Sustainable Minerals, Metals, and Materials

The First Annual Scialog Conference
September 4-7, 2024

scialog2024®

ALFRED P. SLOAN FOUNDATION

RESEARCH CORPORATION *for* SCIENCE ADVANCEMENT

THE KAVLI FOUNDATION

Scialog: Sustainable Minerals, Metals and Materials

Objectives

1. Engage in dialogue with the goal of accelerating high-risk, high-reward research.
2. Analyze bottlenecks related to the sustainable use of critical minerals and novel materials, both inorganic and organic. We seek to promote basic science that supports thinking about the entire lifecycle of precious resources. Across this sector we must consider the sustainable acquisition of new resources, minimizing waste throughout design and manufacturing workflows, and planning for the recovery and/or recycling at the end of a material's useful life.
3. Build a creative better-networked community of scientists that crosses disciplinary silos.
4. Form new teams to write proposals to seed novel projects based on innovative ideas that emerge from the dialogue.
5. Most importantly, enjoy the discussions about where this field should go and how we can work together to get there.

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 inclusive and respectful environment for listening in which the different identities, backgrounds, and perspectives of all participants are valued, and in which everyone is empowered to share ideas 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.

Read RCSA's Code of Conduct

From the President

Welcome to the 2024 ***Scialog: Sustainable Minerals, Metals and Materials*** meeting, cosponsored by Research Corporation and the Alfred P. Sloan Foundation, with additional support from The Kavli Foundation. This is the first of three Scialog meetings on this theme and the third Scialog that we have co-sponsored with the Sloan Foundation.

The goal of this Scialog is to catalyze multidisciplinary collaboration on fundamental science projects for how we acquire, use, and recycle precious resources from our environment that contribute to the high-tech infrastructure that defines modern society. Across this sector we must consider the sustainable acquisition of new resources, minimizing waste throughout design and manufacturing workflows, and planning for recovery and/or recycling at the end of a material's useful life.

Scialog's overarching purpose is to advance cutting-edge science of great significance to humanity by catalyzing innovative, basic research. 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 Program Directors **Andrew Feig, Richard Wiener, Eileen Spain** and **Silvia Ronco** (Research Corporation), and with assistance from our initiative partners **Evan Michelson** and **Isabella Gee** (Sloan Foundation) and **Jeff Miller** (Kavli Foundation), we hope you will be engaged in passionate discussions with colleagues, many of whom you will meet for the first time at Scialog. The process is designed to stimulate new ideas that you might not be able to pursue on your own but become possible to try out in collaborative teams. The result, we expect, will be a meeting unlike others that you attend. We are confident that you will find the next two 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 incremental studies. This is the time to come up with, and be open to, completely new ideas that may truly change the world and to find new colleagues and collaborators with whom to pursue them.

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. For all Fellows, whether or not you develop a funded project, we are sure that this Scialog network will provide long-term benefits. I wish you every success in exploring new and compelling ideas over the next two days.

Have a terrific meeting!

Daniel Linzer
President
Research Corporation for Science Advancement

From the Program Director

Research Corporation's highly interactive Scialog meetings seek to catalyze new collaborations among Scialog Fellows who constitute a highly select group of exemplary early-career scientists from the U.S. and Canada. The emphasis is on dialogue, networking, and pursuit of novel, high-risk discovery research based on blue-sky ideas.

Research Corporation, the Alfred P. Sloan Foundation, and The Kavli Foundation chose to focus on Sustainable Minerals, Metals and Materials because we believe modern life thrives on technical innovations that use the novel properties of new materials and polymers. At the same time, however, we must think of the impact these advances have on our environment. We cannot continue to take to scale products for which we lack critical elemental materials required for their synthesis. We cannot continue to take to scale polymeric materials that fail to break down or that damage fragile ecosystems when they do. We need new basic science that supports how we acquire new sources of critical elements, how we recover and reuse materials at the end of their lifecycles, and how we make polymers that readily revert to natural materials when we no longer need them for their designed function.

We have two outstanding keynote speakers, **Ikenna Nlebedim** (Ames National Laboratory) and **Jonathan Wilker** (Purdue University), to set the stage for breakout discussions. They will be joined by a terrific group of senior scientists to round out the team of facilitators:

Kwame Awuah-Offei (Missouri University of Science and Technology)
Will Dichtel (Northwestern University)
Peter Dorhout (Iowa State University)
Jennifer Dunn (Northwestern University)
Andrea Hicks (University of Wisconsin – Madison)
Amy Landis (Colorado School of Mines)
Eric Schelter (University of Pennsylvania)

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 to enable major advances in automated laboratory technologies.

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. My fellow Program Directors, **Richard Wiener, Silvia Ronco**, and **Eileen Spain**, the RCSA staff, and I are here to help make the meeting a great experience!

Andrew Feig
Senior Program Director
Research Corporation for Science Advancement

Conference Agenda

Wednesday, September 4

2:00 – 6:00 pm	**Registration**	Main Hotel Lobby
2:00 – 5:00 pm	**Snacks & Informal Discussions**	Kiva B
5:00 – 6:30 pm	**Poster Session and Reception**	Kiva B & Kiva Patio
6:00 – 6:30 pm	**Meeting for Discussion Facilitators**	Kiva A
6:30 – 7:30 pm	**Dinner**	Kiva Patio
7:30 – 8:30 pm	**Welcome** Dan Linzer, President, RCSA Evan Michelson, Program Director, Sloan Foundation **Conference Overview, Outcomes and Proposal Guidelines** Andrew Feig, Senior Program Director, RCSA **Introductions/Ice Breakers**	Kiva A
8:30 – 10:00 pm	**Starlight Cafe**	Kiva Patio

Thursday, September 5

7:00 – 8:00 am	**Breakfast**	Flying V
8:00 – 8:45 am	**Keynote Presentation** *Innovative, Simple and Non-Disruptive Solutions for Sustainable Critical Materials Challenges* Ikenna Nlebedim, Ames National Laboratory	Kiva A
8:45 – 9:00 am	**Breakout Session Overview and Instructions**	Kiva A
9:00 – 10:15 am	**Breakout Session I**	Kiva A/B Ventana 1/2 Flying V
10:15 – 10:35 am	**Report Out**	Kiva A
10:35 – 11:15 am	**Conference Photo and Morning Break**	TBD
11:15 – 11:45 am	**Mini Breakout Session I** (Fellows) **Facilitator Meeting**	All spaces Kiva A
11:45 – 1:00 pm	**Lunch**	Flying V
1:00 – 2:15 pm	**Breakout Session II**	Kiva A/B Ventana 1/2 Flying V
2:15 – 2:35 pm	**Report Out**	Kiva A
2:35 – 3:05 pm	**Mini Breakout Session II** (Fellows)	All spaces
3:05 – 5:15 pm	**Afternoon Break, Informal Discussions and Leisure Time**	Kiva B
5:15 – 6:30 pm	**Poster Session and Reception**	Kiva B & Kiva Patio
6:30 – 7:30 pm	**Dinner**	Kiva Patio
7:30 – 8:15 pm	**Keynote Presentation** *Making Biomimetic Adhesives and Commercializing Sustainable Technologies* Jonathan Wilker, Purdue University	Kiva A
8:15 – 10:00 pm	**Starlight Cafe**	Kiva Patio

Friday, September 6

7:00 – 8:00 am	**Breakfast**	Flying V
8:00 – 8:15 am	**Discussion of Team Formation**	Kiva A
8:15 – 8:45 am	**Mini Breakout Session III** (Fellows)	All Spaces
8:45 – 10:00 am	**Breakout Session III**	Kiva A/B Ventana 1/2 Flying V
10:00 – 10:20 am	**Morning Break**	Kiva B
10:20 – 10:40 am	**Report Out**	Kiva A
10:40 - 11:10 am	**Mini Breakout Session IV** (Fellows)	All Spaces
	Facilitator and Funding Partners Discussion	Kiva A
11:20 – 11:50 am	**Mini Breakout Session V** (Fellows) **- with self-selected partners**	All Spaces
11:50 – 1:00 pm	**Lunch**	Flying V
1:00 – 5:45 pm	**Team Formation, Informal Discussions and Proposal Writing**	All Spaces
5:45 – 6:30 pm	**Reception**	Kiva Patio
6:30 – 7:30 pm	**Dinner**	Kiva Patio
7:30 – 10:00 pm	**Starlight Cafe**	Kiva Patio

Saturday, September 7

6:30 – 7:30 am	**Breakfast**	Flying V
7:30 – 11:00 am	**Presentation of Proposals**	Kiva A
	Assessment Survey and Wrap-up	
11:00 – 12:00 pm	**Lunch** (available to go)	Kiva B

Keynote Presentations

Innovative, Simple and Non-Disruptive Solutions for Sustainable Critical Materials Challenges

Ikenna C. Nlebedim
Ames National Laboratory

Abstract:
It has been widely recognized that the transition to a cleaner future with net-zero emissions would be materials-intensive, hence attention is being drawn to the sustainable supply of minerals and metals for clean energy technologies. There are complexities associated with addressing critical materials challenges. For example, it can be very complex to integrate the required technical and non-technical aspects of the solutions into a sustainable practice. Take rare earth elements for example, there is the need for high-impact technical solution for their sustainable supply, while considering the difficult challenge due to the similarity in their chemical and physical properties, the low concentration of the key elements of interest, and the need to extract/recycle them with minimal negative impacts to the environment. On the other hand, the non-technical solutions require managing the need for resources, community engagement, collaboration, competition, economic impact, and the speed of innovation. Consequently, complex and disruptive technologies are often proposed as solutions. However, are we overlooking simple solutions due to the complexity of the challenges? Should the technological solutions for addressing critical minerals and metals challenges be disruptive? Can we achieve the sustainable and innovative solutions to complex critical materials challenges through simple and drop-in technologies? What is the role of interdisciplinary collaborative environment in simplifying the complexities? This keynote address intends to answer these questions. It aims to underscore the importance of the Scialog initiative on Sustainable Minerals, Metals, and Materials by highlighting the place of practical, simple and drop-in solutions for sustainable critical materials innovation ecosystem.

Making Biomimetic Adhesives and Commercializing Sustainable Technologies

Jonathan Wilker
Purdue University

Abstract:
Adhesives are wonderful materials, holding together our electronics, furniture, and packaging. However, most glues are petroleum-based, do not degrade, and prevent substrate separation, thereby meaning that most consumer products end up in landfills for centuries. A sustainable materials ecosystem requires new adhesive technologies. We have turned to sea creatures for design cues. Mussels, barnacles, and oysters all bond to rocks with chemistry not found in commercial glues. Using biomimetic chemistry, a new series of plant-based precursors have been cross-linked together for creating bio-based adhesives. Bond strengths can be similar to commercial epoxies. Bulk scale costs are a modest ~1/3 premium over existing materials. Calculations indicate that, overall, the materials are carbon negative. With such new materials in hand, how do we create sustainability via market impact? Our experiences working with both large companies and startups will help to illustrate roadmaps for displacement of existing non-sustainable materials. Performance, cost, available scales, incumbent products, market demand, and entrepreneurship are all becoming relevant topics for scientists when developing new technologies.

2024 Proposal Guidelines

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. The application package should be submitted as a single PDF file. Pages one and two should describe the project and role of each team member. A third page may be used for references. No budget is necessary.

3. Awards will be in the amount of $60K 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: AUT 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. Scialog Fellows who have previously won two Scialog AUT Collaborative Awards are not eligible to be funded members of a team, but they can participate as a non-funded team member.

7. 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.

8. Teams are encouraged (but not required) to:
    a. Include members with different research approaches and methods.
    b. Include members from different disciplines.

9. Proposals must be submitted electronically by **6:00 a.m. PST Saturday, September 7, 2024**. Instructions for submission will be provided at the meeting.

10. Awards are anticipated to start around **December 1, 2024**.

Scialog Fellows

Brooks Abel brooks.abel@berkeley.edu
Chemistry, University of California, Berkeley
Primary research interests: Cationic Ring-Opening Polymerizations, Hydrogen bond and halogen bond donor catalysis, Hypervalent silicon Lewis acid catalysis, Group Transfer Polymerization, Chemically recyclable and biodegradable polymers, Recyclable and degradable thermosets

Diego Alzate-Sanchez d.alzatesanchez@northeastern.edu
Chemistry and Chemical Biology, Northeastern University
I am interested in the development of sustainable solutions to recycle polymeric material, with the ultimate goal of strengthening societal efforts to create a more sustainable future for coming generations.

Claudia E. Avalos claudia.avalos@nyu.edu
Chemistry, New York University
Broadly, my lab seeks to understand how defect incorporation and site specific structural changes in photoactive materials affect their spin and optical properties. We use photoluminescence, transient absorption, transient EPR and solid-state NMR to probe these changes.

Junwei Lucas Bao lucas.bao@bc.edu
Chemistry, Boston College
We develop computational methods/theories and AI tools to model electronic structures, kinetics, and dynamics in materials chemistry, catalysis, gas-phase, and interfacial chemistry, with applications in energy storage, photocatalysis, and transition metal-ligand interactions.

Jaime Barros-Rios Jaime.Barros@missouri.edu
Plant Science and Technology, University of Missouri
Plant biochemistry, genetics, and biotechnology; Synthetic biology and gene editing; Carbon sequestration and climate change; Sustainable production of energy, materials, and commodity chemicals.

Chris Bartel cbartel@umn.edu
Chemical Engineering and Materials Science, University of Minnesota Twin Cities
My group uses first-principles calculations and machine learning to design and discover solid-state inorganic materials for energy-related applications. We are particularly interested in predicting phase transformations related to synthesis, degradation, and device operation.

Isabel Barton fay1@arizona.edu
Mining & Geological Engineering, University of Arizona
Geometallurgy, extractive metallurgy, economic geology, geochemistry, sustainable metals extraction. Side interests: history of mining, metallurgy, and geology; impact of mineral resource use on society.

Chris Cooper cbcooper@wustl.edu
Energy, Environmental, and Chemical Engineering, Washington University in St. Louis
The Cooper group designs dynamic polymers for applications in sustainability, energy, and human health. Projects: Enhanced bio-based plastics, Upcycled mixed plastic waste, solid-state electrolytes Advantages: scalable synthesis, solvent-free processing, industry compatible.

Scialog Fellows Continued

Dami Daramola o.daramola@northeastern.edu
Chemical Engineering, Northeastern University
Resource recovery from waste materials and engineering electrochemical approaches to enhance this recovery. Also interested in solvolysis-based approaches to recalcitrant polymer upcycling.

Sili Deng silideng@mit.edu
Mechanical Engineering, Massachusetts Institute of Technology
Developing 1) scientific machine learning methods for combustion and reacting flows, 2) metal-based energetic materials for energy conversion, 3) flame synthesis for energy storage materials, and 4) techno-economic and life-cycle analysis for system-level assessment.

Qi Dong qidong@purdue.edu
Chemistry, Purdue University
My research interests focus on energy and sustainability. Leveraging the increasingly available renewable electricity, we develop electrified techniques for materials manufacturing, e-waste and battery recycling, plastic and biomass upcycling, and greenhouse gas conversion.

Leora Dresselhaus-Marais leoradm@stanford.edu
Materials Science and Engineering, Stanford University
I use and develop the cutting edge of measurement techniques to learn the fundamental science to enable sustainable manufacturing. Our research explores sustainable & emissions-free metals extraction, the performance of parts, and metal 3D printing to produce efficient components.

Austin Evans austinevans@ufl.edu
Chemistry, Materials Science and Engineering, University of Florida
I am an organic materials chemist interested in structurally defined macromolecules.

Megan Fieser fieser@usc.edu
Department of Chemistry, University of Southern California
My group is interested in using catalysis to address challenges in polymer sustainability, either through the synthesis of degradable materials or through repurposing of commercial waste. Our research is also expanding to use polymers and ionic liquids for metal separations.

Victor Fung victorfung@gatech.edu
Computational Science and Engineering, Georgia Institute of Technology
I am interested in exploring the application and development of of machine learning and materials modelling methods to enable sustainable materials (e.g. through designing new materials which limit the use of critical elements, or for recycling/upcycling synthetic materials).

Grace Han gracehan@brandeis.edu
Chemistry, Brandeis University
My team develops light-responsive organic materials that undergo phase transitions and solubility changes. We are interested in applications including waste heat recovery, solar energy conversion and storage, as well as recycling catalysts.

Scialog Fellows Continued

Kailong Jin kailong.jin@asu.edu
School for Engineering of Matter, Transport & Energy, Arizona State University
My main research thrusts are: (1) Recyclable polymers based on dynamic covalent chemistries; (2) Mixed plastics recycling and biodegradable composites; (3) Sustainable photoresins for 3D printing; and (4) Covalent organic frameworks for sustainable applications.

Jihye Kim jihyekim@mines.edu
Metallurgical and Materials Engineering, Colorado School of Mines
My research aims to advance the development of efficient and sustainable metallurgical technologies that facilitate the extraction and separation of critical metals.

Junsoo Kim junsoo.kim@northwestern.edu
Mechanical Engineering, Northwestern University
I study the fracture of soft materials to curtail polymer pollution and improve the performance of degradable/sustainable polymers. I focus on how polymer network structures affect fracture resistance and identify principles that can improve fracture resistance.

Erika La Plante eclaplante@ucdavis.edu
Materials Science and Engineering, University of California, Davis
I apply my expertise in the kinetics of low-temperature aqueous processes at mineral–fluid interfaces to address the many research questions in the field of materials for climate and sustainability (e.g., cementitious materials, carbon dioxide removal, critical metal extraction).

Karl Lang karl.lang@eas.gatech.edu
Earth and Atmospheric Sciences, Georgia Institute of Technology
I am a geologist. My research applies techniques from geochronology and geochemistry to answer problems in areas of tectonics, geomorphology and sedimentology. With respect to critical minerals, I am interested in the origin of placer deposits and mineral separation techniques.

Nadia Leonard nleonard@ucsb.edu
Chemistry & Biochemistry, University of California, Santa Barbara
My interests are in the design of inorganic molecular complexes and materials with unique physical and catalytic properties for applications in energy storage and conversion, pollutant sensing, and catalysis using light and electricity the main inputs to drive reactivity.

Xuefei Li xli81@gsu.edu
Chemistry, Georgia State University
The Xuefei Li group at GSU is interested in utilizing electrochemistry to synthesize metal, transition metal oxide, and chalcogenide nanomaterials that conventionally require high energy input, and understanding electrochemically triggered structural transformation pathways.

Chong Liu chongliu@uchicago.edu
Pritzker School of Molecular Engineering, University of Chicago
My research interest is to understand how molecules and materials behave at electrified interfaces and in confinement.

Scialog Fellows Continued

Zhenfei Liu zfliu@wayne.edu
Chemistry, Wayne State University
My research employs interdisciplinary techniques from theoretical/computational chemistry, condensed matter physics, and materials sciences, to understand the electronic structure and dynamics related to interfaces, complex sustainable materials, and energy conversion mechanisms.

Danielle Mai djmai@stanford.edu
Chemical Engineering, Stanford University
Biopolymers are the building materials of life, and the Mai Lab engineers biopolymers to fulfill needs for new materials in sustainability and health. We seek molecular patterns from natural systems to program their rich functions into sustainable polymeric materials.

Tushar Mittal tmittal@psu.edu
Geosciences, Pennsylvania State University
My research focuses on understanding solid-Earth processes using a combination of two approaches -- Geofluids & Geomechanics and developing new geophysical and geochemical characterization methods (hyperspectral imaging, acoustics) -- to understand fundamental physical processes.

Ivan Moreno-Hernandez ivan.moreno-hernandez@duke.edu
Chemistry, Duke University
The Moreno-Hernandez Lab specializes in observing the nanoscale structural dynamics of electrochemical materials with liquid phase transmission electron microscopy, and the synthesis of precisely-defined nanocrystals for studies of the electrode/electrocatalyst interface.

Thandie Moyo tvm5825@psu.edu
Energy and Mineral Engineering, Pennsylvania State University
Hydrometallurgy
Printed circuit board processing
Secondary battery recycling
Sustainable development of mineral resources

Matthew Nava mnava@chem.ucla.edu
Chemistry and Biochemistry, University of California, Los Angeles
Our lab is interested in translating molecular structure and reactivity to address challenges at the frontiers of materials, biological, and energy conversion chemistries. In particular, we leverage synthetic design to manipulate metals at their extreme of formal oxidation states.

Oscar Nordness oan2106@columbia.edu
Earth and Environmental Engineering, Columbia University
My research is at the interface of fundamental electrolyte transport and thermodynamics and chemical separations. In my research group, we seek to quantify the underlying mechanism that dictate electrolyte behavior towards the design of new materials for chemical separations.

Scialog Fellows Continued

Michelle Personick mpersonick@virginia.edu
Chemistry, University of Virginia
I am interested in developing materials-generalizable electrochemical and chemical tools for controlling the facet structure, composition, and surface ligand environment of metal nanoparticles, as well as using these materials to define catalytic structure-function relationships.

Anh Pham Pham pham16@llnl.gov
Materials Science Division, Lawrence Livermore National Laboratory
My research interests lie in the integration of multiscale simulation and data science to understand and predict properties of complex materials. Primary topics include energy conversion and storage, degradation and corrosion science, critical materials, and chemical separation.

Zhe Qiang zhe.qiang@usm.edu
Polymer Science and Engineering, University of Southern Mississippi
My research interests focus on materials, manufacturing, and measurement science on unlocking the power of commodity plastics for environmental remediation and decarbonization, enabling their integrated and robust use for a sustainable society.

Shelby Rader shtrader@iu.edu
Earth and Atmospheric Sciences, Indiana University Bloomington
My research focuses on the redistribution and isotopic fractionation of heavy metals through geologic processes and how geogenic metal signatures may persist or be affected by incorporation into biological materials, such as plants.

Jeromy Rech jrech@unca.edu
Chemistry and Biochemistry, University of North Carolina at Asheville
My research lab is focused on the design and synthesis of conjugated polymers for organic electronics, primarily lightweight and flexible solar cells. I am especially interested in designing less synthetically complex and recyclable conjugated polymers.

Loretta Roberson lroberson@mbl.edu
Bell Center, Marine Biological Laboratory
I work with seaweeds that naturally absorb and concentrate carbon, metals, minerals, and other substances, making them an ideal candidate for nature-based solutions to water quality improvement, nutrient and mineral bioextraction, and biodiversity enhancement in our oceans.

Nick Rolston nicholas.rolston@asu.edu
Electrical, Computer, and Energy Engineering, Arizona State University
Our focus is to develop the next-generation of photovoltaics and battery technology using the paradigm of design for mechanical and operational reliability. We leverage scalable, open-air deposition methods to fabricate robust energy devices toward the goal of manufacturing.

Scialog Fellows Continued

Julie Rorrer jrorrer@uw.edu
Chemical Engineering, University of Washington
The research in the Rorrer lab is focused on utilizing heterogeneous catalysis for sustainable chemical transformations. These include the chemical recycling of waste plastics and the synthesis of renewable fuels and chemicals with catalysts made of earth-abundant materials.

Zack Schiffer zschiffer@seas.harvard.edu
Applied Physics, Harvard University
I am interested in developing sustainable chemical processes for chemical manufacturing, with a focus on electrochemistry. In particular, I am interested in combining heat and convection with voltage to optimize electrochemical reactors for synthesis reactions.

Michael Schulz mdschulz@vt.edu
Chemistry, Virginia Polytechnic Institute and State University
My research interests are in polymer chemistry, focusing on (1) polymer-metal interaction thermodynamics in solution (with an emphasis on rare-earth elements) and (2) polyesters (including recycling processes, biorenewable monomers/polymers, and structure-property relationships).

Udayan Singh usingh@anl.gov
Fuels and Chemicals Group, Argonne National Laboratory
My research interests primarily involve understanding sustainability features of energy systems and infrastructures in context of their environmental, economic and societal impacts.

Rebecca Smaha rebecca.smaha@nrel.gov
Materials, Chemical, and Computational Sciences, National Renewable Energy Laboratory
I am passionate about designing, synthesizing, and characterizing novel inorganic materials for energy applications including permanent magnets, multiferroics, and microelectronics. I work at the intersection of chemistry, materials science, and condensed matter physics.

Wen Song wensong@utexas.edu
Center for Subsurface Energy and the Environment, University of Texas at Austin
I aim to understand and control coupled reactive transport mechanisms at fluid-mineral interfaces that enable the extraction of decarbonization-critical elements such as rare earths and lithium from natural and waste resources using novel operando micro/nanovisualization tools.

Sam Srivastava samsri@ucla.edu
Chemical and Biomolecular Engineering, University of California, Los Angeles
My current research interests are in harnessing diverse intermolecular interactions and self-assembly processes to modulate soft material structure and properties; and to combine this fundamental understanding with molecular engineering to improve soft material design.

William Tarpeh wtarpeh@stanford.edu
Chemical Engineering, Stanford University
My research focuses on electrochemical wastewater refining, or generating tunable product portfolios from wastewaters as unconventional feedstocks. Our efforts combine electrocatalysis and electrochemical separations to extract nitrogen, lithium, phosphorus, and sulfur.

Scialog Fellows Continued

Agnes Thorarinsdottir agnes.thorarinsdottir@rochester.edu
Chemistry, University of Rochester
My group and I seek to apply the tools of synthetic molecular and materials chemistry to the design of new electrochemical systems that address challenges in energy, catalysis, and environmental sustainability.

Thao Tran thao@clemson.edu
Chemistry, Clemson University
My research aims to develop a deep understanding of how chemical bonding and electronic structure result in targeted physical properties in quantum materials and why such chemistry – property relationships exist — relevant to essential advances in quantum information science.

Julian West jgwest@rice.edu
Chemistry, Rice University
The West group is interested in making organic molecules sustainably using earth abundant element catalysis, photocatalysis, and the chemistry of free radicals.

Josh Worch jworch@vt.edu
Chemistry, Virginia Polytechnic Institute and State University
We develop sustainable polymers with a holistic approach - from synthesis and application to end-of-life. We are interested in dynamic bonding, recycling & degradation, green chemistry, adhesives, composites from native biomass, and sustainable resins for additive manufacturing.

Shuwen Yue shuwen.yue@cornell.edu
Chemical Engineering, Cornell University
Our group focuses on understanding liquid-phase and interfacial phenomena, especially electrolytes and electrochemical systems, from a molecular perspective. We build and apply tools in molecular simulation, machine learning, and statistical mechanics towards these goals.

Helen Zha zhar@rpi.edu
Chemical and Biological Engineering, Rensselaer Polytechnic Institute
My research interests lie in understanding structure-property-processing relationships in bioderived and biomimetic materials, synthesizing new peptide and protein-based materials, and developing microbial platforms for green materials synthesis and waste remediation.

Qiaofu Zhang qzhang60@ua.edu
Metallurgical and Materials Engineering, University of Alabama
Develop Integrated Computational Materials Engineering (ICME) modeling and materials informatics to investigate the behavior and properties of materials. Utilize the computational tools to engineer novel materials or refine advanced manufacturing technologies.

Wencai Zhang wencaizhang@vt.edu
Mining and Minerals Engineering, Virginia Polytechnic Institute and State University
My research focuses on the beneficiation and processing of mineral resources, with a specific emphasis on the sustainable production of critical minerals, using various technologies like froth flotation, enhanced leaching, solvent extraction, and selective adsorption.

Scialog Fellows Continued

Micah Ziegler micah.ziegler@gatech.edu
School of Chemical and Biomolecular Engineering; School of Public Policy, Georgia Institute of Technology
I evaluate energy and chemical technologies, their impact, and their potential. With data and models, I aim to help researchers, policymakers, and investors accelerate the improvement and deployment of technologies to enable a transition to sustainable and equitable systems.

Michael Zuerch mwz@berkeley.edu
Chemistry, University of California, Berkeley
Exploring the unseen, my research traverses the realms of physical chemistry and condensed matter physics, focusing on interrogating properties of matter and interfaces of matter at a molecular level at and away from equilibrium.

Discussion Facilitators

Kwame Awuah-Offei kwamea@mst.edu
Mining & Explosives Engineering, Missouri University of Science & Technology
I work on sustainable mining practices including sustainability assessment (mainly life cycle assessment), mine safety and health, and energy efficiency.

Will Dichtel wdichtel@northwestern.edu
Chemistry, Northwestern University
My research focuses on controlling chemical reactions and non-covalent interactions within organic materials. We have long studied two-dimensional polymerization, porous polymers for water purification, and new methods to reprocess polyurethanes.

Peter Dorhout dorhout@iastate.edu
Chemistry, Iowa State University
My areas of interest include materials science, solid state chemistry, rare earth elements, crystallography, surface science, and radiochemistry. I also research leadership development and research ethics.

Jennifer Dunn jennifer.dunn1@northwestern.edu
Chemical and Biological Engineering, Northwestern University
Cost and sustainability analysis of emerging energy, water, and material systems. Life cycle assessment, material flow analysis of mineral supply chains. Additional nterest include hydrogen, carbon capture and sequestration, desalination, and wastewater treatment technologies.

Andrea Hicks hicks5@wisc.edu
Civil and Environmental Engineering, University of Wisconsin - Madison
I am interested in the environmental impacts and sustainability implications of emerging technologies. In particular considering the impacts of the circular economy and the potential to recover materials from wastes.

Amy Landis amylandis@mines.edu
Civil & Environmental Engineering, Colorado School of Mines
I have 20 years experience in research on bioplastics, plastic sustainability, renewable energy and materials, life cycle assessment, material flow analysis. I also have nearly a decade of administrative experience leading diversity, equity, and inclusion.

Ikenna Nlebedim nlebedim@iastate.edu
Division of Critical Materials, Ames National Laboratory
My current research area is on critical materials discovery and synthesis, integration into systems for applications, as well as reuse and recycling. Materials of interest include rare earth elements, other elements for permanent magnets, and battery materials.

Eric Schelter schelter@sas.upenn.edu
Chemistry, University of Pennsylvania
Sustainable metals separations chemistry

Jon Wilker wilker@purdue.edu
Chemistry, Purdue University
Biological materials, biomimetic materials, adhesives, marine biology, sustainability, chemistry

Guests

Danny Abrams dmabrams@northwestern.edu
Engineering Sciences & Applied Mathematics, Northwestern University
My interests relevant to this Scialog are focused on how new scientific collaborations are established, and in particular the role conferences may play in that process.

Sue Merrilees smerrilees@sciphil.org
Advising/Membership Team, Science Philanthropy Alliance
sciencephilanthropyalliance.org

Evan Michelson michelson@sloan.org
Energy and Environment Program, Alfred P. Sloan Foundation
Our Energy and Environment program supports research, training, networking, and knowledge dissemination to inform the societal transition toward low-carbon energy systems in the United States by investigating economic, environmental, technological, and distributional issues.

Jeffrey Miller jmiller@kavlifoundation.org
Nanoscience, The Kavli Foundation
Nanoscience for sustainability. Frontiers of quantum materials.

Alfred P. Sloan Foundation

Evan Michelson michelson@sloan.org
Program Director, Energy and Environment Program

Isabella Gee gee@sloan.org
Program Associate, Energy and Environment Program

The Kavli Foundation

Jeffrey Miller jmiller@kavlifoundation.org
Science Program Officer, Nanoscience

Research Corporation for Science Advancement

Jennifer Brown jbrown@rescorp.org
Director of Finance and Human Resources

Laura Esham lesham@rescorp.org
Program Assistant

Andrew Feig afeig@rescorp.org
Senior Program Director

Danny Gasch dgasch@rescorp.org
Chief Financial Officer

Suzette Gonzalez sgonzalez@rescorp.org
Program & Award Administrator

Angela Hagen ahagen@rescorp.org
Communications Director

Lisa Jo Kastigar ljkastigar@rescorp.org
Executive Assistant to the President

Dan Linzer dlinzer@rescorp.org
President

Meg Zimlich Martin mmartin@rescorp.org
Director of Program & Award Administration

Aileen Quezada aquezada@rescorp.org
Senior Program & Award Administrator

Silvia Ronco sronco@rescorp.org
Senior Program Director

Abhishek Shivaram ashivaram@rescorp.org
Data Analytics Specialist

Eileen Spain espain@rescorp.org
Program Director

Richard Wiener rwiener@rescorp.org
Senior Program Director

4703 East Camp Lowell Dr.
Suite 201
Tucson, Arizona 85712
Phone 520.571.1111
www.rescorp.org

RESEARCH CORPORATION
for SCIENCE ADVANCEMENT