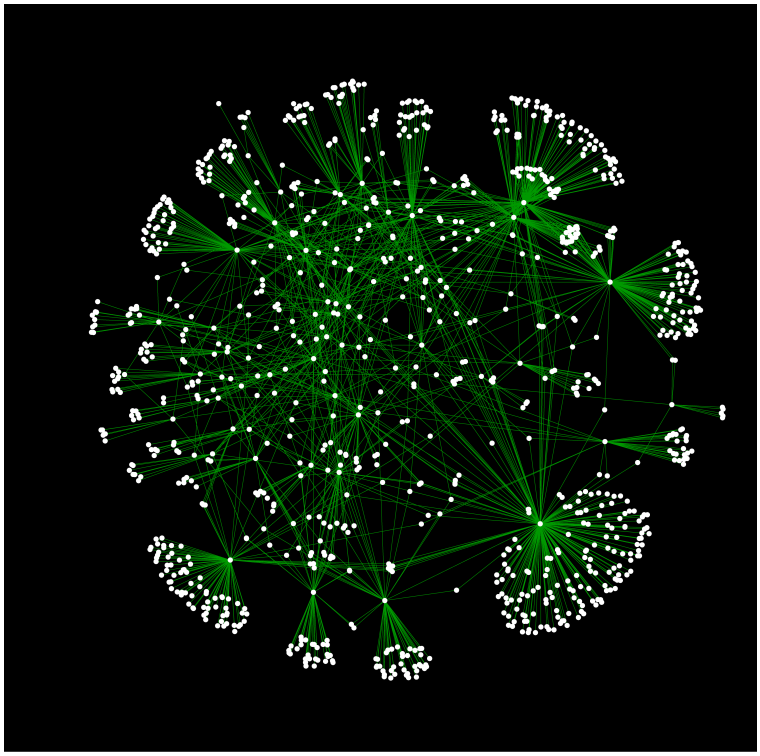
School of Life Sciences
University of Hyderabad

GLOBAL INITIATIVE OF ACADEMIC NETWORKS

सत्यमेव जयते
Ministry of
Human Resource Development
Government of India

MHRD- Global Initiative of Academic Networks (GIAN)

Systems Biology For Drug Discovery and Personalized Medicine
July 2nd to 14th July 2018



Centre for Systems Biology
School of Life Sciences

About the course

Overview:

Systems Biology is the study of biological phenomena at the level of systems. These systems could be molecules, cells, processes, organisms or species. As biological systems are both dynamic and complex, it is difficult to infer or predict function by studying individual components. In order to obtain a systems perspective, it is imperative that we integrate data from multiple sources including studies of genomes, proteomes, metabolomes and multiple other measurements and then generate computational and mathematical models that predict behavior. Thus Systems Biology requires quantitative measurements that can be mathematically and/or computationally modeled.

The course is designed to introduce the students to the tremendous potential of Systems Biology in not only understanding basic biology but also to contribute to drug discovery and personalized medicine. This course will provide a glimpse of the potential of System Biology approach to understand physiology at multiple architectural levels including metabolite and molecular interactions, genetic and gene-protein interactions, cellular pathways and networks. The tutorials and discussions will examine the application of these concepts to drug discovery and personalized medicine.

Course Objectives

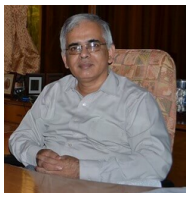
Provide overview of various arms of Systems Biology
Discuss methodologies used for each of these arms
Discuss means of integrating large-scale data
Provide insights into how these approaches can be applied to drug discovery and personalized medicine

Course Instructors

Prof. Animesh Ray

Systems Biology
Keck Graduate Institute, 5
35 Watson Drive, Claremont, CA 91711

Professor Ray earned his PhD in microbial genetics from Monash University in Melbourne, Australia. His PhD research led to the identification of a gene for efficient plasmid maintenance in *Escherichia coli* and a method for generating a multi-copy infectious plasmid that is packageable inside a virus coat--an early example of synthetic biology. He subsequently conducted research at the Institute of Molecular Biology, University of Oregon, and the Department of Biology, Massachusetts Institute of Technology; University of Rochester. In the late 1990s, Dr. Ray, along with a computer scientist colleague Dr. Mitsunori Ogihara, published a series of papers on experimental and theoretical investigations on designing massively parallel computing devices using solution phase DNA chemistry. He currently teaches courses on molecular systems biology that includes molecular mechanisms of human diseases and pharmacogenomics. He was KGI's faculty chair (2010-2016) and director of KGI's PhD programs (2006-2016). His current research work involve systems biology of Huntington's disease, chromosome instability, non-coding RNAs in cancers, and cancer drug resistance mechanisms.



Prof. Shekar Mande

Director, National Centre for Cell Science,
Pune, India

Dr. Mande did hid PhD in Molecular Biophysics, from theIndian Institute of Science. Following his PhD, he joined Prof. Wim G. J. Hol as Post Doctoral Fellow at Rijksuniversiteit Groningen in the Netherlands. He was a scientist at IMTECH, Chandigarh and Centre for DNA Fingerprinting and Diagnostics, Hyderabad until . Currently, he serves as Director at National Centre for Cell Science in Pune, India. His laboratory has been involved in two broad research themes in the recent past: (1) structural characterization of *M. tuberculosis* proteins and (2) computational analysis of genome-wide protein:protein interactions. Our interest primarily is in applying graph theory to protein:protein interactions and attempt to understand how cells respond to external environmental signals.

Dr. Debashis Barik

Assistant Professor,
School of Chemistry

Dr. Barik obtained his PhD from the Indian Association for Cultivation of Science, Kolkota. He did his post-dioctral studies at Memorial Sloan-Kettering Cancer Center, NY, USA and Virginia Tech, VA, USA. The main focus of the group is to find out consequences of molecular fluctuations (chemical noise) of chemical species in biochemical reaction network inside living cells. They build theoretical/computational models of biological reaction networks to understand the dynamics of chemical noise propagation through reaction networks. They use theories/methods from statistical mechanics, stochastic calculus, chemical kinetics, non-linear dynamics, computer simulations and experimental data from published literature for their research.

Topics to be discussed:
(All topics will have lectures and tutorials)

- **Principles of Biological interaction**
- **DNA-protein interaction**
- **Small signaling networks**
- **Protein-protein interaction**
- **Genetic interactions and their interpretation**
- **Metabolic pathways and flux balance analysis**
- **Integration of interaction data and its power**
- **Inference of interaction data**
- **Interaction networks—dynamics**
- **Interaction networks—topological considerations**
- **Bridging single molecule studies with systems of networks**

Who can attend?

Students of

1) Systems Biology program
2) Bioinformatics programs
3) Bioengineering programs
4) Physics/Chemistry/Information Technology with an interest in Systems Biology

Registration details:

Interested candidates must login at GIAN-MHRD website (http://www.gian.iitkgp.ac.in) to fill application. Please submit your detailed resume and a statement on why you want to take this course and how you think this will be benefit you.

For any further queries contact

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