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SYNBIO CONCLAVE 2.0

SEPT 16-17-18-19

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KEYNOTE SPEAKER

Dr. Domitilla Del Vecchio

Domitilla Del Vecchio is an Italian control theorist. Having received the Laurea degree in Electrical Engineering (Automation) from the University of Rome at Tor Vergata and her Ph.D. in control theory and dynamical systems from the California Institute of Technology in 2005, she is now a professor of mechanical engineering at the Massachusetts Institute of Technology (MIT), and a member of the MIT Synthetic Biology Center. Her research group focuses on model-based analysis, design, and control of biomolecular networks in living cells. She is a recipient of the 2016 Bose Research Award (MIT) and the Donald P. Eckman Award from the American Automatic Control Council (2010) for her contributions to hybrid dynamical systems and systems biology.

SEPTEMBER 16TH @ 10 PM IST

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Mammalian synthetic biology by controller

The ability to reliably engineer the mammalian cell will impact a variety of applications in a disruptive way, including cell fate control and reprogramming, targeted drug delivery, and regenerative medicine. However, our current ability to engineer mammalian genetic circuits that behave as predicted remains limited. These circuits depend on the intra and extra cellular environment in ways that are difficult to anticipate, and this fact often hampers genetic circuit performance. This lack of robustness to poorly known and often variable cellular environment is the subject of this talk. Specifically, I will describe control engineering approaches that make the performance of genetic devices robust to context. I will show a feedforward controller that makes gene expression robust to variability in cellular resources and, more generally, to changes in intra-cellular context linked to differences in cell type. I will then show a feedback controller that uses bacterial two component signaling systems to create a quasi-integral controller that makes the input/output response of a genetic device robust to a variety of perturbations that affect gene expression. These solutions support rational and modular design of sophisticated genetic circuits and can serve for engineering biological circuits that are more robust and predictable across changing contexts.

SEPTEMBER 16TH @ 10 PM

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KEYNOTE SPEAKER

Dr. G.K.Ananthasuresh

Gondi Kondaiah Ananthasuresh is an Indian mechanical engineer and Professor at the Department of Mechanical Engineering, Indian Institute of Science, Bengaluru, India. He received his PhD degree in Mechanical engineering from University of Michigan and was a Postdoc at Massachusetts Institute of Technology. Having worked as a faculty at University of Pennsylvania from 1996 to 2004, Mr. Ananthasuresh now heads the Multidisciplinary and Multi-scale Device and Design Lab (M2D2) at IISc, Bengaluru. He is best known for his work in the areas of Topology optimization, Compliant mechanism and Micro-Electro-Mechanical Systems (MEMS).

SEPTEMBER 17TH @ 7 PM IST

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Micromachinery for Mechano-diagnostics

There is increasing evidence that mechanical response of biological cells changes when a cell is under disease conditions. Correlating the changed mechanical response to a specific disease condition paves the way for mechano-diagnostics as much as it would help us understand a disease from the viewpoint of biomechanics. In this presentation, we will discuss the micromachined tools and computational techniques developed in assessing the mechanical responses of single cells, suspended or adhered, in their native medium. Prospects for mechano-diagnostics will be outlined and some examples will be discussed.

The premise for mechano-diagnostics at the level of single cells is rooted in early works more than a century ago when researchers, including Francis Crick, investigated the physical properties of biological cells. A biological cell, being a complex mechanical entity with passive and motile particles and filaments of varied sizes and shapes jostling about in a viscous fluid, gives different mechanical response depending on the composition and arrangement of organelle. It is akin to a heterogeneous solid made of granular medium. Physics, mechanics in particular, decides a cell's response in addition to complex biochemical phenomena.

SEPTEMBER 17TH @ 7 PM IST

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KEYNOTE SPEAKER

Dr. Peng Yin

Peng Yin is a Professor in the Department of Systems Biology at Harvard Medical School. Peng's lab uses synthetic DNA/RNA to construct, manipulate, and visualize nanoscale structures. They have developed a general framework to program DNA/RNA strands to self-assemble into structures with user-specified geometry or dynamics.

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Engineering synthetic DNA/RNA nanostructures and devices

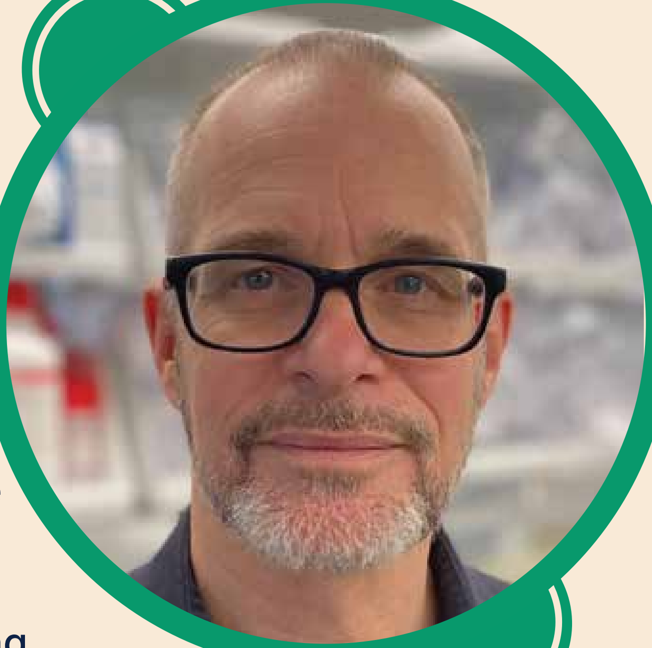
The engineering synthetic DNA/RNA nanostructures and devices and their practical applications in bio imaging and biosensing . Examples will include DNA bricks for constructing nanostructures with user specified geometry, DNA-PAINT for super-resolution imaging, SABER for highly multiplexed tissue imaging, ROCK for sub-3 A cryo-EM RNA structure visualization, SPEAR for ultra-sensitive, low-volume immunoassay, etc, LightSeq for spatially prescribed whole transcriptome sequencing etc.

SEPTEMBER 17TH @ 10 PM IST

SYNBIO CONCLAVE 2.0

KEYNOTE SPEAKER

Mr. Andrew Hessel



Andrew Hessel is a microbiologist, geneticist and entrepreneur. He is the co-founder and Co-Executive Director of the Genome Project-write and the Founder and Past President, Humane Genomics, Inc. He is also the co-author of “The Genesis Machine - Our quest to rewrite life in the age of synthetic biology”(very cool book!) He has been involved in the iGEM competition almost since its start and was among the first iGEM Ambassadors appointed in 2006 who were charged with helping new teams at the time.

SEPTEMBER 18TH @ 10:30AM IST

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The short history and possible future of GP-write

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SEPTEMBER 18TH @ 10:30AM IST

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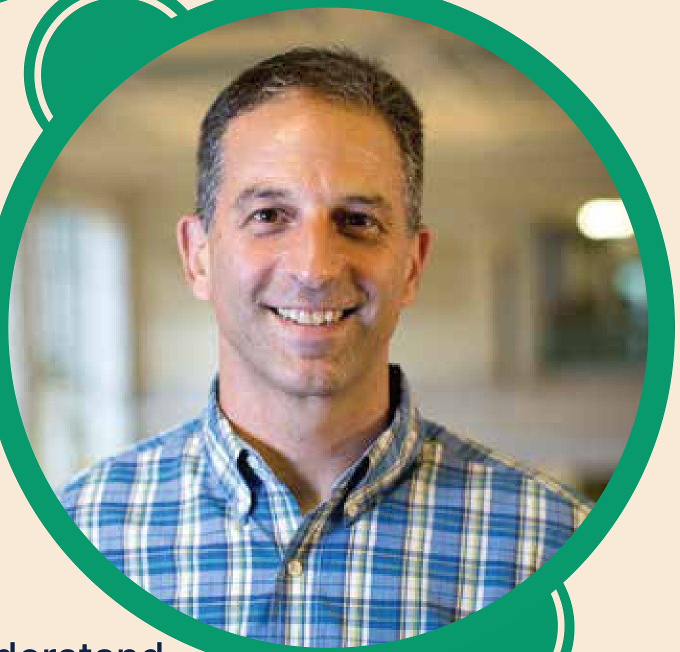
KEYNOTE SPEAKER

Prof. Ron Weiss



Prof. Ron Weiss is a Professor in the Department of Biological Engineering and the Department of Electrical Engineering and Computer Science at Massachusetts Institute of Technology. He is one of the pioneers of synthetic biology.
He's been involved in synthetic biology research since his graduate student days at MIT.
His lab has various projects going on, like the assembly of genetic circuits to help understand regulatory functions and communication within cells, and in vivo biosensors

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Mammalian Synthetic Biology

Mammalian synthetic biology has recently emerged as a field that is revolutionizing how we design and engineer biological systems for diagnostic and medical applications. In this talk, we will describe our integrated computational / experimental approach to engineering complex behavior in mammalian cells with applications to Programmable Organoids derived from iPS cells. In our research, we apply design principles from electrical engineering and other established fields. These principles include abstraction, standardization, modularity, and computer aided design. But, we also spend considerable effort towards understanding what makes synthetic biology different from all other existing engineering disciplines by discovering new design and construction rules that are effective for this unique discipline. We will present Programmable Organoids, a new platform for drug discovery that enables rapid and effective drug screening. Based on programmed differentiation into synthetic mammalian tissues having multiple cell type architectures that are similar to human organs, Programmable Organoids mimic the response of a target organ to both positive and negative effects of drug candidates. Factors that can be non-destructively measured include cell state, viability, and function. Because they are synthetic, Programmable Organoids can host a large array of live-cell biosensors, built-in to one or more cell types, providing a rapid and real-time spatial readout of pathway-specific biomarkers including miRNAs, mRNAs, proteins, and other metabolites. Organoids programmed with both general and disease specific sensors then provide detailed information that can be used to identify candidates for further analysis. We envision a programmable common platform that can be shared among multiple drug candidates.

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