

**Siemens Competition
2016 Regional Finals**

California Institute of Technology Judges



Richard C. Flagan, Lead Judge

Richard Flagan received his B.S. in mechanical engineering from the University of Michigan, and his S.M. and Ph.D. from the Massachusetts Institute of Technology, also in mechanical engineering. He is the McCollum/Corcoran Professor of Chemical Engineering and Professor of Environmental Science and Engineering at the California Institute of Technology, where he also serves as Executive Officer for Chemical Engineering. Flagan has published over 300 scientific papers, a textbook: “Fundamentals of Air Pollution Engineering,” and has 19 patents. He has served as the President of the American Association for Aerosol Research and as Editor-in-Chief of its journal, “Aerosol Science and Technology.” He has received numerous awards for his aerosol research, including the David Sinclair Award of the American Association for Aerosol Research.



Mario Blanco

Mario Blanco’s research career has been centered on the assembly and function of ribonucleoprotein (RNP) complexes. His undergraduate experience as a Biochemistry major at Florida State University involved solving high resolution structures of an RNA modifying RNP and utilizing ensemble fluorescence measurements to identify substrate recognition and positioning. For graduate work he enrolled in the Cellular and Molecular Biology program at the University of Michigan. His thesis focused on understanding the role structural dynamics play within spliceosome assembly and catalysis. To accomplish this, he developed novel experimental and analytical tools to measure spliceosome structural dynamics using single molecule fluorescence microscopy techniques. Currently, he is a postdoctoral scholar in Mitch Guttman’s lab at Caltech, investigating RNA-protein interactions on a recently identified gene product long noncoding RNAs (lncRNAs). RNA-protein interactions are mediated by a variety of factors, RNA sequence and structure being among the most important. The lab is leveraging the power of high throughput

sequencing techniques to create comprehensive maps of structural and sequence binding specificities for lncRNA binding proteins.



Alex Cunha

Alexandre Cunha is a computational scientist with the Center for Advanced Computing Research at Caltech. He is a member of Caltech's Center for Integrative Study of Cell Regulation, where he works developing algorithms and tools for bioimaging processing and for computational plant simulation. He has a doctoral degree in computational science and engineering from Carnegie Mellon University, Pittsburgh, Pennsylvania, and has done postdoctoral work at the Center for Computational Biology at the University of California, Los Angeles. His research interests are in developing fast

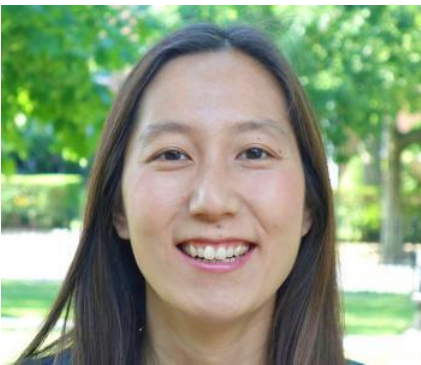
and effective algorithms for image processing, geometry extraction from images and computer simulations.



Julia Greer

Julia Greer is Professor of Materials Science and Mechanics. She received her BS from MIT in Chemical Engineering and her MS and Ph.D degrees in Materials Science and Engineering from Stanford. The key focus of the Greer group is on creating and studying advanced materials that utilize combination of 3-dimensional hierarchical architectures and nanoscale material size effects. Creation of extremely strong yet ultra-light materials can be achieved by capitalizing on the hierarchical

design of 3-dimensional nano-architectures. Such structural meta-materials exhibit superior thermomechanical properties at extremely low mass densities (lighter than aerogels), making these solid foams ideal for many scientific and technological applications. The dominant deformation mechanisms in such “meta-materials”, where individual constituent size (nanometers to microns) is comparable to the characteristic microstructural length scale of the constituent solid, are essentially unknown. To harness the lucrative properties of 3-dimensional hierarchical nanostructures, it is critical to assess mechanical properties at each relevant scale while capturing the overall structural complexity.



Elizabeth Hong

Assistant Professor of Neuroscience Betty Hong is interested in how animals sense cues in their environment, process that information in the brain, and then use that information to guide behaviors. To study the processing of information from synapse to behavior, her work focuses on olfaction—or chemical sensing via smell—in fruit flies. Synapses are a fundamental unit of computation in the brain and vary widely in their structural and functional properties. Each

synapse is a biochemically complex machine, comprised of hundreds of different proteins that vary in both identity and quantity across synapses. The functional significance for most of these differences in molecular composition is poorly understood. Our goal is to understand how molecular diversity at synapses gives rise to useful variation in synaptic physiology, and how this may reflect the specialization of synapses to perform specific useful computations in their respective circuits.

Hong, who received her bachelor's degree from Caltech in 2002 and her doctorate from Harvard in 2009, came from a postdoctoral position at Harvard Medical School to join the Caltech faculty in June, 2015.



Zuli Kurji

Zuli Kurji did her undergraduate work (in Chemistry and Biology) at Cornell University and received her PhD in Chemistry at Caltech in 2013. She is now a joint postdoctoral scholar with the Physics department at Washington State University and the Chemical Engineering Department at Caltech. Her long-term research goals reflect her interest in using soft materials, including liquid crystal polymers, as sensors and actuators. She has mentored

many undergraduate and high school students in original laboratory research and loves to see high schoolers so engaged in science.



Jay Labinger

Jay Labinger's research interests are in the areas of organotransition metal chemistry and homogeneous and heterogeneous catalysis, with a particular focus on conversion technologies and other energy-related applications. Most of his recent work has been carried out in collaboration with colleagues at Caltech as part of the "XC2" program, sponsored by BP and also involving UC

Berkeley and the University of Virginia.

He is also involved in scholarly work at the borders between science and the humanities, and have written on topics including history of chemistry, sociology of science, and science and literature. Labinger is an active member of the [Society for Literature, Science and the Arts \(SLSA\)](#), an organization that will offer much to others interested in these fields.

Labinger received his doctorate in Chemistry from Harvard University.



Brittany Needham

Brittany Needham got her PhD in Microbiology from the University of Texas at Austin, where she worked to understand and engineer the bacterial surface structure, lipopolysaccharide (LPS) in the laboratory of M. Stephen Trent. LPS provides a barrier against the often-hostile environment encountered by a bacterial cell. The bioactive portion of LPS that anchors the molecule into the cell surface is lipid A (endotoxin). In its natural, unmodified form, lipid A can over-stimulate the human immune system, leading to severe inflammation and toxic shock.

After graduating in 2014, she began as a post doc in Sarkis Mazmanian's lab. Here, she is studying the gut microbiota and how intestinal bacteria affect diverse host functions. Her main focus is to understand how gut bacteria are involved in the etiology and potential treatment of autism spectrum disorder.



Haowen Ruan

Haowen Ruan received his PhD in Biomedical Imaging from the University of Nottingham. His research focuses on the area of biomedical imaging and its translation to clinical studies. He is currently researching the development of novel imaging techniques combining light and ultrasound, aiming to tackle the challenges of imaging inside the optical scattering biological tissue. He is particularly interested in ultrasound modulated optical tomography, time reversal deep tissue imaging based on optical phase conjugation, photoacoustic imaging, ultrasonic imaging with nonlinear ultrasound and contrast agents, and biomedical instrumentation.



Zak Staniszewski

Zak Staniszewski is an instrument systems engineer at NASA Jet Propulsion Laboratory, and a former postdoctoral scholar at Caltech. He is currently working on new astrophysics satellite experiments at NASA to explore the early Universe and to test inflation and Big Bang scenarios. He came to Caltech as a Moore fellow in 2009 to work on the Keck Array with Jamie Bock and Andrew Lange in their observational cosmology group. He helped design and build two telescopes at the South Pole station in Antarctica and spent a full winter season running one of them. He specializes in telescope design and assembly, detector development and data analysis. He received his Ph.D. in physics from Case Western Reserve University, where he worked on the South Pole Telescope with Prof. John Ruhl. His Ph.D resulted in the first ever discovery of galaxy clusters using a millimeter wave telescope.



Tony Szempruch

Tony Szempruch's research focuses on the role of long noncoding (lnc)RNAs in the three dimensional architecture of the nucleus. By understanding the mechanisms lncRNAs use to coordinate RNAs, proteins and DNA we can better understand how these processes are dysregulated in cancer.

One aspect of his research focuses on understanding the mechanisms utilized by *Trypanosoma brucei* in generating mitochondrial protein diversity. From these studies he has identified a novel cell signaling structure that these parasites use to alter host cells during infection. To understand mechanisms of mitochondrial RNA editing and alternative editing, he adapted a protein mediated method to knock down specific mitochondrial transcripts to dissect the editing process. His team identified a nuclear encoded, mitochondrial targeted protein with alternative functions resulting in differential cellular localization between the two lifecycle stages of *T. brucei*. He is also working on cellular signaling and host interactions mediated by a novel cell structure produced by bloodstream form *T. brucei*. Szempruch received his doctorate in Biochemistry and Molecular Biology from the University of Georgia.