One of the significant advantages that foundations have in supporting science is flexibility to move funds to address sudden and unexpected needs. Spring 2020, with the onset of the pandemic, highlighted this point. At RCSA, we heard from many of the physical scientists we support about new challenges they were facing: faculty had to redevelop courses to teach and evaluate students online; universities closed most faculty searches, and postdoctoral fellows who were expected to move into independent positions had nowhere to go; laboratories, except those working directly on COVID-19, were closed; at many institutions, even once laboratories partially reopened, undergraduates were unable to participate in research; with fewer or no researchers on campus, the business model to sustain shared instrumentation facilities with user fees broke down; and those scientists in fields outside of the biomedical sciences, but with potentially novel approaches to viral detection or to modeling and limiting the spread of infection, were typically excluded from pandemic research conversations.

In response to these issues, RCSA quickly launched initiatives to help. We switched the theme of the annual Cottrell Scholar Conference in summer 2020 to online education, and we created a virtual forum to share best practices and to discuss challenges. For 2020-21 and 2021-22, we offered fellowships to senior postdocs working in the research groups of Cottrell Scholars, and we were able to augment our support with grants from the National Science Foundation. Over the past two years, we provided post-baccalaureate fellowships to undergraduates working with Cottrell Scholars, undergraduates whose research opportunities disappeared or were severely limited during the pandemic; a key consideration for these awards was how each post-baccalaureate fellow would be able to help the Cottrell Scholar after the pandemic rebuild a highly active research program, in part by supervising a new cohort of undergraduate lab members. At primarily undergraduate institutions, many of which experienced significant budget disruptions because of the pandemic, maintaining and replacing scientific instrumentation became a lower priority, so we stepped in to offer support to keep those shared facilities functional. And in 2020, we invited chemists, physicists, and astronomers to several virtual meetings to learn about SARS-CoV2, and to design innovative approaches to analyze, detect, or limit the spread of this virus; RCSA then funded several of the projects that emerged from the discussion.

While we moved forward with these programs, we also had to delay the start of one extremely relevant initiative. In 2019, we developed with the United States Department of Agriculture the plan for a Scialog to bring together early-career scientists from academia and from the USDA to collaborate on promising, out-of-the-box ideas on mitigating zoonotic disease. A few months after finalizing that plan, the rapid spread of a zoonotic disease disrupted our timetable. We did begin that Scialog in 2021, and the enthusiasm and creativity of the Scialog Fellows was no doubt enhanced by the looming and very real public health crisis that has coincided with this three-year sequence of meetings.

With the waning of the pandemic, this annual report provides an opportunity to look back on these initiatives to assess if the redeployment of funds to address what we perceived to be pressing needs was in fact successful. Thus, we take the somewhat unusual step for an annual report of considering initiatives from the past three years, not just 2022. In so doing, we intend to learn from these efforts and to be even better prepared to respond as critically important needs arise again in the future.

Daniel Linzer
President & CEO
Research Corporation for Science Advancement
As the COVID-19 pandemic began, RCSA actively listened to the needs and concerns of our community of scientists, and swiftly developed a suite of pandemic responses. Our ability to adapt enabled us to redeploy funds freed up by the cancellation of in-person events, provided crucial financial support to early career scientists facing career disruptions, and kept program participants engaged with their research and with each other. Now, as the world navigates toward a “new normal,” RCSA reflects on our approaches, our challenges, and the impact of our response.

**COVID-19 Initiative: Detecting and Mitigating Epidemics April 2020**
This Scialog-style virtual workshop brought together 109 Cottrell Scholars, past Scialog Fellows, and Scialog Facilitators from the physical sciences to develop research projects on virus detection and characterization that could be used during this or future pandemics. Expedited proposal submission and review enabled RCSA to make awards in less than five weeks. Lessons learned helped refine the model for future virtual convenings.

**Awards:** 13 awards of $55,000

**Outcomes:** The initiative kept faculty active and resulted in at least 27 publications (several high-profile in the scientific literature as well as popular media), three patents, and significant follow-up funding for several teams.

**Virtual Cottrell Scholar Convenings 2020 and 2021**
RCSA held four virtual meetings during the pandemic to keep the Cottrell Scholar community engaged through dialogue and problem-solving. As before the pandemic, innovative ideas for collaborative projects emerged from these discussions. RCSA funded three Cottrell Scholar Collaborative projects in 2020, and three in 2021.

- A Cottrell Scholar Conversation in May 2020 on the topic of “Reopening Research Laboratories and Programs” was attended by 100 Cottrell Scholars, including established faculty and members of the new class of 2020.
- To respond to the rapid shift from in-person to online courses for the upcoming fall term, the virtual CS Conference in July 2020, “Challenges and Opportunities with Online Education,”

### Pandemic Timeline

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engaged 153 attendees in discussions about virtual lectures and labs, equity, and the assessment of teaching and learning objectives.

A Cottrell Scholar Conversation on online education in September 2020 was attended by 53 teacher-scholars concerned about a host of challenges with online or hybrid models of education, including student stress and accessibility. They shared tips and tools they found effective.

The virtual 2021 CS Conference, “Reimagining Higher Education,” engaged 154 attendees in discussions designed to help convert lessons of the pandemic into sustainable, positive change in classrooms, labs, and across campuses. Participants shared strategies for fighting inequities in academia and pedagogical practices to continue in a post-pandemic world to improve undergraduate and graduate education and the development of postdocs.

**Awards:** 6 awards of $25,000

**Outcomes:** Despite Zoom fatigue and faculty burnout as the pandemic continued, the Cottrell Scholar community remained strong. Open dialogue and sharing of challenges faced by teacher-scholars from different institutions and at different points in their careers generated important ideas for RCSA and partner philanthropies, greatly informing RCSA’s continued pandemic response.

### Cottrell Postdoctoral Fellowships 2020-21 and 2021-22

The sudden closure of faculty searches in response to the pandemic disrupted the plans of many senior postdoctoral fellows who intended to interview for faculty positions in 2020-21 or 2021-22. RCSA offered Cottrell Scholars the opportunity to apply for funding to support an additional postdoctoral year for fellows. Seven of these awards were made possible by two grants from the National Science Foundation, which heard of our effort and encouraged RCSA to expand the initiative. Importantly, awards required that the fellows be provided with significant teaching opportunities to prepare them for a major responsibility as faculty; typically, postdoctoral support focuses entirely on research, and precludes training in pedagogy.

**Awards:** 27 awards of up to $75,000

**Outcomes:** Recipients reported the fellowships provided a much-needed year of additional financial support, teaching opportunities, and research experience that lent a competitive advantage to their later searches for academic positions. All participating postdoctoral fellows stayed in STEM, with 16 securing faculty positions and three finding full-time industrial jobs. Eight are still postdoctoral fellows with plans to interview in fall 2023.

### Cottrell Instrumentation Supplements 2020-21

Many Cottrell Scholars at primarily undergraduate institutions rely on shared instrumentation facilities for research, teaching labs, and lecture demonstrations. When colleges experienced a rapid decline in revenue due to campus shutdowns, their support to maintain or upgrade these essential facilities was at risk. RCSA offered Cottrell Scholars partial support for the cost of new or upgraded “priority” instrumentation, with an institutional match required for at least half of the cost.

**Awards:** 11 awards of up to $20,000

**Outcomes:** Recipients reported significant positive impact on both teaching and research as new instrumentation encouraged collaborations and yielded quality data for publications and grants. Recipients used new or modernized instrumentation to establish seven new techniques.
Cottrell Postbaccalaureate Awards 2021-22 and 2022-23

Many Cottrell Scholars conduct research with undergraduates and rely on more senior students to train new members of the group. PUI laboratory closures during the pandemic resulted in a disruption of research programs and a loss of research opportunities for these students. To help their research programs recover, RCSA offered Cottrell Scholars awards to support undergraduate seniors working under their supervision for a year after graduation.

**Awards:** 16 awards of $50,000

**Outcomes:** These awards enhanced the research programs of the Cottrell Scholars and increased the opportunities of postbacs to be admitted to graduate school or secure science jobs. Their research resulted in two published articles and various manuscripts in preparation, and helped recipients renew or secure new grants. At least six 2022 Postbac Fellows were accepted into graduate programs starting in Fall 2023. Implementation challenges RCSA experienced with this award have been used to design a targeted PUI track for Cottrell SEED awards starting in 2024.

Scialog: Mitigating Zoonotic Threats 2021-23

Planning for this Scialog in partnership with the United States Department of Agriculture was well underway before the onset of the pandemic, but it proved to be eerily on point. The first meeting took place virtually after the pandemic began, so participation and research projects have been very much with COVID-19 in mind.

**Awards:** 42 awards of $50,000 in direct costs

**Outcomes:** Permitting and other delays led to a slow roll-out of many projects, most of which are still ongoing, but one team has received significant ongoing USDA support based on their preliminary data. Collaboration with a new network of academic scientists has been described as “career-transforming” for USDA researchers.

Lessons Learned

While RCSA is always looking for ways to improve the work of the foundation, the COVID-19 pandemic offered us a chance to experiment with new approaches and learn ways to improve current initiatives. Listening to our stakeholders allowed us to target support in very specific ways that had a strong and lasting impact for grantees, and while the pandemic disrupted RCSA’s ability to hold in-person meetings, it presented an opportunity to experiment with virtual meetings, to understand what about face-to-face events is important, and to bring in new practices that make in-person meetings more effective.
In 2022, 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 2022, Cottrell Scholar Program funding included $2,400,000 for 24 initial Cottrell Scholar Awards, $70,000 for Cottrell Scholars Collaborative Awards, and $265,000 for eight Cottrell Plus Awards, which include the competitive SEED, STAR and IMPACT awards. A new initiative, Cottrell Postbac Awards, awarded $450,000 to nine Cottrell Scholars, and one Cottrell Scholar received $5,000 to fund a regional meeting. Scialog promotes dialogue and community-building to catalyze transformational science through collaborative, interdisciplinary research. In 2022, RCSA awarded $1,031,000 to early career scientists for research through Scialog Collaborative Innovation Awards. Partner philanthropies—which in 2022 included the Paul G. Allen Frontiers Group, the Canadian Institute for Advanced Research (CIFAR), the Chan Zuckerberg Initiative, the ClimateWorks Foundation, the Frederick Gardner Cottrell Foundation, the Heising-Simons Foundation, The Kavli Foundation, NASA, the Alfred P. Sloan Foundation, the U.S. Department of Agriculture, and Walder Foundation—contributed a further $5,009,250 toward Scialog awards.
The Cottrell Scholar Program, started in 1994, champions the very best early career teacher-scholars in chemistry, physics, and astronomy by providing significant discretionary awards for research and by nurturing a community of outstanding leaders in science, education, and academia. Although the Cottrell Scholar Award is the entry point to this interdisciplinary community, the program also supports scholars throughout their academic careers with competitive Cottrell Plus awards.

Maintaining an active, multigenerational community of academic scientists is a unique aspect of the Cottrell Scholar program. Cottrell Scholars engage in an annual networking event, providing them an opportunity to share insights and expertise through the Cottrell Scholar Collaborative. As the pandemic eased, Cottrell Scholars met in person at the 2022 Cottrell Scholar Conference, which focused on the theme “Creativity and Innovation in STEM Education.”

“The Cottrell Scholar network has been the most influential network in my career.”

– CS 2015 Jen Heemstra
Cottrell Scholar Awards

$100,000 is awarded to each scholar for a total of $2,400,000

Darcy Barron
Physics, University of New Mexico
Enabling Discoveries in Fundamental Physics by Maximizing the Sensitivity of Cosmic Microwave Background Polarization Surveys from Chile

Scott Cushing
Chemistry, California Institute of Technology
The Role of Picosecond Correlations in Solid-State Electrolytes for Batteries

Ben Feldman
Physics, Stanford University
Thermodynamic Characterization of Metal-insulator Transitions in Dual Gated Moiré Superlattices

Carl Brozek
Chemistry, University of Oregon
Clean Water from Porous Nanocrystals: An Undergraduate Training Program in Soft Skills and Sustainable Materials

Ryan Davis
Chemistry, Trinity University
Chemistry Beyond the Beaker: Exploring Supramolecular Assembly in Aqueous Microdroplets and Addressing Inequities in Chemical Education

Kate Follette
Astronomy, Amherst College
Moving Forward – Towards Accurate Recovery and Interpretation of Accreting Protoplanets and a Socially Just Undergraduate Astronomy Curriculum

Ilse Cleeves
Astronomy, University of Virginia
Identifying Molecular Patterns that Reveal the Chemistry of Planet Formation

Serena Eley
Physics, Colorado School of Mines
Identifying the Microscopic Origins of Energy Loss Mechanisms in Superconducting Quantum Circuits through Defect Landscape Engineering

Wen-fai Fong
Astronomy, Northwestern University
Toward the Next Breakthroughs in Time-Domain Astronomy: The Origins of Fast Radio Bursts
Stephen Fried
Chemistry, Johns Hopkins University
Bringing New Life to Prebiotic Peptide Chemistry and to the Physical Chemistry Curriculum

Ryan Hadt
Chemistry, California Institute of Technology
Research: Learning How to Engineer Spin-Phonon Coupling in Molecules and Materials; Educational: Tackling Theoretical Topics in Inorganic Chemistry: A Worked Example Approach

Christine Hagan
Chemistry, College of the Holy Cross
Mechanistic Studies of Protein Toxin Delivery by Bacterial Contact-Dependent Inhibition Systems

Sarah Keane
Chemistry, University of Michigan
RNA Matchmaker: The Role of Loops and Mismatches in RNA Processing

Daniel Keedy
Chemistry, CUNY Advanced Science Research Center & City College of New York
Illuminating Structural Motions that Underlie Allostery in Dynamic Phosphatase Enzymes

Michael Larsen
Chemistry, Western Washington University
Diverse N-Functionalized Polyureas by Cationic Ring-Opening Polymerization of Iminooxazolidines

Lauren Marbella
Chemistry, Columbia University
Tracking (Electro)Chemical Reduction at Electrode/Electrolyte Interfaces with Operando NMR

Krystle McLaughlin
Chemistry, Vassar College
Structural Basis for the Conjugative Spread of Antibiotic Resistance

Jorge Muñoz
Physics, University of Texas at El Paso
Fast and Accurate Computation of Anharmonic Phonons in Polymorphic Materials
As they climb the ranks in academia, Cottrell Scholars throw down the ladder and coach you and cheer for you as you make it up as well. It has been transformative for me.

— CS 2018 Lou Charkoudian
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 Scholar Collaborative program, RCSA gave awards of up to $25,000 each to four projects in 2022 to support efforts to improve undergraduate and graduate-level science education.

**Supporting Making to Align Research and Teaching (SMART): A Cottrell Collaborative**

This project builds on an existing Cottrell Scholar Collaborative project, Art and the Creative STEM Classroom, which aims to increase awareness of making, an emerging instructional practice where students learn a discipline (and enjoy enhanced creativity and self-expression) by creating shared physical and digital artifacts. The goal of this project is to support and document faculty training and adoption of making methods, as well as to generate examples of making activities in disciplines, such as chemistry and astronomy, that have not adopted this technique.

*Lead Cottrell Scholar:*

**Tim Atherton**  
Physics, Tufts University

*In collaboration with additional Cottrell Scholars:*

**Elisabetta Matsumoto**  
Physics, Georgia Institute of Technology

**Carl Brozek**  
Chemistry, University of Oregon

**Charles Doret**  
Physics, Williams College

**Ben Feldman**  
Physics, Stanford University

**Infusing Computational Science Concepts into STEM Courses through Multidisciplinary Instructor Collaborative Networks**

This project follows on a previous Cottrell Scholar Collaborative effort, Enhancing Science Courses by Integrating Python (ESCIP). The new project aims to create a centralized web resource based on the materials developed by faculty who attended ESCIP workshops virtually in 2020 and in-person in 2022. This resource will enable STEM faculty to collaboratively create and manage educational materials, including notebooks, exercise databases, and best practices guides.

*Lead Cottrell Scholar:*

**Davit Potoyan**  
Chemistry, Iowa State University

*In collaboration with additional Cottrell Scholars:*

**Tim Atherton**  
Physics, Tufts University

**Justin Caram**  
Chemistry, University of California, Los Angeles

**Jay Foley**  
Chemistry, University of North Carolina, Charlotte

**Geoff Hutchinson**  
Chemistry, University of Pittsburgh

**Daniel Keedy**  
Chemistry, City College of New York
Casey Londergan  
Chemistry, Haverford College

Tyler Luchko  
Physics, California State University, Northridge

Britt Lundgren  
Astronomy, University of North Carolina, Asheville

Dennis Perepelitsa  
Physics, University of Colorado, Boulder

Brenda Rubenstein  
Chemistry, Brown University

Brian Shuve  
Physics, Harvey Mudd College

Juliane Simmchen  
Chemistry, Technische Universität Dresden

Grace Stokes  
Chemistry, Santa Clara University

Ruby Sullan  
Chemistry, University of Toronto, Scarborough

Christina Vizcarra  
Chemistry, Barnard College

Lowering Activation Barriers to Success in PChem (LAB-SIP): Towards Better Access to Creative Practice for Students in a Re-envisioned and Re-invigorated Physical Chemistry Curriculum

This project seeks to establish a community framework to rethink and redesign the intimidating and popularly stigmatized physical chemistry curriculum that is taught in most undergraduate chemistry programs in the United States. This collaborative, which envisions more flexible and outcomes-oriented PChem courses that would better serve students of all backgrounds, plans to organize a workshop to identify needs and establish consensus around learning objectives for PChem courses, build on the results of the workshop, and provide shared resources and concrete guidelines to support curricular transition.
The Cottrell Astronomy Network: Collecting and Distributing Resources to Support Undergraduate Astronomy Student Success

Ten Cottrell Scholars in astronomy and physics, facing increased student demand for genuine, in-depth research experiences but a lack of important resources (including time) to accommodate them, formed an informal collaboration at this year’s Cottrell Scholar Conference to pool student-focused educational resources they had developed. This group will convene in conjunction with next year’s conference to lay the groundwork for a summer undergraduate research exchange program and other efforts to share and scale creative solutions in educating a growing number of astronomy and physics students.

Lead Cottrell Scholar:
Jessica Werk
Astronomy, University of Washington

In collaboration with additional Cottrell Scholars:
Darcy Barron
Physics, University of New Mexico
Rachel Bezanson
Astronomy, University of Pittsburgh
Laura Blecha
Physics, University of Florida
Laura Chomiuk
Astronomy, Michigan State University
Carla Fröhlich
Physics, North Carolina State University
Eilat Glikman
Astronomy, Middlebury College
Britt Lundgren
Astronomy, University of North Carolina, Ashville
Leslie Rogers
Astronomy, University of Chicago
Ryan Trainor
Astronomy, Franklin & Marshall College

Cottrell Scholars met face-to-face for the first time since 2019 at the 2022 Cottrell Scholar Conference in Tucson.
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 2022, 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 2022, all SEED awards were for research.

**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.

**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.
Cottrell Plus Awardees

**SEED**
Stephen Bradforth  
Cottrell Scholar 1999  
Chemistry, University of Southern California  
*Role of Flanking Bases and Secondary Structure in Thymine Dimer Formation*

**SEED**
Luis Campos  
Cottrell Scholar 2015  
Chemistry, Columbia University  
*Carbon Dioxide Click Chemistry*

**SEED**
Nancy Makri  
Cottrell Scholar 1994  
Chemistry, University of Illinois at Urbana-Champaign  
*Real-Time Path Integral Studies of Cavity-Controlled Exciton Dynamics*

**SEED**
Ken Mills  
Cottrell Scholar 2003  
Chemistry, College of the Holy Cross  
*Folding Inhibitors of Inteins: A Novel Drug Target*

**SEED**
Art Winter  
Cottrell Scholar 2013  
Chemistry, Iowa State University  
*Laboratory Photosynthesis of Oligosaccharides: Towards Glycan Chips*

**STAR**
Rae Robertson-Anderson  
Cottrell Scholar 2010  
Physics, University of San Diego

**STAR**
Scott Snyder  
Cottrell Scholar 2009  
Chemistry, University of Chicago

**IMPACT**
Seth Cohen  
Cottrell Scholar 2004  
Chemistry, University of California, San Diego
RCSA offered these awards to strengthen Cottrell Scholar research programs disrupted by the pandemic. Nine Cottrell Scholars received awards of $50,000 to provide undergraduate seniors working under their supervision the opportunity to continue a research project for a year after graduation.

**Jeanine Amacher** (postbac Jadon Blount)
Chemistry, Western Washington University
*Molecular Dynamics Simulations of Sortase Enzymes*

**John Gilbertson** (postbac Allison Teigen)
Chemistry, Western Washington University
*Reduction of the Pervasive Environmental Pollutants Nitrate/Nitrite via Redox-Active Complexes*

**Ryan McGorty** (postbac Philip Neill)
Physics, University of San Diego
*Micro- and Macro-rheology of Topologically-active DNA-based Materials*

**Cedric Owens** (postbac Kellie Omori)
Chemistry, Chapman University
*The Activation Heat Capacity of Enzymatic Catalysis is a New Target for Protein Engineering*

**Katherine Plass** (postbac Qi Luo)
Chemistry, Franklin & Marshall College
*Post-synthetic Transformation of Copper Sulfide Nanoparticles to Design Novel Multicomponent Nanoparticles*

**Grace Stokes** (postbac Elliott Anderson)
Chemistry, Santa Clara University
*Surface Characterization of Peptoids at the Liquid/Air Interface*

**David Strubbe** (postbac Elsa B. Vazquez)
Physics, University of California, Merced
*Raman Spectroscopy and Friction in Doped 2D Materials*

**Adam Urbach** (postbac Sara Trauth)
Chemistry, Trinity University
*Supramolecular Controlled Release of Protein Drugs*

**Rory Waterman** (postbac Evan Beretta)
Chemistry, University of Vermont and State Agricultural College
*Phosphinidene Transfer Reactions to Launch a Career in Research*

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RCSA makes funds available to Cottrell Scholars who wish to host one-day regional meetings at their institutions to discuss research, teaching, and career development. In 2022, RCSA awarded $5,000 for one regional meeting.

**Grace Stokes**
Chemistry, Santa Clara University
*Enhancing Science Courses by Integrating Python (ESCIP) Workshop*
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.

“Junior faculty like me really benefit from thinking across scales and chatting with folks that have expertise in different modalities. Scialog facilitates those cross-disciplinary discussions with ease... a big part of this is that the participants are so willing to share.”

—ABI Awardee Mark Sellmyer
Emerging from the pandemic, RCSA convened one virtual and five in-person Scialog conferences in 2022. RCSA along with its funding partners provided a total of $6,040,250 in seed funding for collaborative team projects. Individual awards are $50,000 each in direct costs.

**Scialog Collaborative Innovation Awards**

$6,040,250 awarded to early career scientists for research through these six multi-year programs.

**Microbiome, Neurobiology and Disease**  
**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.  
**Funding:** Provided by RCSA, the Paul G. Allen Frontiers Group, the Frederick Gardner Cottrell Foundation, and the Walder Foundation.

**Advancing BioImaging**  
**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.  
**Funding:** Provided by RCSA, the Chan Zuckerberg Initiative, the Frederick Gardner Cottrell Foundation, and the Walder Foundation.

**Signatures of Life in the Universe**  
**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.  
**Funding:** Provided by RCSA, the Heising-Simons Foundation, The Kavli Foundation, and NASA.

**Mitigating Zoonotic Threats**  
**Goal:** To catalyze multidisciplinary teams of early career scientists to launch new research in the detection and mitigation of emerging animal-borne infectious diseases.  
**Funding:** Provided by RCSA and the U.S. Department of Agriculture.

**Molecular Basis of Cognition**  
**Goal:** To catalyze teams of researchers working across disciplines, including neurobiology, neuroscience, and related cognitive sciences, to devise new ways to probe the chemistry, biology, physics, and computational science that underlie memory and other cognitive processes.  
**Funding:** Provided by RCSA, CIFAR, the Frederick Gardner Cottrell Foundation, The Kavli Foundation, and the Walder Foundation.

**Negative Emissions Science**  
**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.  
**Funding:** Provided by RCSA, the Alfred P. Sloan Foundation, and the ClimateWorks Foundation.
Microbiome, Neurobiology and Disease
Year 2

Elizabeth Bess
Chemistry, University of California, Irvine

Aida Ebrahimi
Electrical Engineering and Biomedical Engineering, Pennsylvania State University

Electrifying Mechanisms of Intestinal Alpha-synuclein Aggregation in Parkinson’s Disease Onset

Annika Barber
Molecular Biology and Biochemistry, Rutgers University

David Durgan
Anesthesiology, Baylor College of Medicine

Diurnal Rhythms in Microbiota-Gut-Brain Signaling Leads to Time-of-Day Dependent Susceptibility to Stroke

Linnea Freeman
Biology, Furman University

Gianna Hammer
Immunology, University of Utah

Lisa Osborne
Microbiology & Immunology, University of British Columbia

The Intersection of Age, Microbiome and the Zeal for Continuous Learning by Cells of the Neuro-Immune Network

Lisa Osborne
Microbiology & Immunology, University of British Columbia

Yanjiao Zhou
Medicine, UConn Health

Ashley Ross
Chemistry, University of Cincinnati

Unraveling the Effect and Mechanism of Enteric Microbiota-Neuron Communication in Aging

Iliyan Iliev
Medicine, Weill Cornell Medicine

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

Identifying Mycobiome-Derived Enteric Neuromodulators

Elizabeth Bess
Chemistry, University of California, Irvine

Stephanie Cologna
Chemistry, University of Illinois at Chicago

Tracking Alpha-synuclein from Enteroendocrine Cells to the Enteric Nervous System

Funding provided by:
1 RCSA, the Paul G. Allen Frontiers Group, and the Frederick Gardner Cottrell Foundation
2 Walder Foundation
Advancing BioImaging
Year 2

Shiva Abbaszadeh¹
Electrical and Computer Engineering, University of California, Santa Cruz
Heather Whitney¹
Radiology, University of Chicago
Real-time AI for Programmable Training Arrays

Yevgenia Kozorovitskiy²
Neurobiology, Northwestern University
Abdoulaye Ndao²
Electrical and Computer Engineering, Boston University
Making Lenses Smart for Optical Imaging and Beyond

Joshua Brake¹
Engineering, Harvey Mudd College
Kevin Cash¹
Chemical and Biological Engineering, Colorado School of Mines
Democratizing Access to Macroscopic Bioimaging

Mark Sellmyer¹
Radiology, University of Pennsylvania
Arnab Mukherjee¹
Chemical Engineering and Biological Engineering, University of California, Santa Barbara
Improving MRI Detection Limits

Kathryn Keenan²
Applied Physics Division, National Institute of Standards and Technology
Crystal Rogers²
Anatomy, Physiology, and Cell Biology, University of California, Davis
Ulubek Kamilov²
Computer Science and Engineering, Washington University in St. Louis
MRI with Molecular Specificity for a New Realm of Neuro-developmental Research

Ying Hu²
Chemistry, University of Illinois at Chicago
Seunghyun (Seu) Sim²
Chemistry, University of California, Irvine
Live Tissue Clearing of Lymph Nodes through Programmed Dendritic Cells

Alexandra Walsh¹
Biomedical Engineering, Texas A&M University, College Station

Johannes Schöneberg¹
Pharmacology and Chemistry & Biochemistry, University of California, San Diego
4D Imaging and Tracking to Resolve Organelle Form vs. Function

Arnold Hayer²
Biology, McGill University
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Physics & Optical Sciences, University of North Carolina at Charlotte
High-speed 4D Morphodynamic Analysis of Migrating Cells

Luke Mortensen¹
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Huanyu Cheng¹
Engineering Science and Mechanics, Pennsylvania State University
Transforming Imaging Collection in the Brain

Stephen Yi²
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Ruixuan Gao²
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In Situ Protein Sequencing by Multiplexed Real-Time Single Molecule Imaging

Funding provided by:
¹ Chan Zuckerberg Initiative
² RCSA and the Frederick Gardner Cottrell Foundation
³ Walder Foundation
Signatures of Life in the Universe
Year 2

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Computational and Experimental Investigations of Martian Brines as Prebiotic Environments

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Earth & Planetary Sciences and Physics, McGill University

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Earth & Space Exploration, Arizona State University

Leslie Rogers ³
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Volatile Reservoirs and the Habitability of M-Earths

Katherine de Kleer ¹
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Sarah Hörst ¹
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Chemistry & Biochemistry, Central Connecticut State University
Enceladus Plume Chemistry: From Lab to Telescope

Kate Follette ¹
Physics and Astronomy, Amherst College

Jeffrey Marlow ¹
Biology, Boston University
From Exoplanets to Microbes: Using Astronomical Image Processing Techniques to Detect Microbes in Astrobiological Contexts

Paul Bracher ²
Chemistry, Saint Louis University

Ilse Cleeves ¹
Astronomy, University of Virginia
Brimstone Life: Hypothetical Sulfur Worlds and Their Possible Biosignatures

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Ziming Yang ³
Chemistry, Oakland University
Methylated Organometallic Gases as Potential Biosignatures

Zachary Adam ²
Geoscience, University of Wisconsin–Madison

Fang Liu ²
Chemistry, Emory University
Assessing False Positive Biosignatures and Prebiotic Synthesis Generated by Two Candidate Autocatalytic Reaction Sets of Aqueous Sulfur

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Earth and Atmospheric Sciences, Georgia Institute of Technology
Mars Sample Return: Connecting Martian Environmental Geochemistry to Returned Samples

¹ The Heising-Simons Foundation
² RCSA
³ The Kavli Foundation
⁴ NASA
Mitigating Zoonotic Threats
Year 2

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Environmental Sciences, Emory University
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Xiaohu Xia
Chemistry, University of Central Florida
A Sensitive Lateral Flow Assay for Point-of-Care Testing of Emerging Zoonotic Diseases

Nicholas DeFelice
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Diagnostics and Biologics, USDA/APHIS Veterinary Services
Sen Pei
Environmental Health Sciences, Columbia University
Impact of Climate Variability on Foreign Animal Disease: Forecasting Highly Pathogenic Avian Influenza

Krisztina Koutmou
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Pilar Fernandez
Silvie Huijben
Life Sciences, Arizona State University
Incorporating Human Behavioral Systems in Insecticide Resistance Management for Mosquito-Borne Diseases

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Gisselle Medina
Chemistry, Tulane University
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Angad Mehta
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Identifying and Engineering Broadly Neutralizing Antibodies against African Swine Fever Virus

Identifying and Engineering Broadly Neutralizing Antibodies against African Swine Fever Virus

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Lars Plate
Chemistry and Biological Sciences, Vanderbilt University
Impact of Synonymous Mutation on Translation Speed and Protein Folding During Host Adaptation

Funding provided by: RCSA and USDA
Molecular Basis of Cognition
Year 1

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Evelyn Tang
Physics and Astronomy, Rice University

Daniel Burnston
Philosophy/Brain Institute, Tulane University
Network Topology Underlying Circuit Dynamics During Flexible Cognitive Behavior

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Biological Sciences, Neuroscience Institute, Carnegie Mellon University

Benjamin Scott
Psychological and Brain Sciences, Boston University

Matthew Lovett-Barron
Neurobiology, University of California, San Diego
Understanding Cortical Control over Subcortical Structures Using an Evolutionary Inspired Engineering Approach

Christina Kim
Center for Neuroscience & Department of Neurology, University of California, Davis

Antonio Fernandez-Ruiz
Neurobiology & Behavior, Cornell University
Bridging Mechanism of Memory Across Levels

Travis Baker
Center for Molecular and Behavioral Neuroscience, Rutgers University

Megan Peters
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Robert Wilson
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Beyond Computational Behaviorism: The Structure of Thought in Naturalistic Behaviors

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Elizabeth Hong
Biology & Biological Engineering, California Institute of Technology

Gordon Berman
Biology, Emory University
FlyRanch: A Platform for Uncovering the Molecular Bases of Hidden Behavioral State Dynamics

Patrese Robinson-Drummer
Psychology, Haverford College

Allyson Mackey
Psychology, University of Pennsylvania

Sydney Trask
Psychological Sciences, Purdue University
From Cradle to Grave: Measuring the Lifetime Impact of Early-Life Stress

Funding provided by:
1 The Walder Foundation
2 Kavli Foundation
3 RCSA and the Frederick Gardner Cottrell Foundation
4 CIFAR – Azrieli Global Scholars
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Marcel Schreier 2
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Electro-swing Modulation of Lipophilic Environments for Direct Air Capture of Methane

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Pritzker School of Molecular Engineering, University of Chicago

Yayuan Liu 1
Chemical and Biomolecular Engineering, Johns Hopkins University

Houlong Zhuang 2
Chemical and Biological Engineering, University of Wisconsin–Madison

Yuanyue Liu 2
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Jimmy Jiang 1
Chemistry, University of Cincinnati

Shaama Mallikarjun Sharada 1
Chemical Engineering and Materials Science, University of Southern California

BioDAC: Integrating Enzyme Engineering & Electrochemistry for Sustainable Acrylate Production

Will Bowman 3
Materials Science and Engineering, University of California, Irvine

Jose Mendoza 3
Chemical Engineering and Materials Science, Michigan State University

Hang Ren 3
Chemistry, University of Texas at Austin

Kandis Leslie Abdul-Aziz 1
Chemical and Environmental Engineering, University of California, Riverside

Mita Dasog 1
Chemistry, Dalhousie University

Sunlight Driven CO2 Capture and Release

Anindita Das 1
Chemistry, Southern Methodist University

Simona Liguori 1
Chemical & Biomolecular Engineering, Clarkson University

Rafael Santos 1
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BioDAC: Integrating Enzyme Engineering & Electrochemistry for Sustainable Acrylate Production

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A Radical Approach to Negative Methane Emissions

Funding provided by:

1 Alfred P. Sloan Foundation
2 RCSA
3 ClimateWorks Foundation
January

Six Cottrell Scholars and two Scialog Fellows were elected 2021 Fellows of the American Association for the Advancement of Science for their important contributions to STEM disciplines: In Chemistry: CS 2009 Penny Beuning, Northeastern University; CS 2014 Mircea Dincă, Massachusetts Institute of Technology; Scialog CMC Awardee Davide Donadio, University of California, Davis; Scialog CMC Fellow Michael D. Pluth, University of Oregon; CS 2015 Stefan Stoll, University of Washington; CS 2008 Charles Sykes, Tufts University; and CS 1994 Lynmarie K. Thompson, University of Massachusetts Amherst. In Physics: CS 2013 Henriette Elvang, University of Michigan.

The “Spotlight on Scialog: Negative Emissions Science” special issue from iScience, a collaboration of Cell Press, RCSA and the Alfred P. Sloan Foundation, continued in 2022 with several articles from Fellows of the initiative. “Predictive Energetic Tuning of C-Nucleophiles for the Electrochemical Capture of Carbon Dioxide” from Oana Luca, Chemistry, University of Colorado Boulder, explored work on electrochemically enabled carbon capture. NES Fellows Caleb Hill, Chemistry, University of Wyoming, Jose Mendoza, Chemical Engineering and Materials Science, Michigan State University, Jesus M. Velázquez, Chemistry, University of California, Davis, and Luisa Whittaker-Brooks, Chemistry, University of Utah, also presented a perspective article on bridging the gap between synthesis, simulations, and analysis of multidimensional catalysts. (Velázquez and Whittaker-Brooks are also Cottrell Scholars.) The issue was curated by and curated by NES Fellow Marta Hatzell, Mechanical Engineering, Georgia Institute of Technology.


February

Cottrell Scholar 2020 Frank Leibfarth, Chemistry, University of North Carolina at Chapel Hill, published a new paper in Science. In “Diversification of Aliphatic C–H bonds in Small Molecules and Polyolefins through Radical Chain Transfer,” he and his colleagues detailed a two-step upcycling sequence to process plastic waste, turning postconsumer polyethylene foam into a potentially valuable ionomer.

Five Scialog Fellows and a Cottrell Scholar were awarded 2022 Sloan Research Fellowships: MND Fellow Pamela Chang, Microbiology and Immunology, Cornell University; NES Fellow Chong Liu, Chemistry and Biochemistry, University of California, Los Angeles; MND Fellow Ashley Ross, Chemistry, University of Cincinnati; Advanced Energy Storage
Fellow Justin Sambur, Chemistry, Colorado State University; ABl and CMC Fellow Lu Wei, Chemistry and Chemical Engineering, California Institute of Technology; and Cottrell Scholar 2022 Wen-fai Fong, Astronomy, Northwestern University.

The American Chemical Society released a podcast featuring a conversation between Cottrell Scholar 2012 and 2019 FRED Award winner Sarah Reisman, Chemistry, California Institute of Technology, and CS 2006 Melanie Sanford, Chemistry, University of Michigan. They talked about how organic chemistry is changing and how they’ve learned to choose priorities.

Cottrell Scholar 2019 and Scialog: Time Domain Astrophysics Fellow Emily Rauscher, Astronomy, University of Michigan, was named a 2022 Simons Fellow in theoretical physics.

March

 Barely a year after their Scialog: NES collaborative award, the team of Greeshma Gadikota, Civil and Environmental Engineering, Cornell University, and Venkat Viswanathan, Mechanical Engineering, Carnegie Mellon University, spawned a startup company called CHEMent to commercialize zero-carbon cement production powered by renewable electricity and won an ARPA-E grant to further their research to integrate CO₂ capture with recycling technology. Later in the year, Gadikota’s new startup company at Cornell University, Carbon To Stone, was awarded a $500,000 pre-purchase agreement to use captured CO₂ to produce carbonates for use in alternative cements.

 Cottrell Scholar 2019 Alison Narayan, Chemistry, University of Michigan, published a new paper in Nature. Featured on the cover, “Biocatalytic Oxidative Cross-Coupling Reactions for Biaryl Bond Formation” detailed the design and engineering of enzyme biocatalysts that help to connect the necessary building blocks through their carbon-hydrogen bonds.

 How do you design an effective, engaging and equitable remote event? In the “What Does a Community Need?” study for the Alfred P. Sloan Foundation, CoRD lab and Simply Secure interviewed attendees of multiple virtual conferences to find out. Scialog, which held seven virtual conferences in 2020 and 2021, was noted for its successful communications and structures for facilitated breakouts.

 Cottrell Scholar 2014 Tyrel McQueen, Chemistry, Johns Hopkins University, was one of three keynote speakers at the Opening Session of the Spring American Chemical Society National Meeting, “Bonding Through Chemistry.” McQueen’s talk, “Quantum Materials,” highlighted recent discoveries that have implications for sustainable energy, information technology and more.

 The American Chemical Society awarded its highest honor, the Priestley Medal, to Peter Dervan, California Institute of Technology. In 1974, in the early days of supramolecular chemistry, RCSA supported Dervan (then an assistant professor) with funding to study “Organometallic anionic rearrangements.” His pioneering work treating DNA as an organic molecule helped lay the foundation for chemical biology.
Yan Yao, Electrical and Computer Engineering, University of Houston, received an ARPA-E OPEN 2021 award for research to develop a high-energy, fast-charging, lithium- and transition metal-free battery. The project grew from a 2017 Scialog: AES collaborative award to Yao, Puja Goyal, Chemistry, Binghamton University, and Jahan Dawlaty, Chemistry, University of Southern California, to investigate the structure-property relationship of quinone crystals.

CS 2015 Timothy Atherton, Physics, Tufts University, was a corresponding author of a paper in Physical Review Physics Education Research. “LGBT+ physicists: Harassment, Persistence, and Uneven Support” focused on the experiences and challenges faced by groups within the LGBT+ community. The paper was featured in Physics. Atherton was also quoted in a Physics Today article on the challenges in retaining LGBT+ physicists and efforts needed to create more actively inclusive classrooms and research spaces.

April

Scialog: Microbiome, Neurobiology and Disease, sponsored by RCSA, the Paul G. Allen Frontiers Group and the Frederick Gardner Cottrell Foundation, with support from the Walder Foundation, convened virtually for its second meeting. Rosa Krajmalnik-Brown from the ASU Biodesign Institute delivered the keynote address, “Can Changing Gut Bacterial Community Improve Gastrointestinal and Autism Symptoms?”

“Women Are Creating a New Culture for Astronomy,” a Scientific American article about a new generation of women scientists challenging the status quo, featured six members of the RCSA community: Cottrell Scholar 2019 Caitlin Casey, University of Texas at Austin; CS 2017 Laura Chomiuk, Michigan State University; CS 2019 Emily Levesque and CS 2020 Jessica Werk, University of Washington; Scialog: TDA Fellow Kathryn Daniel, Bryn Mawr College; and Scialog: SLU Fellow Sarah Hörs, Johns Hopkins University. (Chomiuk and Levesque are also Scialog: TDA Fellows.)

1996 Cottrell Scholar and 2021 SEED Award recipient Ziqiang Wang, Physics, Boston College, was a corresponding author of a paper in the journal Nature Physics. In “External Magnetic Field Causes Shift in Electronic Dirac Band Structure in a Kagome Magnet,” measurements by the team of U.S. and Chinese researchers confirmed predictions about the quantum behavior of kagome magnets. The paper is an outcome of Wang’s SEED Award project.

In a Science article, “New Goals for Science Philanthropy,” Science Philanthropy Alliance president France Cordova called attention to RCSA and other Alliance members that are catalyzing more equitable science funding and bringing fresh approaches to grantmaking.

Cottrell Scholar 2019 Emily Levesque, Astronomy, University of Washington, and Scialog: Solar Energy Conversion Fellow So Hirata, Chemistry, University of Illinois, Urbana-Champaign, were awarded 2022 Guggenheim Foundation Fellowships.

A Cottrell Scholars Collaborative project is expanding connections between Cottrell Scholars and FLAMENet, a national network of science faculty, psychologists and education researchers working to promote resilience and tenacity among college-level STEM students. In the spring of 2022, the collaboration presented three mini-workshops on “Inclusivity in Introductory STEM Courses” sponsored by FLAMEnet (Factors affecting Learning, Attitudes, and Mindsets in Education network) and RCSA.

Scialog: SLU Fellow Betül Kaçar, Astrobiology, University of Wisconsin, Madison, studies the origin of life on Earth to understand the potential for life on other worlds. In a TED talk, she explored how a deeper understanding of chemical processes that allowed life to emerge on our planet might enable us to spark life on other planets.
Cottrell Scholar 2008 Tehshik Yoon, Chemistry, University of Wisconsin – Madison, was guest editor of a special “Trailblazers” issue of Chemical & Engineering News celebrating the work and contributions of LGBTQ+ chemists. Yoon and CS 2020 Song Lin, Cornell University, were among the out, proud, and successful LGBTQ+ chemists profiled.

Cottrell Scholar 2020 Elisabetta Matsumoto, Physics, was featured in a “Profiles in Versatility” article in the April edition of APS News. The profile discussed Matsumoto’s work on the mathematics and physics of knitting, creativity in science, and how she weaves her many interests together into a rich intellectual fabric.

Seppe Kuehn, Physics, University of Illinois at Urbana-Champaign, and Madhav Mani, Engineering Sciences and Applied Mathematics, Northwestern University, didn’t write a Scialog proposal together, but the conversation they began as Fellows at Scialog: Molecules Come to Life in 2016 led to a paper in Cell titled “Genomic Structure Predicts Metabolite Dynamics in Microbial Communities.” Highlighted in a perspective article, their research could offer new insights into global climate.

May

Scialog: Advancing BiolImaging, sponsored by RCSA, the Chan Zuckerberg Initiative, and the Frederick Gardner Cottrell Foundation, with additional support from Walder Foundation, held its second meeting (its first in person) in Tucson. Keynote speakers Brian Pogue, University of Wisconsin-Madison, and CS 2014 Jenn Prescher, University of California, Irvine, set the stage for discussion with talks about their research, current tools and breakthroughs needed to accelerate development of the next generation of imaging technologies.

Six Cottrell Scholars and Scialog Fellows were honored as 2022 Camille Dreyfus Teacher-Scholars: CS 2021 Justin Caram, Chemistry, University of California, Los Angeles; CS 2021 Christopher Hendon, Chemistry, University of Oregon; CS 2020 & NES Fellow Jesús Velázquez, Chemistry, University of California, Davis; CMC Fellow Jefferson Chan, Chemistry, University of Illinois at Urbana-Champaign; CMC Fellow Brian Liau, Chemistry and Chemical Biology, Harvard University; and AES Fellow V. Sara Thoi, Chemistry, Johns Hopkins University.

Cottrell Scholar 2018 and Scialog: CMC Fellow Lou Charkoudian, Chemistry, Haverford College, was selected as the first recipient of the Council on Undergraduate Research’s Silvia Ronco Innovative Mentor Award. The award, established in February 2022 by a gift from RCSA in honor of CUR’s past president and current RCSA Senior Program Director Silvia Ronco, recognizes a tenure-track faculty member within 10 years of their first faculty appointment who demonstrates success in chemical sciences and whose mentoring practices have supported undergraduate research.

Four RCSA awardees spoke at RCSA’s May Board of Directors meeting in New York City. Cottrell Scholar 2015 Luis Campos, Chemistry, Columbia University; Scialog TDA Fellow Jackie Faherty, American Museum of Natural History; Scialog TDA Fellow Melissa Ness, Astronomy, Columbia University; and CS 2020 Glen O’Neil, Chemistry.
Montclair State University, shared their experiences and perspectives on how RCSA can work to make its programs more inclusive.

June

The second meeting of Scialog: Signatures of Life in the Universe, co-sponsored by RCSA and the Heising-Simons Foundation, with additional support from The Kavli Foundation, convened in Tucson to catalyze fundamental science in the search for life beyond Earth. Keynote speakers Tori Hoehler and Niki Parenteau, NASA Ames, and Victoria Meadows, University of Washington, set the stage for discussions with talks on the key areas of research that are needed to inform mission design in the search for life beyond Earth.

The German-American Fulbright Commission awarded its 2022 Fulbright-Cottrell Award for excellence in research and teaching to Diego Andrada, a chemist at Saarland University in Germany. The award is based on RCSA’s Cottrell Scholar Award. Awardees become eligible to participate in Cottrell Scholar meetings and conferences, and to take part in Cottrell Scholar Collaborative projects.

Scialog: Mitigating Zoonotic Threats Fellow Salvador Almagro-Moreno, a microbiologist at the University of Central Florida’s Burnett School of Biomedical Sciences, was among 10 researchers to receive the Burroughs Wellcome Fund Investigators in the Pathogenesis of Infectious Disease (PATH) award. Almagro-Moreno’s research focuses on emerging strains of flesh-eating bacteria.

Cottrell Scholar 1996 and RCSA Board Member Catherine J. Murphy, the Larry Faulkner Endowed Chair in Chemistry and Head, Chemistry Department, University of Illinois, Urbana-Champaign, won the Royal Society of Chemistry’s 2022 Centenary Prize for “pioneering work on the growth, size and shape control, biological applications and environmental implications of gold nanocrystals, and for excellence in communication.”

Cottrell Scholar 2010 Duncan Brown was named Syracuse University’s vice president for research. He is a member of the Cottrell Scholar Selection Committee and is a Scialog: TDA Fellow.

Four RCSA-supported scientists were among 31 recipients of the 2022 Blavatnik National Awards for Young Scientists, which honor early career scientists and engineers: Scialog MND Awardee Elaine Hsiao, Integrative Biology and Physiology, University of California, Los Angeles; Cottrell Scholar 2013 and Scialog SEC Awardee Gordana Dukovic, Chemistry, University of Colorado, Boulder; and Scialog TDA Fellow Mansi M. Kasliwal, Astronomy, California Institute of Technology; and TDA Awardee Raffaella Margutti, Physics & Astronomy, University of California, Berkeley.

Inside Philanthropy called RCSA “philanthropy’s steadiest supporter of basic scientific research” in a feature article on the foundation’s work and goals. The article gave details about RCSA’s Cottrell Scholar and Scialog programs and explained how the foundation has made a difference to many researchers at a point in their careers when a little bit of support and recognition meant a lot.

“Thermodynamics of Wettability: A Physical Chemistry Laboratory Experiment,” a paper in the Journal of Chemical Education by Cottrell Scholar 2010 Sarbjit Banerjee and Rachel Davidson, Chemistry, Texas A&M University, was an outcome of the Cottrell Fellowship they received in 2020. Cottrell Fellowships supported the work of postdocs whose plans to start independent academic or research careers were delayed or derailed by pandemic-related hiring freezes.
July

More than 100 Cottrell Scholars met face to face to welcome a new class of teacher-scholars at the 28th Annual Cottrell Scholar Conference in Tucson. Centered around the theme of “Creativity and Innovation in STEM Education,” the conference was the community’s first in-person meeting since 2019. The conference was a platform for discussions on incorporating creativity and innovation into STEM education, and an opportunity to develop ideas for educational collaborations. The importance of inclusive teaching approaches and more equitable academic environments—to prevent loss in the STEM pipeline and build scientific identity for students—ran throughout the talks, workshops, presentations and discussions at the conference. RCSA launched a new award to recognize and welcome outstanding senior scientists with diverse perspectives and backgrounds into the Cottrell Scholar community: the Robert Holland Jr. Award.

Cottrell Scientists who authored Teach Better, Save Time, and Have More Fun: A Guide to Teaching and Mentoring in Science in 2014 to help early career faculty become effective educators without “reinventing the wheel” published an expanded second edition with a particular focus on effective online and hybrid teaching, student and faculty mentoring, graduate student support, and inclusive teaching and mentoring. The new edition is authored by Cottrell Scholar 2009 Penny J. Beuning, Chemistry, Northeastern University; CS 1996 Dave Z. Besson, Physics, University of Kansas; CS 2009 Scott A. Snyder, Chemistry, University of Chicago; and CS 2003 Nicola L.B. Pohl, Chemistry Indiana University Bloomington.

Cottrell Scholar 2009 Maura McLaughlin, Physics, West Virginia University, received the Southeastern Universities Research Association’s Distinguished Scientist Award. McLaughlin studies neutron stars and their environments through radio, X-ray, and gamma-ray observations, and helps lead a project that involves high school students across the U.S. in pulsar-related research.

Chemical & Engineering News named two 2021 Cottrell Scholars among their 2022 Talented 12 for using chemistry to make the world a better place: Alexis C. Komor, Chemistry, University of California, San Diego (also a Scialog: CMC awardee) and Alexandra Velian, Chemistry, University of Washington.

Three Scialog Fellows received 2022 Beckman Young Investigator Awards: MND Awardee Mark Mimeo, Microbiology/Pritzker School of Molecular Engineering, University of Chicago; ABI Awardee Lisa Poulikakos, Mechanical and Aerospace Engineering, University of California, San Diego; and NES Fellow Marcel Schreier, Chemical and Biological Engineering, University of Wisconsin, Madison. These awards are given to foster the invention of methods, instruments, and materials that will open new avenues of research in science.

Robert Holland Jr. Maura McLaughlin
Cottrell Scholars 2018 Lou Charkoudian, Chemistry, Haverford College, and 2015 Jen Heemstra, Chemistry, Emory University, teamed up with education researcher Lisa Corwin to publish a new, open-access book from the Council on Undergraduate Research (CUR) on helping students learn from failure: Confronting Failure: Approaches to Building Confidence and Resilience in Undergraduate Researchers.

The 2nd meeting of Scialog: Mitigating Zoonotic Threats, sponsored by RCSA and the U.S. Department of Agriculture, with support from Walder Foundation, was held in Tucson. Keynote speaker Amy Vincent, USDA Agricultural Research Service, spoke on Influenza A in pigs and humans, and its implications for public health and pandemic planning, and Michael Wimberly, University of Oklahoma, gave a talk on human-caused climate change and its effects on infectious disease transmission.

Three RCSA-supported scientists are lead investigators of energy frontier research centers funded by the U.S. Department of Energy: Scialog AES & NES Fellow Jenny Yang, Chemistry, of the Center for Closing the Carbon Cycle, and Cottrell Scholar 2017 Shane Ardo, Chemistry, of the Ensembles of Photosynthetic Nanoreactors center, both at the University of California, Irvine; and CS 1999 Dimitri Basov, Physics, of the Programmable Quantum Materials center at Columbia University.

August

Cottrell Scholars 2012 Will Dichtel, Northwestern University, and 2019 Ellen Matson, University of Rochester, gave keynote talks at the American Chemical Society National Meeting in Chicago. Dichtel, who won RCSA’s FRED Award in 2018, spoke at the opening session titled “Sustainability in a Changing Word.” Matson, who is also a Fellow of two Scialog initiatives, AES and NES, gave The Kavli Foundation Emerging Leader in Chemistry Lecture. CS 2010 Nicole Snyder, Davidson College, was also elected a 2022 American Chemical Society Fellow for her contributions to science and was recognized at the meeting.

Cottrell Scholar 2022 Scott Cushing, Chemistry, California Institute of Technology, received a $1.1 million grant from the W.M. Keck Foundation to build a new type of all-electron instrument for measuring processes that happen on a femtosecond timescale.

Two Scialog: SLU Fellows – Ilse Cleeves, Astronomy, University of Virginia (also a 2022 Cottrell Scholar) and Ke Zhang, Astronomy, University of Wisconsin-Madison—were among the co-authors of a paper in The Astrophysical Journal Letters presenting evidence of what is perhaps the galaxy’s youngest planet.

Two Scialog: CMC Fellows were selected by the editors of ACS Infectious Diseases and the ACS Division of Biological Chemistry as winners of the 2022 ACS Infectious Diseases Young Investigator Awards: Tania Lupoli, Chemistry, New York University, and Laura Sanchez, Chemistry and Biochemistry, University of California, Santa Cruz.

A 2020 Cottrell Scholar Collaborative project to cultivate the STEM pipeline is an integral part of the Center for Interfacial Ionics, selected by the National Science Foundation to receive a Phase I Center for Chemical Excellence award. CS 2014 Shannon Boettcher, Chemistry, University of Oregon, is PI for the center, which seeks to revolutionize the understanding of interfacial-ion-transfer kinetics. The center’s broader agenda of integrating diverse educational institutions into its research strategy incorporates the STEM pipeline model developed with CS 2015 Tom Markland, chemistry Stanford University, CS 2017 Yogi Surendranath, chemistry, Massachusetts Institution of Technology, and collaborators Yixian Wang, California State University, Los Angeles, Matt Minus, Prairie View A&M University, and Niya Sa, University of Massachusetts, Boston.

In an article published in Science, research led by Cottrell Scholar 2012 William Dichtel and Brittany Trang, Chemistry, Northwestern University, detailed a cheap new method that shows promise in breaking down some “forever chemicals” that contaminate soils and drinking water worldwide. The research in “Low-Temperature Mineralization of Perfluorocarboxylic Acids” was also featured in the New York Times.

September

The 2nd meeting of Scialog: Mitigating Zoonotic Threats, sponsored by RCSA and the U.S. Department of Agriculture, with support from Walder Foundation, was held in Tucson. Keynote speaker Amy Vincent, USDA Agricultural Research Service, spoke on Influenza A in pigs and humans, and its implications for public health and pandemic planning, and Michael Wimberly, University of Oklahoma, gave a talk on human-caused climate change and its effects on infectious disease transmission.

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Five members of the RCSA community were named winners of American Chemical Society 2023 national awards: Scialog: CMC Fellow Julia A. Kalow, Northwestern University, won the ACS Award in Pure Chemistry. Scialog NES Awardee Robert J. Gilliard Jr., University of Virginia, won the Harry Gray Award for Creative Work in Inorganic Chemistry by a Young Investigator. Cottrell Scholar 1994 Nancy Makri, University of Illinois Urbana-Champaign, won the ACS Award in Theoretical Chemistry. CS 2014 Jennifer A. Prescher, University of California, Irvine, and CS 1996 Vincent M. Rotello, University of Massachusetts, won Arthur C. Cope Scholar Awards. Maria Gomez, professor of chemistry at Mount Holyoke College, received the 2023 ACS Award for Research at an Undergraduate Institution, sponsored by RCSA. Cottrell Scholar 2012 and 2017 Cottrell FRED Award recipient Sara Skrabalak, Chemistry, Indiana University Bloomington, is leading a new National Science Foundation-supported research center focused on transforming nanocrystal discovery and design. The multi-institution research team also includes CS 2009 Lane Baker, Chemistry, Texas A&M University.

Eight students from Hawai‘i participated in the first two years of a summer astronomical research program for undergraduates that began with a Scialog: Time Domain Astrophysics collaborative award. Scialog Fellows Sukanya Chakrabarti, Physics and Astronomy, University of Alabama in Huntsville, Daniel Huber, Astronomy, University of Hawai‘i, and Robyn Sanderson, Physics and Astronomy, University of Pennsylvania, received a team award in 2019 for their collaborative proposal, “Beyond Gaia: Expanding the Dynamical Map of the Milky Way with Asteroseismic Distances.” The proof-of-concept study arising from their initial groundwork led to a large collaborative Astronomy and Astrophysics Research Grant from the National Science Foundation to apply their method to a much larger sample, mapping distances across the galaxy, and to involve local undergraduates in an astronomical research program.

The inaugural meeting of Scialog: Molecular Basis of Cognition, co-sponsored by RCSA, the Frederick Gardner Cottrell Foundation and the Canadian Institute for Advanced Research (CIFAR), with additional support from The Kavli Foundation and Walder Foundation, was held in Tucson. The initiative, which seeks to advance understanding of the molecular processes that underlie memory and cognition, began with keynote talks by Marina Picciotto, Yale, and Adam Cohen, Harvard.

Two RCSA-supported scientists were awarded the 2022 Nobel Prize in Chemistry. Carolyn R. Bertozzi, Morten Meldal and K. Barry Sharpless share the award “for the development of click chemistry and bioorthogonal chemistry.” Bertozzi received an RCSA Research in Innovation Award in 1997 to develop new strategies for anti-tumor therapy and diagnosis. Sharpless, who is being awarded his second Nobel Prize in Chemistry, received an RCSA grant in 1971 to study the chemistry of cis-dioxotransition metal species and its relevance to the action of mixed function oxygenases.

Well-designed interactions can help scientists form the collaborations that have become increasingly important in today’s research environment, according to a study based on data from four series of Scialog conferences. The paper, “Dynamics of Social Interaction: Modeling the Genesis of Scientific Collaboration,” was published in Physical Review
Research. Northwestern University Ph.D. candidate Emma Zajdela was first author, and she and her adviser Daniel Abrams were corresponding authors. Co-authors were RCSA’s Senior Program Directors Richard Wiener and Andrew Feig, RCSA Data Analytics Specialist Kimberly Huynh, and Northwestern undergraduate Andy Wen. The paper analyzed data from four Scialog series—12 conferences over the pre-COVID period from 2015 to 2019, highlighting the importance of small-group interactions in catalyzing collaborations. Further study could shed more light on the impact of conference design.

Three Scialog Fellows were 2022 recipients of the National Institutes of Health Director’s New Innovator Award: ABI awardee Johannes Schöneberg, Pharmacology and Chemistry & Biochemistry, University of California, San Diego; ABI Fellow David Van Valen, Biology and Bioengineering, California Institute of Technology; and CMC awardee Wenjing Wang, Chemistry and Life Sciences Institute, University of Michigan, Ann Arbor.

The American Physical Society’s 2023 Prize for a Faculty Member for Research in an Undergraduate Institution, sponsored by RCSA, was awarded to Cottrell Scholar 2010 Rae Robertson-Anderson, University of San Diego, “for outstanding contributions and innovative approaches to fundamental understanding of biopolymer composite dynamics and highly impactful research opportunities and physics training to a diverse set of undergraduate students.” She is a 2022 RCSA STAR Award recipient, a Scialog: MCL Fellow, and was 2022 chair of the Cottrell Scholar Program Committee.

Three RCSA awardees from University of Arizona shared the impact of RCSA support on their work at the October RCSA Board of Directors meeting in Tucson: Scialog CMC Fellow Judith Su, Optical Sciences and Biomedical Engineering; Cottrell Scholar 2018 Eduardo Rozo, Physics; and CS 2021 Thomas Gianetti, Chemistry.

The American Physical Society’s Fellows for 2022 included nine members of the RCSA community: Cottrell Scholar 2002 Jonathan R. Friedman, Amherst College; CS 2014 Carla Fröhlich, North Carolina State University; Scialog MCL Fellow Thomas Gregor, Princeton University; CS 2003 Michael Hildreth, University of Notre Dame; CS 2020 Huey-Wen Lin, Michigan State University; Scialog SLU Fellow Smadar Naoz, University of California, Los Angeles; CS 2010 and Scialog MCL Fellow Rae Robertson-Anderson, University of San Diego; CS 2003 and Scialog SEC Fellow Richard Taylor, University of Oregon; and CS 2016 Di Xiao, University of Washington. Cottrell Scholar 1998 Vivek Sharma, University of Illinois.
Chicago, was named recipient of the 2023 John H. Dillon Medal “for fundamental advances toward a molecular-level understanding of non-equilibrium polymer dynamics and for developing methods to accurately measure extensional deformation of polymeric materials and interfacial flows.”

Scialog: Negative Emissions Science Awardee Simona Liguori, Clarkson University, received funding from the U.S. Department of Energy in October 2022 for a project to develop a potentially transformational approach to produce low-cost, carbon-neutral hydrogen from biomass gasification using hydrogen-selective membrane-assisted water-gas shift reactors. The idea was conceived outside of Scialog with another NES Awardee, Andrea Hicks, University of Wisconsin–Madison, who will conduct life-cycle assessment and environmental analysis.

November

The third meeting of Scialog: Negative Emissions Science, sponsored by RCSA and the Alfred P. Sloan Foundation, with additional support from Climate Pathfinders Foundation and ClimateWorks Foundation, convened in Tucson. Keynote speaker Jeffrey Long, University of California, Berkeley, discussed some of the critical research needs for extracting CO₂ from air at scale.

Two 2019 Cottrell Scholars—Dennis Cao, Chemistry, Macalester College, and Paul Raston, Chemistry, James Madison University—were named Henry Dreyfus Teacher-Scholars for 2022. The award honors young faculty in the chemical sciences for their scholarship and commitment to undergraduate education.

RCSA President Daniel Linzer was quoted in a Physics Today article on the important role of private philanthropy in funding basic research in the physical sciences. The article also featured quotes from RCSA board member Lars Bildsten, partners from the Science Philanthropy Alliance, the Heising-Simons Foundation, the Gordon and Betty Moore Foundation and the Alfred P. Sloan Foundation, as well as a photo of Cottrell Scholar 2018 Abigail Vieregg, Kavli Institute for Cosmological Physics.

Astronomy’s November issue highlighted “Rising Stars in Astronomy,” including CS 2022 and TDA Fellow Wen-Fai Fong, Astronomy, Northwestern University, CS 2023 Chanda Prescod-Weinstein, Physics, University of New Hampshire, and TDA Fellow Jedidah Isler, Physics and Astronomy, Dartmouth College.

December

Cottrell Scholar 2019 Kerstin Perez, Physics, Massachusetts Institute of Technology, published her second op-ed on inclusive teaching in Inside Higher Ed, suggesting ways for minoritized instructors to balance support for students with their own personal and professional success. Perez was among 25 scientists RCSA supported in attending The OpEd Project’s training program and is a member of a Cottrell Scholar Collaborative working to promote resilience and tenacity among college-level STEM students.

Scialog: Molecules Come to Life awardee Margaret Gardel, Physics, University of Chicago, was selected as the inaugural lead editor of PRX Life, a new APS Physical Review journal. The fully open access journal will publish research articles, perspectives, reviews and tutorials by and for scientists working at the interface of physics and biology.

Cottrell Scholar 1996 and RCSA Board Director Sean Decatur was named the new president of the American Museum of Natural History. He is a chemist and had been president of Kenyon College since 2013.

Scialog: NES Fellow Kandis Leslie Abdul-Aziz, Chemical and Environmental Engineering, University of California, Riverside, was named to the Popular Science Brilliant 10 for 2022. Her research explores converting refuse products such as agricultural waste and plastic trash into useful materials.
Scialog: Advanced Energy Storage Fellow James McKone, Chemical & Petroleum Engineering, University of Pittsburgh, is helping lead a multi-site project to enable the design of new technologies for an environmentally sustainable chemical industry. Demonstrating the long-term value of the multidisciplinary networks forged at Scialogs, the project includes two other Fellows from AES, which concluded in 2019: Veronica Augustyn, Materials Science & Engineering, North Carolina State University, and Cottrell Scholar 2019 Ellen Matson, Chemistry, University of Rochester.

Scialog: NES Fellow Houlong Zhuang is one of seven winners of Materials Today’s 2022 Rising Star Awards. Zhuang is an assistant professor in the School for Engineering of Matter, Transport and Energy at Arizona State University.

Inside Philanthropy’s year-end awards recognized Scialog: Signatures of Life in the Universe as its “Science-Fiction-Worthy Cause of the Year” for 2022, highlighting a November article quoting RCSA Senior Program Director Richard Wiener on private and philanthropic support for the search for life beyond Earth.
In Memoriam: Brian Andreen, Former RCSA Vice President

RCSA mourns the loss of Brian Andreen, who died in Tucson on January 19, 2023. Although Andreen ended his decades-long career with the foundation in 1996 as vice president, he is remembered today as much for his warmth and easygoing manner as for his dedication to nurturing early career physical scientists, especially at undergraduate institutions.

“Brian Andreen helped create a culture of community building at RCSA that went beyond just giving out awards,” RCSA President & CEO Daniel Linzer said. “That culture continues today.”

“Brian understood the power of building scientific community,” said RCSA Senior Program Director Silvia Ronco. “At RCSA, Brian started programs like Cottrell Scholars and Partners in Science aimed at improving science teaching by embedding research activities at the college and high school levels. His tireless work with science faculty at primarily undergraduate institutions prompted the start of the Council on Undergraduate Research in 1978 as a way to advocate successfully for new programs from federal funding agencies.”

“His passion in promoting community building to impact change went beyond starting a national organization,” said Ronco, who also served as CUR’s 2020-2021 president. “Brian’s endless sense of humor and wise advice is still remembered by many in the communities he touched.”

Andreen was born in Superior, Wisconsin, and received his undergraduate degree from the University of Wisconsin at Superior and a master’s degree in analytical chemistry from Florida State University. He was supervisor of chemical research at the Institute of Gas Technology in Chicago before joining Research Corporation in 1964. He was editor of three editions of Research in Chemistry and the first edition of Research in Physics and Astronomy. He was a Fellow of the American Association for the Advancement of Science (AAAS), and a member of the American Chemical Society (ACS) and the Midwest Association of Chemistry Teachers in Liberal Arts Colleges (MACTLAC).

Andreen joined Research Corporation in 1964 as regional director, serving the Chicago office from 1964-1969, the Minneapolis office from 1969-1983, and the Tucson headquarters when the foundation consolidated operations in 1983. In 1986 he became coordinator of RCSA’s newly organized and expanded grants program. He was director of programs for science research and education when he was appointed vice president in 1992.

“This was an era where you didn’t wait for proposals to come in,” said former RCSA President John P. Schaefer. “You went and walked the halls. You found the good ideas. Brian would ferret out promising young people. And a lot of those people came to be significant players in the field of science and technology.”

“She had an incredible ability to relate to people,” Schaefer said. “He had the evangelical spirit that drove him to find potentially fertile ground for the seeds Research Corporation could plant.”

Andreen leaves a legacy at RCSA, CUR, and the countless colleges and universities impacted by his work. The Partners in Science program, through which RCSA funded research opportunities for high-school science teachers to work with research scientists at colleges and universities nationwide from 1988 to 1999, continues today under the sponsorship of the Murdock Trust. The Cottrell Scholar Program continues to grow in impact, having championed more than 500 outstanding early career teacher-scholars in chemistry, physics, and astronomy since it began in 1994. And CUR, which Andreen served as executive secretary from 1979-1987 and as a guiding force for many years, has grown into an organization with nearly 700 institutional and more than 13,000 individual members from around the world.

Andreen is survived by his wife, Jacqueline, and four children: Karin, Laurie, Carole and Eric.
2022 Financial Summary

Program Expenses, including Grants and Awards 88%
General and Administrative Costs 12%

Total Expenses $11.7 million

Scialog Collaborative Awards (includes $2.8M in partner-funded awards administered by RCSA and excludes $2.4M in non-administered partner-funded awards) 50%
Cottrell Scholar Awards 34%
Cottrell Career Advancement, Fellowships (includes $122K in direct partner support), Collaborative Awards 13%
Discretionary Grants and Special Initiatives 3%

Grants and Awards $7.1 million

Net Assets at Beginning of Year $239.1 million
Net Assets at End of Year $189.3 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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RCSA provides catalytic funding for research and sponsors conferences to support:

- A diverse and inclusive community of early career faculty
- Innovative ideas for basic research
- Integration of research and science teaching
- Interdisciplinary research
- Building the academic leadership of the future