Negative Emissions Science

The Second Annual Scialog Conference
November 4–5, 2021

scialog2021®

Alfred P. Sloan Foundation

Research Corporation for Science Advancement

Objectives

Engage in dialogue with the goal of accelerating high-risk/high-reward research.

Identify and analyze bottlenecks to advance fundamental understanding of negative emissions science and develop approaches for breakthroughs.

Build a creative, better-networked community that is more likely to produce breakthroughs.

Form teams to write proposals to seed novel projects based on highly innovative ideas that emerge at the conference.

Process

Brainstorming is welcome; don't be afraid to say what comes to mind.

Consider the possibility of unorthodox or unusual ideas without immediately dismissing them.

Discuss, build upon and constructively criticize each other's ideas – in a spirit of cooperative give and take.

Make comments concise to avoid monopolizing the dialogue.

Diversity, Inclusion and No Harassment

Research Corporation for Science Advancement fosters an environment for listening and considering new ideas from a diverse group, with respect for all participants without regard to gender, race, ethnicity, sexual orientation, age or any other aspect of how we identify ourselves other than as fellow scientists.

RCSA does not tolerate any form of harassment, which could include verbal or physical conduct that has the purpose or effect of substantially interfering with anyone else's participation or performance at this conference, or of creating an intimidating, hostile, or offensive environment; any such harassment may result in dismissal from the conference.

From the President

Welcome to the 2021 *Scialog: Negative Emissions Science* meeting, cosponsored by Research Corporation and the Alfred P. Sloan Foundation. This is the second of three Scialog meetings on this theme.

The goal of this Scialog is to catalyze theorists, computational and data scientists, observers and experimentalists across multiple disciplines to collaborate on developing new and innovative projects to accelerate fundamental science to drive advances in understanding the underlying science that will allow negative emissions technologies to become efficient, affordable, and scalable.

Scialog's overarching purpose is to advance cutting-edge science of great significance to humanity by catalyzing innovative, basic research leading to fundamental discoveries. Our focus is on scientists in the early years of their independent careers. Through the unique Scialog process, we seek to lay the foundation for an ongoing, highly creative, cross-disciplinary community of scientists that will prove adept at identifying exciting areas for research advances for decades to come.

To that end, under the guidance of Research Corporation Program Directors **Richard Wiener**, **Andrew Feig**, and **Silvia Ronco** and **Evan Michelson** of the Sloan Foundation, we hope you will be engaged in passionate discussions with colleagues, many of whom you will have met for the first time at Scialog. The process may even push you out of your comfort zone with the goal of stimulating new and better ideas. The result, we expect, will be a meeting unlike others that you attend. We are confident that you will find the next few days to be extremely worthwhile.

This is your opportunity to air that wild idea you have been reluctant to share with others, or to discuss a nagging hunch that does not yet have sufficient supporting data, or to take a leap on a high- impact/high-risk project instead of concentrating all your effort on somewhat more "incremental" studies. This is the time to come up with, and be open to, completely new ideas that may truly change the world.

We hope this first meeting on this topic yields a crop of outstanding team proposals, which will make our job of determining who receives funding very challenging. I wish you every success in exploring new and compelling ideas over the next few days.

Have a terrific meeting!

Daniel Linzer
President
Research Corporation for Science Advancement

From the Program Director

This year Research Corporation and the Alfred P. Sloan Foundation are cosponsoring the second annual meeting of *Scialog: Negative Emissions Science*. Research Corporation's highly interactive Scialog meetings have the goal of catalyzing new collaborations based on blue-sky ideas among Scialog Fellows who constitute a highly select group of exemplary early career U.S. and Canadian scientists. The emphasis is on dialogue, networking, and building new collaborations to pursue novel, high-risk discovery research.

Research Corporation and the Alfred P. Sloan Foundation chose to focus on *Negative Emissions Science* because we believe this critical area of science requires major breakthroughs in fundamental understanding of capturing and utilizing or sequestering carbon and other greenhouse gases in the atmosphere and oceans that will lead to a sustainable future. Just as firmly, we believe these breakthroughs can be accelerated by chemists and engineers and those in related fields working collaboratively on novel, high-risk projects, particularly combining multiple research approaches, such as modeling, data science, and experiments.

We have an outstanding keynote speaker to set the stage for breakout discussions:
Jennifer Wilcox, Principal Deputy Assistant Secretary for the Office of Fossil Energy and Carbon Management, U.S. Department of Energy.

We have a team of terrific discussion facilitators: **Roger Aines** (Lawrence Livermore National Laboratory), **Sarbajit Banerjee** (Texas A&M University), **Joan Brennecke** (University of Texas at Austin), **Jordi Cabana** (University of Illinois at Chicago), **Emily Carter** (University of California, Los Angeles), **Christopher Jones** (Georgia Institute of Technology), **Jeffrey Long** (University of California, Berkeley), **Alissa Park** (Columbia University), **George Shields** (Furman University), **Ellen Stechel** (Arizona State University), and **Aleksandra Vojvodic** (University of Pennsylvania).

We have representatives on hand as observers from several organizations with a strong interest in climate issues and science philanthropy. Please see the Conference Attendees section below for a complete list.

Scialog meetings focus on dialogue and team building with the goal of creating novel strategies and collaborative approaches. An important feature is the opportunity for Scialog Fellows to form teams and write proposals to pursue particularly creative ideas that emerge through the dialogue. We hope this competition is exciting, but regardless of which proposals are funded, the primary purpose is to catalyze a deeper and more meaningful exchange of ideas than ordinarily occurs at scientific conferences. Our intent is for this process to help participants gain new insights and connections that significantly advance fundamental science.

We hope each participant finds the Scialog experience of great value. Please do not hesitate to provide feedback on how to make the conference better. **Evan Michelson**, Program Director from the Sloan Foundation, my fellow RCSA Program Directors, **Andrew Feig** and **Silvia Ronco**, the RCSA staff, and I are here to help make the meeting a great experience!

Richard Wiener
Senior Program Director
Research Corporation for Science Advancement

Conference Agenda (Optional activities in green)
November 4–5, 2021

Thursday, November 4 *(all times listed in Pacific time zone)*

8:00 – 8:30 am	**Early login, Informal dialog, BYO breakfast/lunch**	Zoom Main Room & Breakout Rooms
8:30 – 8:40 am	**Welcome** Dan Linzer, President, RCSA Adam Falk, President, *Sloan Foundation*	Zoom Main Room
8:40 – 8:55 am	**Conference Overview & Desired Outcomes** Richard Wiener, *RCSA*	Zoom Main Room
8:55 – 9:30 am	**Small Group Ice Breakers**	Zoom Breakout Rooms
9:30 – 10:05 am	**Keynote Presentation & Discussion** *The Role of Carbon Management in Helping to Achieve Net-Zero by Mid-Century* Jennifer Wilcox, DOE	Zoom Main Room
10:05 – 10:20 am	**Break**	
10:20 – 10:30 am	**Directions for Breakout Sessions**	Zoom Main Room
10:30 – 11:45 am	**Breakout Session I**	Zoom Breakout Rooms
11:45 am – 12:15 pm	**Report Out**	Zoom Main Room
12:15 – 12:30	**Directions for Mini Breakout Sessions**	Zoom Main Room
12:30 – 1:30 pm	**Break Lunch/Snack & Optional informal discussions**	Zoom Main Room
1:30 – 2:15 pm	**Mini Breakout Session I (Fellows only)**	Gather Rooms
2:15 – 2:30 pm	**Break**	
2:30 – 3:15 pm	**Mini Breakout Session II (Fellows only)**	Gather Rooms
3:15 – 5:00 pm	**Break**	
5:00 – 7:00 pm	**Social Mixer**	Gather Rooms

Friday, November 5 *(all times listed in Pacific time zone)*

8:00 – 8:30 am	**Early login, Informal dialog, BYO breakfast/lunch**	Zoom Main Room
8:30 – 8:40 am	**Check in regarding Thursday Sessions**	Zoom Main Room
8:40 – 9:00 am	**Discussion of Team Formation/Proposals**	Zoom Main Room
9:00 – 10:15 am	**Breakout Session II**	Zoom Breakout Rooms
10:15– 10:45 am	**Report Out**	Zoom Main Room
10:45 – 11:00 am	**Break**	
11:00 am – 12:15 pm	**Breakout Session III**	Zoom Breakout Rooms
12:15 – 12:45 pm	**Report Out**	Zoom Main Room
12:45 – 1:00 pm	**Wrap-up**	Zoom Main Room
1:00 – 2:00 pm	**Break Lunch/Snack & Optional informal discussions**	Zoom Main Room
2:00 – 2:45 pm	**Mini Breakout Session III (Fellows only)**	Gather Rooms
2:45 – 3:00 pm	**Break**	
3:00 – 3:45 pm	**Mini Breakout Session IV (Fellows only)**	Gather Rooms
3:45 – 5:00 pm	**Break**	
5:00 – 7:00 pm	**Social Mixer**	Gather Rooms

Keynote Presentation

The Role of Carbon Management in Helping to Achieve Net-Zero by Mid-Century

Jennifer Wilcox
Principal Deputy Assistant Secretary for Office of Fossil Energy and Carbon Management, U.S. Department of Energy

Abstract: President Biden has laid out a bold and ambitious goal of achieving net-zero carbon emissions in the U.S. by 2050. The pathway to that target includes cutting total greenhouse gas emissions in half by 2030 and eliminating them entirely from the nation's electricity sector by 2035. Investment in technology research, design, development, and deployment (RDD&D) will be required to achieve the president's objectives, including investments in both carbon capture at point sources in addition to carbon dioxide removal approaches that target the accumulated pool of carbon in the atmosphere. Both will be required to achieve net-zero carbon emissions in time, and they will require increased deployment in order to move down the cost curve. These efforts combined with effective policy will make these approaches economically viable.

These approaches are critical and must be deployed in parallel. Deployment of these technologies at the scale required will necessitate the use of resources including land, water, and in some cases, low-carbon energy, while ensuring the secure and reliable storage of carbon dioxide (CO2) on a timescale that impacts climate. Therefore, CCS and CDR deployment must be implemented strategically in terms of regional goals and requirements.

The Office of Fossil Energy and Carbon Management will play an important role in the transition to net-zero carbon emissions by reducing the environmental impacts of fossil energy production and use—and helping decarbonize other hard-to-abate industrial sectors—through investments in technology solutions including CCS, direct air capture, and the deployment of carbon capture technologies to produce low-carbon products and fuel, including hydrogen.

2021 Proposal Guidelines and Collaborative Awards

Scialog: Negative Emissions Science

1. Awards are intended to provide seed funding for teams of two to three Scialog Fellows formed at this conference for high-risk, high-impact projects.
2. Two-page proposals should describe the project and the role of each team member. No budget is necessary. A third page may be used for references.
3. Awards will be in the amount of $50K direct funding per team member, plus a small percentage for overhead. Grant duration will be one year
4. No Scialog Fellow can be a member of more than two teams. If a Scialog Fellow is a member of two teams, other members of the teams must be different. No team can submit more than one proposal.
5. No Scialog Fellow who previously has won a Scialog NES Collaborative Award can be a member of more than one team. The other team members must be different from the members of the previously awarded team.
6. Teams cannot include members who have previously collaborated with one another. If you are unsure of your status (e.g., prospective team members were part of a large collaboration but did not significantly interact), please check for clarification with an RCSA program director.
7. Teams are encouraged (but not required) to:
   a. Include members with different research approaches and methods.
   b. Include members from different disciplines.
8. Proposals must be submitted electronically by 11:59 p.m. PST on **November 12, 2021**. Instructions for submission will be provided at the meeting.
9. Awards are anticipated to start on **February 1, 2022**.

2020 Collaborative Awards

Electrifying Humidity-Swing Adsorption for DAC by Modulation of Redox-Polymer Hydration
Shaama Mallikarjun Sharada, Chemical Engineering and Materials Science,
University of Southern California
Burcu Gurkan, Chemical and Biomolecular Engineering, Case Western Reserve University
Xiao Su, Chemical and Biomolecular Engineering, University of Illinois at Urbana-Champaign

Using Electrochemistry to Improve Selectivity of Plasma-Assisted CO2 Reduction William
Bowman, Materials Science and Engineering, University of California, Irvine
Eva Nichols, Chemistry, University of British Columbia
Robert Coridan, Chemistry and Biochemistry, University of Arkansas

Integrated Low-Temperature Electrified Process for CO2 Direct Air Capture and Transformation to Solid Carbon
Kathryn Knowles, Chemistry, University of Rochester
Carlos Morales-Guio, Chemical and Biomolecular Engineering, University of California, Los Angeles
Robert Coridan, Chemistry and Biochemistry, University of Arkansas

Investigation of the Carbonation Dynamics of Synthetic Silicates: Guiding the Development of Net- Negative Production Process and Deployment in Enhanced Rock Weathering
Rafael Santos, School of Engineering, University of Guelph
Pratik Dholabhai, Physics and Astronomy, Rochester Institute of Technology
Andrea Hicks, Civil and Environmental Engineering, University of Wisconsin-Madison

Bricks from The Ocean: Hybrid Microbial-Electrochemical Mineralization of CO2
Nanette Boyle, Chemical & Biological Engineering, Colorado School of Mines
Shu Hu, Chemical and Environmental Engineering, Yale University

Solar-Augmented Direct Air Capture of Methane Using Methanotrophic Bacteria
Nanette Boyle, Chemical and Biological Engineering, Colorado School of Mines
Chong Liu, Chemistry and Biochemistry, University of California, Los Angeles

Envisioning a Low Carbon Built Environment through Innovative Electrochemical and Chemical Processing of Construction Materials and Enhanced Circular Reuse
Greeshma Gadikota, Civil and Environmental Engineering, Cornell University
Venkat Viswanathan, Mechanical Engineering, Carnegie Mellon University

Electrochemically Driven Reactive Capture of CO2 from Air Using Azolium-Carboxylates
Wilson Smith, Chemical and Biological Engineering, University of Colorado Boulder
David Kwabi, Mechanical Engineering, University of Michigan
Robert Gilliard, Department of Chemistry, University of Virginia

Scialog Fellows

Kandis Leslie Abdul-Aziz klabdulaziz@engr.ucr.edu
University of California, Riverside,
Chemical and Environmental Engineering
Dr. Abdul-Aziz leads the Sustainable Catalysis and Materials Group, which focuses on developing sustainable processes and catalytic schemes for the full utilization of waste (carbon, plastics, biomass) to value-added fuels and chemicals.

Ashleigh Baber baberae@jmu.edu
James Madison University, Chemistry and Biochemistry
Exploration of bifunctional and multifunctional catalysts for the conversion of carbon dioxide into value added fuels.

Praveen Bollini ppbollini@uh.edu
University of Houston,
Chemical and Biomolecular Engineering
Adsorption-heterogeneous catalysis-reaction engineering.

William J. Bowman will.bowman@uci.edu
University of California, Irvine,
Materials Science and Engineering
My lab applies and develops advanced electron microscopy methods for materials characterzation. We study inorganic oxide ceramics for energy storage, conversion, and CO2 capture.

Nanette Boyle nboyle@mines.edu
Colorado School of Mines,
Chemical and Biological Engineering
Studying carbon fluxes in biological organisms and complex consortia so that we can engineer them more efficiently.

Fikile Brushett brushett@mit.edu
Massachusetts Institute of Technology,
Chemical Engineering
I am interested in advancing the science and engineering of new electrochemical systems for a sustainable energy future.

Rob Coridan rcoridan@uark.edu
University of Arkansas, Chemistry and Biochemistry
Structured, nanomaterials-based composite structures for solar-to-fuels applications.

Pratik Dholabhai pratik.dholabhai@rit.edu
Rochester Institute of Technology,
Physics and Astronomy
Computational materials scientist with expertise in application and development of atomistic simulation methods to design novel materials and technologies.

Greeshma Gadikota gg464@cornell.edu
Cornell University, Civil and Environmental Engineering
Sustainable energy and resource recovery.

Betar Gallant bgallant@mit.edu
Massachusetts Institute of Technology,
Mechanical Engineering
Study and design of non-thermal CO2 capture technologies for improved versatility, modularity, and efficiency at scale.

Rebecca Gieseking gieseking@brandeis.edu
Brandeis University, Chemistry
Quantum mechanical modeling of photochemical and electrochemical electron transfer; plasmon- enhanced catalysis.

Matt Green mdgreen8@asu.edu
Arizona State University, Chemical Engineering
The Green lab designs sorbents (primarily polymeric sorbents), sorbent form factors, and systems to capture carbon dioxide from air.

Burcu Gurkan burcu@case.edu
Case Western Reserve University,
Chemical and Biomolecular Engineering
Reactive CO2 separations by solvents (ionic liquids and deep eutectic solvents); hybrid materials for direct air capture; facilitated transport membranes.

Kelsey B. Hatzell kelsey.hatzell@princeton.edu
Princeton University,
Mechanical and Aerospace Engineering
Electrochemical systems, energy conversion.

Marta Hatzell marta.hatzell@me.gatech.edu
Georgia Institute of Technology, Mechanical Engineering
Design of cost effective separations and catalytic systems for CO2 sequestration and conversion.

Andrea Hicks hicks5@wisc.edu
University of Wisconsin-Madison,
Civil and Environmental Engineering
Environmental impacts and sustainability implications of emerging technologies, using tools such as life cycle assessment and techno economic analysis.

Caleb Hill caleb.hill@uwyo.edu
University of Wyoming, Chemistry
The development and application of analytical methods to characterize the chemical and physical behavior of individual nanoscale entities.

Adam Holewinski adam.holewinski@colorado.edu
University of Colorado Boulder, Chemical Engineering
Electrochemistry, catalysis, biomass conversion, kinetics, spectroscopy.

Scialog Fellows Continued

Katherine Hornbostel hornbostel@pitt.edu
University of Pittsburgh, Mechanical Engineering
Direct ocean capture; carbon capture membrane modeling; metal organic frameworks for direct air capture; novel system modeling for direct air capture.

Shu Hu shu.hu@yale.edu
Yale University, Chemical and Environmental Engineering
Photocatalysis utilizing natural resources, light-driven fuel production and organic synthesis, in situ multi-modal characterizations, and reactor engineering.

Jimmy Jiang jiangjb@ucmail.uc.edu
University of Cincinnati, Chemistry
Our research interest is centered on molecular catalysis for small molecule conversion, with a primary focus on the elucidation of catalysis mechanisms.

Feng Jiao jiao@udel.edu
University of Delaware,
Chemical and Biomolecular Engineering
I am interested in science and engineering research related to carbon capture and utilization, electrochemical systems, and catalysis.

Katie Knowles kknowles@ur.rochester.edu
University of Rochester, Chemistry
Synthesis, electrochemistry, and photophysics of first-row transition metal oxide nanomaterials.

David Kwabi dkwabi@umich.edu
University of Michigan, Mechanical Engineering
Electrochemical separation (CO2 capture, desalination, nitrogen recovery), energy storage at grid- scale (redox-flow batteries), multi-physics modeling.

Siona Liguori sliguori@clarkson.edu
Clarkson University,
Chemical and Biomolecular Engineering
My research interests are focused on the synthesis, development and application of inorganic membrane and membrane reactors, where the interactions between catalysis and separation lead to process intensification allowing for clean energy conversion and carbon capture.

Feng Lin fenglin@vt.edu
Virginia Polytechnic Institute and State University, Chemistry
Electrochemical energy chemistry and advanced synchrotron characterization.

Zhou Lin zhoulin@umass.edu
University of Massachusetts Amherst, Chemistry
Developing versatile computational methods combining quantum mechanics and machine learning to model significant chemical reactions in energy, materials, and environmental sciences. Interpreting rigorous quantum mechanical behaviors of molecules in various energy and time scales.

Chong Liu chongliu@chem.ucla.edu
University of California, Los Angeles,
Chemistry and Biochemistry
Electrochemistry, connecting inorganic nanomaterials with microorganisms,CO2/N2/CH2 activation.

T. Leo Liu leo.liu@usu.edu
Utah State University, Chemistry and Biochemistry
My group's research interests broadly cover energy and catalysis sciences applied to sustainable energy and chemical conversions.

Yayuan Liu yayuanliu@jhu.edu
Johns Hopkins University,
Chemical and Biomolecular Engineering
Our lab develops electrochemical methods for carbon dioxide separation and utilization with efforts spanning from fundamental understanding to materials design and prototyping.

Yuanyue Liu yuanyue.liu@austin.utexas.edu
University of Texas at Austin, Mechanical Engineering
My research focuses on developing and applying atomistic simulation methods to study electron transport and electrochemistry especially catalysis.

Oana Luca oana.luca@colorado.edu
University of Colorado Boulder, Chemistry
Sustainable electrochemical methods for capture and conversion of abundant gases.

Jarad Mason mason@chemistry.harvard.edu
Harvard University, Chemistry and Chemical Biology
The Mason Group applies the tools of synthetic chemistry and nanoscience to design materials that address basic science challenges in energy and medicine, with a particular emphasis on manipulating entropic effects, phase transitions, and porosity in metal-organic materials.

Ellen Matson matson@chem.rochester.edu
University of Rochester, Chemistry
The Matson Lab studies the synthesis and reactivity of metal oxide clusters with interests in energy storage and conversion.

Scialog Fellows Continued

Charles McCrory cmccrory@umich.edu
University of Michigan, Chemistry
My research program focuses on using careful electroanalytical studies to elucidate the mechanism of electrocatalytic systems, then using this mechanistic understanding to inform the rational design of next-generation catalyst materials.

Jose Mendoza jmendoza@msu.edu
Michigan State University,
Chemical Engineering and Materials Science
My research focus on the development of theoretical and computational techniques for Quantum Simulations, Machine Learning and Multiscale simulations to study structural, electronic, transport and optical properties of materials, low-dimensional systems and nanostructures.

Phill Milner pjm347@cornell.edu
Cornell University, Chemistry and Chemical Biology
Uncovering new reversible chemical reactions that enable separations of greenhouse gases within porous framework materials.

Gary F. Moore gary.f.moore@asu.edu
Arizona State University, Molecular Sciences
My research aims to understand and advance the fundamental molecular sciences required to unleash a range of renewable energy and chemical manufacturing technologies.

Carlos Morales-Guio moralesguio@ucla.edu
University of California, Los Angeles,
Chemical and Biomolecular Engineering
Our research is focused on the understanding of electrocatalytic technologies at multiple scales to close the gap between atoms, electrodes, devices and process plants.

Eva Nichols enichols@chem.ubc.ca
University of British Columbia, Chemistry
We study the local environment's role in homo/heterogeneous electrocatalytic CO2/CO reduction and use IR spectroscopy to probe mechanisms.

Michael Nippe nippe@chem.tamu.edu
Texas A&M University, Chemistry
We are working on developing on new design elements for electro- and photo-catalysts for small molecule conversions and have experience in carbon dioxide reduction, formate conversion, and nitrogen reduction.

Valentina Prigiobbe vprigiob@stevens.edu
Stevens Institute of Technology, Civil, Environmental, and Ocean Engineering
My work focuses on the development of a bio-carbon mineralization process for CO2 storage and mining.

Lina Quan linaquan@vt.edu
Virginia Polytechnic Institute and State University, Chemistry
Our research is interested in developing efficient semiconductors for clean energy applications such as photovoltaics and related technology.

Ananya Renuka Balakrishna renukaba@usc.edu
University of Southern California,
Aerospace and Mechanical Engineering
We develop novel mathematical models to predict and understand how materials respond to external stimuli.

Fateme Rezaei rezaeif@mst.edu
Missouri University of Science and Technology,
Chemical and Biochemical Engineering
My research interests are novel sorbents and intensified separation processes for energy and environmental applications.

Emily Ryan ryanem@bu.edu
Boston University, Mechanical Engineering
Meso-scale modeling of multi-phase reactive systems.

Rafael Santos santosr@uoguelph.ca
University of Guelph, Engineering
I am working on realizing the full potential of enhanced rock weathering towards climate change mitigation. This includes identifying the best minerals, understanding how they weather and the fate of the sequestered carbon, and finding conditions that accelerate weathering.

Caroline Saouma caroline.saouma@utah.edu
University of Utah, Chemistry
We are interested in improving CO2 reduction catalysis through catalyst design, mechanistic studies, thermodynamic understanding, and combining carbon capture with recycling.

Kristen Schell kristenschell@cunet.carleton.ca
Carleton University,
Mechanical and Aerospace Engineering
My research interests are in developing machine learning and optimization models to inform the design of low energy negative emissions technologies (NETs).

Marcel Schreier mschreier2@wisc.edu
University of Wisconsin-Madison,
Chemical and Biological Engineering
The Schreier group takes a bottom-up approach to understand and tune electrocatalytic interfaces on the molecular level, widening the scope of electricity-driven reactions that can be driven by electricity.

Linsey Seitz linsey.seitz@northwestern.edu
Northwestern University,
Chemical and Biological Engineering
Catalyst synthesis, reaction mechanisms, degradation processes, in situ spectroscopy, and reactor design for electrocatalytic processes.

Shaama Sharada ssharada@usc.edu
University of Southern California, Chemical Engineering
Developing and applying quantum chemistry methods towards catalyst design for sustainable chemistry.

Wilson A Smith wilson.smith@nrel.gov
National Renewable Energy Laboratory,
University of Colorado Boulder, Materials, Chemical, and Computational Science/Chemical Engineering
I am interested in scaling electrochemical processes that can contribute to negative emissions science, with a focus on integrating systems for optimized balance of plant operation.

Xiao Su x2su@illinois.edu
University of Illinois at Urbana-Champaign,
Chemical and Biomolecular Engineering
My research focuses on the design electrochemical interfaces with a high degree of molecular specificity for applications in chemical and environmental separations.

Andrew Teixeira arteixeira@wpi.edu
Worcester Polytechnic Institute, Chemical Engineering
Microreaction engineering using dynamic multiphase reactor design, porous media, catalysis, and transport phenomena.

Jesús Velázquez jevelazquez@ucdavis.edu
University of California, Davis, Chemistry
Synthesis and electronic structure characterization of multidimensional solid-state materials and thin films for energy conversion and environmental remediation.

Venkat Viswanathan venkvis@cmu.edu
Carnegie Mellon University, Mechanical Engineering
Electrochemical routes for sustainable synthesis, electrochemical cement production, electrocatalysis.

Haotian Wang htwang@rice.edu
Rice University, Chemical and Biomolecular Engineering
My group's research is mainly focused on electrochemically converting atmospheric molecules such as CO2, O2 and N2 into valuable fuels and chemicals.

Luisa Whittaker-Brooks luisa.whittaker@utah.edu
University of Utah, Chemistry
Heat recovery, CO2 capture. Synthesis and morphology control of 2D and 3D coordination polymers. Understanding electrochemical processes via in situ spectroscopy and diffraction.

Jenny Yang j.yang@uci.edu
University of California, Irvine, Chemistry
CO2 capture and concentration, direct air, electrochemical methods, CO2 as a feedstock to fuels.

Sen Zhang sz3t@virginia.edu
University of Virginia, Chemistry
My research interest is on the development of nanoscale and sub-nanoscale catalytic materials with atomically precise surfaces, interfaces and ordered architectures that enables emerging applications in energy and environmental sustainability.

Discussion Facilitators

Roger Aines aines@llnl.gov
Atmospheric, Earth, and Energy Division,
Lawrence Livermore National Laboratory
I seek to understand, develop, and implement technologies for the removal of carbon dioxide from the atmosphere—so-called negative emissions technologies, especially in the context of real limitations of societal acceptance and resource limitations.

Sarbajit Banerjee banerjee@chem.tamu.edu
Texas A&M University, Chemistry
Solid-state chemistry, phase transitions, design of electrocatalysts and photocatalysts informed by electronic structure considerations, hard-to-abate sectors, critical minerals and resource flows.

Joan Brennecke jfb@che.utexas.edu
University of Texas at Austin, Chemical Engineering
Ionic liquids, thermodynamics, gas separations, supercritical fluid technology, environmentally benign chemical processing.

Jordi Cabana jcabana@uic.edu
University of Illinois at Chicago, Chemistry
We conduct research in inorganic solid state chemistry @thisisuic. Currently interested in materials for electrochemistry and energy.

Emily Carter eac@ucla.edu
University of California, Los Angeles,
Chemical and Biomolecular Engineering/Provost
Development and application of efficient, accurate quantum mechanics techniques for the discovery and design of molecules and materials for sustainable energy and carbon dioxide utilization, including converting sunlight to electricity and producing chemicals and fuels.

Christopher Jones cjones@chbe.gatech.edu
Georgia Institute of Technology,
Chemical and Biomolecular Engineering
Direct air capture materials and processes, catalytic CO2 conversion.

Jeffrey Long jrlong@berkeley.edu
University of California, Berkeley,
Chemistry and Chemical and Biomolecular Engineering
Our research focuses on the synthesis and characterization of new porous materials for potential applications in gas storage, molecular separations, catalysis, and energy storage.

Alissa Park ap2622@columbia.edu
Columbia University, Earth and Environmental Engineering and Chemical Engineering
Our research focuses on the development of novel materials for CO2 capture including direct air capture and their integration into different CO2 conversion pathways such as carbon mineralization and CO2 electrochemical conversion to chemicals, materials and fuels.

George Shields george.shields@furman.edu
Furman University, Chemistry
Computational chemistry applied to important societal problems.

Ellen Stechel ellen.stechel@asu.edu
Arizona State University, ASU LightWorks

Aleksandra Vojvodic alevoj@seas.upenn.edu
University of Pennsylvania,
Chemical and Biomolecular Engineering
Computational-driven materials design for chemical transformations and energy conversion with the focus on transition metal compounds.

Guests

Tosh Barron toshbarron@gmail.com
Research Corporation for Science Advancement,
Board Member Emerita
Uniquely new scientific issues

Daren Ginete dginete@sciphil.org
Science Philanthropy Alliance

Isabella Gee isabella.gee@utexas.edu
University of Texas at Austin, Mechanical Engineering
Energy system transformation and deep decarbonization

Gayle Jackson galejackson@mac.com
Research Corporation for Science Advancement,
Board Member Emerita

Diane Matar dmatar@sciphil.org
Science Philanthropy Alliance, Fellows
Natural processes of carbon sequestration

Evan Michelson michelson@sloan.org
Alfred P. Sloan Foundation,
Energy and Environment Program
I oversee a research program that aims to inform the societal transition toward low-carbon energy systems in the United States by investigating economic, environmental, technological, and distributional issues.

Pete Reiners reiners@arizona.edu
University of Arizona, College of Science
I am interested in all aspects of getting toward zero and negative emissions, particularly with the help of geology/geochemistry.

Jennifer Wilcox jennifer.wilcox@hq.doe.gov
U.S. Department of Energy,
Fossil Energy and Carbon Management
Investing in strategies that minimize environmental and social impacts of our dependence on fossil fuels, e.g., methane mitigation, carbon capture, carbon removal, and dedicated storage

Dan Yawitz dan@climatepathfinders.org
Climate Pathfinders Foundation, Grants
Early-stage grant funding for negative emissions

Alfred P. Sloan Foundation

Adam Falk falk@sloan.org
President

Evan Michelson michelson@sloan.org
Program Director

Research Corporation

Jennifer Dukes jdukes@rescorp.org
Program & Award Administrator, Senior

Laura Esham lesham@rescorp.org
Program Assistant

Andrew Feig afeig@rescorp.org
Senior Program Director

Danny Gasch dgasch@rescorp.org
Chief Financial Officer

Angela Hagen ahagen@rescorp.org
Communications Director

Kimberly Huynh khuynh@rescorp.org
Data Analytics Specialist

Dan Linzer dlinzer@rescorp.org
President

Meg Martin mmartin@rescorp.org
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