

Molecules Come to Life

scialog2017[®]

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

Scialog: Molecules Come to Life

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, <i>Interim President, RCSA</i> Gary Greenburg, <i>Program Officer, Moore Foundation</i> Mike Espey, <i>Program Director, NIH</i>	Ocotillo & Cholla
7:30 - 7:45 pm	Conference Overview, Hoped for Outcomes & Guidelines for Collaborative Proposals Richard Wiener, <i>Senior Program Director, RCSA</i>	Ocotillo & Cholla
7:45 - 8:30 pm	Keynote Presentation <i>From water to fish: the multiple scales of biological dynamics</i> Martin Gruebele, <i>UIUC</i>	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 <i>Theory in Biology: Figure 1 vs Figure 7</i> Rob Phillips, <i>Caltech</i>	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 Sackler 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).

Scialog: Molecules Come to Life

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

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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 (rwien@rescorp.org) and Silvia Ronco (sronco@rescorp.org) and Moore Program Officer Gary Greenburg (gary.greenburg@moore.org).

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Molecules Come to Life

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