Virginia Western Community College
BIO 251
Protein Applications in Biotechnology

Prerequisites

Successful completion of BIO 101 or BIO 173 within the last 3 years, and ENG 111; completion of CHM 111 is recommended.

Course Description

Prepares students to understand protein structure and function and teaches the laboratory skills needed to successfully work with proteins. Focuses on levels of protein structure and protein function. Includes common laboratory assays for protein synthesis, purification, detection, and quantification.

Semester Credits: 3 **Lecture Hours: 3** **Laboratory/Recitation Hours: 3**

Required Materials

Textbooks:
Academic Cell: Biotechnology. Clark & Pazdernik. 2nd edition. Academic Press. ISBN: 9780123850638
Molecular Biology Techniques. Carson, Miller, & Witherow. 3rd edition. Academic Press. ISBN: 9780123855442

Other Required Materials:
Lab Notebook
Lab Coat

Course Outcomes

At the completion of this course, the student should be able to:

- Identify key pieces of laboratory equipment (e.g. centrifuges, electrophoresis equipment, incubator, microplate reader)
- Apply knowledge of basic laboratory math, including significant figures, unit conversions, dilutions, and other necessary techniques
- Prepare solution and pH measurements
- Use proper pipetting technique for accurate measurement of small (microliter) volumes
- Use proper aseptic technique
- Have knowledge of prokaryotic and eukaryotic cell culture
- Perform protein isolation, purification, extraction, and measurement/visualization techniques such as:
    - SDS-PAGE Electrophoresis
    - Western Blotting
    - Protein Assays (ELISA, Bradford, BCA, Lowry)
    - Immunohistochemistry
    - Column Chromatography
- Properly utilize bioinformatics techniques

- Troubleshoot an experiment and develop alternative options (if necessary) for experimental design
- Generate professional and accurate written materials (e.g. lab notebook, report, poster) to document their laboratory work.

Topical Description

Chapter 2: DNA, RNA, and Protein

- Translating the genetic code into protein
- Differences between prokaryotic and eukaryotic translation
- Mitochondria and chloroplast protein projection
- Protein structure

Chapter 6: Immune Technology

- Antibody structure and function
- Antibodies, antigens, and epitopes
- Monoclonal antibodies
- ELISA
- Visualizing cell components using antibodies

Chapter 9: Proteomics

- Gel electrophoresis
- Western blotting
- HPLC
- Mass spectrometry
- Protein tagging systems
- Protein interactions
- Protein arrays

Chapter 10: Recombinant Proteins

- Expression of eukaryotic proteins in bacteria
- Protein fusion vectors
- Expression of proteins in eukaryotic cells
- Expression of proteins in yeast cells
- Expression of proteins in mammalian cells
- Protein glycosylation
- Protein stability and secretion

Applications of Biotechnology (as time permits at the discretion of the instructor)

Chapter 7: Nanobiotechnology

Chapter 13: Pathway Engineering

Chapter 18: Cancer Biology

Chapter 19: Noninfectious Diseases

Chapter 23: Biowarfare and Bioterrorism

Suggested Laboratory Topics

- Introduction to Laboratory Safety/Pipetting
- Making Solutions and Basic Laboratory Math
- Aseptic Technique/Bacterial Cell Culture
- Bacterial Transformations
- Eukaryotic Cell Culture
- SDS-PAGE Electrophoresis
- Western Blotting
- Column Chromatography
- Protein Assays
- Immunohistochemistry and Immunofluorescence

Notes to Instructors

1. Departmental policy dictates that instructors do not allow students to keep tests.
2. A comprehensive final exam counting 15%-20% of the total grade will be given at the end of the semester.
3. The syllabus should state what the course grade will be based on, such as tests, quizzes, a comprehensive final exam, and any other assignments made by the instructor.
4. The VWCC Biology Department uses a 10-point grading scale.
5. Comprehensive study of the listed topics is beyond the reasonable expectations of a 15-week Protein Applications course. It is up to the discretion of the instructor to choose which topics are more detailed but each topic should be adequately covered.