

SABANCI UNIVERSITY

Faculty of Eng. & Natural Sci.

BIO-335

Analytical Techniques

Instructor(s)

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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:

Wilson and Walker's Principles and Techniques of Biochemistry and Molecular Biology 8th Edition by Andreas Hofmann (Editor), Samuel Clokie (Editor), Publisher : Cambridge University Press; 8th edition (June 13, 2018), ISBN-10 : 1107162270

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

Students would be able to perform basic laboratory techniques.

Learning Outcomes

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 is required. No more than 6 absents in the lecture class.

Lab sessions are obligatory. No more than 3 absents in lab class.

Each week in the lab sessions one quiz to the related topic.
Protocols for the experiments should include a brief introduction, detailed methodology, presentation of the results and a short discussion.

| | Percent | Number of |
|---------------|----------------|------------------|
| Final | 30 % | |
| Midterm | 20 % | 1 |
| Group Project | 10 % | |
| Lab Reports | 20% | |
| Lab Quizzes | 10% | |
| Attendance | 10% | |

Lab There will be no lab on Tuesday 20th which is the first week of labs.
Practical Sessions will be in person from Feb 27th following the course plan given below

BIO 335L - Analytical Techniques - Lab

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|--------|---|
| Week 2 | Lab Safety & Buffer Preparation |
| Week 3 | Light microscopy |
| Week 4 | Fluorescence microscopy |
| Week 5 | Protein Isolation and SDS-PAGE |
| Week 6 | Affinity & Size exclusion Chromatography |
| Week 7 | ICP-MS & atomic emission spectrometry (AES) |
| Week 8 | Bradford Assay, OD, and Nanodrop |
| Week 9 | Nanopore Sequencing |