

Montgomery County Community College
 BIT 220
 Biotechnology Research
 4-3-3

COURSE DESCRIPTION:

This course provides a foundation for the principles of molecular genetics as they apply to research performed in the biotechnology industry. Lectures topics will include transcription, translation, and protein expression as they pertain to both prokaryotic and eukaryotic cells. Laboratory experiments will provide hands on experience in recombinant DNA technology protein purification, protein detection methods and mammalian cell culture. This course is subject to a course fee. Refer to <http://mc3.edu/adm-fin-aid/paying/tuition/course-fees> for current rates.

REQUISITES:*Previous Course Requirements*

- BIT 120 Introduction to Biotechnology with a minimum grade of "C"
- BIT 123 Basic Techniques and Instrumentation for Biotechnology with a minimum grade of "C"
- CHE 132 Chemistry for Technology II, or CHE 152 Principles of Chemistry II (For students intending to transfer)

Concurrent Course Requirements

None

LEARNING OUTCOMES Upon successful completion of this course, the student will be able to:	LEARNING ACTIVITIES	EVALUATION METHODS
1. Discuss biological systems and their role in biotechnology research.	Lecture Guest Lecturers from Industry Laboratory Experiments Small Group Discussions Reading Assignments Laboratory Experiments	Section Examinations Final Comprehensive Examination Written Assignment
2. Explain the processes which control the central dogma of biology (DNA – RNA – protein).	Lecture Guest Lecturers from Industry Laboratory Experiments Small Group Discussions Reading Assignments	Section Examinations Final Comprehensive Examination Written Assignment

LEARNING OUTCOMES Upon successful completion of this course, the student will be able to:	LEARNING ACTIVITIES	EVALUATION METHODS
3. Compare and contrast the processes of replication, transcription and translation between prokaryotes and eukaryotes.	Lecture Guest Lecturers from Industry Laboratory Experiments Small Group Discussions Reading Assignments	Section Examinations Final Comprehensive Examination Written Assignment
4. Discuss molecular biology techniques such as DNA cloning, polymerase chain reaction, DNA sequencing and site directed mutagenesis.	Lecture Guest Lecturers from Industry Laboratory Experiments Small Group Discussions Reading Assignments	Section Examinations Final Comprehensive Examination Written Assignment Lab. Reports
5. Perform several molecular biology techniques used in biotechnology laboratories.	Lecture Videos Laboratory Experiments	Section Examinations Final Comprehensive Examination Written Assignment Lab. Reports
6. Discuss strategies for protein purification. and perform column chromatography experiments for protein purification.	Lecture Videos Guest Lecturers from Industry Laboratory Experiments Virtual training module Small Group Discussions Reading Assignments	Section Examinations Final Comprehensive Examination Written Assignment Lab. Reports
7. Perform column chromatography experiments for protein purification.	Lecture Laboratory Experiments Virtual Training module Small Group Discussions Reading Assignments	Section Examinations Final Comprehensive Examination Written Assignment Lab. Reports

LEARNING OUTCOMES	LEARNING ACTIVITIES	EVALUATION METHODS
8. Discuss vaccines, biologics, and other traditional molecules exploited by the biotechnology industry for drug development.	Lecture Guest Lecturers from Industry Laboratory Experiments Small Group Discussions Reading Assignments	Section Examinations Final Comprehensive Examination Written Assignment
9. Perform the culture and maintenance of mammalian cells with good aseptic technique.	Lecture Laboratory Experiments and demonstrations Small Group Discussions Reading Assignments	Section Examinations Final Comprehensive Examination Written Assignment Lab. Reports Practical exam
10. Manipulate the tools and processes associated with genome databases.	Lecture Laboratory Demonstrations Small Group Discussions Reading Assignments	Section Examinations Final Comprehensive Examination Written Assignment
11. Develop a strategy for gaining information about a gene of interest through searching genome databases on the internet, using at least 2 different public genome databases.	Lecture Laboratory Demonstrations Small Group Discussions Reading Assignments	Section Examinations Final Comprehensive Examination Written Assignment
12. Plan and deliver an oral presentation about relevant journal article pertaining to biotechnology	Lecture Guest Lecturers from Industry Laboratory Experiments Small Group Discussions Reading Assignments Oral Presentation	Oral Presentation

At the conclusion of each semester/session, assessment of the learning outcomes will be completed by course faculty using the listed evaluation method(s). Aggregated results will be submitted to the Associate Vice President of Academic Affairs. The benchmark for each learning outcome is that *70% of students will meet or exceed outcome criteria*

SEQUENCE OF TOPICS:

A. LECTURE

1. Biological Systems and Cellular Processes
2. Nucleic Acids, Recombinant DNA techniques

3. Importance of cultured cells in research and emerging therapies
4. Polymerase Chain Reaction
5. Mutagenesis
6. Characteristics of Proteins
7. Protein purification techniques and schemes
8. DNA and Protein Synthesis in Prokaryotes and Eukaryotes
9. Isolation of and characterization of Genes
10. Cloning and expression of genes in bacteria
11. Vaccines and Biologics

B. LABORATORY

1. Preparation for Recombinant DNA Techniques (Pipetting, Solution Preparation, etc.) (1 Experiment)
2. Basic Recombinant DNA Techniques (Restriction Digests, Agarose Gel Electrophoresis, Analysis of Gels) (2 Experiments)
3. Cloning Laboratory (Plasmid and fragment isolation, Ligation, Transfection into Bacterial Host, Identification of Cloned Gene) (2 Experiments)
4. Polymerase Chain Reaction (PCR) (1 Experiment)
5. Maintenance and Propagation of Bacterial Cells (1 Experiment)
6. Culture of mammalian cells, CHOs and mESC (2-3 experiments)
7. Column chromatography for protein separation and analysis on SDS PAGE and Western blot(2 experiments)
8. Fluorescent microscopy
9. Computer Based Genome Database Manipulation (1 Experiment)
10. Oral Presentation on Biotechnology Research paper

LEARNING MATERIALS:

There is no required textbook assigned to this course.

Learning materials such as laboratory protocols, standard operating procedures and research articles will be made available directly to the student and/or via the College's Libraries and/or course management system.

COURSE APPROVAL:

Prepared by: Linda R. Rehfuss, Ph.D.
Biotechnology Instructor

Date: 11/1/2004

Revised by: Margaret Bryans, Ph.D.

Date: 12/22/2012

VPAA/Provost or designee Compliance Verification:
Dr. Victoria Bastecki-Perez, Ed. D.

Date: 3/13/2013

Revised by: Margaret Bryans, Ph.D.

Date: 11/19/2015

VPAA/Provost or designee Compliance Verification:
Dr. Victoria Bastecki-Perez, Ed. D.

Date: 11/19/2015

Revised by: Margaret Bryans, Ph.D.
VPAA/Provost or designee Compliance Verification:

Date: 12/22/2017
Date: 1/8/2018



This course is consistent with Montgomery County Community College's mission. It was developed, approved and will be delivered in full compliance with the policies and procedures established by the College.