Course Content

A general introduction to basic techniques used in characterization and separation of biological systems and molecules. Topics include microscopy, centrifugation, liquid chromatography methods, spectroscopy and electrophoresis. Lab sessions will give a chance to use these techniques individually.

Objectives

To teach students the basic concepts of bioanalytical techniques in both, theory and practice, which are relevant to biologists and bioengineers but also students from different fields.

Recommended or required reading

Textbooks:
Bioanalytics: Analytical Methods and Concepts in Biochemistry and Molecular Biology
Friedrich Lottspeich (Editor), Joachim W. Engels (Editor)
ISBN: 978-3-527-33919-8

Readings:
Course slides updated annually.

Course Outline

Module 1: Microscopy
Module 2: Electrophoresis Techniques
Module 3: Centrifugation Techniques
Module 4: Spectroscopic Techniques
Module 5: PCR Techniques
Module 6: Chromatography and Mass spectrometry

Learning Outcomes

Upon completion of the course, students will have a general knowledge of basic laboratory techniques for characterization and separation of biological systems and molecules.
Students would be able to perform basic laboratory techniques.

Module 1 Microscopy: Students will have a deeper understanding of both, theory and application in the following topics:

- Basic Concepts in Microscopy
- Light microscopy
- Fluorescence microscopy
- Confocal Microscopy
- Live-cell imaging and Sensor techniques

Module 2 Electrophoresis Techniques: Students will learn how to use Gel electrophoresis techniques for analysis of nucleic acids and proteins for both, diagnostic purposes and preparative purposes, which includes:

- Basic Concepts in Electrophoresis
- Horizontal and Vertical Electrophoresis
- 2D Gel Electrophoresis and Protein Detection Methods
- Electrophoresis of Nucleic Acids

Module 3 Centrifugation Techniques:

- Basic Concepts of Centrifugation Techniques
- Types of Centrifuges and analytical ultracentrifugation techniques
- Separation methods and preparative ultracentrifuges
- Types of rotors

Module 4 Spectroscopic Techniques:

- Introduction and basic concepts of Spectroscopic Techniques
- UV-VIS Spectroscopy
- Infrared and fluorescence spectroscopy
- Circular dichroism (CD) spectroscopy
- NMR Spectroscopy and X-ray crystallography
- Atomic Spectroscopy and Mass spectroscopy

Module 5 PCR Techniques:

- Principles of Polymerase Chain reaction
- Preparative and Diagnostic PCR
- DNA Sequencing methods
- Sanger Sequencing, Next Generation Sequencing Methods

Module 6 Chromatography and Mass spectrometry:

- Basic Principles of Chromatography
- Thin layer chromatography
- Liquid Chromatography
- Gas Chromatography
- Principles of MALDI-TOF
- Electrospray Ionization Mass Spectrometry

Course Policies

Class attendance not required but strongly recommended.
Lab sessions are obligatory.
Each week in the lab sessions one quiz to the related topic. Protocols for the experiments should include a brief introduction, presentation of the results and a short discussion.

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