



# Organs- and Tissues-on-Chips

April 8–12, 2018 | Big Sky Resort | Big Sky, Montana | USA

## Scientific Organizers:

**Christopher P. Austin**, National Institutes of Health, USA

**Danilo Tagle**, NCATS, National Institutes of Health, USA

**Christine L. Mummery**, Leiden University Medical Center, Netherlands

**Brian R. Berridge**, NIEHS, National Institutes of Health, USA

*More than 30% of promising medications have failed in human clinical trials because they are determined to be toxic despite promising pre-clinical studies in 2-D cell culture and animal models. Another 60% fail due to lack of efficacy. Consequently, though several thousand diseases affect humans, only about 500 have approved treatments. However, with the growing understanding of human biology, along with increased availability of innovative technologies, there is now an unprecedented opportunity to translate scientific discoveries more efficiently into new, more effective and safer health interventions. Organs- or Tissues-on-Chips are innovative, alternative approaches that would enable early indications and potentially more reliable readouts of toxicity and efficacy. These microfabricated devices recapitulate the multicellular architectures, tissue-tissue interfaces, physicochemical microenvironments, vascular perfusion and innervation, producing in essence microphysiological systems that mimic human tissue and organ functionality not possible with conventional 2D or 3D culture systems. Through innovative biosensing and readout approaches, these devices employ high-resolution, real-time imaging and non-invasive analysis of biochemical, genetic and metabolic activities of living cells in a functional tissue and organ context. This technology has great potential to advance the study of tissue development, organ physiology and disease etiology. In the context of drug discovery and development, it should be especially valuable for the study of molecular mechanisms of action, prioritization of lead candidates, toxicity testing and biomarker identification. These microfabricated devices have also proven to be useful for modeling human diseases. The conference will touch on ongoing efforts and various applications of tissue-on-chips technology to studies in precision medicine, environmental exposures, reproduction and development, cancer and for use at the International Space Station.*


## Session Topics:

- Organs-on-Chips in Drug Development
- Integrated Organs-on-Chips
- Organs-on-Chips for Disease Modeling I & II
- Other Opportunities: 1) Tissue-on-Chips for Translational Research in Space; 2) Environmental Health
- Commercializing Tissue Chip Technologies
- Perspectives from Regulatory Agencies and the Pharmaceutical Industry
- Validating Tissue Chips  
*plus two workshops*

**Scholarship Application & Discounted Abstract Deadline: December 6, 2017**

**Abstract Deadline: January 9, 2018**

**Discounted Registration Deadline: February 6, 2018**



Note: Scholarships are available for graduate students and postdoctoral fellows and are awarded based on the abstract submitted. Submitting an abstract is an excellent opportunity to gain exposure for your work. Abstracts submitted by the abstract deadline will also be considered for short talks on the program.

Upper image of lung tissue on a chip courtesy of National Center for Advancing Translational Sciences, NIH

Meeting Hashtag: #KSchips

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# KEYSTONE SYMPOSIA

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### SUNDAY, APRIL 8

#### Arrival and Registration

### MONDAY, APRIL 9

#### Welcome and Keynote Address

\***Danilo A. Tagle**, NCATS, National Institutes of Health, USA

\***Christine L. Mummery**, Leiden University Medical Center, Netherlands

\***Brian R. Berridge**, National Institute of Environmental Health Sciences, NIH, USA

\***Christopher P. Austin**, National Institutes of Health, USA  
*Overview of Organs-on-Chips in Drug Development for Safety, Toxicity and Efficacy Testing*

#### Organs-on-Chips in Drug Development

\***Brian R. Berridge**, National Institute of Environmental Health Sciences, NIH, USA

\***Kevin Kit Parker**, Harvard University, USA

**D. Lansing Taylor**, University of Pittsburgh Drug Discovery Institute, USA

*Role of a Human Liver Microphysiology System as a Key Component of a Quantitative Systems Pharmacology Platform for Investigating Liver Disease Progression and Drug Discovery and Development*

**Christine L. Mummery**, Leiden University Medical Center, Netherlands

*Cardiovascular Diseases and Drugs in Organ-on-Chip hiPSC Models*

**Misti Ushio**, TARA Biosystems, USA

*Short Talk: Biowire™ II: A Commercial Platform for the Production and Functional Assessment of Adult-Like Engineered Human Cardiac Tissue*

**Jonathan Himmelfarb**, University of Washington, USA

*A Human Kidney on a Chip for Disease Modeling and Toxicity Testing*

#### Integrated Organs-on-Chips

\***Jason Ekert**, GlaxoSmithKline, USA

\***Christopher P. Austin**, National Institutes of Health, USA

**Gordana V. Vunjak-Novakovic**, Columbia University, USA  
*Human Multi-Tissue Platforms with Perfusable Vasculature*

**Donald E. Ingber**, Wyss Institute for Biologically Inspired Engineering at Harvard, USA

*DARPA Integrated 10-Organ System Using Microfluidic Platform*

**Linda G. Griffith**, Massachusetts Institute of Technology, USA  
*DARPA Integrated 10-Organ System Using a Microwell System*

**Olivier Frey**, InSphero, Switzerland

*Short Talk: Automating Multi-Tissue Microphysiological Systems Based on 3D Microtissues*

#### Poster Session 1

### TUESDAY, APRIL 10

#### Organs-on-Chips for Disease Modeling I

\***Christine L. Mummery**, Leiden University Medical Center, Netherlands

\***Bruce R. Conklin**, Gladstone Institutes, USA

**Kevin Kit Parker**, Harvard University, USA

*Cardiomyocytes-on-Chips as Models for Barth Syndrome and Long QT*

**Steven C. George**, University of California, Davis, USA

*3D "Organ-on-a-Chip" Models of Atrial Conduction and Primary Human Cancer*

**Megan Laura McCain**, University of Southern California, USA  
*Short Talk: Engineering  $\mu$ Myocardium with Tunable Cell-Matrix and Cell-Cell Interactions for Cardiac Disease Modeling*

**George Truskey**, Duke University, USA  
*Microphysiological Systems Vascular Model of Progeria*

**Nancy L. Allbritton**, University of North Carolina at Chapel Hill and North Carolina State University, USA  
*Intestinal Simulacra on a Microscale*

**Robert Barrett**, Cedars-Sinai Medical Center, USA  
*Short Talk: Intestine-Chip: A New Model to Understand the Role of the Intestinal Epithelium in IBD by Combining Microengineering Technology and iPSC-Derived Human Intestinal Organoids*

#### Organs-on-Chips for Disease Modeling II

\***Danilo A. Tagle**, NCATS, National Institutes of Health, USA

\***Clive N. Svendsen**, Cedars-Sinai Regenerative Medicine Institute, USA

**Helena Therese Hogberg**, Johns Hopkins Bloomberg School of Public Health, USA

*3D Neuronal Microphysiology Systems and Neuronal Disease Models*

**Samuel Sances**, Cedars-Sinai Medical Center, USA  
*Short Talk: Microphysiological Systems to Study Human Neurodegenerative Disease*

**Kevin E. Healy**, University of California, Berkeley, USA  
*Microphysiological Systems for Drug Discovery, Disease Modeling, and Precision Medicine*

**Joanna Burdette**, University of Illinois at Chicago, USA  
*Reproductive Cycles in a Dish Engineered to Model PCOS*

#### Poster Session 2

### WEDNESDAY, APRIL 11

#### Other Opportunities: 1) Tissue-on-Chips for Translational Research in Space 2) Environmental Health

\***Gordana V. Vunjak-Novakovic**, Columbia University, USA

\***Liz Warren**, CASIS, USA

**Bruce R. Conklin**, Gladstone Institutes, USA  
*CRISPR and Stem Cells: Disease Mechanism and Genome Surgery*

**Rocky S. Tuan**, University of Pittsburgh School of Medicine, USA  
*Tissue Chip Modeling of Synovial Joint Physiology and Pathologies*

**Warren M. Casey**, NIEHS, National Institutes of Health, USA  
*Tissue Chips for Chemical Safety Testing: "Build it and They Will Come" Is Not a Viable Strategy*

**Richard S. Paules**, NIEHS, National Institutes of Health, USA  
*Tox21 Efforts in Improving Toxicology and Human Safety Assessment*

**Sreenivasa Ramaiahgari**, National Toxicology Program of NIEHS, USA

*Short Talk: Functional Characterization of Microplate Cultured Human and Rat 3D Hepatocyte Spheroids and Their Use with High-Throughput Transcriptomics (S1500+) in Toxicology Screening*

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### Workshop 1: Innovative Approaches, Designs, Readouts

\*Lorna Ewart, AstraZeneca, UK

\*Steven C. George, University of California, Davis, USA

Riccardo Barrile, Emulate Inc., USA

*Organ-on-Chip Technology Recapitulates Thrombosis Induced by an Anti-CD154 Candidate Therapeutic Monoclonal Antibody*

Stefano Da Sacco, University of Southern California, USA  
*Development of a Barrier-Free Glomerulus-on-a-Chip System as a Model to Study the Glomerular Filtration Barrier in vitro*

Viktoras Frismantas, Wyss Institute for Biologically Inspired Engineering at Harvard University, USA

*Modeling Drug- and Radiation-Induced Myelosuppression in a Vascularized Human Bone Marrow-on-a-Chip*

Dhvanit I. Shah, Brigham and Women's Hospital, Harvard Medical School, USA

*Development of a Bioreactor Simulating Mechanosensation to Stimulate Hematopoietic Stem Cell Formation*

Berend J. van Meer, Leiden University Medical Center, Netherlands  
*Generic and Simultaneous Optical Measurement Method of Electrophysiology, Calcium and Contractility for Heart-on-Chips in Response to Drugs and Disease*

Remi Villenave, Emulate Inc., USA

*A Micro-Engineered Airway Lung-Chip that Recapitulates Unique Features of Human Viral-Induced Exacerbation of Asthma*

Ashutosh Agarwal, University of Miami, USA  
*Resealable, Optically Accessible, PDMS-Free Fluidic Platforms for Organs on Chips*

### Commercializing Tissue Chip Technologies

\*Ivan Rusyn, Texas A&M University, USA

\*Murat Cirit, Massachusetts Institute of Technology, USA

Geraldine A. Hamilton, Emulate Inc., USA  
*Organs-on-Chips Technology: A Platform for Advancing Efficacy and Safety Testing in Drug Discovery and Development*

Thomas Neumann, Nortis, Inc., USA  
*How Organ-on-Chip Technologies Will Revolutionize in-vitro Methods*

Uwe Marx, TissUse GmbH and Technische Universität Berlin, Germany

*Commercializing Integrated Multi-Organ Tissue Chips*

Jos Joore, Mimetas, Netherlands  
*Short Talk: Commercializing High-Throughput Organ-on-a-Chip Systems for Early Implementation into Therapeutic Development*

### Poster Session 3

#### THURSDAY, APRIL 12

#### Perspectives from Regulatory Agencies and the Pharmaceutical Industry

\*Mark E. Schurdak, University of Pittsburgh, USA

\*Tracy C. MacGill, U.S. Food and Drug Administration, USA

Donna Mendrick, Food and Drug Administration, USA  
*FDA Perspectives on Tissues-on-Chips*

Adrian Roth, F. Hoffmann-La Roche Ltd., Switzerland  
*Industry Perspective on Organ-on-Chip Technology*

Brian R. Berridge, National Institute of Environmental Health Sciences, NIH, USA  
*Tissue Chips to Improve Clinical Translation and Reduce Late-Stage Drug Development Attrition*

Amy Pointon, AstraZeneca, UK  
*Short Talk: The Value of Functional Multi-Organ Microphysiological Systems to Cardiovascular Safety*

Andrew Schwab, Environmental Protection Agency, USA  
*Short Talk: Development of a Human Neurovascular Unit Organotypic Systems Model*

Elizabeth Baker, Physicians Committee for Responsible Medicine, USA  
*Short Talk: Preclinical Innovation and Patient Safety: Supporting Human-Based Science Through Advances in Law, Policy, Education and Training*

Lorna Ewart, AstraZeneca, UK  
*Short Talk: Liver-Chip and Spheroids as Systems to Determine Hepatic Safety and Metabolism*

### Workshop 2: Tissue Chips for Personalized Medicine

\*Kevin E. Healy, University of California, Berkeley, USA

\*Donald E. Ingber, Wyss Institute for Biologically Inspired Engineering at Harvard, USA

Zongyou Guo, Columbia University, USA  
*Atopic Cytokines IL4/13 Perturb iPSC-Derived Itch-Specific Sensory Neurons*

Peter Loskill, Fraunhofer Institute for Interfacial Engineering and Biotechnology, Germany  
*Merging High-Content and High-Throughput Screening: Microphysiological Organ-on-a-Chip Systems Integrating Human Retinal, Cardiac and Adipose Tissue*

Chris P. Miller, University of Washington, USA  
*A 3D Human Renal Cell Carcinoma on a Chip for the Study of Tumor Angiogenesis*

Kasper Renggli, ETH Zürich, Switzerland  
*Leukemia on Chip – Flow- and Metabolism-Based Microphysiological Multi-Tissue System for Patient-Derived Liquid Biopsies*

Gad David Vatine, Ben Gurion University, Israel  
*Microphysiological Human iPSC-Based Isogenic Blood Brain Barrier-on-Chip Platform for Personalized Predictive Medicine*

Hee-Gyeong Yi, POSTECH, South Korea  
*3D Cell-Printed Glioblastoma-on-a-Chip for Personalized Medicine*

Leigh Joan Atchison, Duke University, USA  
*An Induced Pluripotent Stem Cell-Derived Tissue-Engineered Blood Vessel to Study Hutchinson-Gilford Progeria Syndrome*

### Validating Tissue Chips

\*Peter Loskill, Fraunhofer Institute for Interfacial Engineering and Biotechnology, Germany

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\***Lucie Low**, National Institutes of Health, USA

**Ivan Rusyn**, Texas A&M University, USA

*Tissue Chip Validation Center at Texas A&M University (TEX-VAL Center)*

**Murat Cirit**, Massachusetts Institute of Technology, USA

*Quantitative Assessment of Tissue Chip Technologies*

**Mark E. Schurdak**, University of Pittsburgh, USA

*The Microphysiology Systems Database for Validation of Tissue Chip Organ Models*

### Meeting Wrap-Up

**Danilo A. Tagle**, NCATS, National Institutes of Health, USA

*The NIH Tissue Chips for Drug Screening Program: Current and Future Directions*

### FRIDAY, APRIL 13

#### Departure