2021 Annual Report

The Power of Collaboration
Letter from
the President

Research Corporation for Science Advancement’s programs focus on catalyzing collaborations and creating inclusive communities of scientists across the physical sciences and other, closely related fields. We take that same approach in the design and development of those programs by encouraging participation of a broad array of individuals and funders. Looking back on 2021, I want to call special attention to all these partners who believe in what we are doing to support early career scientists, and who have made it possible to target more resources to address significant needs and opportunities.

For our Cottrell Scholar community, the second year of partnership with the National Science Foundation enabled us to support a larger cohort of senior postdoctoral fellows whose plans were derailed by the pandemic as institutions canceled faculty searches. The case for RCSA to pivot and address this need was made by Cottrell Scholars, who saw firsthand the potential disruption for some of the most talented and accomplished scientists who were on the verge of launching their independent careers. The Cottrell Scholar community has been critically important in guiding the foundation to direct resources into additional initiatives, including a post-baccalaureate program and an expansion of our diversity, equity, and inclusion efforts.

For our Scialog program, 2021 marked the first year that we were able to offer Scialogs on six different themes of global importance. The shaping of these themes and the identification of early career faculty as Scialog Fellows arose from discussions with senior scientists, many of whom then served as Scialog Facilitators, and with other foundations and federal funding agencies that joined RCSA as cosponsors. That so many other funders worked with us on these initiatives is a vote of confidence in our programming. These partnerships allow us to achieve a much greater impact than we would have with just our own, limited resources, and greatly expand the network of scientists who benefit from cross-disciplinary interactions as they explore new research directions. Our thanks go to the Paul G. Allen Frontiers Group, the Chan Zuckerberg Initiative, the Frederick Gardner Cottrell Foundation, the Heising-Simons Foundation, the Gordon and Betty Moore Foundation, the Alfred P. Sloan Foundation, and the U.S. Department of Agriculture as our major cosponsors, and to Climate Pathfinders, the Kavli Foundation, and the National Aeronautics and Space Administration for their participation and support during the past year.

As you read through the many highlights of the past year, please join me in celebrating the organizations that helped make all this possible by joining with RCSA to support groundbreaking, basic research on critical challenges, and the scientists who carried out these studies and who are educating and training the next generation of scientific leaders.

Daniel Linzer
President & CEO
Research Corporation for Science Advancement
In 2021, Research Corporation for Science Advancement supported early career scientists at colleges and universities in the United States and Canada through two core programs: the **Cottrell Scholar Program** and **Scialog**.

The **Cottrell Scholar Program** develops outstanding teacher-scholars recognized by their scientific communities for the quality of their research programs, innovation in education, and potential for academic leadership. In 2021, Cottrell Scholar Program funding included $2.5 million for 25 initial Cottrell Scholar Awards, $75,000 for three Cottrell Scholars Collaborative Awards, and $265,000 for eight Cottrell Plus Awards, which include the competitive SEED, STAR and IMPACT awards. A second year of Cottrell Fellowships awarded $971,250 to 14 Cottrell Scholars to support postdocs working in their labs or groups. Three of these awards were funded through a grant from the National Science Foundation.

**Scialog** promotes dialogue and community-building to catalyze transformational science through collaborative, interdisciplinary research. In 2021, RCSA awarded $1,424,000 to early career scientists for research through Scialog Collaborative Innovation Awards. The contributions of partner philanthropies toward Scialog awards brought this total to $7,065,000. Funding partners in 2021 included the Paul G. Allen Frontiers Group, the Chan Zuckerberg Initiative, the Frederick Gardner Cottrell Foundation, the Heising-Simons Foundation, the Kavli Foundation, the Gordon and Betty Moore Foundation, NASA, the Climate Pathfinders Foundation, the Alfred P. Sloan Foundation, and the U.S. Department of Agriculture.
Cottrell Scholar Awards

$100,000 is awarded to each scholar for a total of $2,500,000

Vinayak Agarwal
Chemistry, Georgia Institute of Technology
Unlocking Marine Eukaryotic Natural Product Biosynthetic Schemes in Research and Education

Rachel S. Bezanson
Astronomy, University of Pittsburgh
Building Bridges in the Steel City: Leveraging the Nearby to Follow Galaxies Across Cosmic Time

Joel F. Destino
Chemistry, Creighton University
Bottoms Up: Investigating the Growth and Glass-Forming Properties of Germania-Containing Colloids

Jeanine Amacher
Chemistry, Western Washington University
Investigating Sortase Enzyme Activity and Specificity Using Natural Sequence Variation and Ancestral Sequence Reconstruction

Laura Blecha
Physics, University of Florida
The Making of a Gravitational Wave Source: Probing the Role of Galaxy Assembly in Black Hole Binary and Triple Formation

Daniela Fera
Chemistry, Swarthmore College
Dissecting the Interactions and Conformations of Protein Kinases to Understand Biochemical Signaling

Jeffrey Bandar
Chemistry, Colorado State University
Salt-Promoted Electron Transfer Processes for Reductive Cross-Coupling Reactions

Justin R. Caram
Chemistry, University of California, Los Angeles
Chemical Physics Informed Design of SWIR Emissive Molecules

Alex Frañó
Physics, University of California, San Diego
Creating Artificial Angstrom-scale Periodic Potentials Using X-ray Standing Waves and Enhancing Creativity in Physics Education
Thomas L. Gianetti  
Chemistry, University of Arizona  
Developing a Photo-Rechargeable and Symmetrical Organic Redox Flow Battery

Alexis C. Komor  
Chemistry, University of California, San Diego  
Harnessing Precision Genome Editing Tools to Study DNA Repair Proteins in Live Cells

Natalie M. Gosnell  
Astronomy, Colorado College  
Constraining the Complexities of Stellar Activity with Sub-Subgiant Stars

Eli M. Levenson-Falk  
Physics, University of Southern California  
Creating Custom Quantum Environments with Superconducting Circuits (For Beginners)

Christopher H. Hendon  
Chemistry, University of Oregon  
Inorganic Defects in Metal-Organic Frameworks

Rosario Porras-Aguilar  
Physics, University of North Carolina at Charlotte  
Label-Free Reconfigurable Microscopy with High Specificity

Davit Potoyan  
Chemistry, Iowa State University  
Uncovering Principles of Bio-molecular Condensation: from Single Molecules to Cellular Organelles

Eli M. Levenson-Falk  
Physics, University of Southern California  
Creating Custom Quantum Environments with Superconducting Circuits (For Beginners)

Tyler D. Robinson  
Astronomy, Northern Arizona University  
Understanding the True Utility of Prior Mass Constraints in Characterizing Exoplanet Atmospheres and Diversifying STEM at NAU

Brian J. Shuve  
Physics, Harvey Mudd College  
Matter-Antimatter Asymmetry from Dark Matter Freeze-In
Marcelle Soares-Santos  
Physics, University of Michigan  
Cosmology with Merging Black Holes and Neutron Stars

Ruby May A. Sullan  
Chemistry, University of Toronto-Scarborough  
Multifunctional and Stimuli-Responsive Nanotherapeutic Platform for Targeted Disruption of Bacterial Biofilms

Rongsheng (Ross) Wang  
Chemistry, Temple University  
A Fluorine Displacement Based Bioorthogonal Labeling Approach to Interrogate Non-Histone Substrates of “Histone” Deacetylases

Leah S. Witus  
Chemistry, Macalester College  
Investigation of Beta-Hairpin Hydrolytic Peptides and Development of an Advanced Undergraduate Scientific Communication Course

Alexandra Velian  
Chemistry, University of Washington  
Synthesis of Functional Metal Chalcogenide Lattices Using Symmetry-Encoded, Atomically Precise Clusters

Joseph M. Zadrozny  
Chemistry, Colorado State University  
Harnessing Ligand-Shell Nuclear Spins to Control Molecular Spin Coherence

Gail Zasowski  
Astronomy, University of Utah  
Understanding the Chemical Enrichment of Our Universe: Unifying Evidence from the Milky Way and Other Galaxies
The awards from RCSA supported not just me, but many research students, a large number of whom were first-generation, non-traditional, from underrepresented groups, from other disadvantaged backgrounds. The ability to work full-time in a meaningful position related to their career, to discover that they can achieve great things in science, and to receive one-on-one guidance from a mentor can be life-changing for students who would otherwise spend their summers in retail, service, or factory jobs that they had previously thought might be their careers.

― Lauren Waters, 2016 Cottrell Scholar

Incredibly grateful to RCSA for all of their support over the years and for relentless efforts to make academia more equitable and inclusive.

― Sarbajit Banerjee, 2010 Cottrell Scholar and Scialog Facilitator
Cottrell Scholar Collaborative Awards

At the annual Cottrell Scholar Conference, participants are encouraged to form teams and develop collaborative projects with potential national impact in science education. Through the Cottrell Scholar Collaborative program, RCSA funded three projects in 2021 at $25,000 each to support efforts to make higher education more inclusive and equitable.

Cottrell Scholar Collaborative as Bridge for National DEI Efforts
This project seeks to develop connections and promote partnerships between Cottrell Scholars and scientific societies and identity groups in science. In addition to developing an action guide to how individual faculty can contribute to any of these programs, the project aims to host a workshop to help foster relationships among allied organizations and individuals.

Lead Cottrell Scholar:
Rory Waterman
Chemistry, University of Vermont

In collaboration with additional Cottrell Scholars:
Jeanine Amacher
Chemistry, Western Washington University
Penny Beuning
Chemistry, Northeastern University

Rachel Bezanson
Astronomy, University of Pittsburgh
Laura Blecha
Physics, University of Florida
Jeffery Byers
Chemistry, Boston College
Lou Charkoudian
Chemistry, Haverford College
Catherine Kealhofer
Physics, Williams College
Charles McCrory
Chemistry, University of Michigan
David Strubbe
Physics, University of California, Merced
Jesús Velázquez
Chemistry, University of California, Davis

Also with:
Philip “Bo” Hammer
University of Chicago
Cottrell Scholar Collaborative Awards

**Art and the Creative STEM Classroom**
This project seeks to build a community of STEAM educators to create evidence-based modules incorporating non-traditional activities such as drawing or making, 3D printing, and other creative skills into undergraduate physics and chemistry classrooms, with the aim of improving student understanding of basic concepts and problem-solving skills, improving student communication about scientific ideas, and improving retention of historically underrepresented groups.

Lead Cottrell Scholar:
**Elisabetta Matsumoto**
Physics, Georgia Tech

In collaboration with additional Cottrell Scholars:
**Tim Atherton**
Physics, Tufts University
**Adam Leibovich**
Physics, University of Pittsburgh
**Gina MacDonald**
Chemistry, James Madison University
**Julio de Paula**
Chemistry, Lewis and Clark College
**Paul Raston**
Chemistry, James Madison University
**Jenny Ross**
Physics, Syracuse University

**A Cottrell Scholar Workshop on Authentic Grading in STEM and Holistic Evaluation of Students' Performance**
This project seeks to help faculty develop more authentic and equitable assessments of student abilities by hosting a workshop for the participants to hear about different grading practices that are becoming more widely used in academia, and to extend the discussion toward a more holistic interpretation of students’ abilities by going beyond measures like the GPA or GRE scores.

Lead Cottrell Scholar:
**Mario Affatigato**
Physics, Coe College

In collaboration with additional Cottrell Scholars:
**Michael Dennin**
Physics, University of California, Irvine
**Daniela Fera**
Chemistry, Swarthmore College
**Alex Frañó**
Physics, University of California, San Diego
**Carla Fröhlich**
Physics, North Carolina State University
**Katie Mouzakis**
Chemistry, Loyola Marymount University
**Rosario Porras-Aguilar**
Physics, University of North Carolina at Charlotte

**Juliane Simmchen**
Chemistry, Technische Universität Dresden
**Hanadi Sleiman**
Chemistry, McGill University
**Claire Till**
Chemistry, Humboldt State University
**Lauren Waters**
Chemistry, University of Wisconsin-Oshkosh

Also with:
**Aaron Teator**
Chemistry, University of Kansas
Cottrell Plus Awards

As their scientific careers advance, Cottrell Scholars are eligible to receive post-tenure Cottrell Plus Awards to further support their research and educational activities. In 2021, SEED, IMPACT and STAR awards were given.

**SEED** (Singular Exceptional Endeavors of Discovery) Awards are competitive grants to launch new projects in research at $50,000 each or education at $25,000 each. (In 2021, all SEED awards were for research.)

**STAR** (excellence in Science Teaching And Research) Awards of $5,000 recognize the outstanding research and educational accomplishments of Cottrell Scholars and encourage the improvement of science education at American and Canadian universities and colleges. **IMPACT** Awards of $5,000 recognize the work of a Cottrell Scholar who has had a national impact in science through their leadership and service activities.
Cottrell Plus Awardees

**SEED**

**David DeMille**  
Cottrell Scholar 2000  
Physics, University of Chicago  
*Developing a New Tabletop-scale Approach to Detect Particles One Million Times More Massive than the Higgs Boson*

**Jonathan Friedman**  
Cottrell Scholar 2002  
Physics, Amherst College  
*Spin-Clock Transitions in Silica Defects*

**Steven Majewski**  
Cottrell Scholar 1998  
Astronomy, University of Virginia  
*Optical Fibers for Astronomical Imaging: Development and Use of the Distributed Field Fiber Imaging Testbed (DIFFIT)*

**SEED**

**John-David Smith**  
Cottrell Scholar 2012  
Astronomy, University of Toledo  
*Tiny Grains Across the Cosmos — The First Physical Models of PAH Emission in Cosmological Simulations in Tissue Regeneration*

**Ziqiang Wang**  
Cottrell Scholar 1996  
Physics, Boston College  
*Correlated and Topological Quantum States in Transition-metal Kagome Lattice Materials*

**SEED**

**Jonathan Friedman**  
Cottrell Scholar 2002  
Physics, Amherst College  
*Spin-Clock Transitions in Silica Defects*

**SEED**

**John-David Smith**  
Cottrell Scholar 2012  
Astronomy, University of Toledo  
*Tiny Grains Across the Cosmos — The First Physical Models of PAH Emission in Cosmological Simulations in Tissue Regeneration*

**Ziqiang Wang**  
Cottrell Scholar 1996  
Physics, Boston College  
*Correlated and Topological Quantum States in Transition-metal Kagome Lattice Materials*

**STAR**

**Tim Clark**  
Cottrell Scholar 2007  
Chemistry, University of San Diego

**Hanadi Sleiman**  
Cottrell Scholar 2002  
Chemistry, McGill University

**IMPACT**

**Penny Beuning**  
Cottrell Scholar 2009  
Chemistry, Northeastern University
RCSA awarded $971,250 to 14 Cottrell Scholars to support the work of postdoctoral fellows whose plans to start independent academic or research careers this year were delayed or derailed due to institutional hiring freezes resulting from the pandemic. Three of these awards were funded through a $225,000 grant from the National Science Foundation. Funding was provided by (1) RCSA and (2) the National Science Foundation.

Timothy Atherton (postdoc J. Anna Philips)  
Tufts University  
Understanding Students’ Expectations for Agency in Hands-On Learning Environment

William Dichtel (postdoc Anna Yang)  
Northwestern University  
Porous Polymer Adsorbent for Sequestering Emerging Contaminants from Water

Mircea Dincă (postdoc Ruperto Mariano)  
Massachusetts Institute of Technology  
Mechanistic Studies of O₂ Electroreduction to H₂O₂ Using Conductive MOFs at Current Densities >100 mA cm⁻²

Gordana Dukovic (postdoc Katherine E. Shulenberger)  
University of Colorado Boulder  
Light-Driven Catalysis: Mechanistic Insights into Quantum Dot-Enzyme Hybrid Systems

Keary Engle (postdoc Malkanthi K. Karunananda)  
Scripps Research Institute  
Predictive Computational Models for the Development of Challenging Ni-Catalyzed Alkene Difunctionalizations with Transient Directing Groups

Claude-André Faucher-Giguère (postdoc Luke Kelley)  
Northwestern University  
Multi-Messenger Signatures of Massive Black Hole Binaries

Joshua Figueroa (postdoc Shuai (Vincent) Wang)  
University of California, San Diego  
Synthesis and Exploration of Carbyne Complexes of the Late 3d Transition Metals

Daniel Gamelin (postdoc Matthew Crane)  
University of Washington  
Tailoring Spin Dephasing in Metal-Halide Perovskites for Next-Generation Computing Applications

Taekjip Ha (postdoc Yang Liu)  
Johns Hopkins University School of Medicine  
Hijacking CRISPR-Cas9 as a Molecular Tool for Biology and Medicine

Alexis Komor (postdoc Zsolt Bodai)  
University of California, San Diego  
Investigations of DNA Repair Genes’ Involvement in Base Editing and Development of a Hands-On Undergraduate Course on Genome Editing at UCSD

Stella Offner (postdoc Dávid Guszejnov)  
University of Texas at Austin  
The Role of Different Physical Processes in Star Formation

Eric Schelter (postdoc Nate Hirscher)  
University of Pennsylvania  
Aerobic, Photolytic Upgrading of Hydrocarbon Feedstocks

Keivan Stassun (postdoc Nina Hernitschek)  
Vanderbilt University  
Machine-Learning Applications for Variable Stars in the LSST and TESS Astronomical Surveys

Ann West (postdoc Meghan Kemper)  
University of Oklahoma  
Elucidating the Role of a Novel Response Regulator in Sporulation of Clostridiodes difficile
The Scialog program was created in 2010 by RCSA, which oversees its administration. Scialog—short for “science + dialog”—funds early career scientists to pursue transformative research with their fellow grantees on crucial issues of scientific inquiry. Scialog initiatives are a multi-year thematic investment, in which around 50 early career Scialog Fellows, facilitated by a group of leading scientists, convene annually to discuss cutting-edge multidisciplinary themes and propose high-risk collaborative projects.

Due to the pandemic, RCSA convened six virtual Scialog conferences in 2021. Through Scialog Collaborative Innovation Awards, RCSA along with its funding partners provided a total of $7,065,000 in seed funding for collaborative team projects.

Conventional funding sources provide specific guidelines and encourage you to ‘color inside the lines.’ What’s nice about Scialog is it’s a plain sheet of paper. You draw what you want, and the more interesting the drawing, the more colors you can bring to it, the better.

– Greeshma Gadikota, Scialog awardee
Scialog: Advancing BiolImaging
Year 1
Scialog: Advancing BioImaging
Year 1

**Goal:** To catalyze early career chemists, physicists, biologists, bioengineers and medical imaging specialists to collaborate on new and innovative projects to accelerate the development of the next generation of imaging technologies. Each of 23 individual awards was for $50,000 in direct costs. Funding for the awards was provided by (1) RCSA and the Frederick Gardner Cottrell Foundation (2) the Chan Zuckerberg Initiative.

**Aseema Mohanty**<sup>1</sup>
Electrical and Computer Engineering, Tufts University

**Sixian You**<sup>1</sup>
Electrical Engineering and Computer Science, Massachusetts Institute of Technology

**NeedleScope: Developing the Smallest Microscope for Bioimaging**

**Nick Galati**<sup>1</sup>
Biology, Western Washington University

**Shannon Quinn**<sup>1</sup>
Computer Science, University of Georgia

**Doug Shepherd**<sup>1</sup>
Physics, Arizona State University

**4-D Molecular Tracking Using Kilohertz Framerate Multi-Modal Microscopy**

**Luke Mortensen**<sup>1</sup>
Chemical, Materials and Biomedical Engineering, University of Georgia

**Aniruddha Ray**<sup>1</sup>
Physics and Astronomy, University of Toledo

**Nanophotonic Probes for Ultra-Deep Functional Multiphoton Imaging**

**Yevgenia Kozorovitskiy**<sup>1</sup>
Neurobiology, Northwestern University

**Ping Wang**<sup>1</sup>
Radiology, Michigan State University

**Light-Sheet Imaging of 3D Bioprinted Islet Organoids Structure and Function**

**Benjamin Bartelle**<sup>2</sup>
Biological and Health Systems Engineering, Arizona State University Fulton School of Engineering

**Ulugbek Kamilov**<sup>2</sup>
Computer Science and Engineering and Electrical and Systems Engineering, Washington University in St. Louis

**Lu Wei**<sup>2</sup>
Chemistry and Chemical Engineering, California Institute of Technology

**Enabling Noninvasive Lipid Profiling with Intermodal Deep Learning**

**Aseema Mohanty**<sup>2</sup>
Electrical and Computer Engineering, Tufts University

**Srigokul Upadhyayula**<sup>2</sup>
Molecular and Cell Biology, University of California, Berkeley

**Chip-scale Light Sheet for High Spatiotemporal Resolution Imaging**

**Carolyn Bayer**<sup>2</sup>
Biomedical Engineering, Tulane University

**Allison Dennis**<sup>2</sup>
Biomedical Engineering, Boston University

**Deep Tissue Photoacoustic Imaging with Degradable Inorganic Nanoparticles**

**Barbara Smith**<sup>2</sup>
Biological and Health Systems Engineering, Arizona State University Fulton School of Engineering

**Bryan Spring**<sup>2</sup>
Physics, Northeastern University

**Microendoscopy-Guided Diagnosis and Treatment of Early-Stage Ovarian Cancer**

**Lisa Poulakis**<sup>2</sup>
Mechanical and Aerospace Engineering, University of California, San Diego

**Douglas Shepherd**<sup>2</sup>
Physics, Arizona State University

**Wide-Field, Single-Pixel Fluorescence Imaging with On-Chip Nanophotonics**
Scialog: Chemical Machinery of the Cell
Year 3

**Goal:** To spark collaborative research that could accelerate breakthroughs in fundamental understanding of chemical machinery and reactions in the intact cell. Each of the 24 individual awards was $55,000.

Funding was provided by RCSA and the Gordon and Betty Moore Foundation.

**Julien Berro**  
Molecular Biophysics and Biochemistry, and Cell Biology, Yale University

**Alexander Green**  
Biomedical Engineering, Boston University

**Intercepting the Cell’s Hidden Signals via Peptide-Activated RNA Switches**

**Caitlin Davis**  
Chemistry, Yale University

**Lars Plate**  
Chemistry and Biological Sciences, Vanderbilt University

**Structure-Function of Enzyme Filaments: Regulators of Cell Metabolism in Space and Time**

**W. Seth Childers**  
Chemistry, University of Pittsburgh

**Elizabeth Read**  
Chemical and Biomolecular Engineering, University of California, Irvine

**Haoran Zhang**  
Chemical and Biochemical Engineering, Rutgers University

**Putting Bacteria to Sleep: Establishing an Artificial Circadian Clock**

**Maria Kamenetska**  
Chemistry and Physics, Boston University

**Jan-Hendrik Spille**  
Physics, University of Illinois at Chicago

**Lu Wang**  
Chemistry and Chemical Biology, Rutgers University

**The Butterfly Effect in Cellular Phase Separation: from Molecular Interactions to Emergent Behavior**

**Jan-Hendrik Spille**  
Physics, University of Illinois at Chicago

**Stephen Yi**  
Biomedical Engineering & Oncology, University of Texas at Austin

**Visualizing Inheritance through the Lens of Phase Separation**

**W. Seth Childers**  
Chemistry, University of Pittsburgh

**Elizabeth Read**  
Chemical and Biomolecular Engineering, University of California, Irvine

**Haoran Zhang**  
Chemical and Biochemical Engineering, Rutgers University

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**Jan-Hendrik Spille**  
Physics, University of Illinois at Chicago

**Stephen Yi**  
Biomedical Engineering & Oncology, University of Texas at Austin

**Visualizing Inheritance through the Lens of Phase Separation**

**Stephanie Gupton**  
Cell Biology and Physiology, University of North Carolina at Chapel Hill

**Alexis Komor**  
Chemistry and Biochemistry, University of California, San Diego

**Yan Yu**  
Chemistry, Indiana University

**Elucidating the Polygenic Origins of Schizophrenia: Linking Protein Trafficking to Synapse Function**

**Ronit Freeman**  
Applied Physical Sciences, University of North Carolina at Chapel Hill

**Tania Lupoli**  
Chemistry, New York University

**Wenjing Wang**  
Chemistry and Life Sciences Institute, University of Michigan

**Decoding Host-Pathogen Molecular Cross-talk via Unbiased Multiplex Profiling**

**Stephen Fried**  
Chemistry, Johns Hopkins University

**Tania Lupoli**  
Chemistry, New York University

**Wenjing Wang**  
Chemistry and Life Sciences Institute, University of Michigan

**Decoding Host-Pathogen Molecular Cross-talk via Unbiased Multiplex Profiling**
Scialog: Mitigating Zoonotic Threats
Year 1
Scialog: Mitigating Zoonotic Threats
Year 1

**Goal:** To catalyze multidisciplinary teams of early career scientists to launch new research in the detection and mitigation of emerging animal-borne infectious diseases. Each of the 25 individual awards was for $50,000 in direct costs. Funding was provided by RCSA and the U.S. Department of Agriculture.

**Tavis Anderson**
Virus and Prion Research Unit, USDA
**Cheryl Andam**
Biological Sciences, University at Albany, SUNY
**Nicole Eikmeier**
Computer Science, Grinnell College
**Darwin’s Naturalization Conundrum Predicts Inter-species Pathogen Transmission Potential**

**Bethany McGregor**
Arthropod Borne Animal Diseases Research Unit, USDA
**Paola Boggiatto**
Infectious Bacterial Diseases Research Unit, USDA
**Jason Ladner**
Biology, Northern Arizona University
**Enabling Comprehensive Immunoprophiling in Animals through a Combination of Xenosurveillance and Highly-multiplexed Serology**

**Laurene Tetard**
Physics/Nanoscience Technology Center, University of Central Florida
**Bethany McGregor**
Arthropod Borne Animal Diseases Research Unit, USDA
**Employing Color-Changing Nanomaterials to Improve Vector-borne Disease Surveillance**

**Gonzalo Vazquez Prokopec**
Environmental Sciences, Emory University
**Tavis Anderson**
Virus and Prion Research Unit, USDA
**Invasion Ecology and Genomics of Emerging Tick Borne Arboviruses: Predicting Niche Expansion of Heartland Virus Following the Invasion of Asian Longhorned Ticks in the U.S.**

**Paola Boggiatto**
Infectious Bacterial Diseases Research Unit, USDA
**Liliana Salvador**
Infectious Diseases and Institute of Bioinformatics, University of Georgia
**Host Adaptation of Mycobacterium bovis: A Comparative Transcriptomics Study of M. bovis Infection in a Multi-host System**

**Pilar Fernandez**
**Matthew Hopken**
National Wildlife Research Center, USDA
**Characterizing the Socio-ecological Spillover Interface by Xenosurveillance of Pathogen Metacommunities Using a Novel Insect Group**

**Crystal Hepp**
School of Informatics, Computing, and Cyber Systems, Northern Arizona University
**Silvie Huijben**
School of Life Sciences, Arizona State University

**Kezia Manlove**
Wildland Resources and Ecology Center, Utah State University
**Estimating Aedes aegypti Spillover Potential and Evaluation of Current Mitigation Strategies**

**Joyce Jose**
Biochemistry and Molecular Biology, Pennsylvania State University
**Kristin Koutmou**
Chemistry, University of Michigan
**Discovering How RNA Epigenomic Modifications Impact Flavivirus Replication Speed and Fidelity**

**Hannah Frank**
Ecology and Evolutionary Biology, Tulane University
**Daniel Becker**
Biology, University of Oklahoma
**Jason Ladner**
Biology, Northern Arizona University
**Enabling Comprehensive Immunoprofiling in Animals through a Combination of Xenosurveillance and Highly-multiplexed Serology**

**Laurene Tetard**
Physics/Nanoscience Technology Center, University of Central Florida
**Bethany McGregor**
Arthropod Borne Animal Diseases Research Unit, USDA
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**Paola Boggiatto**
Infectious Bacterial Diseases Research Unit, USDA
**Liliana Salvador**
Infectious Diseases and Institute of Bioinformatics, University of Georgia
**Host Adaptation of Mycobacterium bovis: A Comparative Transcriptomics Study of M. bovis Infection in a Multi-host System**

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**Kezia Manlove**
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**Joyce Jose**
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Chemistry, University of Michigan
**Discovering How RNA Epigenomic Modifications Impact Flavivirus Replication Speed and Fidelity**

**Hannah Frank**
Ecology and Evolutionary Biology, Tulane University
**Daniel Becker**
Biology, University of Oklahoma
**Jason Ladner**
Biology, Northern Arizona University
**Enabling Comprehensive Immunoprofiling in Animals through a Combination of Xenosurveillance and Highly-multiplexed Serology**

**Laurene Tetard**
Physics/Nanoscience Technology Center, University of Central Florida
**Bethany McGregor**
Arthropod Borne Animal Diseases Research Unit, USDA
**Employing Color-Changing Nanomaterials to Improve Vector-borne Disease Surveillance**
Scialog: Negative Emissions Science
Year 2
Goal: To catalyze chemists, engineers, environmental scientists and those in related fields to collaborate on innovative projects to advance fundamental understanding of capturing and utilizing or sequestering carbon and other greenhouse gases in the atmosphere and oceans. Each of the 22 individual awards was $55,000. Funding was provided by (1) RCSA, with support from the Climate Pathfinders Foundation, and (2) Alfred P. Sloan Foundation.

Matthew Green 2
Chemical Engineering, Arizona State University

Gary Moore 2
School of Molecular Sciences, Arizona State University

Emily Ryan 2
Mechanical Engineering, Boston University

Zhou Lin 1
Chemistry, University of Massachusetts Amherst

Yayuan Liu 1
Chemical and Biomolecular Engineering, Johns Hopkins University

Sen Zhang 1
Chemistry, University of Virginia

Carbon Dioxide-Methane Coupling with Electric-Field-Polarized Microelectrodes

Marta Hatzell 2
Mechanical Engineering, Georgia Institute of Technology

Kathryn Knowles 2
Chemistry, University of Rochester

Jose Mendoza 2
Chemical Engineering and Materials Science, Michigan State University

Photochemical Amine Production from N2 and CO2

David Kwabi 2
Mechanical Engineering, University of Michigan

Michael Nippe 2
Chemistry, Texas A&M University, College Station

Carbon Dioxide Removal from Seawater Driven by a Visible Light-Induced pH Gradient

Matthew Green 1
Chemical Engineering, Arizona State University

Katherine Hornbostel 1
Mechanical Engineering and Materials Science, University of Pittsburgh

Jenny Yang1
Chemistry, University of California, Irvine

Novel Membrane Design for Hybrid Ocean Capture and Desalination

Charles McCrory 2
Chemistry, University of Michigan

Carlos Morales-Guio 2
Chemical and Biomolecular Engineering, University of California, Los Angeles

Electrified Low-Temperature Process for CO2 Capture and Conversion (e-LT-C3)

Andrea Hicks 1
Civil and Environmental Engineering, University of Wisconsin-Madison

Chong Liu 1
Chemical and Biochemistry, University of California, Los Angeles

Haotian Wang 1
Chemical and Biomolecular Engineering, Rice University

CO2 Conversion to Bioplastics via Electrochemical-Bio Synthesis

Adam Holewinski 1
Chemical and Biological Engineering, University of Colorado Boulder

Katherine Hornbostel 2
Mechanical Engineering and Materials Science, University of Pittsburgh

Yuanyue Liu 1
Mechanical Engineering, University of Texas at Austin

Electric-Swing Solid State Sorbents for Direct Air Capture of CO2
Scialog: Signatures of Life in the Universe
Year 1
Scialog: Signatures of Life in the Universe
Year 1

**Goal:** To catalyze cutting-edge research with the potential to transform our understanding of the habitability of planets, of how the occurrence of life alters planets and leaves signatures, and of how to detect such signatures beyond Earth. Each of the 20 individual awards was $55,000. Funding was provided by (1) the Heising-Simons Foundation, (2) RCSA, (3) NASA, and (4) RCSA with Kavli Foundation support.

**Greg Fournier**
Earth, Atmosphere and Planetary Sciences, Massachusetts Institute of Technology
*Can the Search for Oxygenated Atmosphere Biosignatures Lead to False Negatives?*

**Marc Neveu**
Astronomy / Planetary Environments Laboratory, NASA Goddard Space Flight Center / University of Maryland

**Ziming Yang**
Chemistry, Oakland University
*How may Biosignatures in Icy Ocean Worlds be Affected by Plume Ejection?*

**Laurie Barge**
Planetary Sciences, NASA Jet Propulsion Laboratory

**Jeffrey Marlow**
Biology, Boston University
*Synthetic Mineral Geo-Electrodes for Detecting Life on Ocean Worlds*

**Rika Anderson**
Biology, Carleton College

**Noah Planavsky**
Geology and Geophysics, Yale University
*Long Term Controls on the Scope of Earth’s Biosphere*

**Bradford Foley**
Geosciences, Pennsylvania State University

**Kimberly Lau**
Geosciences, Pennsylvania State University

**Stephanie Olson**
Earth, Atmospheric, and Planetary Science, Purdue University
*Water, Water Everywhere … Drops to Drink but Nothing to Eat? A Model for the Evolution of Ocean Chemistry on Waterworlds*

**Aaron Engelhart**
Genetics, Cell Biology, and Development, University of Minnesota

**Stilianos MacGregor**
Astrophysical and Planetary Sciences, University of Colorado Boulder

**Smadar Naoz**
Physics and Astronomy, UCLA
*Could Nucleic Acid-Based Life Survive on Oxygen-Rich M Dwarf Planets?*

**Edwin Kite**
Geophysical Sciences, University of Chicago

**Jen Glass**
Earth and Atmospheric Sciences, Georgia Institute of Technology

**Edwin Kite**
Geophysical Sciences, University of Chicago

**Marc Neveu**
Astronomy / Planetary Environments Laboratory, NASA Goddard Space Flight Center / University of Maryland

**Ziming Yang**
Chemistry, Oakland University
*How may Biosignatures in Icy Ocean Worlds be Affected by Plume Ejection?*

**Laurie Barge**
Planetary Sciences, NASA Jet Propulsion Laboratory

**Jeffrey Marlow**
Biology, Boston University
*Synthetic Mineral Geo-Electrodes for Detecting Life on Ocean Worlds*

**Rika Anderson**
Biology, Carleton College

**Noah Planavsky**
Geology and Geophysics, Yale University
*Long Term Controls on the Scope of Earth’s Biosphere*
Goal: To catalyze interdisciplinary teams including chemists, physicists, biologists and neurophysiologists to collaborate on new projects to advance fundamental understanding of the gut-brain axis and the roles microbiota play in neurodegenerative disorders. Each of the 14 individual awards was $55,000.

Funding was provided by RCSA, the Paul G. Allen Frontiers Group, and the Frederick Gardner Cottrell Foundation.

Elaine Hsiao
Integrative Biology and Physiology, University of California, Los Angeles

Amina Schartup
Scripps Institution of Oceanography

Mei Shen
Chemistry, Neuroscience Program, Beckman Institute, University of Illinois at Urbana-Champaign

Harnessing the Microbiome to Combat the Neurotoxic Effects of Dietary Mercury

Nandita Garud
Ecology and Evolutionary Biology, University of California, Los Angeles

Will Ludington
Embryology, Carnegie Institution

Do Aging Microbiomes Evolve Pathogenicity Via Gene Shedding? Using Evolutionary Theory to Deconstruct Microbiome-based Neurodegeneration

David Durgan
Anesthesiology, Baylor College of Medicine

Abhishek Shrivastava
Life Sciences, Arizona State University

Do Bacterial Outer Membrane Vesicles (OMVs) Act as Modulators of Microbiota-brain Communication Involved in the Development of Neurological Diseases?

Faranak Fattahi
Biochemistry and Biophysics, University of California, San Francisco

Mark Mimee
Microbiology and Pritzker School of Molecular Engineering, University of Chicago

Species-specific Modulation of Human Enteric Neurons by Gut Microbiome Metabolites

Maayan Levy
Microbiology, University of Pennsylvania

Ashley Ross
Chemistry, University of Cincinnati

Kai Zhang
Biochemistry, University of Illinois at Urbana-Champaign

Engineering Enteric Neuron Activity to Enhance Antimicrobial Immunity in the Gut

Carolina Tropini
Microbiology and Immunology, School of Biomedical Engineering, University of British Columbia

JP Yu
Radiology, Psychiatry, and Biomedical Engineering, University of Wisconsin-Madison

Impact of Missing Microbes on Brain Development
January
2019 Scialog: Time Domain Astrophysics team award recipients James Davenport, Astronomy, University of Washington, and Timothy Brandt, Physics, University of California, Santa Barbara, presented a paper analyzing more than 125 years of astronomical observations of a nearby eclipsing stellar binary called HS Hydrae at the 237th meeting of the American Astronomical Society, and their work was selected for an invited press conference at the meeting.

Pablo Jarillo-Herrero, Massachusetts Institute of Technology, received the NAS Award for Scientific Discovery for his pioneering developments in nanoscience and nanotechnology. The biennial award was endowed by RCSA and the Frederick Gardner Cottrell Foundation in honor of former RCSA president John P. Schaefer. It was presented, along with a medal, a $50,000 prize, and $50,000 to support the recipient’s research, during the National Academy of Sciences’ 158th annual meeting.

Scialog: Chemical Machinery of the Cell Fellow and team award recipient Juan Perilla, Chemistry and Biochemistry, University of Delaware, who is researching the mechanical properties of virus particles, was quoted in a New York Times article: “If You Squeeze the Coronavirus, Does it Shatter?”

Jennifer Wilcox, Scialog: Negative Emissions Science Facilitator and Science Advisory Committee member, became Principal Deputy Assistant Secretary for Fossil Energy for the U.S. Department of Energy. Her work will help set policy for the transition to a clean-energy economy.

Scialog: Advanced Energy Storage Fellows and collaborative award recipients Matthew McDowell, Materials Science and Mechanical Engineering, Georgia Tech, and Partha Mukherjee, Mechanical Engineering, Purdue, and their coworkers have observed the behavior of electrode materials inside solid-state lithium batteries as they charge and discharge. The research was reported in the January 28 edition of Nature Materials. Neil Dasgupta, Mechanical Engineering, University of Michigan, is also a member of the team. Their research could help pave the way for better battery design.
February


Four Scialog Fellows (one also a Cottrell Scholar) were selected as Allen Distinguished Investigators for research projects in the emerging field of immunometabolism. Scialog: Microbiome, Neurobiology and Disease Fellows Nandita Garud, Department of Ecology and Evolutionary Biology, University of California, Los Angeles, and Carolina Tropini, Microbiology and Immunology, University of British Columbia, will explore the variation between patients with inflammatory bowel disease. Cottrell Scholar 2014 and Scialog: Chemical Machinery of the Cell awardee Jennifer Prescher, Chemistry, University of California, Irvine, will work with Molecules Come to Life awardee Michelle Digman, Biomedical Engineering, University of California, Irvine, to research tools to better understand the immune system.

Two Cottrell Scholars and six Scialog Fellows were awarded 2021 Sloan Research Fellowships: CS 2020 Carlos Baiz, Chemistry, University of Texas at Austin; CS 2018 Luisa Whittaker-Brooks, Chemistry, University of Utah; Time Domain Astrophysics Fellow Timothy Brandt, Physics, University of California, Santa Barbara; Negative Emissions Science Fellow Robert Gilliard, chemistry, University of Virginia; Chemical Machinery of the Cell Fellow Julia Kalow, Chemistry, Northwestern University; Chemical Machinery of the Cell Fellow David Limmer, Chemistry, University of California, Berkeley; Chemical Machinery of the Cell Fellow Steven Townsend, Chemistry, Vanderbilt University; and Advanced Energy Storage and Negative Emissions Science Fellow Haotian Wang, Chemical and Biomolecular Engineering, Rice University.

March

How do conferences spark scientific collaborations? Emma Zajdela and Daniel Abrams, Applied Mathematics, Northwestern University, are working with RCSA data analyst Kimberly Huynh and program directors Andrew Feig and Richard Wiener to study data on interactions at Scialog conferences and create dynamical models for understanding the rapid formation of teams of researchers who have not previously collaborated. Zajdela gave a presentation on this research at the American Physical Society’s March meeting.

RCSA Senior Program Director Richard Wiener chaired a session on communicating science to the public at the 2021 APS March Meeting. Invited presenters included Ira Flatow of Science Friday, Ann Merchant of the National Academy of Sciences, and Dennis Overbye of The New York Times.

Scialog: Negative Emissions Science Fellow Robert J. Gilliard Jr., Chemistry, University of Virginia, received Organometallics’ 2021 Distinguished Author Award.

Fulbright-Cottrell Scholar 2016 Olalla Vazquez, Chemistry, Philipps-Universität Marburg, was named recipient of the Ars legendi Faculty Prize.
for excellent university teaching. Her course on epigenetics combines lectures, discovery-based research, and science communication.

Designing a course for her 2021 Cottrell Scholar proposal led to a pandemic hobby for Leah Witus, Chemistry, Macalester College. That hobby, making animated science videos, resulted in an unexpected research project that offered timely and useful insights into public health messaging around COVID-vaccine hesitancy. Her findings were featured in an article in The New York Times, and her video explaining mRNA vaccines for English-speaking viewers of all ages was later released in Spanish and Arabic as well.

Leah Witus and her video explaining mRNA vaccines

April

More than 50 Fellows from multiple disciplines and institutions across the U.S. and Canada gathered virtually April 22-23 for the inaugural meeting of Scialog: Microbiome, Neurobiology and Disease, a three-year initiative to brainstorm creative, new research ideas that could advance our understanding of the gut microbiome and its relationship to the brain and neurobiology.

Two Cottrell Scholars and a Scialog Fellow were keynote speakers April 7 at the American Chemical Society meeting. The National Science Foundation-sponsored session “Toward Sustainable Chemistry—Reinventing Catalysis,” led by Division of Chemistry Director David Berkowitz, included presentations from: CS 2004 Paul Chirik, Chemistry, Princeton University; Scialog: Advanced Energy Storage Fellow Jenny Yang, Chemistry, University of California, Irvine; and CS 2007 Tehshik Yoon, Chemistry, University of Wisconsin, Madison.

Scialog: Time Domain Astrophysics Fellows Yue Shen, Astronomy, University of Illinois at Urbana-Champaign, and Nadia Zakamska, Physics and Astronomy, Johns Hopkins University, published a paper in Nature Astronomy based on their 2018 Scialog-seeded team project.

Cottrell Scholar 2004 and Scialog: Time Domain Astrophysics Facilitator Vicky Kalogera, Physics and Astronomy, Northwestern University, was awarded a 2021 Guggenheim Foundation Fellowship.

Two Cottrell Scholars were elected to the American Academy of Arts and Sciences: CS 2004 Vicky Kalogera, Physics and Astronomy, Northwestern University; and CS 1994 Nancy Makri, Chemistry, University of Illinois at Urbana-Champaign. Members are leaders from around the world who serve as experts on challenges facing society, identify solutions, and promote nonpartisan recommendations that advance the public good.

Cottrell Scholar 2000 Wilfred van der Donk, Chemistry, University of Illinois at Urbana-Champaign, and Scialog: Chemical Machinery of the Cell Facilitator Judith Frydman, Biology and Genetics, Stanford University, were among 120 new members elected to the National Academy of Sciences in recognition of their distinguished and continuing achievements in original research.

Four Cottrell Scholars and two Scialog Fellows were honored as 2021 Camille Dreyfus Teacher-Scholars: CS 2020 Carlos Baiz, Chemistry, University of Texas at Austin, Song Lin, Chemistry, Cornell University, and Brenda Rubenstein, Chemistry, Brown University; CS 2018 Luisa Whittaker-Brooks, Chemistry, University of Utah; and Scialog: Chemical Machinery of the Cell Fellows Julia Kalow, Chemistry, Northwestern University, and Markita Landry, Chemical and Biomolecular Engineering, University of California, Berkeley. Whittaker-Brooks is also a Fellow for two Scialog initiatives, Advanced Energy Storage and Negative Emissions Science.
Cottrell Scholar 2013 Ognjen Š. Miljanić, Chemistry, University of Houston, was the latest RCSA grantee to publish an op-ed piece after participating in a training program designed to increase the diversity of voices, expertise and experience reflected on the nation’s editorial pages. CS 2010 Jenny Ross, Physics, Syracuse University, and CS 2019 Kerstin Perez, Physics, Massachusetts Institute of Technology, also published opinion pieces following the training. The training came as a result of the 2019 Cottrell Scholar Conference, which focused on communicating science. It featured a session by The Op-Ed Project, a nonprofit that trains people to communicate effectively and publish their informed opinions. Following the conference, RCSA supported 25 scientists in attending The OpEd Project’s “Write to Change the World” workshops.

May

More than 50 early-career chemists, physicists, biologists, bioengineers and medical imaging specialists gathered May 20-21 to launch Scialog: Advancing BiolImaging, a three-year initiative aiming to accelerate the development of the next generation of imaging technologies. It is sponsored by RCSA, the Chan Zuckerberg Initiative, and the Frederick Gardner Cottrell Foundation.

A group of Cottrell Scholars led by Snezana Stanimirovic, Astronomy, University of Wisconsin – Madison, produced a comic strip for elementary school students highlighting the life and research of scientists. Funded by RCSA and the Astronomy Department at the University of Wisconsin– Madison, the comic is a collaboration between a team of Cottrell Scholars (in addition to Stanimirovic, CS 2010 Sarbjit Banerjee, Chemistry, Texas A&M; CS 1999 Karen Bjorkman, Astronomy, University of Toledo; CS 2009 Mike Gladders, Astronomy, University of Chicago; and CS 2009 Yadong Yin, Chemistry, University of California, Riverside) and science illustrator Jan Lin, with assistance from Philip “Bo” Hammer, University of Chicago. The story was developed and initial sketches of characters done by physicist-artist team Rebecca Thompson and David Ellis, the creators of Spectra. Stanimirovic said the group developed the idea at the 2012 Cottrell Scholars Conference during a discussion about designing a novel outreach project to encourage young people’s interest in science.

June

What makes a world habitable? How can we tell if certain molecules are signs of life? These questions and more were discussed at the first meeting of Scialog: Signatures of Life in the Universe, held virtually June 10-11, 2021. The initiative is cosponsored by the Heising-Simons Foundation, with additional support from the Kavli Foundation.

The Heising-Simons Foundation, a cosponsor of two Scialog initiatives, launched a new site called 1400Degrees.org highlighting the contributions of women and people of marginalized genders who are transforming physics and astronomy. Cottrell Scholars and Scialog participants listed include: Chung-Pei Ma, Astronomy, University of Pennsylvania; Cindy Regal, Physics, University of Colorado Boulder; Courtney Dressing, Astronomy, University of California, Berkeley; Emily Rauscher, Astronomy, University of Michigan; Curtina Besla, Astronomy, University of Arizona; Huey-Wen Li, Physics, Michigan State University; Jackie Faherty, Astrophysics, The American
Museum of Natural History; Jennifer Sokoloski, Astronomy, Columbia University; Juna Kollmeier, Astrophysicist, Carnegie Institution for Science; Katherine de Kleer, Geological and Planetary Sciences, Caltech; Kathryn Johnston, Astronomy, Columbia University; Kerstin Perez, Physics, Massachusetts Institute of Technology; Leslie Rogers, Astronomy, University of Chicago; Lisa Kaltenegger, Astronomy, Cornell University; Mansi Kasliwal, Astronomy, California Institute of Technology; Nikole Lewis, Astronomy, Cornell University; Quinn Konopacky, Physics, University of California, San Diego; Raffaella Margutti, Physics and Astronomy, Northwestern University; and Smadar Naoz, Physics and Astronomy, UCLA.

Two Scialog Fellows received 2021 Beckman Young Investigator Awards: Negative Emissions Science Fellow Robert Gilliard, Chemistry, University of Virginia, and Chemical Machinery of the Cell Fellow Tania Lupoli, Chemistry, New York University. The awards are given to foster the invention of methods, instruments, and materials that will open new avenues of research in science.

Juliane Simmchen, Physical Chemistry, Technische Universität Dresden, and Simon Stellmer, Physics and Astronomy, University of Bonn, were named recipients of the 2021 Fulbright-Cottrell Award for excellence in research and teaching, becoming welcomed members of the Cottrell Scholar community.

Four members of the RCSA community were among 31 rising stars named finalists for the Blavatnik National Awards for Young Scientists: Cottrell Scholar 2014 and Scialog Solar Energy Conversion awardee Shannon Boettcher, Chemistry, University of Oregon; CS 2014 Mircea Dincă, Chemistry, Massachusetts Institute of Technology; CS 2012 and FRED Award recipient Sara Skrabalak, Chemistry, Indiana University Bloomington; and Scialog Chemical Machinery of the Cell Fellow Wenjun Zhang, Chemical and Biomolecular Engineering, University of California, Berkeley.

RCSA Senior Program Director Silvia Ronco concluded her term as 2020-2021 president of the Council on Undergraduate Research. In recognition of her contributions, RCSA funded a CUR-administered award in Silvia’s name, which will be given to a physical scientist for outstanding mentoring of undergraduates in research.

July

How can we turn the lessons of the pandemic into sustainable, positive change in academia? “Reimagining Higher Education” was the theme of the virtual 2021 Cottrell Scholar Conference held July 7-9, 2021. With more than 150 participants, it was the largest conference yet. CS 1996 Sean Decatur, president of Kenyon College, gave a thoughtful and inspiring keynote address, “Building More Equitable Colleges and Universities in the Aftermath of COVID.”

Cottrell Scholar 1999 Karen Bjorkman, provost and executive vice president for academic affairs at The University of Toledo, was elected to the board of directors of AURA, the Association of Universities for Research in Astronomy. AURA is responsible for the operation of the National Science Foundation’s National Optical-Infrared Astronomy Research Laboratory, the National Solar Observatory, and the Space Telescope Science Institute.
2014 Cottrell Scholar Mircea Dincă, Chemistry, Massachusetts Institute of Technology, was named one of three laureates of the 2021 Blavatnik National Awards for Young Scientists in recognition of his work developing metal-organic frameworks.

August

Cottrell Scholar 2009 Lane Baker, Chemistry, Indiana University, and Cottrell College Science Award recipient Tim Hanks, Chemistry, Furman University, were elected 2021 American Chemical Society Fellows for their outstanding achievements in and contributions to science, the profession, and ACS.

Three members of RCSA's Scialog community were among nine researchers chosen to receive U.S. Department of Energy funding for Direct Air Capture of CO2. They are: Negative Emissions Science Fellow and awardee Burcu Gurkan, Chemical and Biomolecular Engineering, Case Western Reserve University; Advanced Energy Storage Fellow and awardee Joaquin Rodriguez-Lopez, Chemistry, University of Illinois at Urbana-Champaign; and Negative Emissions Science Facilitator Jeff Long, Chemistry, University of California, Berkeley.

Chemical & Engineering News named 2020 Cottrell Scholar and Scialog: Advanced Energy Storage and Negative Emissions Science Fellow Jesús Velázquez, Chemistry, University of California, Davis, one of its 2021 Talented 12 for engaging in “world-changing work” studying materials that could mitigate climate change or clean up water.


September

Cottrell Scholar 2017 Amanda Wolfe, Chemistry, University of North Carolina at Asheville, was awarded a nearly $385,000 grant from the National Institute of Allergy and Infectious Disease to address a growing threat to human health, multidrug resistant Pseudomonas aeruginosa (MDRPA) infections. Her project will explore targeted development and selective delivery of small molecule antibiotics for the treatment of these infections. Wolfe also serves on the Cottrell Scholar Program Committee.

A 2018 Scialog: Advanced Energy Storage team award for collaborative research resulted in one of August’s most-read articles in ACS Energy Letters. The paper—by AES Fellows Partha Mukherjee, Mechanical Engineering, Purdue University; Venkat Viswanathan, Mechanical Engineering, Carnegie Mellon University; and Lauren E. Marbella, Chemical Engineering, Columbia University—opens up new possibilities in the design of metal-anode-based batteries to prevent dendrite formation.

If anyone out there were looking, which nearby stars are in the right place to spot Earth? Scialog: Signatures of Life in the Universe Facilitator Lisa Kaltenegger, Astronomy, Cornell University, penned a fun article in Nautilus based on a 2021 Nature paper she wrote with Scialog: Time Domain Astrophysics Fellow Jackie Faherty on past, present and future stars with a “perfect cosmic front seat to Earth.”

2015 Cottrell Scholar and Scialog: Microbiome, Neurobiology and Disease Facilitator Emily Balskus, Chemistry, Harvard University, was one of 33 biomedical researchers named 2021 Howard Hughes Medical Institute Investigators. She studies microbial metabolism and its influence on the human microbiome.

The 2022 American Chemical Society National Award for Research at an Undergraduate Institution, sponsored by RCSA, was awarded to Chip Nataro, a professor of chemistry at Lafayette College.

Six members of the RCSA community were named American Chemical Society 2022 national award winners. Cottrell Scholar 2008 Matthew Disney,
Ibrahim Cissé, Physics, Massachusetts Institute of Technology, was announced as a 2021 MacArthur Fellow. Cissé is a Scialog: Molecules Come to Life Fellow and 2016 team award recipient.

Two members of the 2020 class of Cottrell Scholars — Frank Leibfarth, Chemistry, University of North Carolina at Chapel Hill, and Brenda Rubenstein, Chemistry, Brown University, who is also a Scialog: Mitigating Zoonotic Threats Fellow — were named to the Popular Science Brilliant 10, a roster of early-career scientists and engineers developing ingenious approaches to problems across a range of disciplines.

Scialog: Advancing Bioimaging Fellow Candace Fleischer, Radiology and Imaging Sciences, Emory University, received a $1.5 million New Innovator Award from the National Institutes of Health. Her “metaboloradiomics” research approach could open new understanding of how metabolic diseases affect the brain and other organs.
A Scialog: Advanced Energy Storage team whose 2019 award sparked a successful collaboration to advance fundamental understanding of the electrochemical interface received $1.8 million in U.S. Department of Energy funding to take their research on a new path into the area of direct air capture of CO₂. **Joaquin Rodriguez-López**, Chemistry, University of Illinois at Urbana-Champaign, will collaborate with **Veronica Augustyn**, Materials Science and Engineering, North Carolina State University, and **Jahan Dawlaty**, Chemistry, University of Southern California, on this project: “**Reversible Electrochemical Capture/Release of Carbon Dioxide Mediated by Electrostatically Enhanced Charge Transfer.**”

2019 Scialog: Advanced Energy Storage team award recipients **Neil Dasgupta**, Mechanical Engineering, University of Michigan, Ann Arbor. Matthew McDowell, Materials Science and Mechanical Engineering, Georgia Institute of Technology, and **Partha Mulherjee**, Mechanical Engineering, Purdue University, published a joint paper in ACS Energy Letters based on their collaborative Scialog project. Featured on the journal’s cover, the article is titled “**Challenges and Opportunities for Fast Charging of Solid-State Lithium Metal Batteries.**”

Two Scialog Fellows and one Facilitator were among 10 scientists who were named recipients of 2022 awards from the Biophysical Society. Molecules Come to Life awardee **Suckjoon Jun**, Physics and Molecular Biology, University of California, San Diego, was honored for groundbreaking research on the biophysical mechanisms of bacterial cell size control. Chemical Machinery of the Cell Fellow **Gabriela Schlau-Cohen**, Chemistry, Massachusetts Institute of Technology, was honored for elucidating structural and energetic dynamics of biological and bio-inspired systems through her innovative applications of spectroscopic methods. CMC Facilitator and 2000 Cottrell Scholar **Paul R. Selvin**, Physics, University of Illinois at Urbana-Champaign, was honored for novel and ongoing contributions to development of single-molecule biophysics and application to important biophysical research problems.

The American Physical Society announced its election of Fellows for 2021, including several members of the RCSA community—Scialog: Molecules Come to Life Fellow **Ibrahim I. Cissé**, Physics, Max Planck Institute; Cottrell Scholar 2000 **Michael Dennin**, Physics, University of California, Irvine; CS 2009 **Maura McLaughlin**, Physics, West Virginia University; CS 2017 **Monika Schleier-Smith**, Physics, Stanford University; and CS 2010 **Kyle M. Shen**, Cornell University.

The American Physical Society gave its 2022 Excellence in Physics Education Award to the **TEAM-UP Task Force** “for groundbreaking analysis revealing sources of persistent underrepresentation of African-Americans in physics and astronomy; recommendation of data-driven, systemic strategies to increase the number of African-American physics bachelor’s degree recipients; and ways to catalyze cultural change.” RCSA provided funding to support the task force’s important work.

The American Physical Society’s 2022 Prize for a Faculty Member for Research in an Undergraduate Institution, sponsored by RCSA, was awarded to **Derek F. Jackson Kimball**, California State University—East Bay, for innovative methods in dark matter detection, exemplary contributions to research, and high impact teaching to a diverse undergraduate student body using research projects.

The American Physical Society’s spring 2022 prize and award recipients include Cottrell Scholar 2020 and Scialog: Negative Emissions Science Fellow **Jesús Velázquez**, Chemistry, University of California, Davis, and Scialog: Time
Domain Astrophysics Fellow Enrico Ramirez-Ruiz, Astronomy and Astrophysics, University of California, Santa Cruz. Velázquez received the 2021 Stanford R. Ovshinsky Sustainable Energy Fellowship for transformative research advancing the production of solar fuels, elucidating fundamental design principles underpinning negative emissions science, and for articulating a bold vision of a sustainable chemical industry using CO₂ instead of fossil fuels. Ramirez-Ruiz received the 2021 Dwight Nicholson Medal for Outreach for innovations in mentoring that have demonstrated how members of historically marginalized populations can thrive, lead, and advance scientific enterprise in astronomy and related fields.

Two Cottrell Scholars were featured in a Physics Magazine interview with five women who have recently won major prizes. CS 2000 Donna Strickland (Nobel Prize in Physics, 2018) and CS 2017 Monika Schleier-Smith (MacArthur Fellowship, 2020) shared their thoughts on carving out a career in physics and what their awards mean to them.

Two Cottrell Scholars were included on the Analytical Scientist’s 2021 Power List of 100 influential scientists: CS 2009 Lane Baker, Chemistry, Indiana University Bloomington, and CS 2002 Neil Kelleher, Chemistry, Northwestern University. (Neil is also a Scialog: Chemical Machinery of the Cell Facilitator and a COVID-19 Initiative awardee.).

November

The second meeting of Scialog: Negative Emissions Science was held November 4-5, 2021. Sponsored by RCSA and the Alfred P. Sloan Foundation, the initiative challenges participants from institutions around the U.S. and Canada to explore together how to advance fundamental science in the design of novel approaches for removing and utilizing or sequestering greenhouse gases. To accompany the initiative, the journal iScience released a series of open-access articles called “Spotlight on Scialog: Negative Emissions Science.” Through the collaboration of Cell Press, RCSA and the Alfred P. Sloan Foundation, and curated with iScience Consulting Editor and NES Fellow Marta Hatzell, Mechanical Engineering, Georgia Institute of Technology, this collection contained collaborative, forward-looking perspectives and research articles by a number of Scialog participants.

Included in the collection:

- A “Backstory” feature with Hatzell and Jennifer Wilcox, Principal Deputy Assistant Secretary for Fossil Energy at the Department of Energy, discussing the role of newcomers to the field of negative emissions science, multidisciplinary approaches to doing research, and the challenges of CO₂ removal and carbon sequestration. Hatzell is a Fellow and Wilcox is a Facilitator of Scialog: Negative Emissions Science.

- A “Backstory” article by RCSA’s Richard Wiener and Andrew Feig, and the Alfred P. Sloan Foundation’s Evan Michelson, explaining how cosponsoring the Scialog: Negative Emissions Science initiative is bringing together a diverse group of early career scientists to meet perhaps the greatest challenge of our time, addressing and mitigating global climate warming.

- An article by four Scialog: Negative Emissions Science Facilitators—Roger Aines, Sarbajit Banerjee, Jordi Cabana and Christopher Jones (plus 2020 Cottrell Fellowship recipient Rachel Davidson)—sharing their thoughts on what the field needs to move forward.

- “Perspective and Challenges in Electrochemical Approaches for Reactive CO₂ Separations” from Scialog Fellows Burcu Gurkan, Chemical and Biomolecular Engineering, Case Western Reserve University; Xiao Su, Chemical and Biomolecular Engineering, University of Illinois at Urbana-Champaign; and Shaama Mallikarjun Sharada, Chemical Engineering and Materials Science, University of Southern California.

Cottrell Scholar 2006 Hai Lin, Chemistry, University of Colorado Denver, won a nearly $460,000 grant from the National Institutes of Health to pursue an unexpected avenue of research that grew out of his 2018 SEED Award project. The knowledge gained
from this research could be used to develop new therapies for tooth decay prevention.


Geraldine Richmond, a 1980 RCSA grantee with long ties to the foundation, was confirmed as Under Secretary of Science and Energy at the U.S. Department of Energy. An exceptional physical chemist and champion of women in science, she served RCSA as former presidential advisory committee member and delivered the keynote at two Cottrell Scholar conferences, most recently in 2017.

The National Academy of Medicine elected 100 new members who have made major contributions to the advancement of the medical sciences, health care, and public health. They include Scialog: Advancing Bioimaging Facilitator Samuel Achilefu, Washington University School of Medicine; Cottrell Scholar 2003 and Scialog: Molecules Come to Life Facilitator Taekjip Ha, Johns Hopkins University; and Scialog: Mitigating Zoonotic Threats Facilitator and keynote speaker Christine Kreuder Johnson.

Gudmundur Stefánsson, a student working on a precision photometry project that got its start at Scialog: Time Domain Astrophysics in 2015, won the prestigious Robert J. Trumpler award, given each year to a Ph.D. thesis in North America of unusual importance to astronomy. Currently a Henry Norris Russell postdoctoral fellow at Princeton University, Stefánsson helped develop a novel Engineered Diffuser that being used by an increasing number of telescopes around the world to achieve high-precision ground-based differential photometry. The concept was developed and proposed by Suvarth Mahadevan, Astronomy and Astrophysics, Penn State; Leslie Hebb, Physics, of Hobart and William Smith Colleges; and John Wisniewski, Physics and Astronomy, University of Oklahoma.

A cross-disciplinary team of Scialog: Molecules Come to Life Fellows was awarded a 4-year $1.8M National Science Foundation grant to continue research that began with a Scialog award in 2015. The team includes: Rae Robertson-Anderson, Physics and Biophysics, University of San Diego; Megan Valentine, Mechanical Engineering, University of California, Santa Barbara; Jennifer Ross, Physics, Syracuse University; Michael Rust, Genetics and Cell Biology, University of Chicago; and Moumita Das, Physics and Astronomy, Rochester Institute of Technology. Their project, “Living Biotic-ABiotic Materials with Temporally Programmable Actuation,” aims to use biological building blocks to create self-directed and reconfigurable materials capable of producing force and motion.

Three RCSA grantees were among eight young faculty in the chemical sciences named 2021 Henry Dreyfus Teacher-Scholars for their scholarship and commitment to undergraduate education.

Grace Stokes, Chemistry, Santa Clara University, is a 2018 Cottrell Scholar and Scialog: Chemical Machinery of the Cell Fellow. Christine Phillips-Piro, Franklin & Marshall College, and Amanda Murphy, Western Washington University, are both recipients of Cottrell College Science Awards.

Sarbajit Banerjee, Chemistry, Texas A&M University, won the 2021 Stanley C. Israel Regional Award for Advancing Diversity in the Chemical Sciences for the American Chemical Society Southwest Region. Banerjee is a 2010 Cottrell Scholar, a Facilitator for two Scialog initiatives—Advanced Energy Storage and Negative Emissions Science—and was a Fellow for Solar Energy Conversion.

Chemical & Engineering News highlighted the research of 1997 Cottrell Scholar Yi Lu, chemistry, University of Illinois at Urbana-Champaign. Lu’s work on a tool to measure lithium levels in neurons could help adjust dosages for people with bipolar disorders and increase understanding of the drug’s mechanism of action.
Two Cottrell Scholars—2014 Mircea Dincă, Chemistry, Massachusetts Institute of Technology, and 2019 Katherine A. Mirica, Chemistry, Dartmouth College—were interviewed in a Chemical & Engineering News feature on the new applications chemists are finding for the conductive properties of metal-organic frameworks.

December

The Mining Foundation of the Southwest inducted RCSA’s founder, Frederick Gardner Cottrell, into the American Mining Hall of Fame. Former RCSA president John P. Schaefer accepted the award at the event, which honored Cottrell’s legacy as an inventor and philanthropist.

1995 Cottrell Scholar Eberhard Bodenschatz, Physics, who helped found the Cottrell-Fulbright Scholars program in Germany, published a timely new study on the effectiveness of face masks. His team from the Max Planck Institute for Dynamics and Self-Organization in Göttingen investigated to what extent masks protect under which wearing conditions.

Scialog: Negative Emissions Science awardee Andrea Hicks, Civil and Environmental Engineering, University of Wisconsin-Madison, won a 2021 Laudise Medal from the International Society for Industrial Ecology.

2000 Cottrell Scholar David Vanden Bout was appointed dean of the College of Natural Sciences at the University of Texas at Austin.

RCSA’s quick support of COVID research at the start of the pandemic in 2020 helped catalyze several projects with remarkable results:

- The project Pan-Covid-19 MultiValent Binders (MVBs) to Block Virus Entry was a collaboration between Scialog: Chemical Machinery of the Cell Facilitator Rommie Amaro, Chemistry and Biochemistry, University of California, San Diego, CMC Fellow Ronit Freeman, Biomaterials, University of North Carolina at Chapel Hill, and Cottrell Scholar 2001 Carlos Simmerling, Chemistry, Stony Brook University. Modeling work by Amaro and Simmerling, which led to a deeper understanding of the dynamics of the spike protein and how it interacts with cell surface receptors, was reported in The New York Times. A second part of this work, which helped to explain how virus particles maintain their integrity in water droplets, was also featured in the Times. Alongside the modeling work, Freeman’s group was working on new ways to detect the virus. During the pandemic, they developed, patented and quickly brought to mass-market production a glycopolymer-based lateral flow assay for detecting SARS-CoV-2 and its rapidly emerging variants.

- The project Establishing Swift, Sensitive, and Selective (3S) Sensing Technologies – Going Beyond RT-PCR brought together the complementary skills of Freeman and Cottrell Scholar 2013 Zachary Schultz. Chemistry and Biochemistry, The Ohio State University. They published a paper in ACS Sensors providing a new route to address SARS-CoV-2 and potentially future virus outbreaks and are now in discussion with companies to license the technology they have patented.
With the project Electric Field-Driven Antigen Enrichment to Achieve Detection of SARS-CoV-2 Nucleocapsid Protein in Urine at the Point-of-Need, Cottrell Scholar 2019 Robbyn Anand, Chemistry, Iowa State University, was able to translate her lab’s work developing a method that integrates a lateral flow assay with electrokinetic enrichment of antigens to the detection of SARS-CoV-2. Anand has received a provisional patent on the method and is currently exploring methods to scale up testing capacity.

The project Targeting the SARS-CoV-2 Frameshift Site Pseudoknot enabled the labs of two 2017 Cottrell Scholars, Amanda Hargrove, Chemistry, Duke University, and CS Katie Mouzakis, Chemistry, Loyola Marymount University, to take on new research directions and identify promising lead molecules that directly bind the SARS-CoV-2 target RNA and inhibit its function. In addition, in an effort to remotely engage undergraduate students in research, Mouzakis integrated the SARS-CoV-2 collaborative project into two of her biochemistry laboratory courses. This work was included in a peer-reviewed pedagogical publication in the Biophysicist in 2021.

In Memoriam

Marye Anne Fox, National Medal of Science recipient and longtime member of RCSA’s scientific community. As a young teacher-scholar in her first year at the University of Texas at Austin, she received a Frederick Gardner Cottrell Grant in 1976 to study the ketone-photosynthesized oxidation of methionine.

Sheila Tobias, author and activist who pioneered research into the relationship between gender and math anxiety. RCSA published several of her books, including “Science Teaching as a Profession: Why It Isn’t, How It Could Be,” “Rethinking Science as a Career: Perceptions and Realities in the Physical Sciences,” and “They’re Not Dumb, They’re Different: Stalking the Second Tier.”

Robert Holland Jr., engineer and corporate executive. Holland served RCSA as a Board Member from 1997-2010 and continued to provide valuable counsel after his term ended.
2021 Financial Summary

Program Expenses, including
Grants and Awards 90%
General and Administrative Costs 10%

Total Expenses $10.8 million

Scialog Collaborative Awards
(includes $2.3M in partner funded awards
administered by RCSA and excludes $2.5M in
non-administered partner funded awards) 49%
Cottrell Scholar Awards 32%
Cottrell Career Advancement, Fellowships
(includes $103K in partner funded awards
administered by RCSA), Collaborative Awards 15%
Discretionary Grants and Special Initiatives 4%

Grants and Awards $7.6 million

Net Assets at Beginning of Year $215.6 million
Net Assets at End of Year $239.1 million

The financial activities of Research Corporation for Science Advancement were audited by Beach Fleischman, PC. For the complete audited financial statements, please visit our website at rescorp.org.
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- Early career faculty
- Innovative ideas for basic research
- Integration of research and science teaching
- Interdisciplinary research
- Building the academic leadership of the future