"B"

FACULTAD DE CIENCIAS EXACTAS Y NATURALES
U.B.A.

1.- DEPARTAMENTO: Física
2.- CARRERA de : a) Licenciatura en: ORIENTACION:
b) Doctorado y/o Post-Grado en: Doctorado
c) Profesorado en:
d) Cursos Técnicos en Meteorología:
e) Cursos de Idiomas:

3.- 1er. CUATRIMESTRE/2do. CUATRIMESTRE Año: 31-7-2006 al 04-8-2006.

4.- N° DE CODIGO DE CARRERA: 02

5.- MATERIA:8va. Escuela J.J.Giambiagi –B.

6.- PUNTAJE PROPUESTO: 1(uno) punto

7.- PLAN DE ESTUDIOS: 1987

8.- CARACTER DE LA MATERIA: Optativa.

9.- DURACION: 31-7-2006 al 04-8-2006

10.- HORAS DE CLASES SEMANALES:40hs

a) Teóricas:	hs.	d) Seminarios:	hs.
b) Problemas:	hs.	e) Teórico-problemas:	hs.
c) Laboratorio :	hs.	f) Teórico-prácticas:	hs.
		g) Totales horas: 40	hs.

11.- CARGA HORARIA TOTAL: 40 hs.

12.- ASIGNATURAS CORRELATIVAS:

13.- FORMA DE EVALUACION: Examen Final

14.- PROGRAMA ANALITICO: (se adjunta)

15.- BIBLIOGRAFIA:

FECHA.: 01-6-06

FIRMA DIRECTOR:

Dra. SILVINA M. PONCE DAWSON
DIRECTORA
DEPARTAMENTO DE FISICA

FIRMA PROFESOR:

ACLARACION FIRMA: Dra.Silvina Ponce Dawson

F 2006

(2)

8va ESCUELA DE INVIERNO J. J. GIAMBIAGI-B

The Lectures

* **Methods and Novel Results on Single Molecule Manipulation,**

by Carlos Bustamante,
University of California, Berkeley, US.

* **Aspects of Neuronal Development**

by Eduardo R. Macagno,
University of California, San Diego, US.

* **Systems biology: from data mining, through network inference to pathway modeling**

by Gustavo Stolovitzky,
IBM TJ Watson Research Center, US.

* **Elementary calcium signals,**

by Ian Parker,
University of California, Irvine, US.

* **Neuronal dynamics and sensory processing in weakly electric fish,**

by John E. Lewis,
University of Ottawa, Ottawa, Canada.

(2) 2006

Carlos Bustamante
University of California, Berkeley, United States

"Methods and Novel Results on Single Molecule Manipulation"
This 6-hour course will review first the most important methods of single molecule manipulation, their physical principles, capabilities and limitations. Emphasis will be placed on the conceptual foundations of these methods and the use of important results from statistical mechanics to interpret and analyze the data. I will then illustrate the application of these techniques with the review of articles in various areas of biochemical research. I will provide the students with a recent list of the most important applications of these methods in biochemistry , biophysics and non-equilibriun statistical mechanics recently appeared in the literature.

Eduardo Macagno
University of Califonia, San Diego ,United States.

"Aspects of Neuronal Development"

This 6-hour course will be divided in three two-hour sessions covering the following topics:

a. Differentiation of Neuronal Stem Cells
In this session we will consider current ideas on how stem cells select particular fates and the role of endogenous and exogenous factors in this critical process. We will also discuss current work on transplantation of stem cells into adult nervous systems and their capacity to integrate into pre-existing structures and achieving normal function.

b. Mechanisms of Outgrowth and Pathway Selection
In this session we will discuss molecular mechanisms that underlie decisions at the growth cone that determine the path taken by extending neural dendrites and axons from the soma to the target region. In particular, we will explore the evidence for specific substrate cues and for the presence of molecular gradients.

c. Tiling of Sensory Fields
In this session we will consider the mechanisms that lead to the formation of sensory fields that provide topographic as well as modality specific information to the central nervous system. In particular, we will discuss interactions between homologous neurons define territories for sensory arborizations of individual neurons.

Gustavo Stolovitzky
IBM TJ Watson Research Center, United States.

"Systems biology: from data mining, through network inference to pathway modeling"

The nascent field of systems biology shares with the more traditional field of physiology the aim of understanding how biological systems work. However, it differentiates from more traditional physiology on two counts: its quantitative thrust and the availability of high throughput data of unprecedented amount and quality. This six-hour course will introduce the main thrusts of today's research in systems biology. The course will emphasize the role that physicists can play in this active field of research. It will be divided in three units as follows (see figure).

1)Data mining (2 hours): We will first discuss a few of the many novel technologies that allow researchers to probe the state of a cell at the transcript, protein and metabolic level. We will then concentrate on transcription data, and discuss some of the noise associated with this technologies [1,2] and review the more traditional methods to infer genes that are associated with a particular type of disease or cellular state [3].

2)Network Inference (2 hours): One of the present challenges in biological research is the organization of the data originating from high-throughput technologies such as transcriptional profiling. One way in which this information can be organized is in the form of networks of influences, physical or statistical, between genes. These interactions provide a high level overview of how genes work together to achieve a specific function within the cellular environment. I will present some strategies and methods for the reconstruction of gene regulatory networks from gene expression data, and analyze the source of possible reconstruction errors due to noise, non-linearity, multiple inputs to the target nodes, etc. I will exemplify these approaches in the context of the gene regulatory network, E. coli network [4] and human B-cells [5]. We will also discuss how to mine these networks using graph theoretic methods to extract valuable biological information in the context of a recently studied cell signaling network of hippocampal neurons [6].

3)Pathway modeling (2 hours). Global network reconstruction is only a step to the creation of predictive models with mechanistic detail which is ultimately the goal of systems biology [7]. We are only beginning to have enough data to construct rather rudimentary models and simulations of a handful of cellular processes. Typically, present models are parsimonious descriptions containing mainly key players with speculative features to fill in gaps in the current knowledge. We will exemplify the present state of mechanistic modeling of important pathways in the context of then NF?B pathway [8] and the p53 pathway [9].

References:
1. Tu Y, Stolovitzky G, Klein U (2002) Quantitative noise analysis for gene expression microarray experiments. Proc Natl Acad Sci U S A 99: 14031-14036.

2. Stolovitzky GA, Kundaje A, Held GA, Duggar KH, Haudenschild CD, et al. (2005) Statistical analysis of MPSS measurements: Application to the study of LPS-activated macrophage gene expression. Proc Natl Acad Sci U S A.
3. Stolovitzky G (2003) Gene selection in microarray data: the elephant, the blind men and our algorithms. Curr Opin Struct Biol 13: 370-376.
4. Rice JJ, Tu Y, Stolovitzky G (2005) Reconstructing biological networks using conditional correlation analysis. Bioinformatics 21: 765-773. Epub 2004 Oct 2014.
5. Basso K, Margolin AA, Stolovitzky G, Klein U, Dalla-Favera R, et al. (2005) Reverse engineering of regulatory networks in human B cells. Nat Genet 37: 382-390. Epub 2005 Mar 2020.
6. Ma'ayan A, Jenkins SL, Neves S, Hasseldine A, Grace E, et al. (2005) Formation of regulatory patterns during signal propagation in a Mammalian cellular network. Science 309: 1078-1083.
7. Rice JJ, Stolovitzky G (2004) Making the most of it: pathway reconstruction and integrative simulation using the data at hand. Biosilico 2: 70-77.
8. Hoffmann A, Levchenko A, Scott ML, Baltimore D (2002) The IkappaB-NF-kappaB signaling module: temporal control and selective gene activation. Science 298: 1241-1245.
9. Ma L, J. W, Rice JJ, Hu W, Levine AJ, et al. (2005) A plausible model for the digital response of p53 to DNA damage. Proc Natl Acad Sci U S A in press.

Ian Parker
University of Clifornia, Irvine, United States.

"Elementary calcium signals"

This two-hour course will describe some aspects of intracellular calcium signals. Calcium ions are used as a ubiquitous signaling system within virtually all cells of the body. Information is encoded by the spatial and temporal patterns of cytosolic calcium elevations, which are generated in a hierarchical manner involving calcium flux through single channels, through clusters of channels, and by coordinated activation of multiple clusters to generate calcium waves. In this course, the lecturer will describe the progress of his group in developing techniques able to image the activity of individual calcium channels, and in modeling the interactions between channels that lead to larger-scale cellular calcium signals.

John E. Lewis
University of Ottawa, Ottawa, Canada

"Neuronal dynamics and sensory processing in weakly electric fish"

This series of lectures will focus on sensory processing in weakly electric fish in the context of two distinct natural behaviours: prey detection and communication. I will outline the physical basis of electrosensory inputs and discuss sensory encoding and signal production, with an emphasis on the underlying neuronal dynamics due to feedback, synaptic plasticity, and synchronous activity.

8va ESCUELA DE INVIERNO J. J. GIAMBIAGI-B

The Workshop

NEW TRENDS IN *IN VIVO* IMAGING AND SINGLE MOLECULE DETECTION

Objective:

The main objective of this practical Workshop is to introduce state-of-the-art microscopy for Cell Biology and Cell Biophysics research to students from Latin-American and other developing countries. We seek to provide a comprehensive overview of the most advanced techniques in fluorescence and atomic force microscopy including single molecule imaging, and the latest developments in reporter probes for in vivo imaging.

Coordinator of the panel:

Prof. Oscar Martínez, Laboratory of Quantum Electronics, University of Buenos Aires, Argentina.
Director of the Quantum Electronics Lab, associate member of the International Center for Theoretical Physics.
Dr. Martínez is an expert in quantum electronics and will cover state-of-the-art of photonics technology for microscopy.

Speakers:

Prof. Carlos Bustamante,
University of California at Berkeley, Berkeley, U.S.A. (confirmed).

Dr. Bustamante is a Howard Hughes Medical Institute Investigator, director, Advanced Microscopies Department, Physical Biosciences Division, LBNL and elected member of the U.S. National Academy of Sciences. Dr. Bustamante will present development of novel methods of single molecule manipulation and detection (such as Optical Tweezers and Single Molecule Fluorescence microscopy) and their application to study the behavior of DNA-binding molecular motors and the mechanical unfolding of globular proteins and RNA's.

Prof. T.W.J. Gadella Jr.,
Center for Advanced Microscopy, Swammerdam Institute for Life Sciences, University of Amsterdam, The Netherlands (confirmed).

Dr. Gadella is director of the Centre for Advanced Microscopy Centre at the University of Amsterdam and an expert on the technology and application of FLIM and spectrally resolved microscopy, particularly applied to plant systems. He will describe the principles, implementation of FLIM and its application in cell signaling.

Prof. Enrico Gratton,
Laboratory for Fluorescence Dynamics, University of Illinois at Urbana-Champaign, Urbana-Champaign, Urbana, U.S.A. (confirmed)

Dr. Gratton is the Principal Investigator and Co-director, Laboratory for Fluorescence Dynamics at UIUC (soon to be moved to UIC Irvine, CA). Dr. Gratton's research interests are varied and many; they include design of new fluorescence instruments and techniques (particularly correlation methods), protein dynamics, hydration of proteins, and I.R. spectroscopy of biological substances. During the course he will cover new instrumentation and applications related to tracking molecules in living cells.

Dr. Thomas Jovin,
Department of Molecular Biology, Max-Planck-Institute for Biophysical Chemistry, Gttingen, Germany (confirmed).

Dr. Jovin is the Department Head, Molecular Biology Dept., MPIbpc, Honorary Professor at University of Buenos Aires and a member of EMBO. He is actively involved in the development and application of novel microscopes for cellular and molecular studies, particularly related to signal transduction. During the course he will cover principles and novel developments for FRET in vivo microscopy.

Prof. Vinod Subramaniam,
Biophysical Engineering, University of Twente, The Netherlands (confirmed).

Dr. Subramaniam is Professor of Biophysical Engineering and an expert in ensemble and single molecule spectroscopy. He will present single molecule detection and spectroscopy: principles, equipment and applications in living cells.
Prof. Ian Parker, Department of Neurobiology and Behavior, University of California, Irvine (confirmed).
The research interests of Ian Parkers lie in the area of cell signaling, including the mechanisms of neurotransmitter release, the interaction of neurotransmitters with their receptors, and the role of intracellular messengers in linking receptor binding to the final cellular response. In this workshop, Prof. Parker will talk about his recent developments on visualizing immune system cells. Recent advances in multi-photon imaging now enable the visualization of real-time movements and interactions of lymphocytes and other immune system cells within their native 3-dimensional environment in intact lymphoid organs. In this talk, he will describe their work imaging the interactions between T cells and antigen-presenting dendritic cells that lead to initiation of the immune response, and discuss issues related to the processing and analysis of these large multidimensional data sets.