



## Bioinformatics Seminar

---

Speaker: Sorin Istrail, Advanced Research and Technology Division  
Applied Biosystems/Celera

Title: On the General and Logical Theory of Genomic Regulatory Systems

Date: Wednesday, 5 May 2004 \*\*\* PLEASE NOTE DAY\*\*\*

Time & Location:

Refreshments: 11:00 am in the Applied Mathematics Common Room at MIT's  
Building 2, Room 349

Talk: 11:30 am The Applied Mathematics Conference Room Building 2, Room 338

URL: <http://www-math.mit.edu/compbiosem/>

---

### Abstract:

Understanding the functional meaning of the genomic DNA sequence might well be considered the most important problem in bioscience. The real frontier in exploration of the functional meaning of animal genomes lies in acquisition, decoding, and causal analysis of the control circuitry. The control system wired into the genomic sequence consists physically of the tens of thousands of specific DNA target sites for the transcription factors which biochemically determine the activity of genes. The key is to understand the logic functions built into the architecture of the regulatory control system, at two different levels: the level of the individual gene regulatory module; and the level of the networks into which these modules and the genes they control are organized.

Towards the search for general principles, we will present a mathematical analysis of perturbation experiments data used in cis-regulatory analysis. As a result we infer a repertoire of 15 functionally irreducible mechanisms that we call "transons;" they are used as elemental building blocks in the general assembly and logical programming of the developmental regulatory machinery. This repertoire allows us to build computationally based models which capture genetically mandated logic functions that the system executes, and leads to direct tests of key architectural features by targeted cis-regulatory analysis. This work extends the computational model for the endo16 gene of the sea urchin done by the Davidson Lab.

We will also present a quick overview of the collaborative project with Eric Davidson aimed at the formation of a "Dream Team" Consortium. Its focus is on cross-species Comparative Gene Networks, as well as industrial strength acceleration of the discovery of the cis-regulatory code. The bottom line is that if we can grasp the functional meaning of the regulatory apparatus built into the genomic DNA, we will have found the pathway that will lead toward acquisition of scientific control over major life processes.

---

The seminar is co-hosted by Professor Peter Clote of Boston College's Biology and Computer Science Departments and MIT Professor of Applied Math Bonnie Berger. Professor Berger is also affiliated with CSAIL & HST.

Massachusetts Institute  
of Technology  
77 Massachusetts Avenue  
Cambridge, MA 02139

For General Questions, please contact [kvdickey@mit.edu](mailto:kvdickey@mit.edu)