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BIOMEDICAL SIMULATIONS RESOURCE
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BMSR Workshop @ EMBC 2011

Dynamic Nonlinear Modeling of Neural Ensemble Activity

NIBIB

Boston Marriott Copley Place, Tremont Room
Tuesday – August 30, 2011

Workshop Program

9:00 a.m.	**Introductory Remarks**	**Vasilis Z. Marmarelis,** *Organizer* University of Southern California
9:05 a.m.	***Characterizing brain dynamics from high-dimensional data***	**Emery N. Brown** MIT & Harvard University
9:45 a.m.	***Nonlinear MIMO modeling of neural ensemble activity in the hippocampus***	**Theodore W. Berger** University of Southern California
10:25 a.m.	*Coffee Break*	
10:40 a.m.	***Behavioral correlates of neural ensemble activity in the hippocampus***	**Sam A Deadwyler &** **Robert E. Hampson** Wake Forest University
11:20 a.m.	***Relating stimulus selectivity to functional connectivity in the macaque visual cortex***	**Christopher C. Pack** McGill University
12:00 p.m.	*Lunch Break*	
1:20 p.m.	***Spatio-temporal dynamics in the motor cortex and possible implications for motor control***	**Nicholas Hatsopoulos** University of Chicago
2:00 p.m.	***Simultaneous Departure from Equilibrium (SDE): A measure of dynamic neural ensemble behavior***	**Apostolos P. Georgopoulos** University of Minnesota
2:40 p.m.	*Coffee Break*	
3:00 p.m.	***Multi-channel recordings and spectro-temporal receptive fields in the auditory cortex***	**Christopher E. Schreiner &** **Craig A. Atencio** University of California, San Francisco
3:40 p.m.	***Modeling of neural ensemble activity & design of optimal stimulation patterns***	**Vasilis Z. Marmarelis** University of Southern California
4:20 p.m.	**Open Discussion** *Vasilis Z. Marmarelis , Moderator*	

About the BMSR Workshop on "Dynamic Nonlinear Modeling of Neural Ensemble Activity"

This Workshop will bring together experts on the emerging subject of modeling the interrelationships among neuronal ensembles using multi-channel (i.e. multi-neuron) recordings. This subject is attracting increasing attention because of its fundamental importance in understanding brain function and the recent availability of multi-channel recordings from multi-electrode arrays. The latter are now chronically implanted in various parts of the brain by several research groups and provide a wealth of electrophysiological data previously unavailable. This creates an exciting opportunity and a new urgency for the development of effective methodologies for the analysis of the collected vast databases in a manner that leads to increased scientific understanding of brain function without simplifying the inherent complexity of the problem.

Fundamental in this regard is the issue of nonlinear dynamic modeling of the activity of multiple interconnected neurons, because of the intrinsic nonlinearities of neuronal dynamics and the nonlinear interconnections among neurons within the ensemble. We seek modeling methodologies that strike the proper balance between neurophysiological fidelity of representation and efficiency of practical implementation. In connection with the latter, a critical issue is the scalability of the approach (i.e. the ability to incorporate hundreds of neurons in a practical context).

An important associated issue is the design, testing and evaluation of optimal (or near-optimal) patterns of external stimulation of multiple neurons that seek to achieve a specific clinical objective. This is an issue of fundamental importance for emerging applications of "functional neurosurgery" (e.g. Deep Brain Stimulation) that can benefit considerably from the scientific knowledge acquired in the study of the interrelationships among neuronal ensembles. This issue also attains critical importance in the design, testing and optimization of neuroprostheses for a host of potential applications ranging from advanced rehabilitation to mitigation of cognitive impairment.

Examples of key issues that will be addressed are:
(1) development of effective methodologies for the analysis of multi-unit recordings;

(2) framework for the comprehensive understanding of multi-unit neural activity;

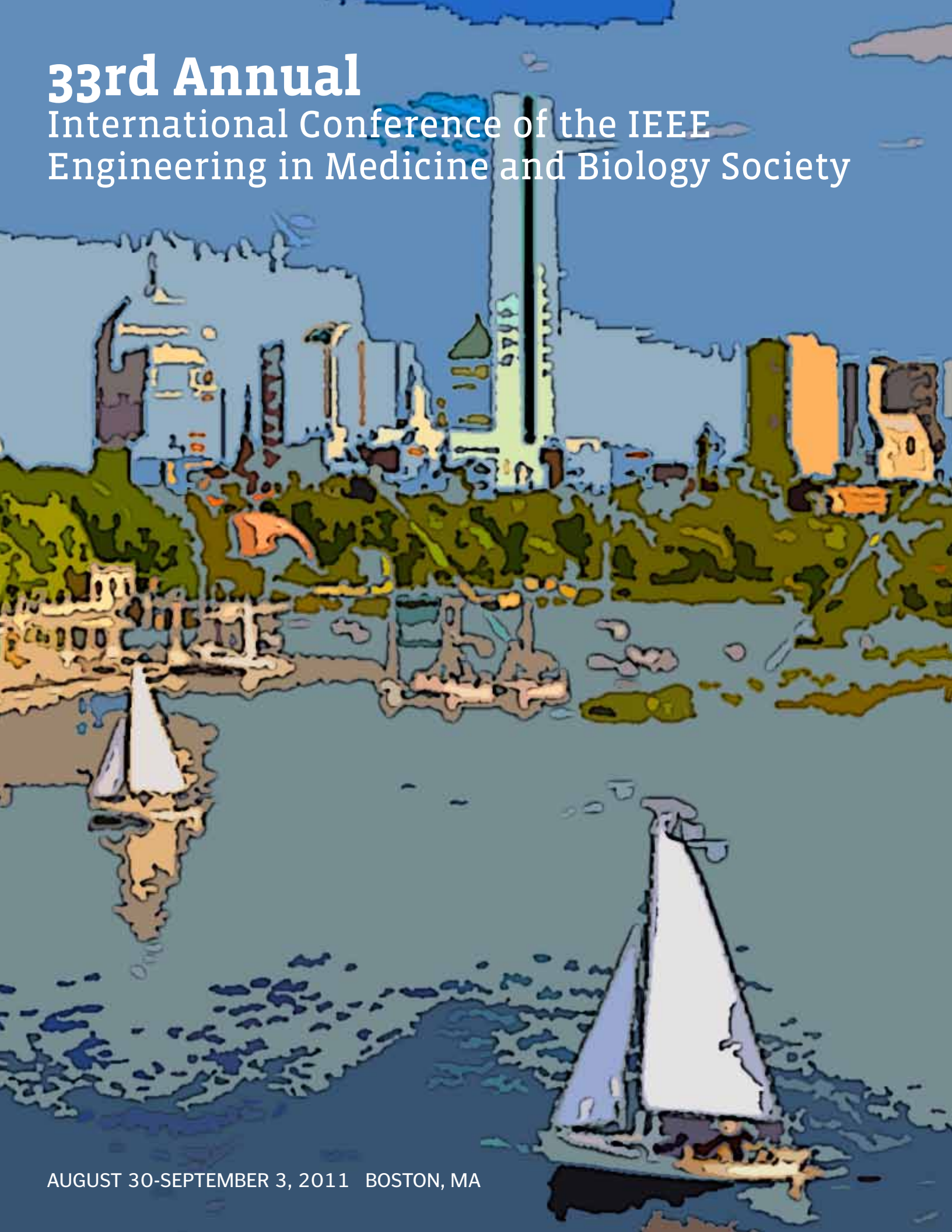
(3) description and understanding of brain dynamics using high-dimensional data;

(4) behavioral correlates of neural ensemble activity in the hippocampus;

(5) implications for the design, control and evaluation of neurostimulation and neuroprostheses.

About the BMSR: The Biomedical Simulations Resource (BMSR) at the University of Southern California was established in 1985 by NIH funding in order to advance the state of the art in modeling and simulation of physiological systems through Core and Collaborative Research, as well as through various Service, Training and Dissemination activities. This Workshop is part of the Dissemination activities. Service and Training is focused primarily on specialized software development and distribution. Neural information processing and modeling of neuronal ensemble activity represent key research interests at the BMSR. Other research interests include the modeling of pharmacokinetics/pharmacodynamics, metabolic-endocrine and cardiovascular systems. Detailed information can be found at the BMSR website: http://bmsr.usc.edu/

33rd Annual
International Conference of the IEEE Engineering in Medicine and Biology Society



AUGUST 30-SEPTEMBER 3, 2011 BOSTON, MA

Full-Day Workshop
Dynamic Nonlinear Modeling of Neural Ensemble Activity
09:00 - 18:30
Marriott 1st floor, Tremont
Registration Required

Organizer: Vasilis Marmarelis, PhD - University of Southern California
Speakers: Theodore W. Berger, PhD - University of Southern California
Emery N. Brown, MD, PhD - Harvard Medical School
Sam Deadwyler, PhD - Wake Forest University
Apostolos Georgopoulos, PhD - University of Minnesota
Nicholas Hatsopoulos, PhD – The University of Chicago
Vasilis Z. Marmarelis, PhD - University of Southern California
Christopher Pack, PhD - McGill University
Christoph E. Schreiner, PhD - University of California in San Francisco

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Half-Day Workshop
Nanobiomaterials
9:00 - 12:00
Marriott 3rd floor, Wellesley
Registration Required

Organizers: Ali Khademhosseini, PhD -Harvard-MIT Division of Health Sciences and Technology
Esmaiel Jabbari, PhD - University of South Carolina
Speakers: Karen Christman, PhD - University of California San Diego
Esmaiel Jabbari, PhD - University of South Carolina
Ehsan Jabbarzadeh, PhD - University of South Carolina
Ali Khademhosseini, PhD -Harvard-MIT Division of Health Sciences and Technology
Helen Lu, PhD - Columbia University
Michael McShane, PhD - Texas A&M University
Kit Parker, PhD - Harvard University
Milica Radisic, PhD - University of Toronto

The extracellular matrix of biological tissues exhibits hierarchical levels of organization from macroscopic to microscopic and nanoscale. This workshop will focus on how to apply material synthesis and processing technologies to the fabrication of biomaterials with well-defined nanoscale structure and chemistry, and to study biological processes at the molecular and cellular scales including cell migration, differentiation, development and maturation. The workshop will begin with a series of invited lectures on natural and synthetic nanomaterials and applications in regenerative medicine, drug delivery, and biosensing. Participants will learn specific details about the practical aspects of fabricating nanofibers, patterning, layered composites, self-assembled or directed assembly of nanostructures and their use for specific applications. The workshop