

**The George and Angelina Kostas Research Center
for Cardiovascular Nanomedicine Symposium**

and

8th Annual NIH PCTC

CARDIOVASCULAR BIOENGINEERING Symposium

May 22-25, 2024

Houston Methodist Research Institute

6670 Bertner, 2nd Floor
John F. Bookout Auditorium (R2-306)
Houston, TX 77030





8th Annual NIH PCTC

CARDIOVASCULAR BIOENGINEERING SYMPOSIUM

In partnership with The George and Angelina Kostas Research Center
for Cardiovascular Nanomedicine Symposium

WEDNESDAY, MAY 22, 2024 | 7:30 a.m. – 6:30 p.m.

AGENDA

7:30 - 8:15 a.m. **Registration and Breakfast Reception**

8:15 - 8:45 a.m. **Welcome Remarks**



H. Dirk Sostman, MD, FACR

Ernest Cockrell, Jr. Presidential Distinguished Chair
EVP & Chief Academic Officer
President & CEO
Houston Methodist Academic Institute



Jianyi (Jay) Zhang, MD, PhD, FAHA

T. Michael and Gillian Goodrich Endowed Chair of Engineering Leadership
Chair, Department of Biomedical Engineering
Professor of Medicine and Engineering
School of Medicine, School of Engineering
The University of Alabama at Birmingham



John P. Cooke, MD, PhD

Joseph C. Walter and Carole Walter Looke Presidential Distinguished Chair
Professor and Chair, Department of Cardiovascular Sciences
Director, Center for Cardiovascular Regeneration
Medical Director, Center for RNA Therapeutics
Chief Translational Officer, Houston Methodist Research Institute

WEDNESDAY, MAY 22, 2024

SESSION 1: Keynote Speakers

8:45 – 9:15 a.m. **The Martha and D. Gibson Walton Lecture in Translational Research
RNA Therapeutics in Cardiovascular Medicine**

Victor J. Dzau, MD

President, U.S. National Academy of Medicine

Vice Chair, U.S. National Research Council

Chancellor Emeritus and James B. Duke Distinguished Professor of Medicine

Professor, Pathology, Duke University School of Medicine

9:15 – 9:45 a.m. **Engineering Human Cardiovascular Tissues for Medical Impact**
Gordana Vunjak-Novakovic, PhD

University Professor

Mikati Foundation Professor of Biomedical Engineering and Medical Sciences

Professor, Dental Medicine, Columbia University

9:45 a.m. **Coffee Break**

SESSION 2: Bioengineered Translational Model Systems

Session Chairs: **Francisco Altamirano, PhD** and **Xander Wehrens, MD, PhD**

9:55 a.m. **Engineering 3D Microvasculature for Disease Modeling**
Ying Zheng, PhD

Associate Professor, Bioengineering, University of Washington

10:20 a.m. **Artificial Intelligence-Enabled Vascularized Biological Systems**
Abhishek Jain, PhD

Associate Professor, Biomedical Engineering, Affiliated Faculty, Medical Physiology

Texas A&M University

10:45 a.m. **Multi-laminar Tissue Constructs to Evaluate Aortic Valve Pathophysiology**
K. Jane Grande-Allen, PhD

Isabel C. Cameron Professor of Bioengineering, Rice University

11:10 a.m. **Vascularized Tumor Microenvironments for Drug Testing**
Christopher C. W. Hughes, PhD

Chancellor's Professor, Molecular Biology and Biochemistry School of Biological Sciences

Professor, Biomedical Engineering, Henry Samueli School of Engineering, University of California, Irvine

11:35 a.m. **Versatility of Extracellular Matrix Cues for Regulating Both Endothelial Differentiation
and De-differentiation**

Ngan Huang, PhD

Associate Professor, Cardiothoracic Surgery, Stanford University

WEDNESDAY, MAY 22, 2024

Luncheon Seminar: Satellite Symposium NovoNordisk

Welcome and Introduction: **Miguel Valderrabano, MD, PhD**

- 12:05–12:20 p.m. **Gene Editing Strategy to Prevent Engraftment Arrhythmia Following Cardiac Remuscularization Therapy**
Silvia Marchiano, PhD
Acting Instructor, University of Washington
- 12:20 – 12:35 p.m. **Manipulating Cell Product Before and After Engraftment to Solve Engraftment Arrhythmias**
James Chong, PhD, FRACP, MBBS
Co-director Centre, Heart Research and Head Cardiac Regeneration Laboratory,
Westmead Institute for Medical Research
Professor, Cardiovascular Medicine, University of Sydney
Cardiologist, Westmead Hospital
- 12:20 – 12:35 p.m. **How Big a Barrier is Engraftment Arrhythmia to Clinical Translation of Cell Therapies? An Electrophysiologist's Perspective**
Miguel Valderrabano, MD, PhD
Lois and Carl Davis Centennial Chair I, DeBakey Heart & Vascular Center
Program Director, Clinical Cardiac Electrophysiology Fellowship, Department of Cardiology
Professor, Cardiology
Houston Methodist
- 12:20 – 12:35 p.m. **Panel Discussion and Q&A**
Facilitator: **Miguel Valderrabano, MD, PhD**

Junior Faculty and Trainee Symposium: Research Highlights

Chairs: **Anahita Mojiri, PhD** and **Li Lai, PhD**

Talks selected from meritorious abstracts (10 min. presentation, 5 min. discussion)

- 1 – 1:15 p.m. **Epigenetic Factors as Drivers of Cardiac Reprogramming**
Glynnis Garry, MD
UT Southwestern Medical Center
- 1:15 – 1:30 p.m. **New Cell-Cycle-Specific Autoencoding Defines Cycling Cardiomyocyte Clusters in Non-Human Models snRNA-seq Data**
Yuji Nakada, PhD
University of Alabama at Birmingham
- 1:30 – 1:45 p.m. **Lymphangiogenesis on Chip**
James Tronolone, MS
Texas A&M University
- 1:45 – 2 p.m. **CD36-Retinoic Acid-FABP5-PPAR δ Signaling Axis Modulates Cardiomyocytes' Ability to Proliferate in Non-Human Models**
Abou Bakr Salama, PhD
Baylor College of Medicine

WEDNESDAY, MAY 22, 2024

SESSION 3: **Cardiovascular Physiology and Bioengineering in Space**

Session Chairs: **Alessandro Grattoni, PhD** and **Abishek Jain, PhD**

- 2 p.m. **Overview of the Opportunities for Discovery in Space**
Dorit Donoviel, PhD
Director, Translational Research Institute for Space Health
Associate Professor, Center for Space Medicine, Baylor College of Medicine
- 2:25 p.m. **Challenges of the Cardiovascular System in Space**
Jennifer Fogarty, PhD
Chief Scientist, Translational Research Institute for Space Health
Assistant Professor, Center for Space Medicine
Baylor College of Medicine
- 2:50 p.m. **Exosomes in Space and Cardiovascular Risk**
David Goukassian, MD, PhD
Professor, Medicine, Cardiovascular Research Institute
Icahn School of Medicine, Mount Sinai
- 3:15 p.m. **Regenerative Medicine Using Space**
Alessandro Grattoni, PhD
Chair, Department of Nanomedicine, Houston Methodist Research Institute
Professor of Nanomedicine, Houston Methodist Academic Institute
- 3:40 p.m. **Bioengineering in Space**
Lynn Harrison, PhD
Deputy Program Scientist, Space Biology, Biological and Physical Sciences Division
Science Mission Directorate
NASA
- 4:05 – 6:30 p.m. **Poster Presentations**
Refreshments Served
Beverages and Snacks
- 7 – 10 p.m. **Faculty Dinner for Speakers and Moderators**

THURSDAY, MAY 23, 2024

7:30 – 8:30 a.m. **Breakfast Reception**

SESSION 4: Update on Clinical Trials

Session Chairs: **Jianyi (Jay) Zhang, MD, PhD** and **Ali Marian, MD**

8:30 a.m.

The POSEIDON-DCM Trial

Josh M. Hare, MD, FAAC, FAHA

Director, Donald Soffer Endowed Program in Regenerative Medicine
Chief Science Officer

Senior Associate Dean for Experimental & Cellular Therapeutics

Louis Lemberg Professor of Medicine (Cardiology)

University of Miami Leonard M. Miller School of Medicine

Professor, Molecular and Cellular Pharmacology

Professor, Biomedical Engineering

Director, Interdisciplinary Stem Cell Institute

8:55 a.m.

Heart Repair with Tissue Engineered Biological Ventricular Assist Tissue

Wolfram-Hubertus Zimmermann, MD

Director, Institute of Pharmacology and Toxicology

Professor, Pharmacology

University Medical Center Göttingen

9:20 a.m.

The CATO Trial: A Phase IIA, Randomized, Double-Blind, Placebo-Controlled, Multicenter Study

Roberto Bolli, MD, FAHA, FACC

Professor, Medicine, Physiology and Biophysics

University of Louisville School of Medicine

9:45 a.m.

Coffee Break

SESSION 5: Computational Modeling & Simulations for Cardiovascular Architecture and Regeneration

Session Chairs: **Guangyu Wang, PhD** and **Longhou Fang, PhD**

10:25 a.m.

Stem Cells, Genomics, and Clinical Trial in Dish

Joseph C. Wu, MD, PhD

Simon H. Stertzer, MD, Professor of Cardiovascular Medicine and Radiology

Director, Stanford Cardiovascular Institute

Stanford Medicine

10:50 a.m.

Molecular Control of Cardiac Regeneration: Insights from Evolution

Guo Huang, PhD

Associate Professor, Cardiovascular Research Institute, University of California

Department of Physiology, Cardiovascular Research Institute, University of California San Francisco

11:15 a.m.

Engineering the microvasculature

Shayn M. Peirce-Cottler, PhD

Professor and Chairman, Department of Biomedical Engineering, University of Virginia

THURSDAY, MAY 23, 2024

- 11:40 a.m. **Transfer Learning to Enable Predictions in Network Biology**
Christina V. Theodoris, MD, PhD
Assistant Professor, Gladstone Institute of Cardiovascular Disease and
Gladstone Institute of Data Science and Biotechnology, University of California San Francisco
- 12:05 p.m. **RNA Velocity and RNA Landscape: Insights into the
Etiology and Novel Therapeutic Avenues for Heart Failure**
Guangyu Wang, PhD
Assistant Professor, Cardiovascular Sciences, Houston Methodist
- 12:30 p.m. **Computational Modeling & Simulations for Cardiovascular Architecture and Regeneration**
Ken Chen, PhD
Professor, Bioinformatics and Computational Biology
The University of Texas MD Anderson Cancer Center
- 12:55 – 2:30 p.m. **Lunch Break**

Luncheon Seminars:

- 1 – 1:25 p.m. **Meet The FDA - Strengthening Regulatory Science to Advance Medical
Countermeasure Development**
Tracy MacGill, PhD, CAPT, USPHS
Director, MCM Regulatory Science, Office of Counterterrorism and Emerging Threats,
Office of the Chief Scientist, Office of the Commissioner
U.S. Food and Drug Administration
- 1:25 – 1:50 p.m. **Meet The Dean
Training a diverse and innovative generation of “Physicianeers”**
Roderic I. Pettigrew, MD, PhD
Inaugural Dean of the School of Engineering Medicine
Texas A&M University in collaboration with Houston Methodist
- 1:50 – 2:15 p.m. **HumanN Symposium
The Role of Nitric Oxide in Cardiovascular Regeneration**
John P. Cooke, MD, PhD
Joseph C. Walter and Carole Walter Looke Presidential Distinguished Chair
Professor and Chair, Department of Cardiovascular Sciences
Director, Center for Cardiovascular Regeneration
Medical Director, Center for RNA Therapeutics
Chief Translational Officer, Houston Methodist Academic Institute

THURSDAY, MAY 23, 2024

SESSION 6: Metabolite, Epigenetics, and Cardiovascular Regeneration

Session Chairs: **Reza Ardehali, MD, PhD** and **Keith Youker, PhD**

2:15 p.m. **Cells and Cell-Products for Myocardial Repair in Large Animal Models**

Jianyi (Jay) Zhang, MD, PhD, FAHA

T. Michael and Gillian Goodrich Endowed Chair of Engineering Leadership
Chair, Department of Biomedical Engineering
Professor of Medicine and Engineering School of Medicine
School of Engineering The University of Alabama at Birmingham

2:40 p.m. **Protein Translation Control in Cardiac Hypertrophy**

Yibin Wang, PhD

Professor, Medicine, Duke University, Duke NUS: Medical School, Singapore

3:05 p.m. **HFpEF: Metabolism and Meta-inflammation**

Joseph A. Hill, MD, PhD

Director, Harry S. Moss Heart Center
Professor, Internal Medicine and Molecular Biology
The University of Texas Southwestern Medical Center

3:30 p.m. **Coffee Break**

SESSION 7: Biomaterials for CV Regeneration

Session Chairs: **Abhishek Jain, PhD** and **Gang Bao, PhD**

3:55 p.m. **Bioprinting a Human Heart**

Mark Skylar-Scott, PhD

Assistant Professor, Bioengineering, Basic Science and Engineering Initiatives
Betty Irene Moore Children's Heart Center, Stanford Medicine

4:20 p.m. **Regenerating Lymphatic Vessels and Valves**

Feng Zhao, PhD

Associate Professor, Department of Biomedical Engineering, Texas A&M University

4:45 p.m. **Reconstructing Organotypic Vasculature from Human iPSCs**

Mingxia Gu, MD, PhD

Assistant Professor, UC Department of Pediatrics
Cincinnati Children's Hospital Medical Center

5:10 p.m. **Imaging Atherosclerosis**

Laura Marcu, PhD

Director, NIH-NIBIB National Center for Interventional Biophotonics Technologies
Professor, Biomedical Engineering and Neurological Surgery, University of California, Davis

Banquet & Awards

7 – 10 p.m. Houston Museum of Natural Science

FRIDAY, MAY 24, 2024

7:30 – 8:30 a.m. **Breakfast Reception**

SESSION 8: Genome Editing in Cardiovascular Regeneration

Session Chairs: **Gang Bao, PhD** and **Wolfram-Hubertus Zimmerman, MD**

8:30 a.m. **Gene Editing in the Treatment of Hyperlipidemia and Atherosclerosis**
William R. Lagor, PhD
Professor, Integrative Physiology, Baylor College of Medicine

8:55 a.m. **Mechanisms and Genetic Strategies to Promote Cardiac Xenotransplantation**
Daniel Garry, MD, PhD
Professor, Medicine, University of Minnesota Medical School

9:20 a.m. **Genome Editing Based Approaches for Treating Cardiovascular and Blood Diseases**
Gang Bao, PhD
Professor and Chair, Biomedical Engineering, Rice University

9:45 a.m. **Long-Range Genome Engineering in Human Cells With CRISPR-Cas3**
Yan Zhang, PhD
Assistant Professor, Biological Chemistry, University of Michigan Medical School

10:10 a.m. **Coffee Break**

SESSION 9: Blood Vessel and Metabolic Disease

Session Chairs: **Jun-ichi Abe, PhD** and **Mikhail Kolonin, PhD**

10:30 a.m. **Vascular Senescence and Dysmetabolic State**
Mikhail Kolonin, PhD
Harry E. Bovay, Jr. Distinguished University Chair in Metabolic Disease Research
Professor and Director, Center for Metabolic and Degenerative Diseases
The University of Texas Health Science Center

10:55 a.m. **Angiogenic Transdifferentiation in Ischemic Tissues**
John P. Cooke, MD, PhD
Chair and Professor, Cardiovascular Sciences
Director Center for Cardiovascular Regeneration
Medical Director, Center for RNA Therapeutics,
Houston Methodist Research Institute

11:20 a.m. **Pathological Angiogenesis and Therapeutic Approaches**
Napoleone Ferrara, MD
Distinguished Professor, Ophthalmology and Pathology, Senior Deputy Director for Basic Sciences
UCSD Moores Cancer Center, University of California San Diego

11:45 p.m. **Bioengineering the Lymphatics in Hypertension**
Ying-Nan Bai, MD
Associate Professor, Cardiology, Zhongshan Hospital, Fudan University,
Shanghai Institute of Cardiovascular Diseases

12:30 – 1 p.m. **Lunch Break**

Concurrent Luncheon Seminars:

- 12:30 – 1 p.m. **Advances in Engineering Human Heart, Lung and Vascular Models of Disease**
Joan Nichols, PhD
Director, Regenerative Medicine Program, Houston Methodist Research Institute
- 1 – 1:30 p.m. **Surgeon Scientists Leading Cardiovascular Device Development**
Shock Wave Therapy – Johannes Holfeld, MD
Clinician and Staff Surgeon, University Clinic of Cardiac Surgery Founder and Head
CARE Cardiac Regeneration Research Group
- 1:30 – 2 p.m. **Next Gen Artificial Heart – William E. Cohn, MD**
Chief Medical Officer, BiVACOR Inc.
Executive Director, Center for Device Innovation, Texas Medical Center
Professor of Surgery, Baylor College of Medicine

SESSION 10: Insights Gained from Reprogramming to a Cardiovascular Fate

Session Chairs: **John P. Cooke, MD, PhD** and **Li Lai, PhD**

- 2 p.m. **Single Cell Omics Approach to Study Somatic Cell Reprogramming to Cardiomyocytes**
Qian Li, PhD
Associate Professor, Pathology and Laboratory Medicine
University of North Carolina
- 2:25 p.m. **Insights into Polycystic Kidney from iPSC-derived Cardiomyocytes**
Francisco Altamirano, PhD
Assistant Professor, Cardiovascular Sciences
Houston Methodist Research Institute
- 2:50 p.m. **Modulation of Cardiovascular Cell Fate by Extracellular Matrix**
Brenda Ogle, PhD
Professor and Department Head, Biomedical Engineering College of Science and Engineering
University of Minnesota
- 3:15 p.m. **The Impacts of Microenvironment on Direct Cardiac Reprogramming**
Reza Ardehali, MD, PhD
Professor and Chief of Cardiology
Baylor College of Medicine
- 3:40 p.m. **Epigenetic Determinants of Direct Cardiac Reprogramming**
Yang Zhou, PhD
Assistant Professor, Biomedical Engineering
The University of Alabama at Birmingham

GEORGE AND ANGELINA KOSTAS RESEARCH CENTER FOR CARDIOVASCULAR NANOMEDICINE

SATURDAY, MAY 25, 2024

7:30 – 8 a.m. **Breakfast Reception**

8 – 8:15 a.m. **Event Check-In**

8:15 – 9 a.m. **Keynote Lecture**

ARPA-H – Advancing Bold Cardiovascular Breakthroughs

Ryan Spitler, PhD

Program Manager, Health Science Future, ARPA-H

SESSION 11: Nanomedicine for the Treatment of Cardiovascular Disease

Session Chairs: **John P. Cooke, MD, PhD** and **Kristopher Brannan, PhD**

9:05 a.m. **In Vivo High Throughput Screening Approaches for Extrahepatic, Tissue-Specific Nucleic Acid Delivery Vehicles**

Kristopher W. Brannan, PhD

Assistant Professor, Cardiovascular Sciences and The Center for RNA Therapeutics, Houston Methodist

9:30 a.m. **Secretome as Diagnostic and Therapeutic Tool for Cardiac Therapies**

Carmen Sucharov, PhD

Professor, Cardiology, University of Colorado Denver

9:55 a.m. **Coffee Break**

SESSION 12: Advances in RNA Nanoengineering

Session Chairs: **Alessandro Grattoni, PhD** and **Ewan McRae, PhD**

10:15 a.m. **Engineering Highly Stable RNA Nanoparticles**

Junhua Mai, PhD

Assistant Research Professor, Nanomedicine, Houston Methodist Academic Institute

10:40 a.m. **Circular RNA and its Therapeutic Potential**

Daniel Kiss, PhD

Assistant Professor, Cardiovascular Sciences, Houston Methodist Academic Institute

11:05 a.m. **RNA Origami and Therapeutic Applications**

Ewan McRae, PhD

Assistant Professor, Cardiovascular Sciences, Center for RNA Therapeutics, Houston Methodist

11:30 p.m. **Engineering New Nanoparticles for Better Drug Delivery**

Henry J. Pownall, PhD

Sanford I. Weill and Antonio M. Grotto Jr., MD Centennial Chair in Translational Biomedical Sciences Education

Professor, Biochemistry in Medicine

Houston Methodist Academic Institute

Weill College Medical College

11:55 a.m. – 2:30 p.m. **Lunch Break and Poster Session**

SESSION 13: Nanomedicine-Based Therapies

Session Chairs: **Alessandro Grattoni, PhD** and **Biana Godin, PhD**

- 2:30 p.m. **RNA Nanotherapeutic for Skin Regeneration**
Biana Godin, MScPharm, PhD
Associate Professor, Nanomedicine, Houston Methodist Academic Institute
Weill Cornell Medical College
- 2:55 p.m. **RNA Nanoparticle Delivery for Vascular Regeneration**
Yun Fang, PhD, FAIMBE, FAHA
Associate Professor, Medicine
Co-Director, Research Training in Respiratory Biology Program, Medicine
University of Chicago
- 3:20 p.m. **In Vivo Delivery Systems for Genome Editing Tools**
YouYang Zhao, PhD
William G. Swartzchild, Jr. Distinguished Research Professor
Director, Program for Lung and Vascular Biology
Head, Injury Repair and Regeneration Research, Stanley Manne Children's Research Institute
Ann & Robert H. Lurie Children's Hospital of Chicago
Professor, Pediatrics, Medicine (Pulmonary and Critical Care Medicine and Pharmacology)
Northwestern University Feinberg School of Medicine
- 3:45 p.m. **Kostas Strategic Impact Project Presentations**
Session Chair: **Alessandro Grattoni, PhD**
- **Co-Investigators 1:** 8 min.
 - **Co-Investigators 2:** 8 min.
 - **Co-Investigators 3:** 8 min.

Shark Tank Session: Cardiovascular Nanomedicine

- 4:10 – 4:55 p.m. **Introduction of Judges**
John P. Cooke, MD, PhD
Shark Tank Judges: **Alessandro Grattoni, PhD**, Houston Methodist
Christopher Lincoln, PhD, Houston Methodist
John Schultz, Houston Methodist
Ryan Spitler, PhD, Health Science Futures, ARPA-H
- Shark Tank Competitors:
- Team 1:** 15 min. (5-minute pitch; 10 min. Q&A)
 - Team 2:** 15 min. (5-minute pitch; 10 min. Q&A)
 - Team 3:** 15 min. (5-minute pitch; 10 min. Q&A)
- 5:00 – 5:10 p.m. **Shark Tank Award Announcement**
Session Chair: **John P. Cooke, MD, PhD**
- 5:10 – 5:15 p.m. **Closing Remarks and Adjournment**
John P. Cooke, MD, PhD and **Alessandro Grattoni, PhD**

Many thanks to the following individuals for their help organizing this meeting

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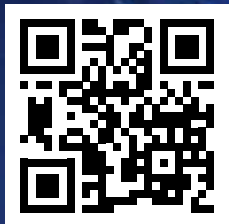
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Gang Bao, PhD		Rice University
Longhou Fang, PhD		Houston Methodist
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