# SYNBIO CONCLAVE

a virtual public talk series on synthetic biology and applications

AUGUST 10 ~ 18, 2021

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SYNBIO CONCLAVE

Keynote speaker

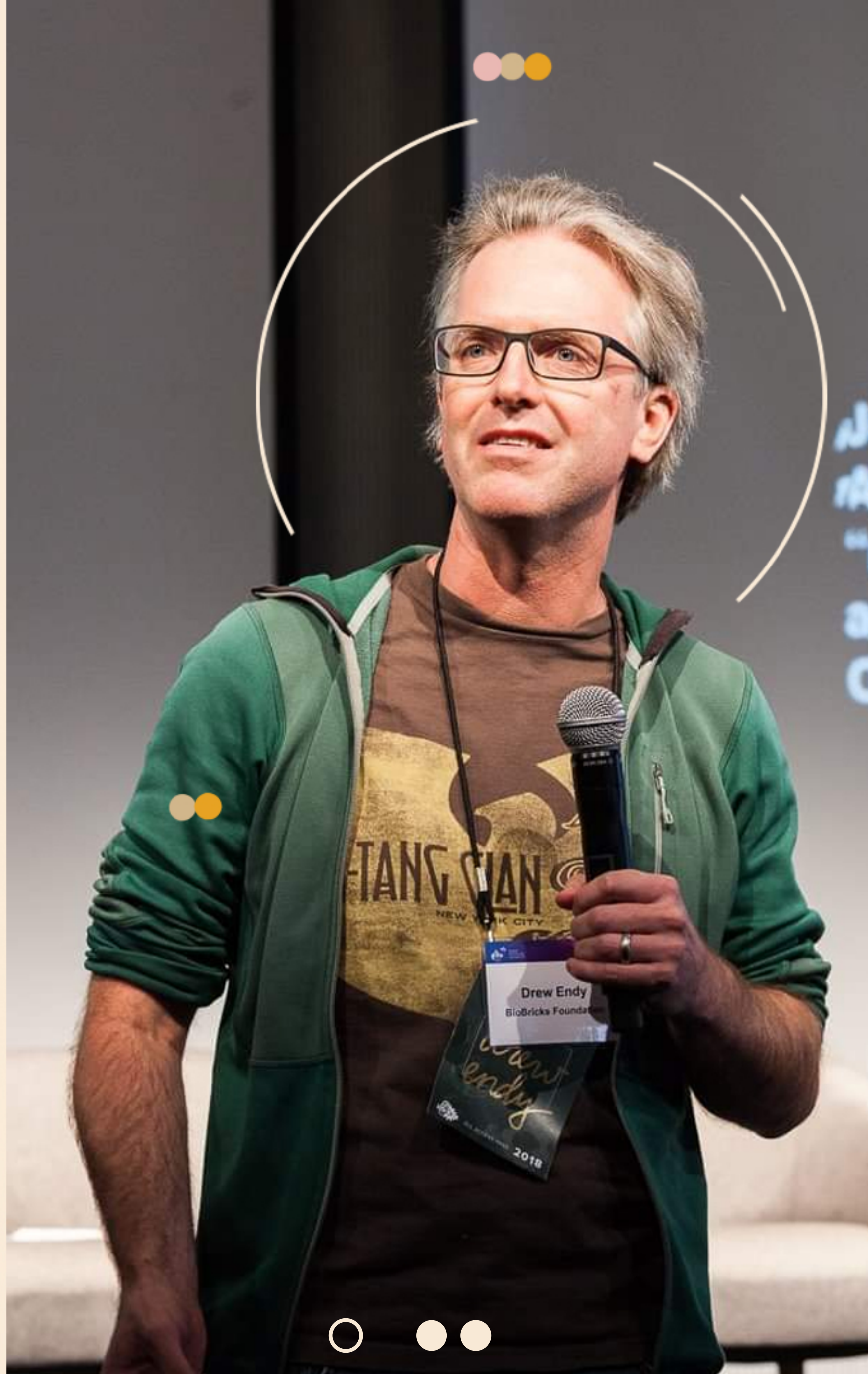
# DR. DREW ENDY

Associate Professor,
Bioengineering faculty at Stanford University
President of the BioBricks Foundation
Co-founder of the iGEM Competition

## "Synthetic biology in the context of biodiversity conservation

12:30 PM EDT / 04:30 PM GMT / 09:30 AM PDT

**AUGUST 10 @ 10 PM IST**

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**SYNBIO CONCLAVE**

Keynote speaker

# DR. MING-RU WU

Assistant Professor, DFCI, Harvard Cancer Center
Assistant Professor, Harvard Medical School

## Synthetic gene circuits for cancer immunotherapy:

turning cancer cells against themselves.

Cancer immunotherapy has demonstrated robust efficacy in clinical trials, but challenges such as the lack of ideal targetable tumor antigens, severe toxicity, and tumor-mediated immunosuppression still limit its success. To overcome these challenges, I have designed a synthetic cancer-targeting gene circuit platform that enables a localized and robust combinatorial immunotherapy from within cancer cells: a Trojan horse-like approach. Once the circuits are introduced into cells, they will sense cancer-specific transcription factor activities, and trigger an effective combinatorial immunotherapy selectively from within cancer cells, while keeping normal cells unharmed. The circuit cured disseminated ovarian cancer in vivo in a mouse model. This platform can be adjusted to treat multiple cancer types and can potentially trigger any genetically-encodable immunomodulators as therapeutic outputs. Moreover, this gene circuit platform can be adapted to treat additional diseases exhibiting aberrant transcription factor activities, such as chronic metabolic diseases and autoimmune disorders.

09 AM EDT / 01 PM GMT / 06 AM PDT

**AUGUST 12 @ 6:30 PM IST**

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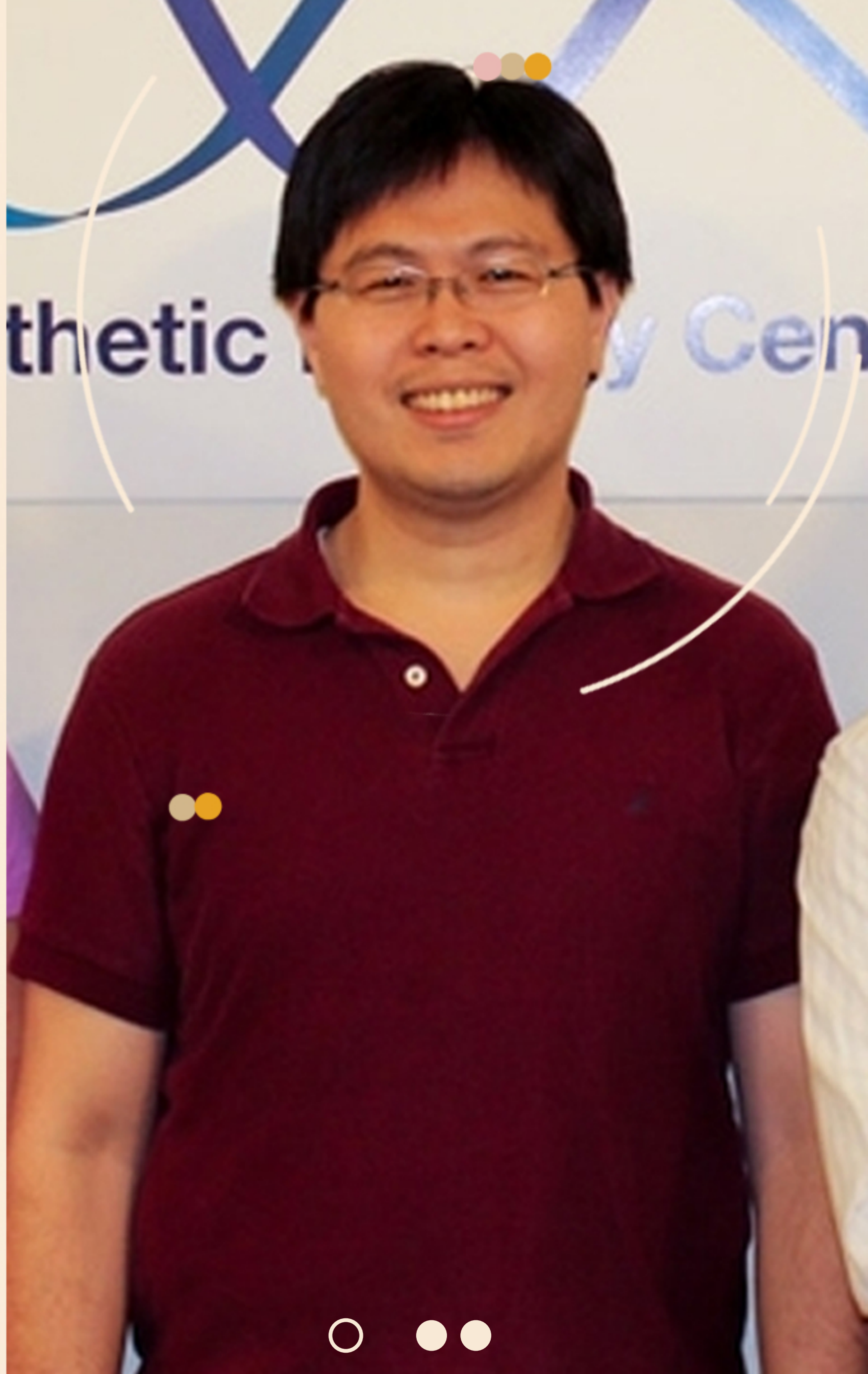


SYNBIO CONCLAVE

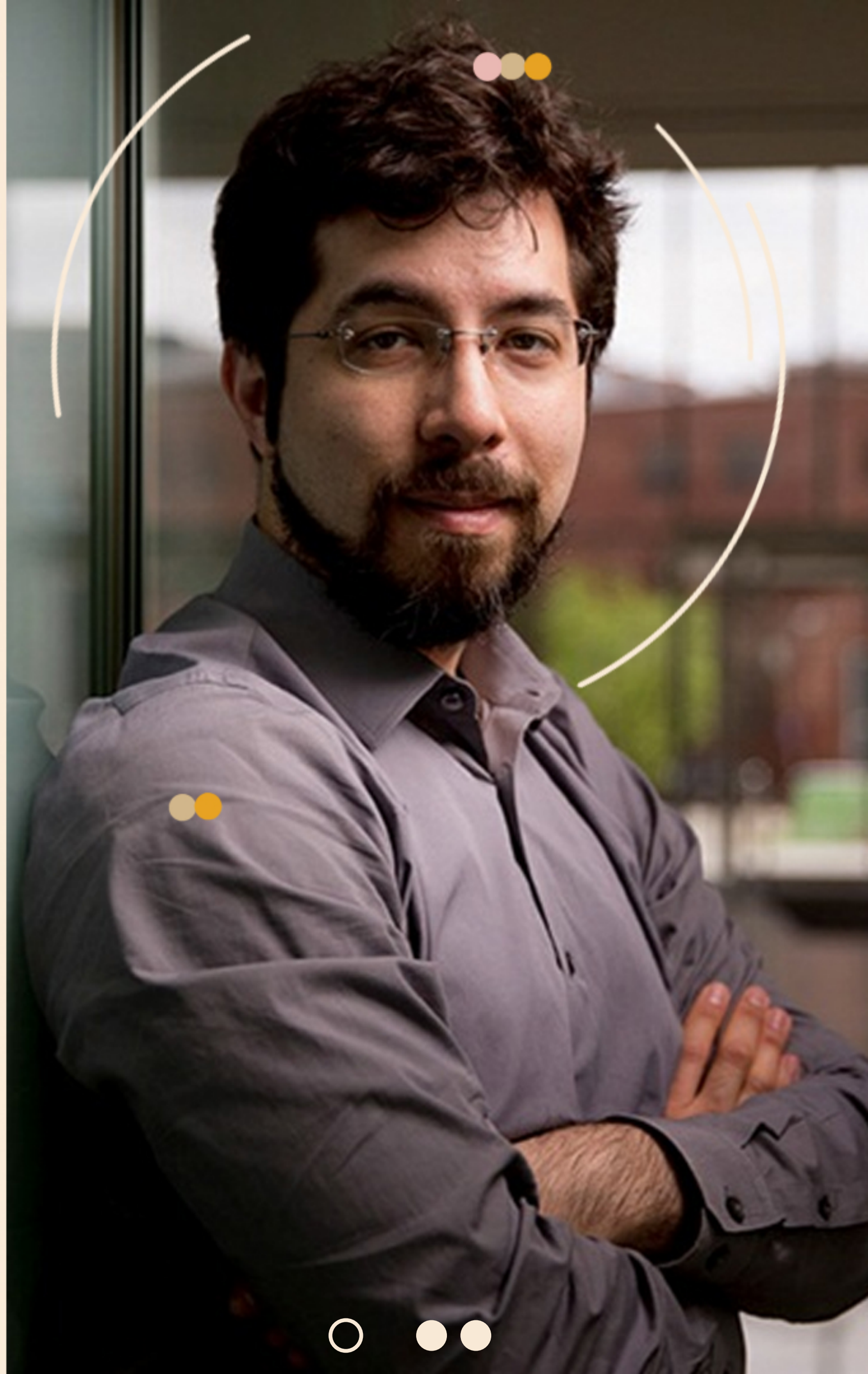
Keynote speaker

# DR. EDWARD BOYDEN

## Tools for analyzing and controlling complex biological systems

Professor of Neurotechnology, MIT
Leader, Synthetic Neurobiology Group, MIT

Understanding and repairing complex biological systems, such as the brain, requires technologies for systematically observing and controlling these systems. We are discovering new molecular principles that enable such technologies. For example, we discovered that one can physically magnify biological specimens by synthesizing dense networks of swellable polymer throughout them, and then chemically processing the specimens to isotropically swell them. This method, which we call expansion microscopy, enables ordinary microscopes to do nanoimaging – important for mapping the brain across scales. Expansion of biomolecules away from each other also decrowds them, enabling previously invisible nanostructures to be labeled and seen. As a second example, we discovered that microbial opsins, genetically expressed in neurons, could enable their electrical activities to be precisely controlled in response to light. These molecules, now called optogenetic tools, enable causal assessment of how neurons contribute to behaviors and pathological states, and are yielding insights into new treatment strategies for brain diseases. Finally, we are developing, using new strategies such as robotic directed evolution, fluorescent reporters that enable the precision measurement of signals such as voltage and calcium. By fusing such reporters to self-assembling peptides, they can be stably clustered within cells at random points, distant enough to be resolved by a microscope, but close enough to spatially sample the relevant biology. Such clusters, which we call signaling reporter islands (SiRIs), permit many fluorescent reporters to be used within a single cell, to simultaneously reveal relationships between different signals. We share all these tools freely, and aim to integrate the use of these tools so as to enable comprehensive understandings of neural circuits.



09 AM EDT / 01 PM GMT / 06 AM PDT

**AUGUST 14 @ 6:30 PM IST**

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SYNBIO CONCLAVE

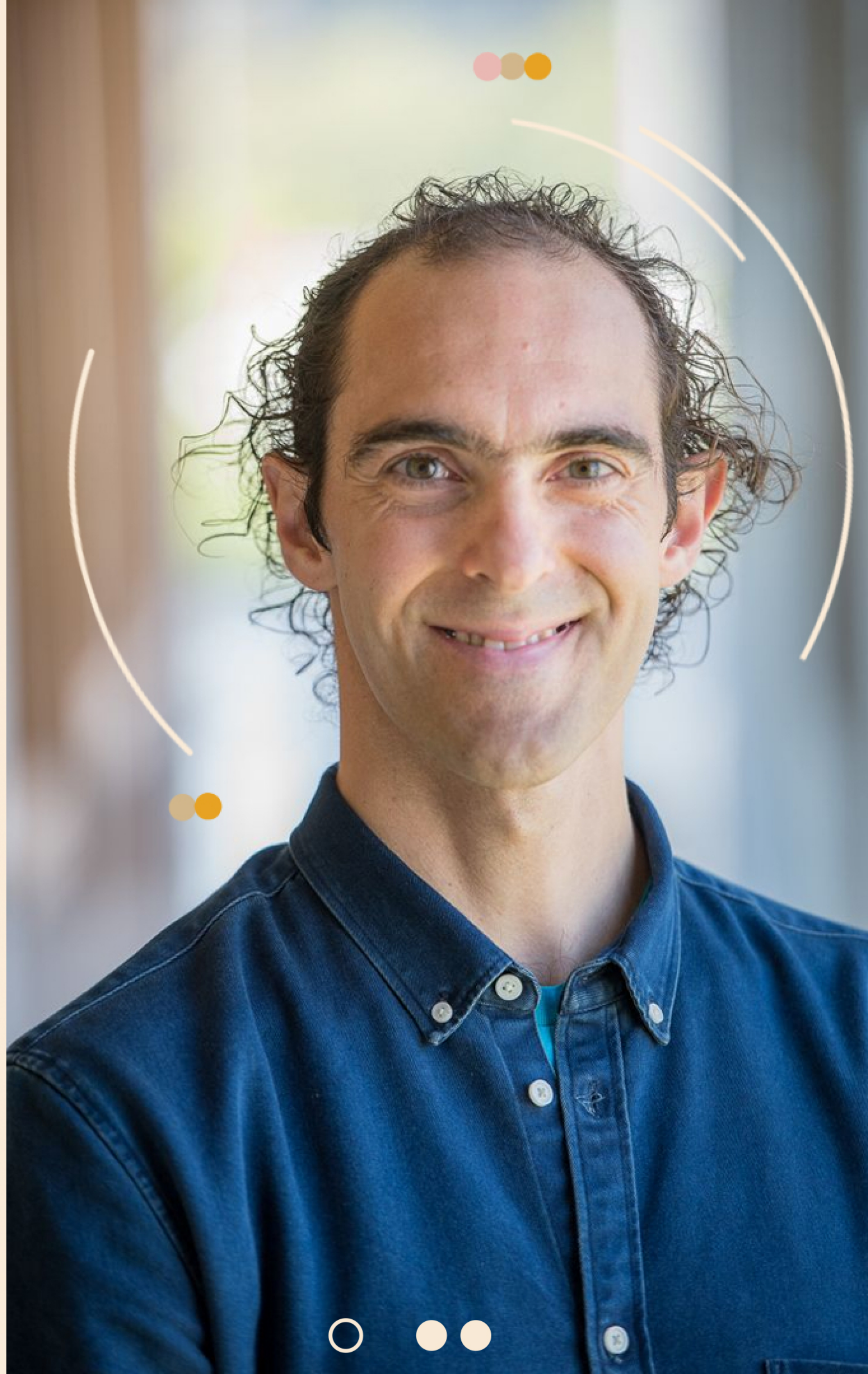
Keynote speaker

# DR. LEONARDO MORSUT

Assistant Professor of stem cell biology and regenerative medicine,
Keck School of Medicine at University of Southern California

## "Learning to program tissue development w/ artificial gene circuits

An ultimate goal of synthetic development is the generation of functional tissue assemblies. A key question in this area is: can we design artificial gene circuits that program the development of user-defined, multicellular structures and functions, even beyond those achieved with naturally-evolved genomes? An answer to this question would be broadly enabling as it would expand the landscape of possible functional structures that can be currently built from cells. Here I will present advancement in this area, including development of synthetic cell-cell communication pathways, implementation of synthetic development trajectories in mammalian cells for patterning and morphogenesis of spheroids, synthetic pathways for functional differentiation into skeletal muscle cells, development of computational pipelines for rational design of genetic networks for morphogenesis. We hope our work will inspire next generation of genetic engineers to continue this ambitious line of research.



12 PM EDT / 04 PM GMT / 09 AM PDT

AUGUST 16 @ 9:30 PM IST

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SYNBIO CONCLAVE

Keynote speaker

# DR. PAMELA A. SILVER

Professor of Biochemistry and Systems Biology, Harvard Medical School
Founding Core Faculty, Wyss Institute at Harvard University
Co-founder of the iGEM Competiton

## "Designing biology for detection and control

The engineering of Biology presents infinite opportunities for therapeutic design, diagnosis, and prevention of disease. We use what we know from Nature to engineer systems with predictable characteristics. We also seek to discover new natural strategies to then re-engineer. I will present concepts and experiments that address how we approach these problems in a systematic way. Conceptually, we seek to both design cells and proteins to control disease states and to detect and predict the severity of emerging pathogens. For example, we have engineered components of the gut microbiome to act therapeutics for infectious disease, proteins to prolong cell states, living pathogen sensors and high throughput analysis to predict immune response of emerging viruses.

09 AM EDT / 01 PM GMT / 06 AM PDT

AUGUST 18 @ 6:30 PM IST

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