



PROTEIN AND GEL-BASED PROTEOMICS

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INTENDED AUDIENCE

Core course

All UG and PG students can attend this course.

It would be applied to B.Sc., M.Sc. and Ph.D

PRE-REQUISITES : B.Sc. Or M.Sc.

The target audiences of this course are required to have a basic biology and biochemistry background.

COURSE OUTLINE:

This course introduces to the basic biology of proteins and gel-based proteomics. To obtain better understanding of cellular processes & regulation, there has been an increasing interest in studying proteomics. Proteomics techniques aim to look into the protein properties from a global perspective, i.e., not undertaking one protein at a time, but an entire set of proteins in the milieu. These proteomic techniques typically aim to elucidate the expression, interaction, and cellular function of proteins.

The course will provide the basic understanding of amino acids and proteins. It would also provide detailed information on gel-based proteomic techniques such as SDS-PAGE and 2-DE. Some of the limitation of 2-DE has been overcome by advanced Difference gel electrophoresis (DIGE) technique, which will be discussed in this course. Protein identification using MALDI-TOF/TOF mass spectrometry will also be discussed. 2-DE in combination with mass spectrometry has become very powerful tool for proteomics applications and students can learn these tools by attending this course.

ABOUT THE INSTRUCTOR:

Prof. Sanjeeva Srivastava Dr. Sanjeeva Srivastava 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. Current research in his group centers on biomarker and drug target discovery and deciphering the protein interaction networks in complex human diseases (gliomas) and infectious diseases (malaria) using high throughput proteomics, protein microarrays and mass spectrometry. Dr. Srivastava is an active contributor to global proteomics science and innovation. He serves on the Executive Council of Human Proteome Organization (HUPO) and Proteomics Society, India (PSI). He has organized three successful international conferences & workshops at IIT Bombay PSI-2014, Targeted Proteomics International Symposium in 2015 and 2018. He has published four special issues as editor, Proteomics in India for Journal of Proteomics; Proteomics Research in India for Nature India, Protein Arrays for Proteomics and Neglected Tropical Infectious Diseases for Proteomics Clinical Applications. Having an extensive teaching experience at IITB and experience of conducting proteomics courses at CSHL, New York provided him with the background to increase proteomics education for the global community. One of his special contributions has been the development of e-learning resources (MOOC mass spectrometry and interactomics courses; Virtual Proteomics Laboratory). He has made first ever proteomics documentaries Proteomics: Translating the Code of Life and Human Proteome Project (HPP). He has directed HUPO Perspective in Proteomics video interview series, which is hosted on HUPO website. Recently we have signed a MOU on clinical proteogenomics cancer research with National Cancer Institute, along with Tata Memorial Centre and India has now become 12th country to join the International Cancer Proteome Consortium (ICPC). Dr. Srivastava continues to develop proteomics & omics science and innovation together with and for the next generation of keen students, researchers and the research and education commons in Asia and global OMICS community.

COURSE PLAN:

Week-1: Basics of amino acids and proteins

L1. Introduction to amino acids

L2. Introduction to proteins

L3. Protein folding & misfolding

L4. Protein purification techniques

L5. Introduction to proteomics

Lab session-1.1 Demonstration of protein-protein interaction using label-free biosensors

Week-2: Gel-based proteomics and Sample Preparation

L6. Systems biology and proteomics

L7. Sample preparation and pre-analytical factors

L8. Sample preparation: Pre-analytical factors (contd.)

L9. Sample preparation: Protein extraction and quantification

L10. One-dimensional electrophoresis

Lab session-2.1 Sample preparation: Tissue sample preservation technology

Lab session-2.2 Protein/peptide pre-fractionation using OFF-GEL FRACTIONATOR

Week-3: Two-dimensional gel electrophoresis (2-DE)

L11. 2-DE: Rehydration, IEF & Equilibration

L12. 2-DE: Second dimension, staining & destaining

L13. 2-DE: Gel analysis

L14. 2-DE: Applications

L15. 2-DE: Applications (contd.) & Challenges

Lab session-3.1 Demonstration of gel analysis using IQTL software

Week-4: Difference in gel electrophoresis (DIGE) & Mass Spectrometry

L16. 2D-DIGE: Basics

L17. 2D-DIGE: Data analysis

L18. 2D-DIGE: Applications

L19. Protein identification using MALDI-TOF/TOF

L20. Proteomics experiment data analysis & challenges

Lab session-4.1 Demonstration of Q-TOF MS technology