Special Guest: Philip Bittihn, PhD student

Max Planck Institute for Dynamics and Self-Organization, Göttingen, Germany

Talk Title: The Role of Cardiac Structural Heterogeneity during Electric-Field Stimulation

[Abstract] Activation patterns in cardiac tissue can range from sinus rhythm (normal heart beat) to life-threatening arrhythmias such as fibrillation. The control of undesirable activity poses a challenging scientific problem due to its complex spatio-temporal dynamics induced by multiple interacting spiral waves. Low-energy anti-fibrillation pacing (LEAP) uses pulsed electric fields to recruit heterogeneities in electrical conductance throughout the tissue as wave emitting sites for non-invasive multi-site control and progressive synchronization [1]. We present a general theoretical framework describing the underlying wave source recruitment mechanisms at structural tissue heterogeneities, such as blood vessels, trabeculae and tissue boundaries [2]. Supported by cell culture experiments on neonatal rat myocytes, the theoretical investigations reveal a hitherto unknown high sensitivity of negative-curvature structures to electric-field stimulation and suggest the relevance of anatomical features located on the endocardium for LEAP at very low field strengths. The potential optimizations of LEAP which might be possible by specifically recruiting these structures are discussed on the basis of the above theory and experimental applications of LEAP in canine hearts [1].

References:[1] S. Luther*, F.H. Fenton* et al., Low-energy control of electrical turbulence in the heart, Nature 475, 235-239 (2011).
[2] P. Bittihn, M, Hörning, and S. Luther, Negative curvature boundaries as wave emitting sites for the control of biological excitable media, Phys. Rev. Lett. 109, 118106 (2012). * Both authors have contributed equally.

Lunch on Discussion & Campus Tour

Lunch: Hiyoshi, Faculty Lounge (13:00 ~ 14:30)
Tour: Start from Hiyoshi Campus to Yagami Systems Biology Laboratory (14:30 ~ 15:20)

Special Lecture & Presentation Battle

Yagami Campus, Bld. 14, BF2 Multimedia Room (15:30 ~ 17:30)
Get the Dinner Ticket with Guests!

IWQB petit 2013 @ Keio University, Yokohama, Japan

Summer Opportunity for Students

PRESENTATION BATTLE!

on Jun 27th , 2013
Keio University, Yagami Campus 3-14-1, Hiyoshi, Kohoku ward, Yokohama, Japan

Program

IWQB petit @ Keio University, Yokohama, Japan

This small workshop consists of a seminar by the special guest from abroad and presentation opportunity for Keio University graduated students was planned as a private welcome event for an invited speaker of Quantitative Biology Session at 2nd High Definition Physiology International Symposium (http://hd-physiology.jp/sympo2013/) by the organizers of the Q-Bio Session.

2 students of Keio University (Takahiro Okuhara, M2; Takumi Hiraiwa, D1) will challenge the special guest, Philip Bittihn, PhD student at the Max Plank Institute for Dynamics and Sefl-organization, Göttingen, Germany.

Now it's show time if they can get the Dinner tickets to go out with the guest!

Time Schedule

Time	Event
13:00 ~ 14:30	Lunch at Hiyoshi, Faculty Lounge
14:30 ~ 15:20	Campus Tour at Hiyoshi Campus, Keio University Systems Biology Laboratory at Yagami Campus
15:20 ~ 15:30	Break
15:30 ~ 15:40	Short Introduction of Speakers Noriko Hiroi
15:45 ~ 16:00	"Computational Modeling of Self-Organization mechanism of *In vivo* environment" Takahiro Okuhara
16:00 ~ 16:15	"Development of Microfluidic Control System of Neuronal Network" Takumi Hiraiwa
16:15 ~ 16:30	Break
16:30 ~ 17:00	"The Role of Cardiac Structural Heterogeneity during Electric-Field Stimulation" Philip Bittihn
17:00 ~ 17:10	Prize Awarding and Remarks Kazuhiro Aoki
18:00 ~ 20:0	Dinner with our special guest

Takahiro Okuhara

2nd Year Master Student
Department of Biosciences and Informatics, Graduate School of Keio University

"Computational Modeling of Self-Organization mechanism of *in vivo* environment"

Motion of the biochemical molecules in vivo is restricted by crowding factors, whereas the molecules in vitro can move freely. Because of such differences in molecular motility, considering the effect of crowding environment on biochemical reactions is important to estimate in vivo molecular behavior precisely.
We reconstructed crowding environments by computer simulations, and analysed reactants behaviors in those models of reaction environment.
We found that the motility of reactants in random DLA and CCA environment changed when the environments were occupied at the level of percolation boundary (40.7%). Based on the observation by transmission electron microscope, background molecular density of intracellular environment is about 41%.
This could mean that the molecular diffusion *in vivo* is confined because of the percolation of environmental molecules, however the relative occupation level is not sufficient and the organization process is important.

Takumi Hiraiwa

1st Year PhD Student
Department of Biosciences and Informatics, Graduate School of Keio University

"Development of Microfluidic Control System of Neuronal Network"

The fabrication method and the functional evaluation of a reusable cell culturing device, designed for colony-based cellular network analysis will be shown in this presentaton. This is the first success of combination of Microcontact Printing (μCP) and Vacuum device.
In contrast to the earlier works, (i) cells stay within the micropatterns for long enough duration to achieve local activation of cells or cellular networks (6h < ~), (ii) the displacement of laminar flow from the boundary of two fluids in Vacuum device keeps smaller than the size of a cell (± 4.08 μm), (iii) all components of our cell culturing device except micropatterned substrates are reusable for further analyses.
The success of the combination of above techniques provided a controllable environment for the local activation of single cell, colony or cellular network. Our device allows to exhibit the different responses induced with the various conditions in a single observation sight at exactly the same time point.

on Jun 27th , 2013
Keio University, Yagami Campus 3-14-1, Hiyoshi, Kohoku ward, Yokohama, Japan