

Workshop on Multi-scale Modelling of the Heart

27-29 March 2008, Auckland, New Zealand

Scientific programme

Day 1

10:15 - 11:50 - Sub-cellular modelling

Chair: David Eisner

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| 10:15-10:40 | Overview Talk - Richard Vaughan-Jones
Spatial regulation of intracellular pH in heart and its link to intracellular Ca ²⁺ signalling |
| 10:40- 11:05 | Overview Talk - Clive Orchard
Transverse tubules: at the heart of cardiac myocyte function? |
| 11:05- 11:20 | Research Talk - Arne Bjørke Gjuvsland
The genotype-phenotype map in a multi-scale model of the heart |
| 11:20 -11:35 | Research Talk - David Paterson
Cardiac-neural signalling in normal and diseased hearts:construction of heart-neural model |
| 11:35-11:50 | Modelling Approach Talk- Dan Beard
Analysis of coronary oxygen transport and mitochondrial cardiac energy metabolism |

11:50 - 12:05 - Morning tea

12:05 - 13:15 - Calcium handling

Chair: Richard Vaughan-Jones

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| 12:05- 12:30 | Overview Talk - David Eisner
How is sarcoplasmic reticulum Ca controlled and what produces instability? Food for thought for the modellers |
| 12:30-12:45 | Modelling Approach - Jose Puglisi
First Things First - Practical thoughts regarding mathematical modeling in biology |
| 12:45-13:00 | Modelling Approach - Christian Soeller
Quantitative 3D high resolution mapping of proteins involved in cardiac excitation-contraction coupling |
| 13:00-13:15 | Modelling Approach – Jeremy Rice
Data decomposition and communication framework for simulation of heart models in the age of petascale computers |

13:15 - 14:00 - Lunch

14:00 - 15:35 - Cardiac mechanics modelling

Chair: Nic Smith

- 14:00-14:25 Overview Talk - Andrew McCulloch
Multi-scale modeling of cardiac mechanoenergetics
- 14:25-14:40 Research Talk - Chris Barclay
Quantifying cross-bridge cycles and Ca^{2+} release in cardiac twitches
- 14:40-14:55 Research Talk - Jeff Holmes
A role for finite element models in improving diagnosis and treatment of ischemic heart disease
- 14:55- 15:20 Overview Talk - Henk ter Keurs
Sarcomere mechanics in uniform and nonuniform cardiac muscle; a link between pump function and arrhythmias
- 15:20-15:35 Modelling Approach - Steven Niederer
We all pull together: The role of the Frank-Starling effect in cardiac synchrony

15:35 - 15:55 - Afternoon tea

15:55 - 17:20 – Imaged-based modelling

Chair: Pengchen Shi

- 15:55- 16:20 Overview Talk - Alex Frangi
GoogleHeart: Integrating of cardiac structural and functional imaging through statistical models
- 16:20-16:35 Research Talk -Peter Kohl
Integration of cardiac structure ‘from nano to macro’
- 16:35-16:50 Modelling Approach - Jack Lee
Anatomical modelling of coronary microarchitecture and myocardial tissue
- 16:50-17:05 Research Talk - Alistair Young
The cardiac atlas project
- 17:05-17:20 Modelling Approach - David Nordsletten
Coupled fluid-solid mechanics in the heart

18:00 - 20:30 - Dinner at Waiheke Island Resort

Entertainment by Pepe Puglisi with his new magic show “Perplexity”.

Master of Ceremonies: James Sneyd

Note: Day 1 programme details continue overleaf.

20:30 - 21:10 - Physiome Issues

Chairs: David Paterson and Peter Hunter

- 20:30-20:50 Editorial- Nic Smith
Where is the data coming from?
- 20:50-21:10 Editorial- Edmund Crampin
Incorporating Gene Regulation, how and why?

Day 2

9:00 - 10:10 - Cardiac Activation

Chairs: Andrew McCulloch

- 9:00-9:25 Overview Talk - Natalia Trayanova
Predictive models of the heart in health and disease
- 9:25-9:40 Research Talk - Bruce Smail
Experiment specific, structure-based modelling of cardiac electrical activation
- 9:40-9:55 Modelling Approach - Sasha Panfilov
Modelling mechano-electric feedback in the heart
- 9:55-10:10 Mark Boyett
Title to be confirmed

Morning tea 10:10 - 10:30

10:30 – 12:05 - Commented poster session (5 minutes per presenter)

- 10:30 James Covell
Changes in myocardial tissue volume during the cardiac cycle: implications for transmural blood flow and cardiac structure
- 10:35 Rafael Sebastian
Sensitivity study in a 3D human ventricular FEM cardiac model for electrical simulation
- 10:40 Bridget Leonard
Investigating structure and function in non-infarcted myocardium following MI
- 10:45 Greg Sands
Reviewing cardiac ventricular microstructure
- 10:50 Harvey Ho
The haemodynamic factors in the genesis of vascular diseases

10:25 – 12:05 - Commented poster session (5 minutes per presenter)

>> session details continued from previous page

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| 10:55 | Marie-Louise Ward
The slow force response to stretch in the mouse heart |
| 11:00 | Mark Trew
Experiment specific activation models for computer analysis of in vivo cardiac recordings |
| 11:05 | Nari Kim
Transmural differences of electrophysiological properties in the rat heart |
| 11:10 | Patricia Cooper
Electrical transgenesis: simulating heart failure in single cells |
| 11:15 | Thomas Desaive
Analysis of spontaneous ventricular fibrillation in acutely ischemic pigs |
| 11:20 | Zoar Engelman
Substrates for rate dependant conduction block in computer models of structural heterogeneity |
| 11:25 | Alan Garny
Moving from COR to PCEnv/COR |
| 11:30 | James Lawson
The CellML model repository as a resource for cardiac modelling |
| 11:35 | David Nickerson
Machine interpretable mathematical model descriptions |
| 11:40 | Mike Cooling
Modelling the IP3/calcineurin/NFAT pathway in cardiac myocytes |
| 11:45 | Jonna Terkildsen
Hyperkalaemia and the onset of electrical alternans in a mathematical model of cardiac ischaemia |
| 11:50 | Kenneth Tran
Modelling energy demand and supply in a cardiomyocyte |
| 11:55 | Vicky Wang
Left ventricular mechanics modelling using cardiac magnetic resonance imaging |
| 12:00 | Adam Alessio
Quantitative PET myocardial perfusion through integrated volume manipulation, display, and modelling |

12:05 - 13:00 - Lunch

13:00 – 14:40 - Commented poster session (5 minutes per presenter)

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| 13:00 | Daniel Ennis
Regional heterogeneity of the myofiber geometry in the ovine left ventricle and comparison to a computationally optimized myofiber geometry |
| 13:05 | Denis Loiselle
At the heart of ventricular trabeculae |
| 13:10 | Bryan Caldwell
Three-dimensional spread of electrical activation from intramural left ventricular stimulus is not explained by myofibre rotation alone |
| 13:15 | Jagir Hussan
A piecewise phase space approximation for solving cardiac membrane models |
| 13:20 | Rikkert Keldermann
Mother rotor fibrillation and effects of heterogeneous APD restitution in a anatomically based model of the human ventricles |
| 13:25 | Shawn Means
Multiscale modelling of calcium microdomains |
| 13:30 | Heye Zhang
A mesh-free framework for simulating cardiac electrical activities |
| 13:35 | Socrates Dokos
Generic ionic model non-linear least squares fitting to cardiac action potentials |
| 13:40 | Martin Falcke
Stochastic multiscale modelling |
| 13:45 | Kaihsu Tai
Modelling the permeation and gating processes of potassium channels |
| 13:50 | Kenneth Tran
Modelling energy demand and supply in a cardiomyocyte |
| 13:55 | Corné Hoogendoorn
Bilinear models for spatio-temporal point distribution analysis: application to extrapolation of cardiac dynamics |
| 14:00 | Chae Hun Leem
Simulation of spontaneous action potentials of cardiomyocytes in pulmonary veins of rabbits |

13:00 – 14:40 - Commented poster session (5 minutes per presenter)

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| 14:05 | Masanori Nakamura
Red blood cell behavior in an intra-ventricular flow |
| 14:10 | Shigeo Wada
Development of a mechano-cell model based on the energy minimum principle |
| 14:15 | Magali Roux
Metamodelling architectures for complex data integration |
| 14:20 | Jichao Zhao
A realistic 3D computer model of right atrial appendage |
| 14:25 | Sally Rutherford
3D reconstruction of the myocardial infarct border zone: effects of structure on propagation |
| 14:30 | Isuru Jayasinghe
Visualization of the 3-D distribution of proteins involved in cardiac excitation-contraction coupling using an optical sectioning method |
| 14:35 | Adam Hill
Genotype-Phenotype correlations in LQTS2: Implications for risk stratification |

14:40 - 15:50 - Human Translation

Chair: David Paterson

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| 14:40-15:05 | Overview Talk – Pengcheng Shi
Non-invasive mapping of 3D cardiac electrophysiology |
| 15:05-15:20 | Research Talk – Martyn Nash
Organisation of re-entry during human ventricular fibrillation |
| 15:20-15:35 | Research Talk - Chris Bradley
Altered dynamics of human ventricular fibrillation during myocardial ischaemia and reperfusion |
| 15:35-15:50 | Research Talk - Bart Bijnens
An integrated, model based, approach for the quantification of cardiac function based on cardiac imaging and knowledge of cardiac physiology and applied to cardiac resynchronisation therapy |

15:50 - 16:10 - Afternoon tea

16:10 - 17:00 - Physiome Overview

Chair: Jim Covell

16:10-16:35 Overview Talk - Jim Bassingthwaite
Cell to heart to system

16:35-17:00 Overview Talk - Peter Hunter
Tools and markup languages for supporting development

17:40 - Wine Tasting and Dinner

Wine Tasting and Dinner at Stonyridge Vineyard. Buses will be leaving the Waiheke Island resort conference centre at 17:40 and will be returning late.

Notes

Overview Talk

A mini keynote which provides a brief overview of the state of the art and/or extended research results.

Research Talk

Research results usually reported from a experimental/measurement perspective.

Modelling Approach

Research results reported from a modelling/tool development perspective; some of these are shorter talks which ideally will couple with the experimental talk before.

Editorial

A more provocative discussion of some of the import issue/challenges the Physiome approach must overcome.

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