The Heart by Numbers: Integrating Theory, Computation, and Experiment to Advance Cardiology

Berlin, Germany | September 4–7, 2018
Organizing Committee

Martin Falcke, Max Delbrück Center for Molecular Medicine, Germany
Gemst Rank, Medical University of Graz, Austria
Zhlin Qu, University of California, Los Angeles, USA
Karín Spido, University of Leuven, Belgium
James Weiss, University of California, Los Angeles, USA

Scientific sessions will be held in Auditorium Auen I and poster sessions will be held in Building 84 Foyer unless otherwise noted.

Monday, September 3, 2018

17:30 - 20:00 Registration/Information.................................................................NH Collection Friedrichstrasse
18:00 - 20:00 Welcome Reception........................................................................NH Collection Friedrichstrasse

Tuesday, September 4, 2018

8:00 – 18:00 Registration/Information.................................................................Grand Foyer
8:45 - 9:00 Martin Lothe, Max Delbrück Center for Molecular Medicine, Germany
Opening Remarks

Session I Disease Modelling I  Martin Falcke, Max Delbrück Center for Molecular Medicine, Germany, Chair
9:00 - 9:35 Stefan Luther, Max Planck Institute for Dynamics and Self-Organization, Germany
Low-Energy Control of Cardiac Arrhythmias
9:35 - 10:10 Colleen Clancy, University of California, Davis, USA
Jee, Drugs, and Funky Rhythms: Cardiology Insights from Modeling and Simulation
10:10 - 10:30 Hemerogeld Arvalo, Simula Research Laboratory, Norway *
Using Virtual Hearts Models to Investigate Arrhythmogenesis during Acute Myocardial Infarction
10:30 - 10:50 Marcus Kelm, German Heart Institute Berlin, Germany *
EurValve
10:50 - 11:10 Coffee Break..................................................................................Grand Foyer

Session II Disease Modelling II  Martin Falcke, Max Delbrück Center for Molecular Medicine, Germany, Chair
11:10 - 11:45 Edward Vignorm, University of Bordeaux, France
Biophysical Models of the Fibrillating Atria: Fibrosis and Electrophysiological Considerations
11:45 - 12:20 Yohannes Shiferaw, California State University, Northridge, USA
Synchronization of Stochastic Calcium Waves in Atrial Tissue
13:25 - 14:45 Poster Session I ...........................................................................Building 84 Foyer

Session III Disease Modelling III  Karin Spido, University of Leuven, Belgium, Chair
14:45 - 15:20 Natalia Tuyanov, Johns Hopkins University, USA
Computational Cardiology: Blending Engineering and Medicine
15:20 - 15:55 Steven Niederer, King’s College London, United Kingdom
Clinical Translation of Cardiac Models
15:55 - 16:30 Emilia Enelichova, George Washington University, USA
Massively-Parallel All-Optical Cardiac Electrophysiology
16:30 - 16:50 Coffee Break..................................................................................Grand Foyer

Session IV Disease Modelling IV  Karin Spido, University of Leuven, Belgium, Chair
16:50 - 17:25 Martin Nash, University of Auckland, New Zealand
Structure-Function Mechanisms of Heart Failure
17:25 - 18:00 Andrej Mcculloch, University of California, San Diego, USA
Multi-Scale Biomechanics and Systems Mechanobiology of Heart Failure

Wednesday, September 5, 2018

8:30 - 17:50 Registration/Information.................................................................Grand Foyer

Session V Excitation Contraction Coupling I  James Weiss, University of California, Los Angeles, USA, Chair
9:00 - 9:35 Julia Gorlik, Imperial College London, United Kingdom
Micromdomain Specific Regulation of L-type Ca Channels and Arrhythmias
9:35 - 10:10 Aleksandra Zahradnikova, Slovak Academy of Sciences, Slovakia
Allotropic Aspects of Ryanodine Receptor Gating
10:10 - 10:30 David J. Christini, Cornell University, USA *
Designing Intact Cardiac Cell Electrophysiological Protocols to Improve Computational Model Fidelity
10:30 - 10:50 James J. Vangberg, Victor Chang Cardiac Research Institute, Australia *
Impact of Correlated Gene Expression Patterns on Population Models of the Cardiac Action Potential
10:50 - 11:10 Coffee Break..................................................................................Grand Foyer

Session VI Metabolism & Mitochondria  James Weiss, University of California, Los Angeles, USA, Chair
11:10 - 11:45 Daniel Beard, University of Michigan, USA
Eliciting Links Between Disruptions to Myocardial Energy Metabolism and Mechanical Dysfunction in Heart Failure
11:45 - 12:20 Brian O’Rourke, Johns Hopkins University, USA
Cascading Mitochondrial Network Failure: Computational and Experimental Studies
12:20 - 12:40 Zhen Song, University of California, Los Angeles, USA *
A Spatially Detailed in Silico Model of Excitation-Contraction-Metabolism Coupling of Cardiac Cells
12:40 - 13:10 Lunch Break..................................................................................Grand Foyer
13:10 - 14:30 Poster Session II ...........................................................................Building 84 Foyer

Session VII Excitation Contraction Coupling II  Zhlin Qu, University of California, Los Angeles, USA, Chair
14:30 - 15:05 Daniela Panáková, Max Delbrück Center for Molecular Medicine, Germany
Wnt, L-type Calcium Channel, and the Developing Heart
15:05 - 15:40 Christian Stolzer, University of Exeter, United Kingdom
Characterisation of Ryanodine Receptor Clusters in Cardiac Myocytes Using Quantitative Imaging Methods
15:40 - 16:00 Richard Clayton, University of Sheffield, United Kingdom *
Calibration of Human Atrial Cell Models Using Bayesian History Matching with Gaussian Process Emulators

Session VIII Data Driven Modelling  Zhlin Qu, University of California, Los Angeles, USA, Chair
16:00 - 16:55 Elizabeth Cherry, Rochester Institute of Technology, USA
Reconstructing Cardiac Electrical Dynamics Using Data Assimilation
16:55 - 17:30 Leonid Goubergrits, Charité – Universitätsmedizin Berlin, Germany
Modelling and Simulation for the Aortic Valve Treatment Planning Using Image-based CFD
17:30 - 17:50 Juan Carlos del Alamo, University of California, San Diego, USA *
Patient-specific Mapping of Blood Stasis in the Left Atrium by Computational Fluid Dynamics

Thursday, September 6, 2018

8:30 - 14:50 Registration/Information.................................................................Grand Foyer

Session IX Arrhythmogenesis and Its Control I  Gemst Rank, Medical University of Graz, Austria, Chair
9:00 - 9:35 Mark B. Sparks, King’s College London, United Kingdom
Identifying the Arrhythmogenic Mechanisms Driven by Midwall Fibrosis in Non-Ischaemic Dilated Cardiomyopathy
9:35 - 10:10 Jonathan Oldenhof, University of Maryland, USA
Diastolic Calcium in Heart: Ca++ “Quarls, CA++ Sparks, CA++ Waves and Arrhythmias
10:10 - 10:30 Johann Schröder, Ludwig-Maximilians-University of Munich, Germany *
Activation of Mitochondrial Calcium Uptake Suppresses Arrhythmogenesis in Cardiomyocytes
10:30 - 10:50 Michael B. Sparks, University of California, Los Angeles, USA *
Arrhythmogenesis in Long QT Syndrome: Mechanism of Initiation and Therapeutic Insight from an in Silico Human Model
10:50 - 11:10 Coffee Break ................................................................. Grand Foyer

Session X

**Arrhythmogenesis and Its Control II**  Gernot Plank, Medical University of Graz, Austria, Chair

11:10 - 11:45 Donald Bers, University of California, Davis, USA
Cardiac Excitation-Contraction Coupling, Arrhythmias and Signaling: Experiments and Modelling

11:45 - 12:20 Alexander Panfilov, Gent University, Belgium
In Silico–in vitro Approach to Study the Mechanisms of Cardiac Arrhythmias

12:20 - 12:40 Vivian Timmermann, Simula Research Laboratory, Norway *
A Computational Study of the Contribution of Mechano-Electric Feedback to Arrhythmogenic Current Generation

12:40 – 13:00 Fernando O. Campos, King’s College London, United Kingdom *
Optimization of an Activation-Repolarization Time Metric to Detect Localized Susceptibility to Reentry

13:00 - 13:30 Lunch Break .................................................................................................................. Grand Foyer

13:30 - 14:50 Poster Session III ......................................................................................................... Building 84 Foyer

14:50 – 18:00 Free Time

18:00 – 21:00 Boat Trip/Banquet .................................................................................................... Station: Märkisches Ufer

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**Friday, September 7, 2018**

8:30 – 15:30 Registration/Information .................................................................................................. Grand Foyer

Session XI

**Excitation Contraction Coupling III**  David J. Christini, Cornell University, USA, Chair

9:00 - 9:35 Pieter de Tombe, Loyola University Chicago, USA
Frank-Starling Law of the Heart: Molecular Mechanisms of Myofilament Length Dependent Activation

9:35 - 10:10 Michael Gotthardt, Max Delbrück Center for Molecular Medicine, Germany
Theory and Practice of Titin Based Mechanotransduction

10:10 - 10:30 Kenneth Campbell, University of Kentucky, USA *
Force-Dependent Recruitment of Cross-bridges from the Myosin Off-state Can Contribute to Length-dependent Activation in Cardiac Muscle

10:30 - 10:50 Lorenzo Marcucci, University of Padova, Italy *
Proposed Mechanism of Length Dependent Maximum Force Developed in Striated Muscle at High Calcium

10:50 - 11:10 Coffee Break .................................................................................................................. Grand Foyer

Session XII

**Excitation Contraction Coupling IV**  David J. Christini, Cornell University, USA, Chair

11:10 - 11:45 Mary Maleckar, Allen Institute for Cell Science, USA
Modeling Experimental Insights from hiPSC and Derived Cells: Integrating the Cardiomyocyte

11:45 - 12:20 Frank Heinzel, Charité – Universitätsmedizin Berlin, Germany
Regulation of Subcellular Ca²⁺ as Source of Intracellular Dyssynchrony in Cardiomyocytes

12:20 - 12:40 Samuel Wall, Simula Research Laboratory, Norway *
In Silico Modeling of Cardiac Microphysiological Systems for Evaluating Drug Side Effects

12:40 - 13:20 Lunch Break .................................................................................................................. Grand Foyer

Session XIII

**Excitation Contraction Coupling V**  Markus Bär, Physikalisch-Technische Bundesanstalt, Germany, Chair

13:20 - 13:55 Peter Kohl, Institute for Experimental Cardiovascular Medicine, Germany
Sat-Nav for the Inner Cities of the Heart: Mapping 3D Cell-Nanostructure

13:55 - 14:15 Enrique Alvarez-Lacalle, Polytechnic University of Catalonia, Spain *
A General Equilibrium Model to Study Intracellular Calcium Homeostasis. New Insights on Ventricular Function

14:15 - 14:35 Coffee Break .................................................................................................................. Grand Foyer

Session XIV

**Re-Entry**  Markus Bär, Physikalisch-Technische Bundesanstalt, Germany, Chair

14:35 - 14:55 Vladimir Zykov, Max Planck Institute for Dynamics and Self-Organization, Germany *
Fast Propagation Regions of a Specific Geometry can Cause Reentry in Excitable Media

14:55 - 15:15 Michael Colman, University of Leeds, United Kingdom *
Dynamic Organ-scale Modelling of Sub-cellular Calcium Release Events in the Heart: After-Depolarisations, Premature Excitation and Re-Entry

15:15 - 15:30 Martin Falcke, Max Delbrück Center for Molecular Medicine, Germany
Closing Remarks and Biophysical Journal Poster Awards

*Contributed talks selected from among submitted abstracts