

Crisis and Community

2020 Annual Report

“I am so thankful that I’m part of a group of people that cares so much about the thoughtful mentoring and education of the next generations of scientists. These are my people.”

Cottrell Scholar

“It was particularly hard during the pandemic to get in touch with fellow scientists, and I only recognized during the Scialog meeting how much I was missing these interactions. Thanks for making this possible.”

Scialog: Negative Emissions Science Fellow

Letter from the President

Along with the terrible losses and disruptions of 2020 came evidence for optimism about human resilience, scientific innovation, and the power of partnerships. The community of teacher-scholars that the Research Corporation for Science Advancement supports adapted to teaching online and to guiding their research groups remotely; long-term investigations were put on hold as efforts detoured toward improving coronavirus diagnostics, therapeutics, and vaccines; and physical scientists with expertise in molecular structure, chemical and materials design, and data analytics forged collaborations with microbiologists and immunologists to develop new strategies in the ongoing battle against human pathogens.

Throughout this difficult year, the foundation's approach has been to listen to the needs of our community and to respond quickly with changes in our programs and support. We put on hold several initiatives to focus instead on funding promising ideas to tackle COVID-19, and on bringing together Cottrell Scholars to consider how to help students learn effectively and equitably online. Through Cottrell Conversations, we gave faculty opportunities to share their thoughts about

the impact of the pandemic. In response to their concerns about keeping scientific careers on track at a time when most universities and colleges severely cut back their faculty hiring plans, we joined with the National Science Foundation to offer fellowships to senior postdoctoral fellows who in a non-pandemic year would have expected to be launching independent research programs. We also offered support for new instrumentation needed to continue research and learning at primarily undergraduate institutions.

By late 2020, with the experience we developed in organizing online discussions to promote collaborative, interdisciplinary approaches to complex challenges, we proceeded in partnership with the Alfred P. Sloan Foundation with the scheduled inaugural meeting of the Sialog: Negative Emissions Science initiative. For both Sloan and RCSA, our thinking was that despite the pandemic, climate change is such a pressing issue that we need to move ahead without delay to support the most compelling ideas to reduce atmospheric levels of greenhouse gases. We were delighted that the Thistledown Foundation joined Sloan and RCSA in the support of projects that emerged from that meeting.

We recognize that a return to “normal” will be neither rapid nor easy. Our support and programs will continue to focus on basic research in the physical sciences, while also paying close attention to how we can help improve the lives and careers of faculty in the sciences at universities, colleges, and research institutes. Please be in touch with your observations and advice as we all work together to put the pandemic behind us and to create a more diverse, equitable, and inclusive environment for scientific inquiry and student learning.



A handwritten signature in dark ink, appearing to read 'Daniel Linzer'. The signature is fluid and cursive, with a large, sweeping 'D' and 'L'.

Daniel Linzer

President & CEO

Research Corporation for Science Advancement

2020 Awards

In 2020, Research Corporation for Science Advancement supported a diverse community of early-career scientists at colleges and universities in the United States and Canada through its **Cottrell Scholar Program** and **Scialog**, in addition to three emergency initiatives in response to the global pandemic: the **COVID-19 Initiative**, **Cottrell Fellowships**, and **Cottrell Instrumentation Supplements**.

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 2020, Cottrell Scholar Program funding included \$2.5 million for 25 initial Cottrell Scholar Awards, \$75,000 for three Cottrell Scholars Collaborative Awards, and \$565,000 for nine Cottrell Plus Awards (the competitive FRED, SEED, STAR, and IMPACT awards).

Scialog promotes dialogue and community-building to catalyze transformational science through collaborative, interdisciplinary research. In 2020, RCSA awarded \$330,000 to early-career faculty for scientific research through Scialog Collaborative Innovation Awards. The contributions of partner philanthropies toward Scialog awards brought this total to \$1,155,000. (Three other Scialog initiatives were postponed to 2021 due to the pandemic.)

The **COVID-19 Initiative** supported cutting-edge research into the detection and mitigation of the current and future epidemics. In 2020, seven teams of scientists were awarded a total of \$715,000.

Cottrell Fellowships supported the work of postdoctoral fellows whose plans to start independent academic or research careers were delayed or derailed due to pandemic-related institutional hiring freezes. In 2020, RCSA awarded \$831,250 to 13 Cottrell Scholars. Four of these awards were funded through a \$340,000 grant from the National Science Foundation.

Cottrell Instrumentation Supplements supported new instrumentation (or updates to existing equipment) needed to continue research and learning at institutions struggling with the financial impact of the pandemic. In 2020, RCSA awarded 11 Cottrell Instrumentation Supplements totaling \$141,000.

Cottrell Scholar Awards

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



Carlos R. Baiz
Chemistry,
University of Texas at Austin
*Molecular Dynamics at
Heterogeneous Oil-Water
Interfaces and a New Approach
to Addressing the Mental Health
Needs of Graduate Students*



Pengfei Huo
Chemistry,
University of Rochester
*Enabling New Chemical
Reactivities through Polariton
Photochemistry*



Kristin S. Koutmou
Chemistry,
University of Michigan
*Chemical Modifications to mRNA
Nucleosides: A New Frontier in
Gene Regulation*



Kateri H. DuBay
Chemistry,
University of Virginia
*Teaching Entropy and
Modeling the Sequence-
Determinants of Surface-Initiated
Copolymerizations*



Catherine Kealhofer
Physics,
Williams College
*Nonequilibrium Phonon
Dynamics in Two-dimensional
Materials*



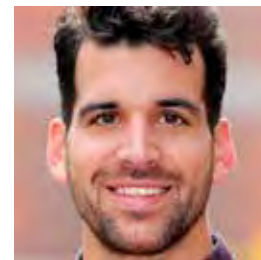
Kah Chun Lau
Physics, California State
University, Northridge
*Data-Driven Solubility Model
Development of Concentrated
Non-aqueous Electrolytes*



Keary M. Engle
Chemistry,
Scripps Research Institute
*Catalytic Difunctionalization
of Alkenes Using Transient
Directing Groups*



Elena F. Koslover
Physics, University of
California, San Diego
*Physics of Cellular Distribution
Networks: Morphology and
Transport in the Endoplasmic
Reticulum*



Frank A. Leibfarth
Chemistry, University of
North Carolina at Chapel Hill
*Organocatalytic Kinetic
Resolution Polymerization of
Lactones*



Huey-Wen Lin

Physics,
Michigan State University
*Unveiling the Three-Dimensional
Structure of Nucleons*



Elisabetta Matsumoto

Physics, Georgia Institute
of Technology
*Knotty Knits: Using Topological
Constraints to Program Geometry
and Elastic Response in Knitted
Textiles with Lattice Defects*



Peter P. Orth

Physics,
Iowa State University
*Probing Fractionalization
and Entanglement in Quantum
Spin Liquids: Theory of
Two-dimensional Spectroscopy*



Song Lin

Chemistry,
Cornell University
*New Catalytic Methods for
Enantioselective Electrosynthesis
and Introducing Electrosynthesis
to College and Graduate
Curricula*



Sharon R. Neufeldt

Chemistry,
Montana State University
*Combined Experimental and
Computational Approach to
Improving Nickel and Palladium-
Catalyzed Cross-Couplings*



Cedric Owens

Chemistry,
Chapman University
*Constructing a Better
Nitrogenase by Uncovering
Protein-protein Interactions
That Protect the Enzyme and
Expand its Chemistry*



Britt F. Lundgren

Astronomy, University of
North Carolina Asheville
*Shedding Light on Star
Formation Driven Galaxy
Outflows across Cosmic Time*



Glen D. O'Neil

Chemistry,
Montclair State University
*Neurotransmitter Detection using
Light-Addressable Electrochemical
Sensors: Investigating the Role of
Metal Morphology and Coverage
on Sensor Response using Scanning
Electrochemical Methods*



Dennis V. Perepelitsa

Physics, University of Colorado
Boulder
*Next-Generation Experimental
Probes of Hot and Dense Nuclear
Matter*



Leslie A. Rogers

Astronomy, University of Chicago

Searching for Water in Distant Worlds: Connecting the Atmospheric and Bulk Compositions of Sub-Neptune-Size Planets



David A. Strubbe

Physics, University of California, Merced

Light-induced Structural Dynamics in Materials: New Theoretical Insight into Ultrafast Phenomena



Jessica K. Werk

Astronomy, University of Washington

The Observational Signatures of Cosmic Gas Flows in a Hydrodynamic Framework



Brenda M. Rubenstein

Chemistry, Brown University

Advancing Chemistry through Data Science: Catalyst Design via Data-Enabled Quantum Chemistry and Integrating Data Science into the Chemistry Curriculum



Claire P. Till

Chemistry, Humboldt State University

Scandium and Iron: Parallels in Chemical Reactivity, and Reducing the Opportunity Gap in the HSU Chemistry Department and Beyond



Lorenzo Sironi

Astronomy, Columbia University

To B or Not to B: The Birth and Death of Magnetic Fields in the Universe



Jesus M. Velazquez

Chemistry, University of California, Davis

Achieving Energy Conversion Functionality through Compositional Modification: The Role of Metal Promotion in Chalcogenide Frameworks

Cottrell Scholars 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 this Cottrell Scholars Collaborative program, RCSA funded three projects in 2020 at \$25,000 each.

Moving the Dial: A Network for Systematic Change

This project seeks to support broader diversification and improved equity and inclusion in science by building a national network of Scholars researching specific areas of DEI and creating readily disseminatable products.

Lead Cottrell Scholar:

Rory Waterman

Chemistry, University of Vermont

In collaboration with additional Cottrell Scholars:

Nandini Ananth

Chemistry, Cornell University

Ashleigh Baber

Chemistry, James Madison University

Lou Charkoudian

Chemistry, Haverford College

Laura Chomiuk

Physics and Astronomy, Michigan State University

Nancy Forde

Physics, Simon Fraser University

Carla Fröhlich

Physics, North Carolina State University

Jordan Gerton

Physics and Astronomy, University of Utah

Amanda Hargrove

Chemistry, Duke University

Rigoberto Hernandez

Chemistry, Johns Hopkins University

Geoff Hutchison

Chemistry, University of Pittsburgh

Kristen Koutmou

Chemistry, University of Michigan

Tim Kowalczyk

Chemistry, Western Washington University

Aaron Leconte

Chemistry, Claremont MacKenna College

Dinah Loerke

Physics and Astronomy, University of Denver

Gina MacDonald

Chemistry and Biochemistry,
James Madison University

Ellen Matson

Chemistry, University of Rochester

Charles McCrory

Chemistry, University of Michigan

Nikki Pohl

Chemistry, Indiana University Bloomington

Sarah Reisman

Chemistry and Chemical Engineering,
California Institute of Technology

Chad Risko

Chemistry, University of Kentucky

David Strubbe

Physics, University of California, Merced

Jesús M. Velázquez

Chemistry, University of California, Davis

Seeing is Believing: Enhancing the Visualization of Atoms, Molecules, and Materials Using Augmented and Virtual Reality

This collaborative aims to develop a process for using augmented and virtual reality in aiding visualization of atoms, molecules, and materials in an effort to enable students in chemistry and physics courses to visualize concepts where conventional resources often prove inadequate.

Lead Cottrell Scholar:

Katherine Mirica

Chemistry, Dartmouth College

In collaboration with additional Cottrell Scholars:

Geoff Hutchison

Chemistry, University of Pittsburgh

Kah Chun Lau

Physics, California State University, Northridge

Huey-Wen Lin

Physics, Michigan State University

Günther Thiele

Inorganic Chemistry, Freie Universität Berlin, Germany

Diversity, Equity, and Inclusion in the Age of COVID-19: A New STEM Pipeline Model that Grows Undergraduate Research at Minority-Serving Institutions via Collaboration, Personnel Exchange and Online Training

The goal of this award is to increase underrepresented minority participation in STEM fields by developing a new pipeline model that combines high-quality collaborative research with research exchanges, available to first year undergraduates at historically Black or Hispanic-serving colleges and universities.

Lead Cottrell Scholar:

Shane Ardo

Chemistry, University of California, Irvine

In collaboration with additional Cottrell Scholars:

Shannon Boettcher

Chemistry and Biochemistry, University of Oregon

Tom Markland

Chemistry, Stanford University

Yogi Surendranath

Chemistry, Massachusetts Institution of Technology

And with:

Matt Minus

Prairie View A&M University

Niya Sa

University of Massachusetts, Boston

Yixian Wang

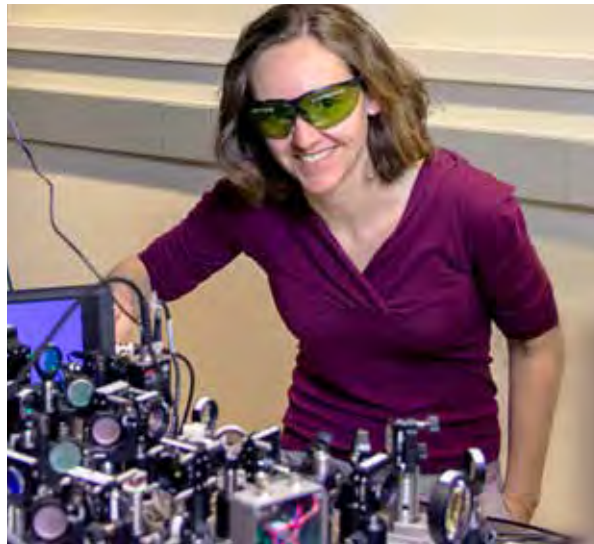
California State University, Los Angeles



2020 Cottrell Scholars Conference

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. Cottrell Plus prizes include FRED, SEED, STAR, and IMPACT awards. FRED is the highest award (\$250,000) for a high-risk, high-reward project with the potential to transform a significant area of research. 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). STAR (Excellence in Science Teaching and Research) awards recognize the outstanding research and educational accomplishments of Cottrell Scholars and encourage the improvement of science education at American and Canadian universities and colleges. STAR and IMPACT (recognizing the work of Cottrell Scholars who have had a national impact in science through leadership and service activities) each award \$5,000 to winners.



Cindy Regal

FRED

Associate Professor of Physics,
University of Colorado Boulder

The 2020 FRED Award was made to Cottrell Scholar 2014 **Cindy Regal**, associate professor of physics at the University of Colorado Boulder. The award will support her efforts to address challenges in nuclear spin detection and imaging, and to broaden approaches to precision mechanical sensing. Her pioneering work could create a new pathway for observing spins through force signatures and perhaps enable 3D imaging at the nanoscale.



Richard Brutchey

SEED

Chemistry, University of Southern California
Optimization of Quantum Dot Nanofabrication Based on High-Throughput Continuous Flow Chemistry



Hanadi Sleiman

SEED

Chemistry, McGill University
UDNA Hydrogels Promoted by Small Molecules: Highly Scalable Synthesis and Stimuli-Responsive Applications in Tissue Regeneration



Helen Blackwell

STAR

Chemistry, University of Wisconsin, Madison
Cottrell Scholar 2005



Mark Bussell

SEED

Chemistry, Western Washington University
Metal Phosphide-Oxide Hybrid Catalysts for Solar Fuels Production



Brian Stoltz

SEED

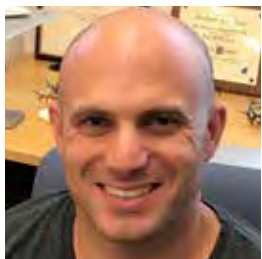
Chemistry and Chemical Engineering, California Institute of Technology
Advancement of Small Molecule Electron Crystallography via MicroED: Leading the Transition from Proofs of Concept to Global Adoption



Julio de Paula

STAR

Chemistry, Lewis and Clark College
Cottrell Scholar 1994



Seth Herzon

SEED

Chemistry, Yale University
Practical Methods for Oxygen-oxygen Bond Formation



Ann West

SEED

Chemistry and Biochemistry, University of Oklahoma
How Does an Anaerobic Microbial Pathogen Sense Oxygen Stress?



Rigoberto Hernandez

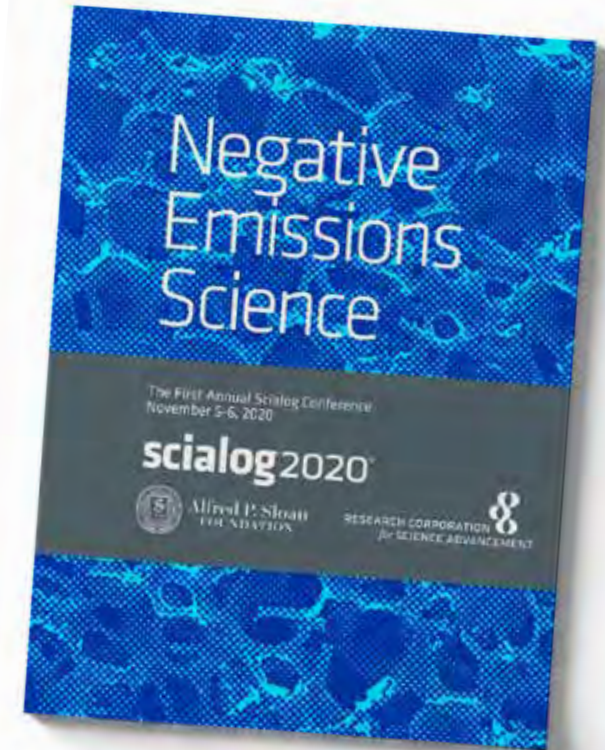
IMPACT

Chemistry, Johns Hopkins University
Cottrell Scholar 1999

Scialog Collaborative Innovation Awards

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 10 leading scientists, convene annually to discuss cutting-edge multidisciplinary themes and propose high-risk collaborative projects.

Due to the pandemic, RCSA convened one Scialog conference in 2020 in which awards were made – the virtual inaugural meeting of the Negative Emissions Science initiative. Through 2020 Scialog Collaborative Innovation Awards, RCSA along with funding partners the Alfred P. Sloan Foundation and the Thistledown Foundation provided a total of \$1,155,000 in seed funding for eight teams’ research.



Scialog: Negative Emissions Science Year 1

Goal: To catalyze chemists, engineers, environmental scientists and those in related fields to collaborate on new and innovative projects to accelerate breakthroughs in the fundamental understanding of capturing and utilizing or sequestering carbon and other greenhouse gases in the atmosphere and oceans that will lead to a sustainable future. Each of the 21 individual awards is \$55,000.

Shaama Mallikarjun Sharada²
Chemical Engineering and Materials Science,
University of Southern California

Burcu Gurkan²
Chemical and Biomolecular Engineering,
Case Western Reserve University

Xiao Su²
Chemical and Biomolecular Engineering,
University of Illinois at Urbana-Champaign
*Electrifying Humidity-Swing Adsorption for DAC by
Modulation of Redox-Polymer Hydration*

William Bowman²
Materials Science and Engineering,
University of California, Irvine

Eva Nichols²
Chemistry, University of British Columbia

Robert Coridan²
Chemistry and Biochemistry, University of Arkansas
*Using Electrochemistry to Improve Selectivity of
Plasma-Assisted CO₂ Reduction*

Kathryn Knowles¹
Chemistry, University of Rochester

Carlos Morales-Guio¹
Chemical and Biomolecular Engineering,
University of California, Los Angeles

Robert Coridan¹
Chemistry and Biochemistry, University of Arkansas
*Integrated Low-Temperature Electrified Process for CO₂ Direct
Air Capture and Transformation to Solid Carbon*

Rafael Santos³
School of Engineering, University of Guelph

Pratik Dholabhai¹
Physics and Astronomy,
Rochester Institute of Technology

Andrea Hicks¹
Civil and Environmental Engineering,
University of Wisconsin-Madison
*Investigation of the Carbonation Dynamics of Synthetic
Silicates: Guiding the Development of Net-Negative Production
Process and Deployment in Enhanced Rock Weathering*

Nanette Boyle¹
Chemical & Biological Engineering,
Colorado School of Mines

Shu Hu³
Chemical and Environmental Engineering,
Yale University

*Bricks from The Ocean: Hybrid Microbial-Electrochemical
Mineralization of CO₂*

Nanette Boyle¹
Chemical & Biological Engineering,
Colorado School of Mines

Chong Liu¹
Chemistry and Biochemistry,
University of California, Los Angeles
*Solar-Augmented Direct Air Capture of Methane
Using Methanotrophic Bacteria*

Greeshma Gadikota³
Civil and Environmental Engineering,
Cornell University

Venkat Viswanathan³
Mechanical Engineering, Carnegie Mellon University
*Envisioning a Low Carbon Built Environment through
Innovative Electrochemical and Chemical Processing of
Construction Materials and Enhanced Circular Reuse*

Wilson Smith¹
Chemical and Biological Engineering,
University of Colorado Boulder

David Kwabi¹
Mechanical Engineering, University of Michigan

Robert Gilliard¹
Department of Chemistry, University of Virginia
*Electrochemically Driven Reactive Capture of CO₂
from Air Using Azolium-Carboxylates*

Total Funding by Source

1: Sloan: \$605,000

2: RCSA: \$330,000

3: Thistledown: \$220,000

COVID-19 Initiative

Detecting and Mitigating Epidemics

RCSA awarded seven teams of scientists a total of \$715,000 for cutting-edge research that could contribute to the global effort to combat the coronavirus. For each proposal, team members were awarded \$55,000 apiece to support the work.

Glycomimetics for Inhibiting SARS-CoV-2 Entry

Nicole Snyder

Chemistry, Davidson College

Collaborating with:

Laura Hartmann

Heinrich-Heine-Universität, Düsseldorf

Mario Schelhaas

Westfälische-Wilhelms-Universität, Münster

Pan-Covid-19 MultiValent Binders (MVBs) to Block Virus Entry

Rommie Amaro

Chemistry and Biochemistry,
University of California, San Diego

Ronit Freeman

Applied Physical Sciences,
University of North Carolina at Chapel Hill

Carlos Simmerling

Chemistry, Stony Brook University

Establishing Swift, Sensitive, and Selective (3S) Sensing Technologies – Going Beyond RT-PCR

Ronit Freeman

Applied Physical Sciences,
University of North Carolina at Chapel Hill

Zachary Schultz

Chemistry and Biochemistry,
The Ohio State University

Modulating Ribosomal Frameshifts to Interfere with Viral Protein Translation

Stephen Fried

Biophysics, Johns Hopkins University

Matthias Heyden

Molecular Sciences, Arizona State University

Carlos Simmerling

Chemistry, Stony Brook University

Targeting the SARS-CoV-2 Frameshift Site Pseudoknot

Amanda Hargrove

Chemistry, Duke University

Katie Mouzakis

Chemistry, Loyola Marymount University

Collaborating with:

Victoria D'Souza

Harvard University

Gary Brewer

Rutgers Robert Wood Johnson Medical School

A New Technology to Assess COVID-19 Serosurveillance

Neil Kelleher

Chemistry, Northwestern University

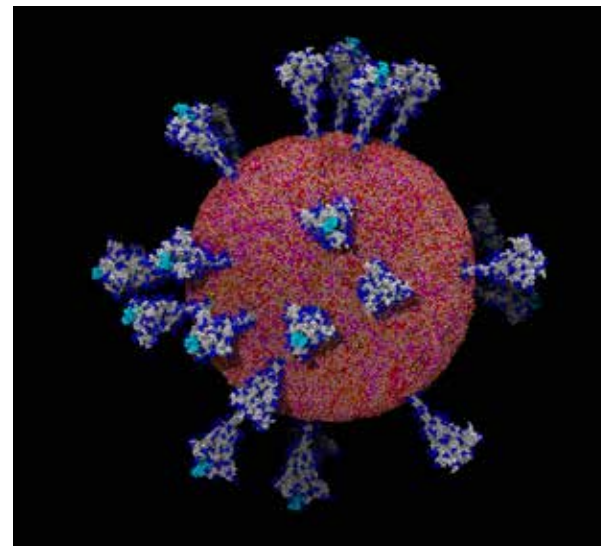
Collaborating with:

Paul Thomas, Eleonora Forte, Rafael Melani,

Richard LeDuc, Daniela Ladner,

Alexander (Sasha) Misharin and Huiping Liu

Northwestern University



SARS-CoV-2 illustration: Rommie Amaro,
University of California San Diego

Electric Field-Driven Antigen Enrichment to Achieve Detection of SARS-CoV-2 Nucleocapsid Protein in Urine at the Point-of-Need

Robbyn Anand

Chemistry, Iowa State University

Cottrell Fellowships

RCSA awarded \$831,250 to 13 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. Four of these awards were funded through a \$340,000 grant from the National Science Foundation.

Seth Cohen (on behalf of postdoc **Kyle Bentz**)
University of California, San Diego
*Cottrell Fellowship – Dr. Kyle Bentz –
MOF-polymer Hybrid Materials*

Jahan Dawlaty (postdoc **Sohini Sarkar**)
University of Southern California
*Designer Electric Fields at Interfaces to
Influence Electrocatalysis*

Luis Campos (postdoc **Rinat Meir**)
Columbia University
*Photon Upconversion Biomaterials for Light-Activated
Tissue Engineering*

Sarbajit Banerjee (postdoc **Rachel Davidson**)
Texas A&M University
*Developing Design Rules for Accessing Metastable Solids
through Global Exploration of Synthetic Landscapes*

John Fourkas (postdoc **Nikos Liaros**)
University of Maryland, College Park
*2-Beam Action Spectroscopy for Elucidating Complex
Nonlinear Optical Phenomena in Emerging 2D Materials*

Teri Odom (postdoc **Shikai Deng**)
Northwestern University
Core-shell Plasmonic Nanoparticle Lattices

Frank Leibfarth (postdoc **Aaron Teator**)
University of North Carolina at Chapel Hill
*Metal-Free, Controlled Stereoselective Polymerization
of Vinyl Ethers*

Maura McLaughlin (postdoc **Dustin Madison**)
West Virginia University
*Innovative Gravitational Research and Creative Curricular
Development: A Bridge to a Career as a Teacher-Scholar*

Kevin McFarland (postdoc **Daniel Ruterbories**)
University of Rochester
*Neutrino-Nucleus Interaction Studies for Neutrino
Interferometry, and a Flipped Classroom for Vulnerable STEM
students in Introductory Physics in the COVID19 Year*

Vicky Kalogera (postdoc **Diego Munoz**)
Northwestern University
*Distorted Accretion Disks: The Restless Environments
of Planet-Forming Systems*

Lorenzo Sironi (postdoc **Lucca Comisso**)
Columbia University
Unveiling Particle Energization in Astrophysical Plasmas

Brent Melot (postdoc **Ahamed Irshad**)
University of Southern California
*Solid Electrolytes with Dual Li⁺ and F⁻ ion Conductivity to
Overcome the Barrier of Gravimetric Capacity*

David Ginger (postdoc **Connor Bischak**)
University of Washington
*Machine Learning Guided Investigations of Structure Function
Relationships in Organic Mixed Ionic Electronic Conductors*

Cottrell Instrumentation Supplements

Following listening sessions with Cottrell Scholars on the challenges of reopening research laboratories and programs during the COVID-19 pandemic, RCSA made awards totaling \$141,000 for new instrumentation (or for updates to existing equipment) needed to continue research and learning at 11 primarily undergraduate institutions. The awards, tailored to individual needs in amounts from \$10,000 to \$20,000, were to be used as a matching-fund commitment for grant applications, or where at least half of the funds to purchase the instrument were identified.

Mario Affatigato

Physics, Coe College

Purchase of a Vickers Microindenter for Glass Studies

Fadi Bou-Abdallah

Chemistry, SUNY Potsdam

Acquisition of an ÄKTA Go Chromatography System to Help Expand and Support Learning and Research at SUNY Potsdam

Mark Bussell

Chemistry, Western Washington University

Instrumentation for Raman Thermometry – Probing Photocatalysis at the Nanoscale

Jason Gillmore

Chemistry, Hope College

Into the Future – Updating a GC and GC/MS Instrumentation Suite at Hope College to Extend Instrument Life and Improve Network Security

Casey Londergan

Chemistry, Haverford College

A New Dynamic Light Scattering Instrument at Haverford College

Ryan McGorty

Physics, University of San Diego

Upgraded Laser-Scanning Confocal Microscope System for Research and Teaching

Gregory O'Neil

Chemistry, Western Washington University

WWU Benchtop NMR Supplement Request

Cedric Owens

Chemistry, Chapman University

A Request to Fund the Purchase of a Fermenter, A Vessel for Learning and Knowledge Creation

Shahir Rizk

Chemistry, Indiana University at South Bend

Surface Plasmon Resonance (SPR) for Analysis of Biomolecular and Surface Interactions

George Shields

Chemistry, Furman University

Acquisition of Computing Nodes to Support Experimental Research at Furman University

Thomas Solomon

Physics, Bucknell University

Instrumentation for Bucknell's Biophysics Program

2020 Year in Review

January

An American Institute of Physics National Task Force to Elevate African American Representation in Undergraduate Physics & Astronomy (TEAM-UP) spent two years investigating reasons for the persistent underrepresentation of African Americans in physics. RCSA provided funding to support this groundbreaking report, *"The Time Is Now: Systemic Changes to Increase African Americans with Bachelor's Degrees in Physics and Astronomy,"* which was released at the American Astronomical Society meeting. **Philip "Bo" Hammer**, Senior Director, American Institute of Physics, who often works with Cottrell Scholar Collaborative teams, played a key role as a task force member.

Cottrell Scholar 1999 **Karen Bjorkman** was named provost and executive vice president for academic affairs at The University of Toledo.

RCSA was a sponsor of the free Arizona Science Lecture Series for 2020, *"Catalysts of Change,"* in Tucson, Ariz. The lectures explored the catalysts – both positive and negative – influencing the pace of global change and how these scientific advances will profoundly impact how we live 20 years from now and beyond.

Scialog: Advanced Energy Storage Fellow **Kimberly See**, Chemistry and Chemical Engineering, California Institute of Technology, was named the 2019 recipient of the prestigious international Science Award Electrochemistry. The



UCSD Vice Chancellor for Research Sandra Brown and RCSA President and CEO Daniel Linzer

award, a joint initiative of Volkswagen and BASF, is aimed at young scientists of excellence. Kimberly was recognized for her outstanding contribution to research into multivalent ion and sulfur batteries.

February

RCSA was honored February 19 at a daylong University of California, San Diego, symposium celebrating philanthropy's role in the future of science. The event, *"Anticipating the Future of Science: A Look Back and a Look Ahead,"* brought together university officials, RCSA-funded scientists, and representatives from philanthropies to celebrate the importance of foundation support in driving scientific research. Early-career faculty at UCSD and the University of San Diego spoke on the impact of RCSA funding on their research and careers.

Three Cottrell Scholars and two Scialog Fellows received 2020 Sloan Research Fellowships of \$75,000: CS 2017 **Amanda Hargrove**, Chemistry, Duke University; CS 2020 **Frank Leibfarth**, Chemistry, The University of North Carolina at Chapel Hill; CS 2018 **Sean Roberts**, Chemistry, The University of Texas at Austin; Advanced Energy Storage Fellow **Kelsey Hatzell**, Chemical & Biomedical Engineering, Vanderbilt University; and Time Domain Astrophysics Fellow **Erik Petigura**, Physics & Astronomy, UCLA.

2018 Cottrell Scholar **Lisa Ryno**, Chemistry, Oberlin College, is leading a new mentoring program for underrepresented students in the sciences, called PERSIST. She wants participants to interact with faculty, learn about work in a research lab, and leave the program thinking, “I can be a scientist.”

Judith Su, Optical Sciences and Biomedical Engineering, University of Arizona, was featured in the 2020 SPIE Women in Optics planner highlighting “women who are making a difference through their work and other contributions to the fields of science, optics, and engineering.” SPIE is the international society for optics and photonics. Su is a Scialog: Chemical Machinery of the Cell Fellow and a recipient of two Scialog Collaborative Innovation Awards,

Four Cottrell Scholars were named 2019 American Association for the Advancement of Science

(AAAS) Fellows: CS 2004 **Vicky Kalogera**, Physics & Astronomy, Northwestern; CS 1999 **Steve Bradforth**, Chemistry, University of Southern California; CS 2013 **Zach Schultz**, Chemistry, The Ohio State University; and CS 1994 **George Shields**, Chemistry, Furman University.

CS 1994 **George Shields** was named a 2020 Council on Undergraduate Research Fellow for facilitating undergraduate research, scholarship, and creative activities through mentorship and demonstrated leadership activities.

CS 2016 **Di Xiao**, Physics, Carnegie Mellon University, and students published an Editors’ Suggestion in Physical Review Letters. Their paper, “*Tunable Layer Circular Photogalvanic Effect in Twisted Bilayers*,” shows that circularly polarized light at normal incidence is predicted to induce a static out-of-plane dipole moment in twisted bilayer structures.

CS 1999 **Rigoberto Hernandez**, Chemistry, Johns Hopkins University, was awarded RCSA’s 2020 IMPACT Award in recognition of more than a decade of effort helping scientists develop the skills they need to grow into leadership roles beyond the classroom or research lab, as well as his commitment to removing the barriers that inequitably affect scientists in pursuing research careers.

Two Cottrell Scholars were named recipients of 2020 STAR Awards. CS 2005 **Helen Blackwell**, Chemistry, University of Wisconsin, Madison, was honored as

an innovator at the interface of chemistry and biology whose work is playing a pioneering role in the field of bacterial quorum sensing. CS 1994 **Julio de Paula**, Chemistry, Lewis & Clark College, was recognized as a researcher, educator and leader who is having a broad impact on science, his students and colleagues, and science education around the world.

March

CS 2013 **Eric Schelter**, Chemistry, University of Pennsylvania, received the American Chemical Society’s 2020 Inorganic Chemistry Lectureship Award. He presented his research on the challenges associated with recycling heavy-duty batteries and electronics at the ACS Fall National Meeting.

Rigoberto Hernandez was interviewed about his career and the need for diversity in the scientific community in the American Chemical Society’s student member magazine, inChemistry. “Diversity allows people to look at solving problems in different ways, using different perspectives,” he said.

CS 2020 **Glen O’Neil**, Chemistry, Montclair State University, earned a National Science Foundation CAREER grant to measure neurotransmission pathways in and around cells, and to increase retention of community college transfer students by engaging them in research.

April

About 120 members of the RCSA community—Cottrell Scholars, Scialog Fellows, and Scialog Facilitators—engaged in a series of online meetings the week of April 20 as part of RCSA's COVID-19 Initiative: Detecting and Mitigating Epidemics. In facilitating the emergency initiative, RCSA aimed to spark collaboration and catalyze rapid responses through immediate funding opportunities for highly promising research projects directly addressing the current pandemic or future pandemics. Seven proposals were funded. (By late 2020, all teams had made progress, with a few notable attainments. The team led by **Rommie Amaro**, Chemistry and Biochemistry, University of California, San Diego, published a paper in ACS Central Science on molecular motions of spike protein and its impact on binding ACE2, its cellular receptor. These findings will enable teammates to design and test inhibitors of spike-ACE2 binding. **Neil Kelleher**, Chemistry, Northwestern University, secured add-on funding for his project researching a new technology to assess COVID-19 serosurveillance. **Robbyn Anand**, Chemistry, Iowa State University, has achieved uniform and reproducible electrokinetic concentration for lateral flow assay strips to enhance sensitivity. The current test strip is targeted to SARS-CoV-2, and can readily be adapted for any other viral antigen in the future.)

Five Cottrell Scholars were honored by the Dreyfus Foundation as 2020 Camille Dreyfus Teacher Scholars: CS 2020 **Frank Leibfarth**, Chemistry,

University of North Carolina at Chapel Hill; CS 2019 **Ellen Matson**, Chemistry, University of Rochester; CS 2019 **Katherine Mirica**, Chemistry, Dartmouth College; CS 2019 **Alison Narayan**, Chemistry, University of Michigan; and CS 2018 **Alex Spokoyny**, Chemistry, University of California, Los Angeles.

CS 2005 **Teri Odom**, Chemistry, Northwestern University, was elected to the American Academy of Arts and Sciences. Academy members are world leaders in the arts and sciences, business, philanthropy, and public affairs.

May

Three Cottrell Scholars were elected members of the National Academy of Sciences in recognition of their distinguished and continuing achievements in original research: CS 1999 **Scott J. Miller**, Chemistry, Yale University; CS 1999 **Dmitri Basov**, Physics, Columbia University; and CS 2000 and 2018 Nobel laureate **Donna Strickland**, Physics, University of Waterloo, Canada.

Nearly 100 Cottrell Scholars met online May 26 and 29 to launch RCSA's new series of virtual meetings, called Cottrell Scholar Conversations. In the absence of an in-person conference this year, the meetings were designed to keep the Cottrell Scholar community engaged through dialogue and problem-solving around issues of importance to teacher-scholars. The first meetings, on the topic of

"Reopening Research Laboratories and Programs," were attended by established faculty as well as members of the new Cottrell Scholar class of 2020. "Thank you for putting these conversations together," one participant said. "It has been helpful to connect with my peers to share stories and to help each other through these challenging times."

Research by CS 2016 **Maiken Mikkelsen**, Physics, Duke University, has demonstrated new ways to boost the brightness of fluorescent markers using plasmonic silver nanocubes, enhancing the ability of low-cost diagnostic tests to detect viruses and other biomarkers.

June

RCSA welcomed two outstanding teacher-scholars to its Cottrell Scholar community: **Ann-Christin Pöppler**, Chemistry, Julius-Maximilians-Universität Würzburg, and **Günther Thiele**, Chemistry, Freie



Ann-Christin Pöppler

Günther Thiele

Universität Berlin's Institute for Chemistry and Biochemistry. Based on RCSA's Cottrell Scholar Award, the Fulbright-Cottrell Award recognizes junior faculty in chemistry, physics, and astronomy for integrating top-notch research with creative teaching. Recipients take part in RCSA's Cottrell Scholar conferences and meetings, and may collaborate on team projects.

A year after three astronomers met at a Scialog: Time Domain Astrophysics conference, sponsored by RCSA and the Heising-Simons Foundation, the research project they envisioned won a nearly \$300,000 grant from the National Science Foundation. "This award would not have happened without Scialog," said **Jason Nordhaus**, Physics, Rochester Institute of Technology National Technical Institute for the Deaf. As the project's principal investigator, he will be collaborating with **Philip Muirhead**, Astronomy, Boston University, and **Maria Drout**, Astronomy and Astrophysics, University of Toronto. The project will study binary star evolution through an observational survey of galactic star clusters and will offer much-needed summer research opportunities for deaf and hard-of-hearing students at RIT.

In a series of interviews with grantees, three members of RCSA's first class of Cottrell Scholars recalled the long-term impact of their 1994 awards. **René Walterbos**, former head of the Department of Astronomy and professor emeritus at New Mexico

State University, says it helped launch his early research on diffused ionized gas in nearby galaxies at a time when few people were working on it, enabling him to become established in the field. Discussions about peer instruction helped shape his approach to education. **Nancy Makri**, professor of chemistry and physics, University of Illinois at Urbana-Champaign, said give-and-take with her Cottrell Scholar colleagues has been invaluable to her as an educator, helping students make the connections they need to understand her research. **Mark Bussell**, professor of chemistry at Western Washington University, said being a part of the RCSA community has offered distinct benefits at different stages of his career.

July

More than 150 teacher-scholars gathered online July 8-10 for the 26th Annual Cottrell Scholar Conference, centered on the theme of "*Challenges and Opportunities with Online Education*." Keynote speaker and CS 2007 **Jordan Gerton**, Physics & Astronomy, University of Utah, said the move to online education is an opportunity for meaningful change, urging faculty to "disrupt convention and lead efforts to remake STEM education into a more equitable and inclusive enterprise."

CS 2012 **Will Dichtel**, Chemistry, Northwestern University, CS 2015 **Luis Campos**, Chemistry, Columbia University, and Scialog: Time Domain

Astrophysics Fellow **Brian Metzger**, Physics, Columbia University, were among 31 rising stars in science named Blavatnik Award finalists.

CS 2002 **Jané Kondev**, Physics, Brandeis University, was named a 2020 Simons Investigator.

RCSA's Scialog initiatives received kudos as effective ways for philanthropy to spark needed discoveries at a July webinar on clean energy storage hosted by the Climate Leadership Initiative and the Science Philanthropy Alliance. "We need new people in the field, and they need funding they can't get from federal sources," said Nobel Laureate **M. Stanley Whittingham**, inventor of the first rechargeable lithium ion battery and Facilitator at Scialog: Advanced Energy Storage, sponsored by RCSA and the Alfred P. Sloan Foundation. Scialog is "The kind of thing that may get totally new ideas into the pipeline."



M. Stanley Whittingham

CS 2014 **Shannon Boettcher**, Chemistry, University of Oregon, published a paper in *Science*, “*Accelerating water dissociation in bipolar membranes and for electrocatalysis*.”

CS 1994 **Herbert Fertig**, Physics, Indiana University at Bloomington, published an Editors’ Suggestion in *Physical Review Letters*. This work is an unanticipated outcome from his 2019 Cottrell SEED award project.

Two members of the RCSA community were named 2020 Laureates of the Blavatnik National Awards for Young Scientists. CS 2012 and 2018 FRED Award winner **Will Dichtel**, Chemistry, Northwestern University, was noted for “pioneering methods to create novel, porous materials from simple, carbon-based building blocks.” Scialog: Time Domain Astrophysics Fellow **Brian Metzger**, Physics, Columbia University, was noted for “settling a long-standing question about the origin of gold and other heavy elements in the universe.”

CS 2014 **Cindy Regal**, Physics, University of Colorado Boulder, was named the 2020 recipient of RCSA’s Cottrell Frontiers in Research Excellence and Discovery (FRED) Award. The \$250,000 award recognizes and rewards innovative research that could transform an area of science. Regal’s research program to date has focused on quantum information and quantum optics. She has both contributed to the development of atomic quantum

bits and devised ways to cool and detect motion of tangible objects at their quantum ground state, bringing mechanical vibrations of solids to the toolbox of quantum physicists.

RCSA announced a new initiative to begin in 2021. Scialog: Advancing Bioimaging, sponsored by RCSA and the Chan Zuckerberg Initiative, with support from the Frederick Gardner Cottrell Foundation, will address challenges in enhancing high-resolution imaging of tissues to support basic science and the treatment of disease.

Scialog: Molecules Come to Life Fellow **Pankaj Mehta**, Physics, Boston University, and colleagues published a paper in *Physical Review Letters* selected as an Editors’ Suggestion and featured in *Physics*. The paper presents a model of how resource dynamics dictate species diversity for some types of ecosystems. Pankaj said: “We have gotten interested in trying to formulate a ‘statistical mechanics of ecology’— in part due to the success of our Scialog project.”

August

Two Cottrell Scholars were selected 2020 American Chemical Society Fellows for outstanding achievements in and contributions to science, the profession, and ACS: CS 2009 **Penny Beuning**, Chemistry, Northeastern University, and CS 1994 **George Shields**, Chemistry, Furman University.

As part of its response to the COVID-19 pandemic, RCSA awarded more than \$800,000 in 13 Cottrell Fellowships to support the work of postdocs affected by institutional hiring freezes. Four of these awards were funded through a grant from the National Science Foundation. “This stopgap funding has been so valuable,” said CS 2009 **Maura McLaughlin**, Physics, West Virginia University. As an example, support from the fellowship enabled McLaughlin’s postdoc **Dustin Madison** to co-author four publications, submit a first-author paper, continue his research, and secure several faculty interviews.

CS 2015 (and Scialog: Microbiome, Neurobiology and Disease Facilitator) **Emily Balskus**, Chemistry and Chemical Biology, Harvard University, was named a 2020 NSF Alan T. Waterman Awardee. The award recognizes researchers age 40 or younger who demonstrate exceptional individual achievements in scientific or engineering research. “Balskus has opened up novel ways to explore and exploit the chemistry and biology of microbes that live in our bodies and how they are linked to our health. And we’re already seeing the potential impact,” the NSF said in announcing the award.

RCSA made Cottrell Instrumentation Supplements of \$141,000 for new instrumentation (or for updates to existing equipment) needed to continue research and learning at 11 primarily undergraduate institutions. The emergency initiative follows listening sessions with Cottrell Scholars on the

challenges of reopening research laboratories and programs during the COVID-19 pandemic. Many expressed concerns about the near- and long-term support for research activities at their institutions due to the devastating financial impact of the crisis. CS 1994 **Mark Bussell** said the supplemental funding allowed him to purchase components for a gas flow system (for in situ sample treatment) permanently installed adjacent to a new Raman microscope, instead of having to shuttle components from his lab, a 5-minute walk away. He called it “a real win-win situation for me and Western Washington University in general!”

Scialog: Time Domain Astrophysics Fellow **Jackie Faherty**, Department of Astrophysics, American Museum of Natural History, CS 2019 **Kerstin Perez**, Physics, Massachusetts Institute of Technology, and CS 2014 and FRED Award recipient **Cindy Regal**, Physics, University of Colorado Boulder, are three of the women scientists to be celebrated in a multicity public art series called FINDINGS. The project is supported by the Heising-Simons Foundation, co-sponsor of our Scialog TDA and Signatures of Life in the Universe initiatives.

CS 1999 **Mike Schatz**, Physics, Georgia Tech, and colleagues published a cover article in *Physical Review Letters* titled “*Capturing Turbulent Dynamics and Statistics in Experiments with Unstable Periodic Orbits.*”

RCSA announced six winners of its competitive SEED (Singular Exceptional Endeavors of Discovery) Awards for 2020. Recipients are: CS 2010 **Richard Brutchey**, University of Southern California; CS 1994 **Mark Bussell**, Western Washington University; CS 2012 **Seth Herzon**, Yale University; CS 2002 **Hanadi Sleiman**, McGill University; CS 2003 **Brian Stoltz**, California Institute of Technology; and CS 1999 **Ann West**, University of Oklahoma. This year’s recipients represent different subfields within chemistry, such as materials, biochemistry, organic chemistry and catalysis.

Daniel Rabinovich, professor of chemistry at the University of North Carolina at Charlotte, will receive the 2021 American Chemical Society National Award for Research at an Undergraduate Institution, sponsored by RCSA. Dan is a previous RCSA awardee who received Cottrell College Science Award funding in 1998 and 2001.

Two Cottrell Scholars were American Chemical Society 2021 national award winners. CS 2004 **Paul Chirik**, Chemistry, Princeton University, will receive the Gabor A. Somorjai Award for Creative Research in Catalysis. CS 2006 **Melanie Sanford**, Chemistry, University of Michigan, Ann Arbor, will receive the ACS Award in Organometallic Chemistry.

CS 2012 (and FRED Award recipient) **Sarah Reisman**, Chemistry & Chemical Engineering, California Institute of Technology, and CS 2008 **Tehshik Yoon**,

Chemistry, University of Wisconsin, Madison, were among the authors of an editorial in *ACS Central Science* arguing for the importance of diversifying the chemistry community.

In partnership with the U.S. Department of Agriculture, RCSA announced a new initiative, Scialog: Mitigating Zoonotic Threats. Set to begin in 2021, it aims to address the global threat to human health from animal-borne infectious diseases.

September

Nearly 50 teacher-scholars met online September 15 and 18 to discuss “*Maintaining Student Engagement During COVID-19,*” the latest in RCSA’s series of Cottrell Scholar Conversations. Participants said that while they and their students face multiple challenges with online or hybrid models of education, some online tools and techniques present opportunities for better and more equitable teaching.

Eight members of RCSA’s community were named 2020 American Physical Society Fellows. Cottrell Scholars include: CS 2009 **Kathy Aidala**, Physics, Mount Holyoke College; CS 2009 **Robert McDermott**, Physics, University of Wisconsin, Madison; CS 2014 **Joe Subotnik**, Chemistry, University of Pennsylvania; and CS 2013 **Xiaodong Xu**, Physics, University of Washington. Scialog Fellows include: Molecules Come to Life Fellows **Ajay Gopinathan**,

Physics, University of California, Merced, and **Raghuveer Parthasarathy**, Physics, University of Oregon; and Chemical Machinery of the Cell Fellow **Kandice Tanner**, Cell Biology and Physiology, National Cancer Institute. Also named was a 2003 Cottrell College Science Award recipient, **Scott Franklin**, Physics, Rochester Institute of Technology.

RCSA's Senior Program Director **Richard Wiener** was named a 2020 American Physical Society Fellow "for leadership on creating Scialog, a unique and highly effective platform for networking early-career scientists and seeding high risk interdisciplinary research to make advances in fundamental science with the long-term goal of solving important global challenges." Wiener joined RCSA in 2006.

In a paper published in ACS Science, COVID-19 Initiative awardee and Scialog: Chemical Machinery of the Cell Facilitator **Rommie Amaro** described how she used molecular dynamics simulations to model SARS-CoV-2 spike glycan shield, illustrating how it modulates conformational dynamics and binding to host protein ACE2. This computational effort laid the groundwork for further experiments on potential inhibitors.

October

Reinhard Genzel, University of California, Berkeley, and the Max Planck Institute for Extraterrestrial

Physics, Garching, Germany, was awarded a share of the 2020 Nobel Prize in physics for his work with **Andrea Ghez**, UCLA, to discover a "supermassive compact object at the center of our galaxy." Genzel and Ghez shared the Nobel Prize with **Roger Penrose**, Oxford University. Genzel was part of the German collaboration that helped launch the RCSA-supported Large Binocular Telescope (LBT) on Mount Graham in Arizona, as well as a 1982 RCSA grant recipient for a far-infrared and submillimeter laser for astronomical spectroscopy. Reinhard is the 41st RCSA awardee to become a Nobel laureate.

Gordon Jones, Physics, Hamilton College, was awarded the American Physical Society's 2021 Prize for a Faculty Member for Research in an Undergraduate Institution. The award is sponsored by RCSA. Jones was cited for "outstanding contributions to fundamental neutron physics, development of neutron polarizers using



Reinhard Genzel

optically polarized helium-3, and extraordinary engagement and education of undergraduate students." The physics department at Hamilton College is a previous recipient of an RCSA Department Development Award. "I have been blessed with a departmental culture of research which was fostered and encouraged by the Department Development Award," Jones said. "That was a short period a long time ago, but it has had an outsized impact on our culture, and will for a long time to come."

Rommie Amaro, one of RCSA's COVID-19 Initiative awardees and a Facilitator of Scialog: Chemical Machinery of the Cell, was featured in a New York Times article, "*The Coronavirus Unveiled*." Accompanied by visualizations of the coronavirus created by her lab, it highlighted the work Rommie and her team are doing using simulations of the virus to try to understand how it infects cells.

Meeting at Scialog: Time Domain Astrophysics sparked the idea, and an RCSA team award provided support for the initial proof-of-concept study by three researchers: Scialog Fellows **Sukanya Chakrabarti**, Physics & Astronomy, Rochester Institute of Technology, **Daniel Huber**, Astronomy, University of Hawaii, and **Robyn Sanderson**, Physics & Astronomy, University of Pennsylvania. The team won new National Science Foundation (NSF) funding that will allow them to apply this method

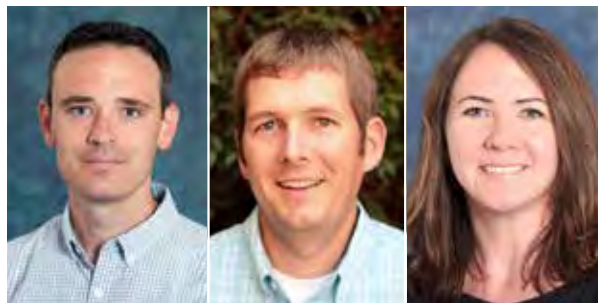
to a much larger sample, mapping distances across the galaxy, and to involve local undergraduates in an astronomical research program.

More than 60 researchers with a wide variety of expertise in chemistry, biology, and related fields explored ideas for collaborative research at the third meeting of Scialog: Chemical Machinery of the Cell, held virtually on October 9. Cosponsored by RCSA and the Gordon and Betty Moore Foundation, the initiative aims to develop interdisciplinary projects that advance understanding of chemical machinery and reactions in the intact, living cell.



Scialog: Chemical Machinery of the Cell meeting

Three members of RCSA's community of scientists were among an interdisciplinary team awarded a National Science Foundation grant to advance discovery and design of energy storage materials. CS 2018 and Scialog: Advanced Energy Storage



Chad Risko, Scott Shaw and Susan Odom

Fellow **Chad Risko**, Chemistry, University of Kentucky, is the principal investigator on the project. CS 2016 **Scott Shaw**, Chemistry, University of Iowa, and Scialog AES Fellow **Susan Odom**, Chemistry, University of Kentucky, are co PIs. **Baskar Ganapathysubramanian**, Iowa State University, and **Sara Mason**, University of Iowa, are also co-PIs. The team credits their multiple RCSA connections for sowing the seeds of the project.

CS 2019 **Jonathan Foley**, Chemistry, William Paterson University, published a paper on the role of cavity losses on nonadiabatic couplings and dynamics in polaritonic chemistry in the Journal of Physical Chemistry Letters.

G.W. Gant Luxton, Molecular and Cellular Biology, University of California, Davis, said being a Fellow at Scialog: Chemical Machinery of the Cell played an important role in being named an Allen Distinguished Investigator. "Being able to talk about

our research with representatives from funding agencies like the Paul G. Allen Frontiers Group gives Scialog participants invaluable opportunities to become more than a name on a grant application," he said. Gant and his collaborator **Daniel Starr** received the award to study a protein complex known as LINC, which enables cells to sense and respond to mechanical forces.

Eight years after brainstorming the idea for a collaborative project at the second Scialog: Solar Energy Conversion conference, **Gordana Dukovic**, Chemistry, University of Colorado Boulder, and **Sean Elliott**, Chemistry, Boston University, published their results in the prestigious journal Proceedings of the National Academy of Sciences. The paper describes a system in which semiconductor nanocrystals are coupled to an enzyme to catalyze CO₂ reduction. "Scialog really made this project happen," Elliott said.



Gordana Dukovic and Sean Elliott



Rae Robertson-Anderson

CS 2010 and Scialog: Molecules Come to Life Fellow **Rae Robertson-Anderson**, Physics, University of San Diego, said her career is a great example of how early seed funding can create opportunity over time. For her, early-career discoveries led to cycles of new funding, new avenues of research, and new collaborations.

Three Scialog Fellows were among 20 innovative early-career researchers named 2020 Packard Fellows for Science and Engineering – Scialog: Chemical Machinery of the Cell Fellow **Keriann Backus**, Chemistry, University of California, Los Angeles; Scialog: Advanced Energy Storage Fellow **Kimberly See**, Chemistry and Chemical Engineering, California Institute of Technology; and Scialog: Advanced Energy Storage and Scialog: Negative Emissions Science Fellow **Haotian Wang**, Chemistry, Rice University.

CS 2017 **Monika Schleier Smith**, Physics, Stanford University, was named a 2020 MacArthur Fellow. She is an experimental physicist advancing understanding of many-particle quantum systems.

November

Scialog: Chemical Machinery of the Cell Fellow **Judith Su**, Optical Sciences and Biomedical Engineering, University of Arizona, received a \$1.82 million award from the National Institute of General Medical Sciences, part of the National Institutes of Health, to advance her research in ultrasensitive optical sensing.

Ongoing collaborations involving two Cottrell Scholars in chemistry from SUNY Stony Brook University, CS 2018 **Jarrod French**, and CS 2001 Carlos Simmerling, have resulted in three papers on the group's research into photoreceptor proteins activated by blue light.

CS 2012, 2017 FRED Award winner and Scialog: Solar Energy Conversion Fellow **Sara Skrabalak** was appointed Editor-in-Chief of Chemistry of Materials and ACS Materials Letters.

The team led by **Rommie Amaro**, one of RCSA's COVID-19 Initiative awardees and a Facilitator of Scialog: Chemical Machinery of the Cell, has received the Association for Computing Machinery's first Gordon Bell Special Prize for High Performance Computing-Based COVID-19 Research. Ongoing

collaboration between Amaro, **Ronit Freeman** and **Carlos Simmerling** funded by RCSA builds on this work to leverage the insights and convert them into lead compounds to inhibit viral infection.

Scialog: Time Domain Astrophysics Fellows **Daniel Huber**, Astronomy, University of Hawaii, and **Melissa Ness**, Astronomy, Columbia University, posted a paper on arXiv presenting a new, data-driven technique to infer stellar properties from light curves. The research stems from their 2018 Scialog Team Award. Undergraduate researcher **Maryum Sayeed** is the first author on the paper.

Ten members of RCSA's scientific community were elected Fellows of the American Association for the Advancement of Science in recognition for important contributions to STEM disciplines! For chemistry: CS 2012 **William Dichtel**, Northwestern University; CS 2003 **Nicola Pohl**, Indiana University; CS 1997 **Daniel Raftery**, University of Washington; CS 2012 **Sara Skrabalak**, Indiana University; CS 2009 **Rory Waterman**, University of Vermont; and 2000 Research Innovation Award recipient **Peidong Yang**, University of California, Berkeley. For engineering, Scialog: Solar Energy Conversion Fellow **Michael Chabiny**, University of California, Santa Barbara, and Scialog: Negative Emissions Science Facilitator **Ah-Hung (Alissa) Park**, Columbia University. For physics, CS 1995 **Eberhard Bodenschatz**, Max Planck Institute, and **Eric Mazur**, Harvard University, keynote speaker for Scialog and Cottrell Scholar conferences.

The inaugural meeting of Scialog: Negative Emissions Science initiative was held virtually November 5-6. More than 50 Fellows – from chemistry, engineering, materials science, physics, and related disciplines – were guided by a group of nine Facilitators in brainstorming ideas to advance fundamental science in the design of novel approaches for removing and utilizing or sequestering greenhouse gases, and for making those technologies globally scalable. Keynote speaker **Julia King** of the University of Cambridge, Chair of the United Kingdom's Carbon Trust



Scialog: Negative Emissions Science awardees

and member of the House of Lords, spoke about the urgent need to decarbonize the global economy, and the potential economic impact.

December

The Cottrell Emerging Scholars Program, which received one of four \$25,000 Cottrell Scholar Collaborative awards from RCSA in 2019, is harnessing the power of the Cottrell Scholar network to enhance faculty diversity in the physical sciences at both research-intensive universities and primarily undergraduate institutions. Project lead is CS 2006 **Keivan Stassun**, Astronomy, Vanderbilt University, collaborating with: CS 2006 **Darren Johnson**, Chemistry, University of Oregon; CS 2006 **Adam Leibovich**, Physics, University of Pittsburgh; and CS 2018 **Grace Stokes**, Chemistry, Santa Clara University.

CS 2004 **Paul J. Chirik**, Chemistry, Princeton University, received the 2020 Linus Pauling Medal Award presented by the American Chemical Society Oregon, Portland, and Puget Sound Local Sections. Chirik is recognized for his work to discover new catalysts based on transition metals abundant in Earth's crust and is editor in chief of the ACS journal *Organometallics*.

CS 2007 **Carlos Meriles**, recipient of RCSA's first FRED Award in 2016, said his award has done more than help him make scientific advances opening new routes to quantum information processing



Keivan Stassun

Carlos Meriles

and nanoscale sensing. He said the funding enabled his lab to do more mentoring and training to help bring new people at the minority-serving City College of New York into the scientific life.

Scialog: Solar Energy Conversion Fellow **Ray Schaak**, Chemistry, Pennsylvania State University, was named recipient of the Akron Section Award presented by the American Chemical Society Akron Section. Schaak, whose research focuses on the development of new synthetic tools for catalysis, photonics, and energy conversion and storage, has also served on RCSA's Cottrell Scholar Selection Committee.

In Memoriam

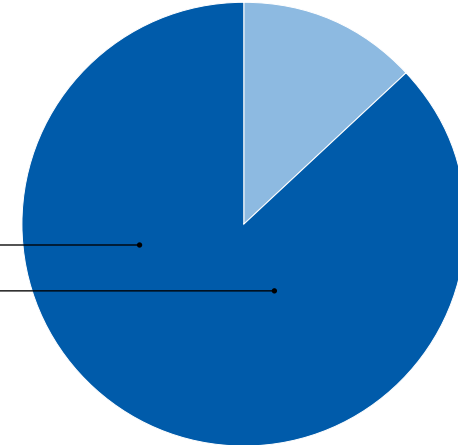
Kathleen Eckert, RCSA Senior Program Assistant
Susan Odom, Scialog: Advanced Energy Storage Fellow

2020 Financial Summary

Program Expenses,
Including Grants & Awards **87%**

General & Administrative Costs **13%**

Total Expenses \$8.3 million



Cottrell Scholars Awards **46%**

Scialog Collaborative Awards
(excludes \$800K in partner awards) **6%**

Cottrell Career Advancement, FRED,
Collaborative Awards **12%**

Discretionary Grants & Special Initiatives **5%**

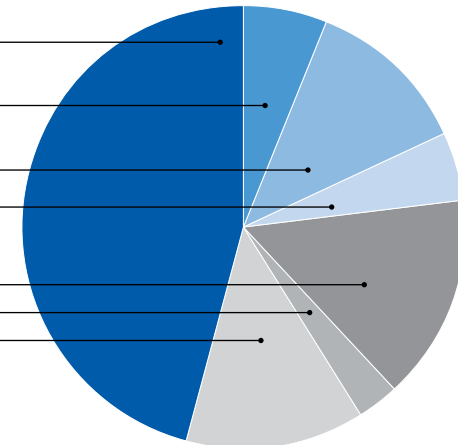
Emergency Initiatives

Cottrell Fellowships (includes NSF support of \$300K) **15%**

Cottrell Instrumentation Supplements **3%**

COVID-19 Initiative **13%**

Grants and Awards \$5.3 million



Net Assets at Beginning of Year **\$188.5 million**

Net Assets at End of Year **\$215.6 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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- Integration of research and science teaching
- Interdisciplinary research
- Building the academic leadership of the future



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