



Cardiac Physiome WORKSHOP



October 31 - November 2, 2012
Catamaran Resort Hotel in San Diego, California

www.nbcr.net/cardiacphysiome



TUESDAY, OCTOBER 30

5:30-7:00 p.m. **WELCOME RECEPTION**

CATAMARAN RESORT PATIO

WEDNESDAY, OCTOBER 31

7:30 a.m. **CONTINENTAL BREAKFAST**

ROUSSEAU FOYER

8:30 a.m. **OPENING REMARKS**

KON TIKI BALLROOM
ANDREW MCCULLOCH AND PETER ARZBERGER

8:45 a.m. **PLENARY LECTURE:** MICHAEL REGNIER, Seattle

KON TIKI BALLROOM

Combining Computational and Experimental Approaches to Study Myofibrillar Structure-Function in Normal and Diseased Cardiac Muscle
CHAIR: ANDREW MCCULLOCH, La Jolla

9:30 a.m. **COFFEE BREAK**

ROUSSEAU FOYER AND SUITE

CARDIAC ELECTROPHYSIOLOGY, CHAIR: DAVID PATERSON, Oxford

KON TIKI BALLROOM

9:45 a.m. Sex, Drugs and Funky Rhythms *In Silico*

COLLEEN CLANCY, Davis

10:00 a.m. Markov Models of Use-dependence and Reverse Use-dependence During the Mouse Cardiac Action Potential

RANDALL RASMUSSEN, Buffalo

10:15 a.m. Fine-Tuning of Cardiac Automaticity by Mitochondria Sodium-Calcium Exchange

SATOSHI MATSUOKA, Kyoto

10:30 a.m. Mathematical Models of the Action Potential in Human Ventricle in Relation to Safety Pharmacology

WAYNE GILES, Calgary

10:45 a.m. Discussion

11:00 a.m. **DISCUSSION OF JOURNAL OF PHYSIOLOGY SPECIAL ISSUE**

KON TIKI BALLROOM

CHAIR: DAVID PATERSON, Oxford

11:15 a.m. **POSTER FLASH PRESENTATIONS**, CHAIR: NICOLAS SMITH, London

KON TIKI BALLROOM

12:00 p.m. **POSTERS AND BOXED LUNCH**

ROUSSEAU FOYER AND SUITE

MYOFILAMENTS, CHAIR: HENK TER KEURS, Calgary

KON TIKI BALLROOM

1:45 p.m. Frank-Starling's Law of the Heart: Myofilament length-Dependent Activation

PIETER DE TOMBE, Chicago

2:00 p.m. Phosphorylation of S-282 in Cardiac Myosin Binding Protein-C is Sufficient to Nearly Double MgADP Release Rate from Myosin Cross-Bridges in Mouse Myocardium

BERT TANNER, Burlington

2:15 p.m. ODE-Based Model of Myofilaments: Keeping up with Times

JEREMY RICE, Yorktown Heights

2:30 p.m. Models of Co-operative Sarcomere Dynamics for Multi-Scale Heart Simulation

SEIRYO SUGIURA, Tokyo

2:45 p.m. Cross-Bridge Kinetics in Intact Multicellular Cardiac Rat, Rabbit, and Human Muscles at Body Temperature

PAUL JANSSEN, Columbus

3:00 p.m. Discussion

3:15 p.m. **COFFEE BREAK**

ROUSSEAU FOYER AND SUITE

EXCITATION-CONTRACTION COUPLING, CHAIR: DON BERS, Davis

KON TIKI BALLROOM

3:45 p.m. Cell Membrane Microanatomy and L-Type Calcium Channel Distribution Modulate Calcium Dynamics in Ventricular Myocytes

ANUSHKA MICHAILOVA, La Jolla

- 4:00 p.m. Regulation of Cardiac Calcium Sparks: Insights Provided by Sensitivity Analysis of Stochastic Models ERIC SOBIE, New York
- 4:15 p.m. Compensation and Decompensation of Cardiomyocyte Calcium Homeostasis During Heart Failure Progression WILLIAM LOUCH, Oslo
- 4:30 p.m. How does Unstable Intracellular Calcium Cycling Induce Spatially Discordant Alternans of Action Potential Duration in Tissue? DAISUKE SATO, Davis
- 4:45 p.m. Cardiac Deformation in the Normal Cycle and Electrical Responses to Point Stimulation PETER KOHL, London
- 5:00 p.m. Discussion

5:15 p.m. **POSTERS AND REFRESHMENTS**

ROUSSEAU FOYER AND SUITE

6:30 p.m. Dinner on your own

THURSDAY, NOVEMBER 1

7:30 a.m. **CONTINENTAL BREAKFAST**

ROUSSEAU FOYER

8:45 a.m. **PLENARY LECTURE:** NATALIA TRAYANOVA, Baltimore
Modeling Cardiac Rhythm Disorders

KON TIKI BALLROOM
CHAIR: JAMES BASSINGTHWAIGHTE, Seattle

9:30 a.m. **COFFEE BREAK**

ROUSSEAU FOYER AND SUITE

METABOLIC AND REGULATORY NETWORKS

KON TIKI BALLROOM

CHAIR: JAMES BASSINGTHWAIGHTE, Seattle

- 9:45 a.m. Mechanisms of Early Afterdepolarizations Prior to Heart Failure in the CaMKII δ c Transgenic Mouse ANDY EDWARDS, La Jolla
- 10:00 a.m. Arrhythmogenic Responses Triggered by Dynamic Changes in Autonomic Tone ROBERT HARVEY, Reno
- 10:15 a.m. Cooperativity in PKA Activation and cAMP Diffusion in Localized Microdomains of Adult Cardiomyocytes BRITTON BORAS, La Jolla
- 10:30 a.m. Control of Energy Metabolism and Substrate Utilization in Cardiac and Skeletal Muscle in Health and Disease DAN BEARD, Milwaukee
- 10:45 a.m. Network Reconstruction and Systems Analysis of Cardiac Myocyte Hypertrophy Signaling JEFFREY SAUCERMAN, Charlottesville
- 11:00 a.m. Discussion

11:15 a.m. **POSTER FLASH PRESENTATIONS**, CHAIR: PETER HUNTER, Auckland

KON TIKI BALLROOM

12:00 p.m. **POSTERS AND BOXED LUNCH**

ROUSSEAU FOYER AND SUITE

ARRHYTHMIA MECHANISMS, CHAIR: NATALIA TRAYANOVA, Baltimore

KON TIKI BALLROOM

- 1:45 p.m. Localized Sources for Cardiac Fibrillation SANJIV NARAYAN, La Jolla
- 2:00 p.m. Study of the Effect of Rapid Pacing from the Septum Area on Atrial Fibrillation NATHALIE VIRAG, Lausanne
- 2:15 p.m. Insights into the Mechanisms of Ventricular Fibrillation in the Human Heart: Experiments and Models RICHARD CLAYTON, Sheffield
- 2:30 p.m. Beyond Channel Blocking: Anti-Arrhythmic Strategies from Bifurcation Theory ALAN GARFINKEL, Los Angeles
- 2:45 p.m. Towards Modeling Arrhythmogenic Cardiomyopathy - Can Simulation Shed Light on a Complex Disease Process? MOLLY MALECKAR, Oslo
- 3:00 p.m. Discussion

3:15 p.m. **COFFEE BREAK**

ROUSSEAU FOYER AND SUITE

VENTRICULAR ELECTROMECHANICS, CHAIR: PETER HUNTER, Auckland

KON TIKI BALLROOM

3:45 p.m. Computational Analysis of 15-Lead ECG System Using an Electromechanical Model of the Heart

EUN BO SHIM, Chuncheon

4:00 p.m. Structural Imaging and Modelling the Mechanics of Heart Failure

MARTYN NASH, Auckland

4:15 p.m. Towards Patient-Specific Simulations of Strongly Coupled Cardiac Electro-Mechanics

JOAKIM SUNDNES, Oslo

4:30 p.m. Integrating Patient-Specific Models with Growth and Remodeling

ROY KERCKHOFFS, La Jolla

4:45 p.m. Applying Personalised Computational Modelling to Clinical Cardiology

STEVE NIEDERER, London

5:00 p.m. Discussion

5:15 p.m. **POSTERS**

ROUSSEAU SUITE

7:00 p.m. **COCKTAILS**

AVIARY ROOM FOYER

7:00 p.m. **CONFERENCE DINNER**

AVIARY ROOM

FRIDAY, NOVEMBER 2

7:30 a.m. **CONTINENTAL BREAKFAST**

ROUSSEAU FOYER

8:45 a.m. **PLENARY LECTURE:** NICOLAS SMITH, London
Of Mice and Men and Multi-scale Cardiac Modelling

KON TIKI BALLROOM
CHAIR: PETER HUNTER, Auckland

9:30 a.m. **COFFEE BREAK**

ROUSSEAU FOYER AND SUITE

CLINICAL IMAGE-BASED MODELING, CHAIR: ROY KERCKHOFFS, La Jolla

KON TIKI BALLROOM

9:45 a.m. The Cardiac Atlas Project: Data Sharing for Population Modeling

ALISTAIR YOUNG, Auckland

10:00 a.m. Shape Determines Non-Uniformity in Intramural Myocardial Mechanics In the Left Ventricle and Atrium

PIET CLAUS, Leuven

10:15 a.m. Simulations for Improved Risk Stratification in Patients With Kawasaki Disease

ALISON MARSDEN, La Jolla

10:30 a.m. Image Based Modeling of Atrial Arrhythmias

ROB MACLEOD, Salt Lake City

10:45 a.m. Towards Personalized Clinical In-Silico Modeling of Atrial Anatomy and Electrophysiology

GUNNAR SEEMANN, Karlsruhe

11:00 a.m. Discussion

11:15 a.m. **DISCUSSION ABOUT PAPERS AND FUTURE MEETINGS**

11:55 a.m. **CLOSING REMARKS**

ANDREW MCCULLOCH

12:00 p.m. **POSTERS AND BOXED LUNCH**

ROUSSEAU FOYER AND SUITE

1:00 p.m. **MEETING CONCLUDES**

Posters

1. **HERMENEGILD AREVALO**, Johns Hopkins University
MRI-Based Models Of Patient-Specific Hearts With Ischemic Disease Can Predict SCD Risk
2. **JASON BAYER**, Johns Hopkins University Schools of Medicine
Spatially Discordant Alternans In Action Potential Voltage Increase Arrhythmia Vulnerability In Human Heart Failure
3. **LAURA BEAR**, Auckland Bioengineering Institute
Inverse Analysis of Body Surface Potentials with Simultaneous Epicardial and Endocardial Mapping
4. **CHIARA BELLINI**, University of Calgary and Universite Bordeaux
Computational Models of the Left Atrium for the Study of Atrial Fibrillation
5. **BOJAN BLAZEVIC**, King's College London and Medical University of Graz
Can We Routinely Build Patient-Specific Models of CRT from Clinical Data?
6. **PATRICK BOYLE**, Johns Hopkins University
A Computational Framework for Simulating Cardiac Optogenetics
7. **MASHID BOZORGIZADEH**, University of Sheffield
How is Dynamic Electrical Activity in the Heart Influenced by Tissue Structure?
8. **SCOTT BUGENHAGEN**, Medical College of Wisconsin
A Minimal Model of the Cardiac Ca^{2+} /Calmodulin-Dependent Protein Kinase II holoenzyme
9. **ALFONSO BUENO OROVIO**, University of Oxford
Fraction Diffusion Models of Electrical Propagation In Cardiac Tissue: Electrotonic Effects And Modulated Dispersion Of Repolarization
10. **STUART CAMPBELL**, Yale University
Aging Alters Ventricular Torsion and the Transmural Distribution of Myocyte Contractile Properties
11. **LEAH CANNON**, Sanford Burnham Medical Research Institute
*Odd-skipped up-regulation compensates for aging-related changes in the *Drosophila* heart*
12. **RADOMIR CHABINIOK**, King's College London
Myocardial Perfusion Modeling From Clinical Data
13. **KELLY CHANG**, Johns Hopkins University
Reduced Inactivation of Ryanodine Receptors in Atrial Fibrillation Drives Alternans at Slow Rates
14. **ANDREW CROZIER**, King's College London and University of Oxford
Determining Indicators of CRT Response Through Computation Modelling
15. **BERNARDO DE OLIVEIRA**, Simula Research Laboratory
Multiple Mechanoelectrical Feedback Mechanisms Affect Conduction Velocity
16. **TAMMO DELHAAS**, Maastricht University
CircAdapt: a User-Friendly Learning Environment for Cardiovascular (Patho)physiology
17. **SUKRITI DEWAN**, UC San Diego and Loyola University Chicago
Altered Cross-Bridge Relaxation Kinetics and Myofilament Phosphoproteome in Guinea Pig Heart Failure
18. **THOMAS FRITZ**, Karlsruhe Institute of Technology
Finite Element Analysis of the Contraction of the Heart within the Pericardium: A Frictionless Contact Problem
19. **ZHUOHUI GAN**, UC San Diego and Gladstone Institute, UC San Francisco
MAAMD: A Workflow to Standardize Meta-Analyses of Affymetrix Microarray Data
20. **SARA GATTONI**, King's College London
Modelling Calcium Dynamics in the Rat Cardiac Myocyte
21. **NAMIT GAUR**, Simula Research Laboratory and UC San Diego
Multiscale Modeling of Ca Cycling in Ventricular Myocytes: Whole-Cell Effects of Dyadic Properties

22. **STEPHEN GILBERT**, University of Leeds
Myocardial 3D Structural Measurement: Comparison of DTMRI and Structure Tensor of High Resolution MR
-
23. **MATTHEW GONZALES**, UC San Diego
Rotor Dynamics in Patient-Specific Batrial Finite Element Models
-
24. **MYRIANTHI HADJIRCHARALAMBOUS**, King's College London
Weak Penalization Method - A Novel Approach to Incompressibility in Cardiac Mechanics
-
25. **JOHAN HAKE**, Simula Research Laboratory
Altered Configurations of Ca²⁺ Release Units Cause Slowed Ca²⁺ Sparks in Failing Cardiomyocytes
-
26. **YUKIKO HIMENO**, Ritsumeikan University and Advanced Scientific Technology & Management Research Institute of Kyoto
Development of an ANS-Regulated Cardiovascular Model Based on Cellular & Molecular Mechanisms
-
27. **DEL RAY JACKSON**, University of Nevada School of Medicine
Simple Models of Muscle Regulation & Contraction
-
28. **PETER KEKENES HUSKEY**, UC San Diego
Calcium Dynamics in Rabbit Ventricular Myocytes
-
29. **SHANKARJEE KRISHNAMOORTHY**, UC Los Angeles
Numerical Quadrature and Operator Splitting for Cardiac Electromechanics
-
30. **ADARSH KRISHNAMURTHY**, UC San Diego
Multi-Scale Constitutive Model Of Active Myocardial Mechanics
-
31. **ADARSH KRISHNAMURTHY**, UC San Diego
Acute CRT Response Correlates With Regional Variation In Work Density From Patient-Specific Ventricular Models
-
32. **GEOFFREY KUNG**, UC Los Angeles
Microstructural Border Zone Remodeling in the Post-Infarct Porcine Heart Measured by DT- and LGE-MRI
-
33. **SANDER LAND**, University of Oxford
Beta-Adrenergic Stimulation Maintains Cardiac Function in Serca2 Knockout Mice
-
34. **JACK LEE**, King's College London
Coronary Flow and Perfusion-Contraction Coupling in the Left Ventricle
-
35. **PAN LI**, UC San Diego
A Model of Cardiac Thin Filament Activation with PKA and CaMKII Regulation
-
36. **JUSTIN LICHTER**, University of Utah
Cytoskeletal Remodeling of Cardiac Ventricular Myocytes During Heart Failure
-
37. **JOOST LUMENS**, Maastricht University Medical Center
Left Ventricular Versus Biventricular Pacing in the Failing Heart with Left Bundle-Branch Block
-
38. **XIAOYU LUO**, University of Glasgow, Xian Jiaotong University and New York University
Finite Strain Modeling of Human Left Ventricle
-
39. **STEPHANIE MARCHESSEAU**, INRIA
Cardiac Mechanical Model Calibration Based on the Unscented Transform
-
40. **GARY MIRAMS**, University of Oxford
Evaluation of an In-Silico Pro-Arrhythmic Safety Assay
-
41. **MICHAEL MOULTON**, University of Nebraska Medical Center
A Low Order Dynamical Model of the Left Ventricle for Clinical Applications
-
42. **LUIGI PEROTTI**, UC Los Angeles
Computational Modeling Requirements to Produce an Accurate ECG
-
43. **EMILY PFEIFFER**, UC San Diego
Stretch Modulation of Cardiomyocyte Conduction
-
44. **SARAH PILOTO**, Sanford Burnham Medical
Roles for Hif1a/sima and Small Heat Shock Protein 23 (Hsp23) in Ischemia/Reperfusion-Induced Cardiac Injury in Drosophila
-
45. **JOSE PUGLISI**, UC Davis
Feed Forward Modelling, Fixing the Force-Frequency Relationship

46. **T ALEXANDER QUINN**, Imperial College London
Transmural Electrophysical Heterogeneity Investigated by Dual Wavelength Optical Mapping
-
47. **ESPEN REMME**, Oslo University Hospital and King's College London
Determinants of Early Systolic Interventricular Septal Motion in Left Bundle Branch Block
-
48. **SIMONE RIVOLO**, King's College London
Biophysical Framework for Stimulating and Analyzing Coronary Wave Intensity Analysis
-
49. **BERNARDO ROCHA**, Federal University of Juiz de Fora-Brazil and Simula Research Laboratory
Mechanical Effects on Simulated Electrograms of a Human Left Ventricular Wedge
-
50. **BLANCA RODRIGUEZ**, University of Oxford
Capturing Parameter Uncertainty and Functional Variability in Cardiac Electrophysiology
-
51. **RAFAEL SEBASTIAN**, Universitat de Valencia
Modeling of Human torso for the Study and Characterization of Atrial Arrhythmias
-
52. **TAKAO SHIMAYOSHI**, ASTEM Research Institute of Kyoto
A Multiscale Cardiovascular Model on Energetic Efficiency
-
53. **AYAKO TAKEUCHI**, Kyoto University
Mechanisms Underlying NCLX Reduction-Mediated Slowing of Cardiomyocyte Beating Rate
-
54. **JARED TANGNEY**, UC San Diego
Novel Role for Vinculin in Ventricular Myocyte Mechanics and Dysfunction
-
55. **KENNETH TRAN**, Auckland Bioengineering Institute
Demand-Driven Regulation of Cardiac Energy Supply
-
56. **BEATRIZ TRENOR**, Universitat Politecnica de Valencia
Effects of Electrical and Structural Remodeling on the Electrical Properties of the Failing Heart
-
57. **CHRISTOPHER VILLONGCO**, UC San Diego
Incorporating Human Ventricular Fiber Architecture in Patient-Specific Computational Models
-
58. **KEVIN VINVENT**, UC San Diego
Behavior of a High-Order Finite Element Solver for 3-D Anisotropic Reaction-Diffusion Models
-
59. **SAM WALL**, Simula Research Laboratory
Strongly Coupled Electromechanical Models of the Left Ventricle - Evaluation of Tissue Engineering Applications
-
60. **JOHN WALMSLEY**, University of Oxford
mRNA Expression Levels Predict Cellular Electrophysiological Remodelling in Failing Human Hearts using a Population-Based Simulation Study
-
61. **MATHIAS WILHELMS**, Karlsruhe Institute of Technology
Integration of Ion Current Measurement Data into Models of Cardiac Electrophysiology
-
62. **ADAM WRIGHT**, UC San Diego
The Role of Caveolae and Membrane Conformation in Load-Induced Ventricular Conduction Slowing
-
63. **PABLO LAMATA**, King's College London
Population Analysis of Cardiac Anatomy Enabled by an Automatic Meshing Service
-
64. **VICKY WANG**, Auckland Bioengineering Institute and Université de Lyon
Estimating In-vivo Human Myocardial Fibre Strain Using FE Modelling of Diffusion Tensor and Tagged MRI
-
65. **MOLLY MALECKAR**, Simula Research Laboratory and University of Calgary
Functional Consequences of Expression of Heart Sodium Channel Nav1.5 in Cardiac Fibroblasts and Myofibroblasts



It is our pleasure to welcome you to the 2012 Cardiac Physiome Workshop in San Diego! We are excited by the high quality of presentations, continued from previous years, and the participation of so many graduate students and postdocs. We look forward to vibrant scientific interactions and fruitful discussions that will continue to promote new collaborations and advance our growing field. Last but not least, we are grateful to the NBCR staff who helped with the organization and the financial support of all of our sponsors for helping to make this year's workshop possible.

