



# The MCDB Graduate Student Symposium

The MCDB Graduate Student Symposium (GSS) brings leading researchers from around the country to The University of Colorado Boulder to share their research with the local scientific community. Originally arranged in 1979 by Dr. Larry Gold and Jane Westyle in remembrance of friend and fellow professor Dr. Charlie Yegian, the symposium has been held biennially ever since. The GSS acts as a valuable learning experience for the graduate students who organize, plan, and participate in the event. Graduate students choose a theme, invite speakers, fundraise, and organize nearly every other aspect of the event in concert with the notable and indispensable aid of the dedicated MCDB Staff. Past symposia have focused on membranes (1979), complex carbohydrates (1985), the human genome (1994), astrobiology (2000), emerging technologies (2015), and much more.\* We greatly appreciate your attendance!

This year's theme, "Novel Model Systems," aims to illustrate how the vast natural world can be leveraged to probe challenging, provocative, and profound biological questions:

- How does social behavior arise, both evolutionarily and mechanistically?
- How are genomes composed and can we synthesize an original one tailored to specific needs?
- How do animal interactions drive evolution?
- How and why do living things age?
- How is viral tropism determined, and how does our microbiome influence susceptibility and progression of viral infections?
- How can complex tissue culture models, such as organoids, improve disease understanding and accelerate drug discovery?
- How do animals maintain and regenerate their body parts in the face of cellular turnover and injury?

*\*A complete list of past topics can be found on the MCDB GSS website.*

## Acknowledgements

### Special Thanks:

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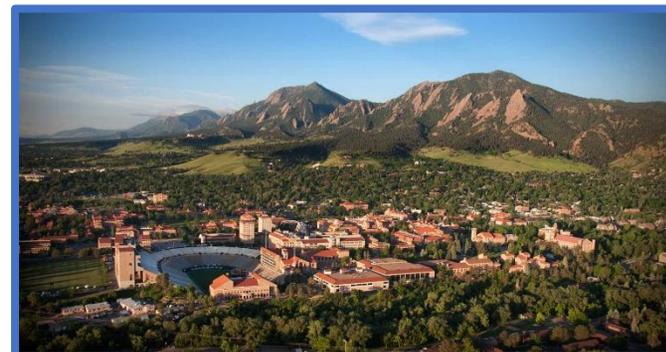
### Thank you to our sponsors who made this event possible:

- MCDB Department
- SomaLogic
- Dr. Larry Gold (GoldLab Symposium)
- Dr. Jenifer Kennedy and Aaron Kennedy
- New England Biosciences
- ThermoFisher Scientific
- USA Scientific
- Avery Brewing Company



### Thank you all from the GSS Organizing Committee for participating:

- Giancarlo Bruni
- Genevieve Kerr
- Deanna Langager
- Doug Peters





Session II (3:30-4pm)

**Calvin Kuo, M.D. Ph.D.**

*Stanford University*

*Department of Chemical and Systems Biology*

In addition to vascular and stem cell biology research, the Kuo Laboratory develops and studies cancer organoids. Organoids are miniaturized and simplified organs produced *in vitro* in three dimensions. Their cell types and organization mimic *in vivo* systems, making them powerful tools for studying particular organ systems. In particular, Dr. Kuo's group has established primary 3D organoid cultures wherein primary intestine, stomach, and pancreas tissues are induced to become adenocarcinomas. These cancer organoid systems comprise a robust *in vitro* system in which putative oncogenic loci can be functionally validated, large-scale cancer genomics datasets can be interrogated, and potential cancer therapeutics can be screened.

Visit the Kuo Laboratory website for more information:  
[www.kuolab.stanford.edu](http://www.kuolab.stanford.edu).



Session II (4-4:30pm)

**Alejandro Alvarado-Sanchez, Ph.D.**

*Stowers Institute for Medical Research*

The Alvarado-Sanchez Laboratory works to uncover the molecular and cellular mechanisms underpinning animal regeneration. Humans must replace an estimated  $10^9$  cells *every day*, a complex process that is critical to many aspects of human health and disease. Perhaps surprisingly, the molecular and cellular mechanisms driving the restoration of cells lost to physiological turnover and/or injury remain largely unexplored. To address this biological question, Dr. Alvarado-Sanchez's group leverages the planarian *Schmidtea mediterranea* as a model system. Planarians display extensive regenerative capacity which is driven by a population of collectively totipotent stem cells.

Visit the Alvarado-Sanchez Laboratory website for more information:  
[Planaria.stowers.org](http://Planaria.stowers.org).



**Keynote Address**  
**(10:30am – 11:30am)**

**Gene Robinson, Ph.D.**

*University of Illinois at Urbana-Champaign*  
*Department of Entomology and Carl R. Woese Institute for Genomic Biology*

The Robinson Laboratory uses the Western honey bee, *Apis mellifera*, to investigate the evolution and mechanisms of social behavior. Honey bees are highly attuned to their social environment and often organize as societies that surpass our own in complexity and cohesion. Dr. Robinson's research synthesizes entomology, genetics, neuroscience, ecology, evolution, computer science, and more to explain the: (1) Function and evolution of behavioral mechanisms that integrate an individual's activities into those of its society, (2) Neural and neuroendocrine mechanisms that regulate behavior within the brain of the individual, and (3) Genes that influence social behavior.

Visit the Robinson Laboratory website for more information:  
[life.illinois.edu/robinson](http://life.illinois.edu/robinson).

Recent Publications:

- Naeger NL, Robinson GE. 2016. Transcriptomic analysis of instinctive and learned reward-related behaviors in honey bees. *J Exp Biol* 219: 3554-3561.
- Liu H, Robinson GE. 2016. Conservation in Mammals of Genes Associated with Aggression-Related Behavioral Phenotypes in Honey Bees. *PLoS Comp Biol* 12(6): e1004921.
- Rittschof CC, Grozinger CM, Robinson GE. The energetic basis of behavior: bridging behavioral ecology and neuroscience. *Curr Opin Behav Sci* 6: 19-27.



Session I (1-1:30pm)

**Jef Boeke, Ph.D.**

*New York University School of Medicine  
NYU Langone Medical Center*

The Boeke Laboratory uses the yeast *S. cerevisiae* as the basis for a synthetic genome that can be used to answer a wide variety of profound biological questions. Dr. Boeke is a leader in the global effort to construct a *full* synthetic genome comprising all sixteen yeast chromosomes. Notably, this endeavor

integrates the efforts of hundreds of undergraduate researchers. An important practical goal of synthetic genomics is to develop generic platforms for biotechnology as well as solutions to societal problems such as the looming energy crisis and bioremediation.

Additionally, Dr. Boeke's lab investigates the mechanisms underpinning retrotransposition in yeast and human cells. Their work in this field led them to study transcriptional silencing, where they discovered a new form of silencing that occurs in yeast ribosomal DNA.

Visit the Boeke Laboratory website for more information:  
[med.nyu.edu/research/boeke-lab](http://med.nyu.edu/research/boeke-lab).



Session I (1:30-2pm)

**Ashlee Rowe, Ph.D.**

*Michigan State University  
Neuroscience Program and Dept. of Integ. Biology*

The Rowe Laboratory is broadly interested in sensorimotor systems and their role in the evolution of adaptive behavior, particularly traits that influence animal interactions. More specifically, Dr. Rowe's group studies the co-evolution of grasshopper mice and the venomous scorpions on which they prey. Of

particular interest are the adaptations employed in grasshopper mice to nullify the pain, paralysis, seizure, and death typically caused by the neurotoxins in scorpion venom. This model confers an opportunity to study the processes underlying co-evolutionary "arms races," wherein the evolution of one species drives and is driven by the evolution of another species.

Visit the Rowe Laboratory website for more information:  
[venomevolution.zoology.msu.edu](http://venomevolution.zoology.msu.edu).



Session I (2-2:30pm)

**Vera Gorbunova, Ph.D.**

*University of Rochester  
Department of Biology, Department of Oncology*

The Gorbunova Laboratory investigates DNA repair and cancer using a variety of established systems, including human cell lines and transgenic mice. Additionally, they leverage comparative studies in short- and long-lived animal species to study the mechanisms underpinning aging. The complex

process of aging remains one of the biggest mysteries of biology. In particular, Dr. Gorbunova's group uses rodents for these analyses. Rodents present a wide variety of life spans, ranging from 4-28 years, and the longest-living rodents (e.g. naked mole rats, beavers, porcupines, and squirrels) belong to different phylogenetic groups. Studying the relationship between DNA repair, genomic stability, and lifespan in these rodent species aims to shed light on the enigmatic aging process.

Visit the Gorbunova Laboratory website for more information:  
[Rochester.edu/College/BIO/labs/Gorbunova](http://Rochester.edu/College/BIO/labs/Gorbunova).



Session II (3-3:30pm)

**Stephanie Karst, Ph.D.**

*University of Florida College of Medicine  
Department of Molecular Genetics & Microbiology*

Human noroviruses cause a majority of gastroenteritis outbreaks across the globe and are the leading cause of severe childhood diarrhea and foodborne disease outbreaks in the United States. The Karst Laboratory has recently revealed that B cells are not only targeted by noroviruses *in vitro*,

but B cells can also support human norovirus replication *in vitro*, thus representing the first cell culture replication system for human noroviruses. Notably, norovirus infection *in vivo* and *in vitro* is enhanced by commensal bacteria. Dr. Karst's group continues to develop and interrogate this system in order to better understand this dangerous human pathogen.

Visit the Karst Laboratory website for more information:  
[mgm.ufl.edu/faculty/faculty-home-pages/karst-stephanie](http://mgm.ufl.edu/faculty/faculty-home-pages/karst-stephanie).