Life Sciences Society

COMPUTATIONAL SYSTEMS BIOINFORMATICS

CSB2007 CONFERENCE PROCEEDINGS

Volume 6

University of California
San Diego, USA
13–17 August 2007

Editors

Peter Markstein
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in silico Labs, LLC, USA

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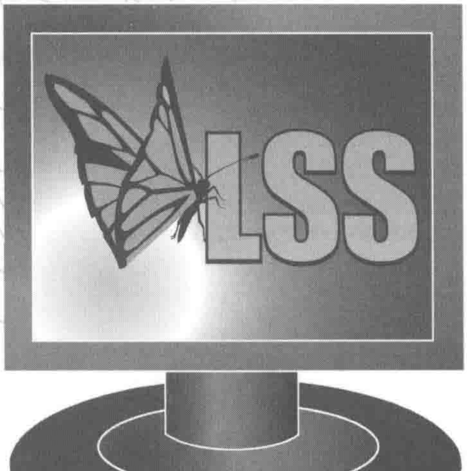

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Life Sciences Society

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PREFACE

The 21st Century has seen the emergence of tremendous vigor and excitement at the interface between computing and biology. Following years of investment by industry and then private foundations, the US Federal Government has greatly increased its support. Increasingly, the experimental findings from all of the biological sciences are becoming data rich and their practitioners are turning to the use of computational methods to manage and analyze the data. In light of the growing opportunities and excitement at the frontier interface between computing and biology, a few scientists turned conference planners organized the first Computational Systems Bioinformatics (CSB) conference in 2001 at Stanford, CA; CSB continued each August at Stanford over the next five years. During this time, many computer scientists and other engineers, as well as biologists, have attended CSB meetings, which have particularly served to introduce cutting edge biological inquiry and challenge problems to investigators from quantitative science backgrounds.

CSB, more recently, became the public venue for the not-for-profit Life Sciences Society, or LSS, which was founded, in part, to enhance the opportunities at the interface between the quantitative / engineering sciences and the biological sciences. In 2006, LSS was honored to be invited to hold CSB2007 on the campus of the University of California at San Diego, UCSD. Some future meetings at UCSD, and ultimately, at other universities, as well as satellite sessions at bioinformatics meetings around the world, are anticipated over the next several years. The Stanford / Bay Area / Silicon Valley venue, along with presenting highlights in bioinformatics, has been especially valuable for connecting individuals from the computer and electronics industry with investigators in the pure and applied life sciences.

The current venue should provide some connections to telecommunications, while sustaining some of the earlier opportunities, but we anticipate an enhanced interaction with basic and applied biotechnology. The University of California at San Diego grew from the Scripps Institute of Oceanography and began as a graduate school with a strong focus on the natural sciences. The rich research culture around UCSD and many neighboring institutions would generally be termed the venue of the Torrey Pines Mesa, an area very rich in biotechnology research activities. Today, San Diego has the largest cluster of Life Sciences centers with 26 research institutes (including UCSD and a suite of Institutes: Salk, Neurosciences, Scripps Research, Burnham Medical, as well as smaller not for profits) located in an area less then 10 square miles. For more on San Diego's R&D Life Sciences Centers and the vibrant biotechnology and pharmacology efforts, do visit the BioCom website: **http://www.biocom.org/Portals/0/SanDiegoLifeScienceNumbers_Fall06.pdf**.

CSB2007 will continue to be a 5 day single track conference, with three core plenary presentations days sandwiched between a day of practical tutorials, long a very popular feature, and a day workshops exploring the future. Thus, CSB2007 includes several half day tutorials, 30 refereed papers plus keynote and invited speakers, and posters, during its five full days. Special events for the evenings are planned.

CSB2007, as in each of its previous years, owes a lot to its many hard working volunteers, who are listed under the Committees. The indefatigable energy of Vicky and Peter Markstein continues to sustain the magnitude and amplitude of the extraordinary science and technology vector that is CSB, and their partnership with Ying Xu also remains essential. The efforts to manage and enhance local arrangements, by Kayo Arima, Patrick Shih, Lydia Grech and Ed Buckingham, should also be acknowledged.

A few words, naturally, about SoCal: bring family and guests to enjoy San Diego's world-famous attractions as SeaWorld, the San Diego Zoo, the Wild Animal Park and LEGOLAND California, as well as historic cultural gems Balboa Park and Old Town, and of course, the “endless” beach.

John Wooley, General Conference Chair

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Keynote Address

QUANTITATIVE ASPECTS OF GENE REGULATION IN BACTERIA: AMPLIFICATION, THRESHOLD, AND COMBINATORIAL CONTROL

Terry Hwa

Center for Theoretical Biological Physics and Department of Physics
University of California San Diego
9500 Gilman Drive
La Jolla, CA 92093-0374

Biological organisms possess an enormous repertoire of genetic responses to ever-changing combinations of cellular and environmental signals. Unlike digital electronic circuits however, signal processing in cells is carried out by a limited number of asynchronous devices in fluctuating aqueous environments.

In this talk, I will discuss the control of genetic responses in bacteria. Theoretical analysis of the known mechanisms of transcriptional control suggests "programmable" mechanisms for implementing a broad class of combinatorial control. Further analysis of post-transcriptional control suggests mechanisms for signal amplification, threshold response, and noise attenuation. I will present experimental characterization of some of these bio-computational "devices", as well as experiments illustrating how promoter sequences may be "trained" by directed evolution. Quantitative characterization and controlled manipulation of these devices may bring about predictive understanding of biological control systems, and reveal interesting, novel strategies of distributed computation.