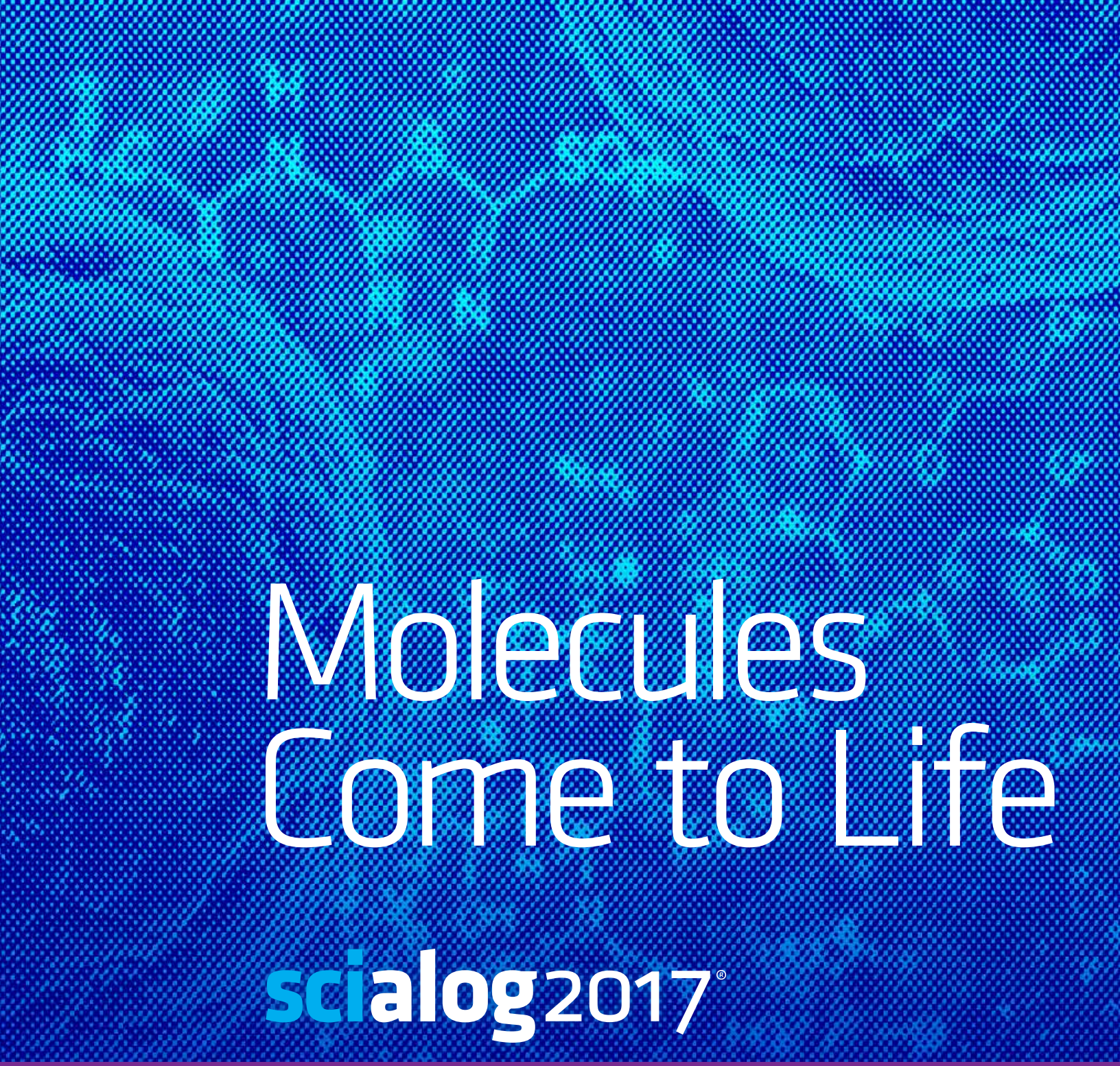


Molecules Come to Life

scialog 2017®

The Third Annual Scialog Conference
April 27-30, 2017 at Westward Look Resort
Tucson, Arizona

GORDON AND BETTY MOORE FOUNDATION

RESEARCH CORPORATION *for* SCIENCE ADVANCEMENT

Conference Objectives and Process

Objectives

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

Identify and analyze scientific bottlenecks and develop approaches for breakthroughs.

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

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

Process

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

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

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

Make comments concise to avoid monopolizing the dialog.

From the Program Officers

This year we are holding the third *Scialog: Molecules Come to Life* conference, which continues Research Corporation's tradition of highly interactive Scialog meetings on scientific topics of great importance with a focus on identifying bottlenecks and finding innovative ideas for potential breakthroughs. The emphasis of Scialog meetings is on science dialog, networking and building new collaborations to pursue novel high-risk discovery research.

The Gordon and Betty Moore Foundation and Research Corporation chose to focus this Scialog on the topic of quantitatively understanding the physical biology of cells and their interactions, because we believe this critical area of science is on the cusp of major breakthroughs. But we just as firmly believe these breakthroughs can be accelerated by physicists, biologists and those in related fields crossing disciplinary boundaries to work collaboratively, particularly with theorists and experimentalists combining efforts. The goal of *Scialog: Molecules Come to Life* is to catalyze multidisciplinary collaborations between Scialog Fellows, a highly select group of exemplary early career U.S. scientists.

We are delighted the National Cancer Institute is co-sponsoring this year's meeting and providing travel support to participants. **Mike Espey**, NCI, a discussion facilitator at last year's Scialog, returns and is joined by NCI colleague **Dan Gallahan**.

We have two outstanding keynote speakers: **Martin Gruebele**, the James R. Eiszner Professor of Chemistry, Professor of Physics, and Professor of Biophysics and Computational Biology, University of Illinois at Urbana-Champaign; and **Rob Phillips**, Fred and Nancy Morris Professor of Biophysics and Biology at the California Institute of Technology.

In addition to **Mike**, **Dan**, **Martin** and **Rob**, also serving as discussion facilitators are **Daniel Cox**, University of California, Davis; **Ken Dill**, Stony Brook University; **Daniel Fisher**, Stanford University; **Holly Goodson**, University of Notre Dame; **Rigoberto Hernandez**, Johns Hopkins University; and **Jané Kondev**, Brandeis University. We are delighted to have **Moses Lee**, Murdock Charitable Trust, in attendance.

An important feature of Scialog meetings is the opportunity for Scialog Fellows to form teams and write proposals to pursue particularly creative ideas that emerge through the dialog. We hope this competition is exciting, but regardless of which proposals are funded, the purpose is to catalyze a deeper and more meaningful exchange of ideas than ordinarily occurs at scientific conferences. This year of the 54 Scialog Fellows, nine are attending for the first time. We hope their new perspectives along with those of the outstanding returning Fellows help make this a great meeting and each participant finds the Scialog experience of great value!

Richard Wiener
Research Corporation

Gary Greenburg
Gordon and Betty Moore Foundation

Conference Agenda
Westward Look Resort
April 27-30, 2017

Thursday, April 27

1:00 pm	**Registration Opens**	Lobby
1:00 - 5:00 pm	**Snacks**	Palm Room & Terrace
5:00 - 6:30 pm	**Poster Session and Reception**	Sonoran Ballroom
6:00 - 6:30 pm	**Meeting for Discussion Facilitators**	Ocotillo & Cholla
6:30 - 7:30 pm	**Dinner**	Ocotillo & Cholla
7:15 - 7:30 pm	**Welcome** Danny Gasch, *Interim President, RCSA* Gary Greenburg, *Program Officer, Moore Foundation* Mike Espey, *Program Director, NIH*	Ocotillo & Cholla
7:30 – 7:45 pm	**Conference Overview, Hoped for Outcomes & Guidelines for Collaborative Proposals** Richard Wiener, *Senior Program Director, RCSA*	Ocotillo & Cholla
7:45 – 8:30 pm	**Keynote Presentation** *From water to fish: the multiple scales of biological dynamics* Martin Gruebele, *UIUC*	Ocotillo & Cholla
8:30 - 11:00 pm	**MCL Starlight Café** Snacks, conversations, etc.	Palm Room & Terrace

Friday, April 28

7:00 - 8:00 am	**Breakfast**	Palm Room & Terrace
8:00 - 9:00 am	**Introductions**	Ocotillo & Cholla
9:00 - 9:45 am	**Keynote Presentation** *Theory in Biology: Figure 1 vs Figure 7* Rob Phillips, *Caltech*	Ocotillo & Cholla
9:45 - 10:15 am	**Conference Photo & Break**	Palm Terrace
10:15 - 10:30 am	**Breakout Sessions Description & Goals**	Ocotillo & Cholla
10:30 - 11:30 am	**Breakout Session I**	Ocotillo & Cholla
11:30 am - 12:00 pm	**Report Out**	Ocotillo & Cholla
12:00 - 12:30 pm	**Mini Breakout Session I**	Multiple Rooms
12:30 - 1:30 pm	**Lunch**	Palm Room & Terrace
1:30 - 2:00 pm	**Collaborative Team Presentations**	Ocotillo & Cholla
2:00 - 3:00 pm	**Breakout Session II**	Ocotillo & Cholla
3:00 - 3:30 pm	**Report Out**	Ocotillo & Cholla
3:30 - 4:00 pm	**Mini Breakout Session II**	Ocotillo & Cholla
4:00 - 5:30 pm	**Afternoon Break**	

Friday, April 28 Continued

5:30 - 6:30 pm	**Poster Session and Reception**	Sonoran Ballroom
6:30 - 7:30 pm	**Dinner**	Ocotillo & Cholla
7:30 - 11:00 pm	**MCL Starlight Café** Snacks, conversations, etc.	Palm Room & Terrace

Saturday, April 29

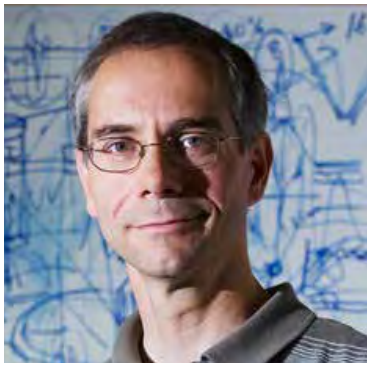
6:15 - 7:15 am	**Optional Guided Nature Walk**	WL Trails
7:00 - 8:00 am	**Breakfast**	Palm Room & Terrace
8:00 - 8:45 am	**Collaborative Team Presentations**	Ocotillo & Cholla
8:45 - 9:45 am	**Breakout Session III**	Ocotillo & Cholla
9:45 - 10:15 am	**Report Out**	Ocotillo & Cholla
10:15 - 10:45 am	**Mini Breakout Session III**	Ocotillo & Cholla
10:45 - 11:15 am	**Morning Break**	
11:15 am - 12:00 pm	**Collaborative Team Presentations**	Ocotillo & Cholla
12:00 - 12:30 pm	**Mini Breakout Session IV**	Ocotillo & Cholla
12:30 - 1:30 pm	**Lunch**	Palm Room & Terrace
1:30 - 6:00 pm	**Team Formation, Informal Discussion, & Proposal Writing** Proposals due 7:00 am Sunday morning	Multiple Rooms
6:00 - 6:30 pm	**Reception**	Ocotillo & Cholla
6:30 - 7:30 pm	**Dinner**	Ocotillo & Cholla
7:30 - 11:00 pm	**MCL Starlight Café & Proposal Writing** Snacks, conversations, etc.	Palm Room & Terrace

Sunday, April 30

7:00 - 8:00 am	**Breakfast**	Palm Room & Terrace
8:00 - 10:30 am	**Presentations of Proposal Ideas**	Ocotillo & Cholla
10:30 - 11:00 am	**Assessment Survey & Wrap-up**	Ocotillo & Cholla
11:00 - 12:00 pm	**Lunch** Available to go	Saguaro Room

Keynote Speaker

From water to fish: the multiple scales of biological dynamics



Martin Gruebele
James R. Eiszner Professor of Chemistry, Professor of Physics, and Professor of Biophysics and Computational Biology, University of Illinois at Urbana-Champaign

Abstract: In my talk, I will discuss some underlying physical principles used for a quantitative description of biological systems. Examples will range from physical studies of solvation water, to dynamics of protein and RNA chains, to dynamics in cells, to organism-level behavioral dynamics. The range goes on upward of course, including organismal ecologies and all the way to planetary ecologies, as well as in the dimension of artificial but biomimetic systems.

Bio: Martin Gruebele was born in Stuttgart, Germany, in 1964. He obtained his B.S. in 1984 and his Ph.D. in 1988 at UC Berkeley. He went on to do femtochemistry in the lab of Ahmed Zewail at Caltech, and then moved to the University of Illinois in 1992. He is currently the James R. Eiszner Professor of Chemistry, Professor of Physics, and Professor of Biophysics and Computational Biology. He is a Fellow of the American Physical, Chemical and Biophysical societies, as well as a recipient of the Sacker International Prize in Biophysics, the ACS Nakanishi Prize, and the Wilhelm Bessel Prize, among others. He is a member of the German National Academy of Sciences, the American Academy of Arts and Sciences, and the National Academy of Sciences (USA). He has served as Senior Editor at the Journal of Physical Chemistry, and as Associate Editor of the Journal of the American Chemical Society. His research includes protein and RNA folding, fast dynamics in live cells, vibrational energy flow in molecules, quantum computing and quantum control, optically assisted STM, glass dynamics, and vertebrate swimming behavior. The work is published in over 250 papers and reviews. Martin is married to Nancy Makri, with two children, Alexander and Valerie.

Keynote Speaker

Theory in Biology: Figure 1 vs Figure 7

Rob Phillips
Fred and Nancy Morris Professor of Biophysics and Biology at the California Institute of Technology

Abstract: One could argue that we are living in a revolution in biology that rivals the revolution in astronomy at the time of the invention of the telescope. But unlike the data that was acquired in the early days of natural philosophy, in biology the amount of data brimming over in our databases is staggering. For example, the total amount of sequence information already deposited at the NIH is the equivalent of 1.5 billion copies of the complete works of Shakespeare. To my mind, this raises the serious and important question of how to come to terms with all this data since as Poincare noted, "a mere accumulation of facts is no more a science than a pile of bricks is a house." My talk will focus on efforts at trying to tame biological data using predictive theory. After some introductory remarks on the nature of predictive understanding, I will focus on a particular case study involving transcription with the ambition of showing a broad array of parameter-free predictions that apply to a diverse collection of transcriptional scenarios and then consider how to test those predictions using precision measurements.

Bio: Rob Phillips is the Fred and Nancy Morris Professor of Biophysics and Biology at the California Institute of Technology in Pasadena, California. Phillips received his Ph.D. in condensed matter physics at Washington University in 1989. Work in his laboratory centers on physical biology of the cell, the use of physical models to explore biological phenomena and the construction of experiments designed to test them. Some of the key areas of interest include the physics of genome management, such as how viruses and cells physically manipulate DNA as part of their standard repertoire during their life cycles, how transcriptional networks lead to regulatory decisions and how the physical properties of lipid bilayers are tied to the behavior of ion channels. Over the last decade, Phillips has been working with Professor Jané Kondev (Brandeis University), Professor Julie Theriot (Stanford University) and Professor Hernan Garcia (UC Berkeley) on a book entitled "Physical Biology of the Cell" published by Garland Science. In addition, he has also been advocating "biological numeracy" through work on a book entitled "Cell Biology by the Numbers" with Prof. Ron Milo (Weizmann Institute).

2015 Scialog Molecules Come to Life Collaborative Renewal Awards

Building an Artificial Motile Tissue through Self-Organized Rhythmic Contractility

Michael Rust, University of Chicago

Jennifer Ross, University of Massachusetts, Amherst

Rae Robertson-Anderson, University of San Diego

Rebooting the Gut Microbial Ecosystem using Bacterial Dueling

Raghuveer Parthasarathy, University of Oregon

Brian Hammer, Georgia Institute of Technology

Joao Xavier, Memorial Sloan-Kettering Cancer Center

2016 Scialog Molecules Come to Life Collaborative Awards

Heteroplasmy: population dynamics of mitochondria in mammalian cells

Moumita Das, Rochester Institute of Technology

Daniel Needleman, Harvard University

Douglas Weibel, University of Wisconsin, Madison

High-dimensional context dependence of a ubiquitous ecological interaction

Seppe Kuehn, University of Illinois

Paul Blainey, Massachusetts Institute of Technology

What constrains microbial diversity? Deriving new ecological principles for the microbial world

Alvaro Sanchez, Yale University

Pankaj Mehta, Boston University

Conditional gene essentiality as a function of cell metabolic state

Kimberly Reynolds, University of Texas

Adilson Motter, Northwestern University

Deconstructing the cell's mechanical circuits

Adriana Dawes, The Ohio State University

Matthew Ferguson, Boise State University

Dinah Loerke, University of Denver

Megan Valentine, University of California, Santa Barbara

Commoditizing advanced molecular imaging techniques

Ibrahim Cissé, Massachusetts Institute of Technology

Moumita Das, Rochester Institute of Technology

Megan Valentine, University of California, Santa Barbara

Ali Yanik, University of California, Santa Cruz

Proposal Guidelines

Collaborative Awards

1. Awards, which are one year in duration, are intended to provide seed funding for teams of two to four Scialog Fellows formed at this conference.
2. Two-page proposals should describe the proposed project and the role of each team member. No budget is necessary. A third page may be used for references.
3. Awards will be in the amount of $50K (direct funding) for each team member.
4. A Scialog Fellow can be a member of no more than two teams. If a Scialog Fellow is a member of two teams, the other team members must be different. No team can submit more than one proposal.
5. Scialog Fellows who previously won one Scialog Collaborative Award can be a member of only one team. The other team members must be different from the members of the previously awarded team.
6. Scialog Fellows who previously won two Scialog Collaborative Awards cannot be a member of a team.
7. Teams may not include members who have previously collaborated with one another.
8. Teams are encouraged to:

   a) Include a theory and experimental component.
   b) Focus on fundamental research rather than disease-oriented research.
   c) Base their proposal on an innovative, high-risk, blue-sky idea.
   d) Address an important question in physical cell biology amenable to quantitative modeling.
   e) Base the proposal on an idea unlikely to garner federal funding because it is too early, cross-cutting or high risk.

9. Additional funding after one year for the most promising projects is possible but not guaranteed.
10. Proposals must be submitted electronically by Sunday morning at 7:00 am to RCSA Senior Program Directors Richard Wiener (rwiener@rescorp.org) and Silvia Ronco (sronco@rescorp.org) and Moore Program Officer Gary Greenburg (gary.greenburg@moore.org).

Discussion Facilitators for 2017
Molecules Come to Life

Daniel Cox
University of California, Davis
dlcox@ucdavis.edu

Ken Dill
Stony Brook University
dill@laufercenter.org

Michael Espey
National Cancer Institute
sp@nih.gov

Daniel Fisher
Stanford University
dsfisher@stanford.edu

Daniel Gallahan
National Cancer Institute
gallahad@mail.nih.gov

Holly Goodson
University of Notre Dame
hgoodson@nd.edu

Martin Gruebele
University of Illinois at Urbana-Champaign
mgruebel@illinois.edu

Rigoberto Hernandez
Johns Hopkins University
r.hernandez@jhu.edu

Jané Kondev
Brandeis University
kondev@brandeis.edu

Rob Phillips
California Institute of Technology
phillips@pboc.caltech.edu

Scialog Fellows Attending 2017
Molecules Come to Life

Grégoire Altan-Bonnet
National Institutes of Health
gregoire.altan-bonnet@nih.gov

Nihal Altan-Bonnet
National Institutes of Health
nihal.altan-bonnet@nih.gov

David Altman
Willamette University
daltman@gmail.com

Ariel Amir
Harvard University
arielamir@seas.harvard.edu

Timothy Atherton
Tufts University
timothy.atherton@tufts.edu

Aparna Baskaran
Brandeis University
aparna@brandeis.edu

Paul Blainey
The Broad Institute/Massachusett
Institute of Technology
pblainey@broadinstitute.org

Jasna Brujic
New York University
jb2929@nyu.edu

Stirling Churchman
Harvard Medical School
churchman@genetics.med.harvard.edu

Ibrahim Cissé
Massachusetts Institute of Technology
icisse@mit.edu

Eva-Maria Collins
University of California, San Diego
emscollins@physics.ucsd.edu

Roy Dar
University of Illinois at Urbana-Champaign
roydar@illinois.edu

Moumita Das
Rochester Institute of Technology
modsps@rit.edu

Adriana Dawes
Ohio State University
dawes.33@osu.edu

Michelle Digman
University of California Irvine
mdigman@uci.edu

Sophie Dumont
University of California, San Francisco
sophie.dumont@ucsf.edu

Nikta Fakhri
Massachusetts Institute of Technology
fakhri@mit.edu

Matthew Ferguson
Boise State University
mattferguson@boisestate.edu

Polly Fordyce
Stanford University
pfordyce@stanford.edu

Kingshuk Ghosh
University of Denver
kghosh@du.edu

Ido Golding
Baylor College of Medicine
igolding@illinois.edu

Ajay Gopinathan
University of California, Merced
agopinathan@ucmerced.edu

Jeff Gore
Massachusetts Institute of Technology
gore@mit.edu

Brian Hammer
Georgia Institute of Technology
bhammer@gatech.edu

Vanessa Huxter
University of Arizona
vhuxter@email.arizona.edu

Srividya Iyer-Biswas
Purdue University
iyerbiswas@gmail.com

Margaret Johnson
Johns Hopkins University
margaret.johnson@jhu.edu

Scialog Fellows Continued

Suckjoon Jun
University of California, San Diego
jun@ucsd.edu

Minsu Kim
Emory University
minsu.kim@emory.edu

Justin Kinney
Cold Spring Harbor Laboratory
jkinney@cshl.edu

Kirill Korolev
Boston University
korolev@bu.edu

Seppe Kuehn
University of Illinois at Urbana-Champaign
seppe@illinois.edu

Thomas Kuhlman
University of Illinois Urbana-Champaign
tkuhlman@illinois.edu

Laura Lackner
Northwestern University
laura.lackner@northwestern.edu

Dinah Loerke
University of Denver
dinah.loerke@gmail.com

Parag Mallick
Stanford University
paragm@stanford.edu

Madhav Mani
Northwestern University
madhav.mani@gmail.com

Pankaj Mehta
Boston University
pankajm@bu.edu

Maiken Mikkelsen
Duke University
m.mikkelsen@duke.edu

Adilson Motter
Northwestern University
motter@northwestern.edu

Daniel Needleman
Harvard University
dan.needleman@gmail.com

Banu Ozkan
Arizona State University
banu.ozkan@asu.edu

Raghuveer Parthasarathy
University of Oregon
raghu@uoregon.edu

Ashok Prasad
Colorado State University
ashokp@engr.colostate.edu

Steve Pressé
Arizona State University
spresse@asu.edu

Kimberly Reynolds
The University of Texas Southwestern Medical Center
kimberly.reynolds@utsouthwestern.edu

Jennifer Ross
University of Massachusetts, Amherst
rossj@physics.umass.edu

Michael Rust
University of Chicago
mrust@uchicago.edu

Alvaro Sanchez
Harvard University
sanchez@rowland.harvard.edu

Jeremy Schmit
Kansas State University
schmit@phys.ksu.edu

Bo Sun
Oregon State University
sunb@onid.orst.edu

Megan Valentine
University of California, Santa Barbara
valentine@engineering.ucsb.edu

Joao Xavier
Memorial Sloan Kettering Cancer Center
xavierj@mskcc.org

Ahmet Ali Yanik
University of California, Santa Cruz
yanik@ucsc.edu

Research Corporation Scientific Staff

Silvia Ronco
Senior Program Director
sronco@rescorp.org

Richard Wiener
Senior Program Director
rwiener@rescorp.org

Gordon and Betty Moore Foundation Scientific Staff

Gary Greenburg
Program Officer
gary.greenburg@moore.org

Foundation Representatives

Michael Graham Espey
National Cancer Institute
sp@nih.gov

Daniel Gallahan National Cancer Institute
gallahad@mail.nih.gov

Moses Lee
M. J. Murdock Charitable Trust
mosesl@murdocktrust.org

Research Corporation Staff

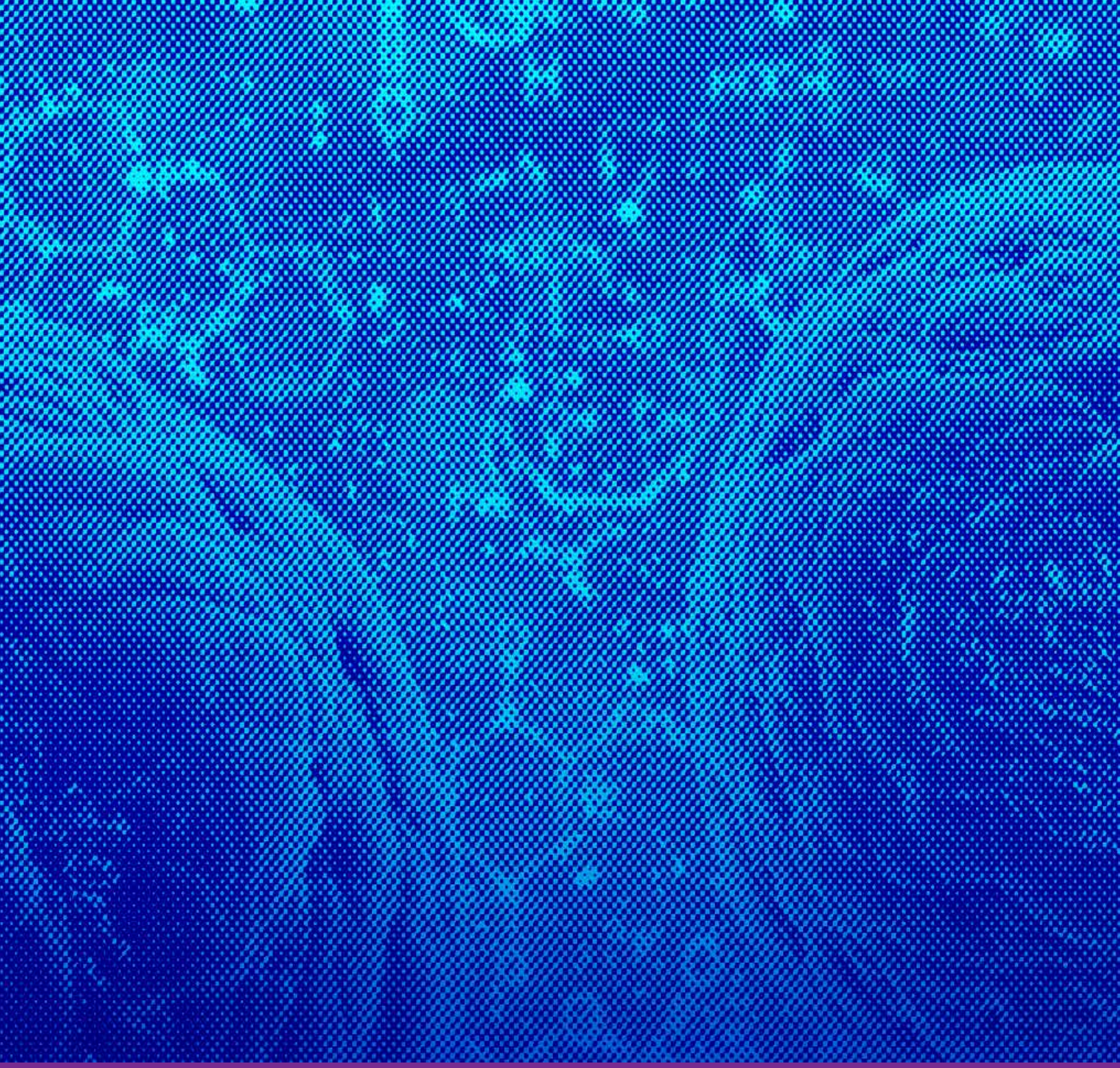
Danny Gasch
Interim President, RCSA
dgasch@rescorp.org

Kathleen Eckert
Senior Program Assistant
kathleen@rescorp.org

Dan Huff
Communications Director, RCSA
dhuff@rescorp.org

Kylie Johnson
Program Assistant, Event Coordinator
kjohnson@rescorp.org

Debra Keiser
Program Assistant, Post-Award Coordinator
dkeiser@rescorp.org



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

RESEARCH CORPORATION
for SCIENCE ADVANCEMENT