INTERACTOMICS : BASICS & APPLICATIONS

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INTENDED AUDIENCE : Biology or biotechnology students having interest in latest technologies,(BE/ B.Tech) , B.Sc. &

students from science background. But course is open to all.
INDUSTRIES APPLICABLE TO : GE Healthcare, Pall Life Sciences, Thermofisher Scientific, Illumina

COURSE OUTLINE :
Proteins are the key effectors of any living system and are largely responsible for the functioning of a cell. Intricate cell signaling and molecular triggers are dependent on interactions involving proteins at the cellular level. It is due to this very reason that, in an age where clinical biology is thriving to make an impact in global health-care and biomedical diagnostics, there has been a surge of interest in the area of Interactomics. Interactomics essentially involves the study of interactions between biomolecules, particularly proteins and the consequences of those interactions in a biosystem.

Due to rapidly evolving technological platforms in biology, there is a need to keep pace with latest developments in field to explore their versatile applications. Interactions resulting from protein-protein, protein-peptide, protein-RNA, protein-DNA or protein- small molecule have immense application in life-sciences and translational biology. Through this course, we aim to provide an interface between distinguished scientists involved in interactomics research, industrial partners, faculties and students. This course would feature an intensive lecture series followed by some demonstrations designed to provide the much needed training required to explore the endless possibilities in interactomics research using genomics and proteomics approach, that can be useful for a researcher at any stage.

Various technology platforms such as Protein microarrays, Label-free biosensors and Next-Generation Sequencing (NGS) Technology will be discussed. The students/participants will gain exposure to the above mentioned technologies and its applications from some of the experts in the field, from both-academia and industry perspective.

ABOUT INSTRUCTOR:
Prof. Sanjeeva is a Professor and group head of proteomics laboratory at the Indian Institute of Technology, Bombay. He obtained his Ph.D. from the University of Alberta and post-doc from the Harvard Medical School in the area of proteomics, stress physiology and has specialized expertise in applications of data enabled sciences in global health, developing country and resource limited settings. He joined IIT Bombay in 2009 as an Assistant Professor and currently working as Professor.

COURSE PLAN :

Week 1 : Interactomics: Basics and Applications
Lecture 1: Introduction to Proteomics
Lecture 2: Introduction to Interactomics
Lecture 3: High throughput platforms of interactomics: Protein arrays
Lecture 4: Cell-free expression based protein microarrays
Lecture 5: NAPPA: Recombinational Cloning, Basic workflow, Surface Chemistry, Printing and Asses

Week 2 : Interactomics: Basics and Applications
Lecture 6: NAPPA Technology and Protein Arrays-I
Lecture 7: NAPPA Technology and Protein Arrays-II
Lecture 8: Biomarkers: Harnessing the immune system for early detection of disease-I
Lecture 9: Biomarkers: Harnessing the immune system for early detection of disease-II
Lecture 10: Biomarkers: Harnessing the immune system for early detection of disease-III

Week 3- Interactomics: Basics and Applications
Lecture11: NAPPA & its applications in study of antibody immune response in disease & in drug screening-I
Lecture12: NAPPA & its applications in study of antibody immune response in disease & in drug screening-II
Lecture13: NAPPA & its applications in study of antibody immune response in disease & in drug screening-III
Lecture 14: Using functional proteomics to identify biomarkers and therapeutic targets-I
Lecture 15: Using functional proteomics to identify biomarkers and therapeutic targets-II

Week 4- Interactomics: Basics and Applications
Lecture 16: Applications of protein microarrays in Malaria Research-I
Lecture 17: Applications of protein microarrays in Malaria Research-II
Lecture 18: Introduction to Bioprinting and Iris™ Optical QC Benefits-I
Lecture 19: Introduction to Bioprinting and Iris™ Optical QC Benefits-II
Lecture 20: Screening of autoantibody signatures in cancer patients: Lab demonstration

Week 5- Interactomics: Basics and Applications
Lecture-21: Basics of Image Scanning and data acquisition
Lecture-22: Applications of protein arrays in the identification of autoantibody signatures-I
Lecture-23: Applications of protein arrays in the identification of autoantibody signatures-II
Lecture-24: Applications of protein microarrays in deciphering PTMs and biological networks
Lecture-25: Basics and Applications of Reverse Phase Protein Arrays-I

Week 6- Interactomics: Basics and Applications
Lecture-26: Basics and Applications of Reverse Phase Protein Arrays-II
Lecture-27: Basics and Applications of Reverse Phase Protein Arrays-III
Lecture-28: An overview of label-free technologies
Lecture-29: An overview of label-free technologies
Lecture-30: Surface Plasmon Resonance- Principles and Assays-II

Week 7- Interactomics: Basics and Applications
Lecture-31: Basics of SPR: Surface chemistry
Lecture-32: Basics of SPR: Experimental design
Lecture-33: Protein immobilization for protein-protein interaction studies
Lecture-34: Protein-protein interaction study: Binding analysis
Lecture-35: Protein-protein interaction study: Kinetic analysis

Week 8- Interactomics: Basics and Applications
Lecture-36: Use of SPR in unravelling domain motif interactions of proteasomal assembly chaperones
Lecture-37: Protein-small molecule interaction study: Immobilization Immobilisation & binding analysis
Lecture-38: Protein-small molecule interaction study: Kinetic analysis
Lecture-39: An introduction to biolayer interferometry (BLI) and its applications in protein research
Lecture-40: Biomolecular interactions using Bio-Layer Interferometry (BLI)-I

Week 9- Interactomics: Basics and Applications
Lecture 41: Biomolecular interactions using Bio-Layer Interferometry (BLI)-II
Lecture 42: Lab session- An introduction to Bio-Layer Interferometry (BLI) and its applications in protein research
Lecture 43: Applications of label-free technologies-II
Lecture 44: Biomolecular interaction analytics using MicroScale Thermophoresis
Lecture 45: Mass Spectrometry coupled Interactomics-I

Week 10- Interactomics: Basics and Applications
Lecture 46: Mass Spectrometry coupled Interactomics-II
Lecture 47: Next-Generation Sequencing Technology- Ion Torrent™
Lecture 48: NGS Technology - Bioinformatics and data analysis-I
Lecture 49: NGS Technology - Bioinformatics and data analysis-II
Lecture 50: Next-Generation Sequencing Technology- Illumina

Week 11- Interactomics: Basics and Applications
Lecture 51: Agilent complete NGS target enrichment workflow for exomes, targeted panels and beyond
Lecture 52: The Human Pathology Atlas: A Pathology Atlas of the Human Transcriptome-I
Lecture 53: The Human Pathology Atlas: A Pathology Atlas of the Human Transcriptome-II
Lecture 54: Statistical Analysis-I
Lecture 55: Statistical Analysis-II

Week 12- Interactomics: Basics and Applications
Lecture 56: Secondary Data Analysis
Lecture 57: Pathway Enrichment and Network Analysis
Lecture 58: Data Repositories and Databases
Lecture 59: Application of multi-omics approach for better understanding of cancers
Lecture 60: Integrated Omics and Systems Biology- Conclusion