CEE 225	Physical and Chemical Separation Processes	4
CEE 226	Biological Treatment Processes	4
CEE 243	Advanced Treatment Technologies	4

ENGR 296 A, B, C, D	Project Design Course A, B, C, D	4 – 1 credit courses
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# Environmental Engineering Systems (Water)

## **CEE 241 Water Chemistry**

Chemical principles and advanced calculation for acid-base equilibrium, metal-ligand coordination, solid precipitation-dissolution, redox chemistry, reaction kinetics

## **CEE 225 Physical and Chemical Processes**

Water Treatment: Coagulation-flocculation-sedimentation-filtration; Disinfection; Water softening; Membrane filtration

## **CEE 226 Biological Processes**

Wastewater Treatment: Microbial principles, BOD removal, Nutrient removal, Sludge treatment, Energy and resource recovery

## **CEE 243 Advanced Water Treatment Technologies**

Materials and modeling for adsorption, ion-exchange, and membrane technologies; Advanced oxidation and reduction methods; Treatment train systems; Case studies and project design on PFAS treatment, nutrient control, catalyst development, and critical thinking on frontier research and development.

# Faculty Members

## **Prof. Haizhou Liu**

Water Treatment and Reuse; Advanced Oxidation; Disinfection Byproduct Control; Heavy Metals in Water Distribution Systems

## **Prof. Jinyong Liu**

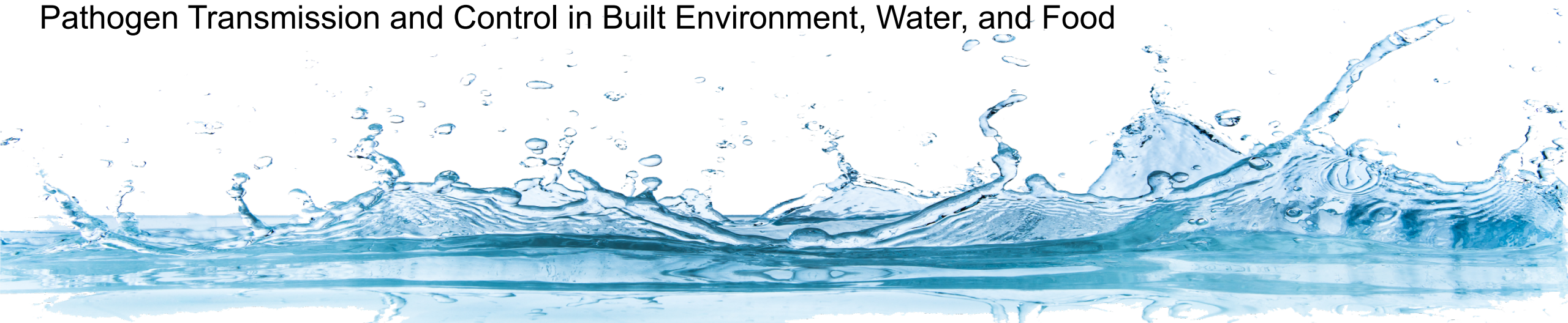
Groundwater Remediation; Advanced Reduction; PFAS Treatment; Catalytic Reduction of Perchlorate

## **Prof. Yujie Men**

Fate, Transport, and Bioremediation of Emerging Organic Contaminants

## **Prof. Yun Shen**

Pathogen Transmission and Control in Built Environment, Water, and Food







# Master's in Air Quality Systems Engineering

Prof. Kelley Barsanti



# Some of our courses on air quality

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## Department Courses

CEE 136	Aerosol Technology
CEE 207	Air Quality Modeling
CEE 233	Advanced Air Pollution Control and Engineering
ENVE 134	Technology of Air Pollution Control
ENVE 138	Combustion Engineering

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## Courses Outside of the Department

ENSC 245	Chemistry and Physics of Aerosols
ME 136	Environmental Impacts of Energy Production and Conversion
PBPL 233	Environmental Economics and Policy



# California air quality in the news

Los Angeles Times

CALIFORNIA

## Los Angeles suffers worst smog in almost 30 years



1/23 Brooks Hubbard with the U.S. Army Corps of Engineers takes photos from the historic North Broadway Bridge over the Los Angeles River Tuesday morning as smoke and ash from the Bobcat fire cloak the area. (AI Seib/Los Angeles Times)

By TONY BARBOZA | STAFF WRITER

SEP. 10, 2020 | 11:45 AM UPDATED 5:09 PM



# Air quality research we do in our labs



THE MOBILE ATMOSPHERIC CHAMBER IN USE IN  
THE VEHICLE EMISSIONS RESEARCH LABORATORY

David Cocker's group uses large Teflon chambers to study pollutant formation from sources like cars and in the complex mixture of species found in the atmosphere.





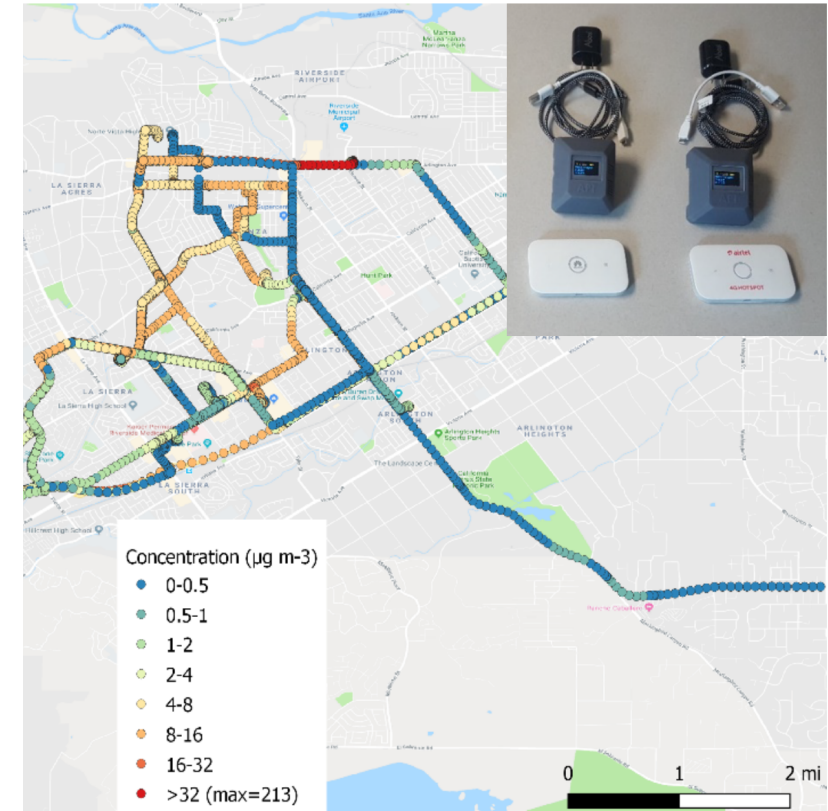
# Air quality research we do in the field



Don Collins' group uses drones to measure ozone and other pollutants

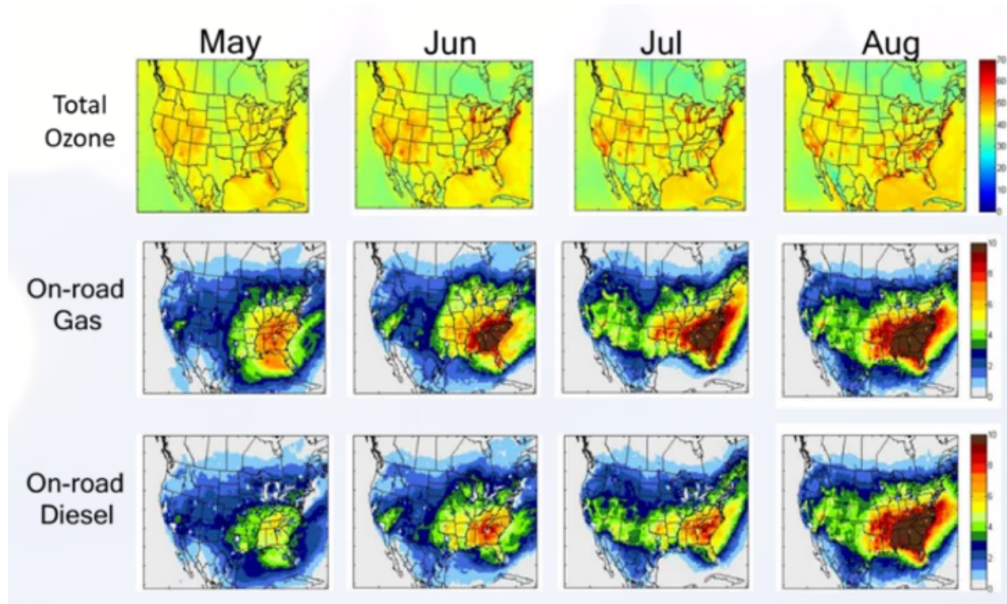


Kelley Barsanti's group collects wildfire smoke samples from aircraft

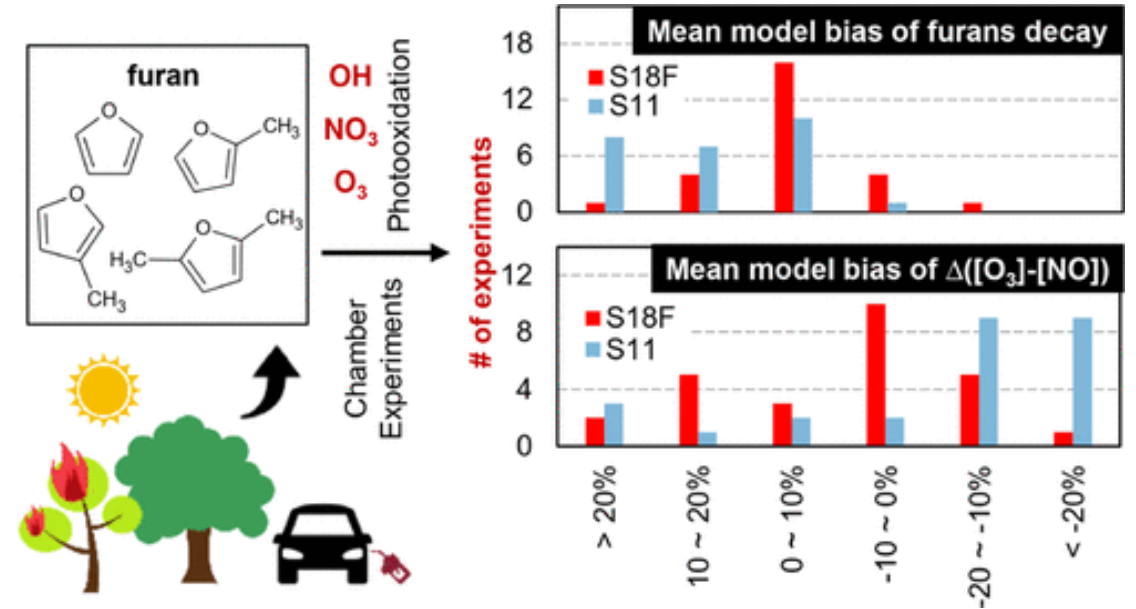


Sunni Ivey's group uses lightweight samplers to study personal exposure

# Air quality research we do with our computers



Sunni Ivey's group uses regional air quality models to simulate ozone formation and concentrations



Kelley Barsanti's group uses laboratory data to improve simulation of atmospheric chemistry



# Many, many others at UCR doing air quality research

## Fundamental Interactions



J. Zhang  
(Chemistry)



Davies  
(Chemistry)



Bahreini  
(Env. Sci.)



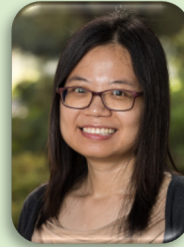
H. Zhang  
(Chemistry)



## Ensemble Dynamics



Cocker  
(Chem. Env.)



Lin  
(Env. Sci.)



Collins  
(Chem. Env.)



Barsanti  
(Chem. Env.)

## Environmental Interactions



Hopkins  
(Env. Sci.)



Jung  
(Mech. Eng.)



Ivey  
(Chem. Env.)



Porter  
(Env. Sci.)



Li  
(Env. Sci.)



Allen  
(Earth Sci.)

Increasing length scale and complexity

Molecular scale  
Molecular and photon interactions  
Chemical kinetics  
Spectroscopy

Nanoscale to microscale  
Aerosol chemistry and trace gas interactions  
Particle formation  
Aerosol composition

Local scale  
Exposure  
Health  
Cloud interactions  
Solar interaction

Urban scale  
Emissions  
Exposure  
Health

Regional scale  
Biomass Burning  
Source Apportionment  
AQ-Meteorology

Global scale  
Transport  
Climate and AQ  
Remote Sensing

# An exciting addition to our (almost) campus



[ABOUT](#) [OUR WORK](#) [RESOURCES](#) [SERVICES](#) [RULEMAKING](#) [NEWS](#) [EQUITY](#)

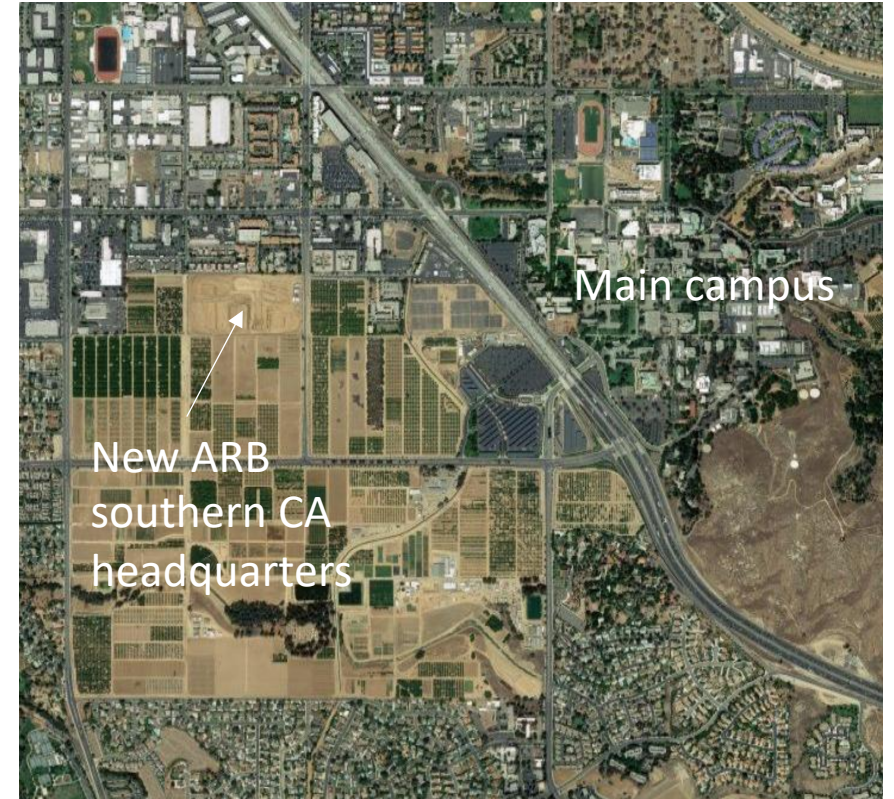


## Southern California Headquarters

CARB is building a new Southern California Headquarters

Under construction on a 19-acre site near the campus of UC Riverside, the approximately 380,000 square-foot facility will be one of the largest and most advanced vehicle emissions testing and research facilities in the world. It will also be the largest 'net-zero energy' structure (producing as much energy as it uses) of its type in the nation. The facility will also be designed to achieve Leadership in Energy and Environmental Design (LEED) Platinum certification and meet CalGreen Tier 2 standards. The facility is scheduled to be completed in early 2021.

*"This striking design will make CARB's new Southern California headquarters an immediately recognizable landmark," said CARB Chair Mary D. Nichols. "It incorporates the highest standards of sustainability in the office and public spaces, and meets the exacting laboratory specifications we need to keep California at the forefront of our world-leading efforts to clean up our air and fight climate change."*







# Faculty Q & A Panel

**Please submit your questions in the chat!**

All specific admissions inquiries may be sent to Mr. Desmond Harvey  
[gradcee@engr.ucr.edu](mailto:gradcee@engr.ucr.edu).





# Connect With Us!

## Chemical and Environmental Engineering



[gradcee@engr.ucr.edu](mailto:gradcee@engr.ucr.edu)



[@CEEatUCR](https://twitter.com/CEEatUCR)



[www.cee.ucr.edu](http://www.cee.ucr.edu)



Apply to CEE!  
Jan. 5<sup>th</sup>



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