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](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

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<thead>
<tr>
<th>LEARNING OUTCOMES</th>
<th>LEARNING ACTIVITIES</th>
<th>EVALUATION METHODS</th>
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<tbody>
<tr>
<td>1. Discuss biological systems and their role in biotechnology research.</td>
<td>Lecture, Guest Lecturers from Industry, Laboratory Experiments, Small Group Discussions, Reading Assignments</td>
<td>Section Examinations, Final Comprehensive Examination, Written Assignment</td>
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<td>2. Explain the processes which control the central dogma of biology (DNA – RNA – protein).</td>
<td>Lecture, Guest Lecturers from Industry, Laboratory Experiments, Small Group Discussions, Reading Assignments</td>
<td>Section Examinations, Final Comprehensive Examination, Written Assignment</td>
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<td>Upon successful completion of this course, the student will be able to:</td>
<td>Lecture, Guest Lecturers from Industry, Laboratory Experiments, Small Group Discussions, Reading Assignments</td>
<td>Section Examinations, Final Comprehensive Examination, Written Assignment, Lab. Reports</td>
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<td>3. Compare and contrast the processes of replication, transcription and translation between prokaryotes and eukaryotes.</td>
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<td>4. Discuss molecular biology techniques such as DNA cloning, polymerase chain reaction, DNA sequencing and site directed mutagenesis.</td>
<td>Lecture, Guest Lecturers from Industry, Laboratory Experiments, Small Group Discussions, Reading Assignments</td>
<td>Section Examinations, Final Comprehensive Examination, Written Assignment, Lab. Reports</td>
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<td>5. Perform several molecular biology techniques used in biotechnology laboratories.</td>
<td>Lecture, Videos, Laboratory Experiments</td>
<td>Section Examinations, Final Comprehensive Examination, Written Assignment, Lab. Reports</td>
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<td>6. Discuss strategies for protein purification. and perform column chromatography experiments for protein purification.</td>
<td>Lecture, Videos, Guest Lecturers from Industry, Laboratory Experiments, Virtual training module, Small Group Discussions, Reading Assignments</td>
<td>Section Examinations, Final Comprehensive Examination, Written Assignment, Lab. Reports</td>
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<td>7. Perform column chromatography experiments for protein purification.</td>
<td>Lecture, Laboratory Experiments, Virtual Training module, Small Group Discussions, Reading Assignments</td>
<td>Section Examinations, Final Comprehensive Examination, Written Assignment, Lab. Reports</td>
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<td>8. Discuss vaccines, biologics, and other traditional molecules exploited by the biotechnology industry for drug development.</td>
<td>Lecture Guest Lecturers from Industry Laboratory Experiments Small Group Discussions Reading Assignments</td>
<td>Section Examinations Final Comprehensive Examination Written Assignment</td>
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<td>9. Perform the culture and maintenance of mammalian cells with good aseptic technique.</td>
<td>Lecture Laboratory Experiments and demonstrations Small Group Discussions Reading Assignments</td>
<td>Section Examinations Final Comprehensive Examination Written Assignment Lab. Reports Practical exam</td>
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<td>10. Manipulate the tools and processes associated with genome databases.</td>
<td>Lecture Laboratory Demonstrations Small Group Discussions Reading Assignments</td>
<td>Section Examinations Final Comprehensive Examination Written Assignment</td>
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<td>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.</td>
<td>Lecture Laboratory Demonstrations Small Group Discussions Reading Assignments</td>
<td>Section Examinations Final Comprehensive Examination Written Assignment</td>
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<td>12. Plan and deliver an oral presentation about relevant journal article pertaining to biotechnology</td>
<td>Lecture Guest Lecturers from Industry Laboratory Experiments Small Group Discussions Reading Assignments Oral Presentation</td>
<td>Oral Presentation</td>
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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, CHO's 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

Revised by: Margaret Bryans, Ph.D.
VPAA/Provost or designee Compliance Verification:
Dr. Victoria Bastecki-Perez, Ed. D.
Date: 11/1/2004

Date: 12/22/2012

Date: 11/19/2015
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.