Middlesex Community College

Course: BIO*109 Principles of Biotechnology
CRN: 4003, Winter 2019

Instructor: Dr. Frank Stellabotte, Ph.D., pronounced /stella-bōt-té/
Office: 209 Wheaton Hall Phone: (860) 343-5747
Email Address: fstellabotte@mxcc.edu
refer to section on "Communication" below
Class Hours: Online

Course Learning Goals:

By the end of the course students will be able to:

- Give examples of the diverse career options and levels within the field of biotechnology and the training that is necessary to achieve them
- Explain the basic molecular biology concepts employed in biotechnology research.
- Identify the fundamental techniques employed in various sectors of the biotechnology industry.
- Articulate the goals and contributions of each sector in biotechnology.
- Recognize what local biotechnology industry companies produce, what techniques they use, and their role in our community.
- List the major regulatory agencies that impact the biotechnology industry.
- Discuss the past, current, and future ethical issues that arise in biotechnology.

Course Description and Prerequisites:

This course provides a basic introduction to the field of biotechnology. Students will gain a broad understanding of the goals, products, practices, regulations, ethics, and career paths in the biotechnology industry. Students will acquire the fundamental knowledge of the biotechnology industry through the introduction of molecular biology, contemporary techniques, and applications. In addition, students will learn about current topics from lectures, as well as guest speakers from industry partners. This course is intended for students in the biotechnology program, as well as students exploring career options in the field of science.
Gen Ed Competencies: Global Knowledge, Historical Knowledge, Scientific Reasoning
Prerequisites: Eligible for ENG*101 or ENG*101E

Communication:

The preferred method of communication is via college email NOT Blackboard messaging. The following are important points to consider when writing emails to any of the faculty with which you interact.

- **Method:** I prefer to receive messages via my campus email.
- **Etiquette:** A polite email consists of:
  1. A salutation (e.g. Dear Dr. S. or Professor Stellabotte,)
  2. The content of your message, written in grammatically correct English.
  3. A sign off and your name (e.g. Thanks, Jane Student)
- **Response time:** I will usually respond to messages quite rapidly; I am not always able to do so. Messages received during the week will be responded to within 24 hours. Email messages received on the weekends will be responded to within 48 hours. When in doubt, please check this syllabus, it probably has the answer to your questions.

Course Outline (this is subject to change):

<table>
<tr><th>Date Beginning:</th><th>Course Objectives:</th></tr>
<tr><td rowspan="2">12/26/19</td><td colspan="2">History of Biotechnology
What is Biotechnology?
• Define Biotechnology and understand the many scientific disciplines that contribute to Biotechnology
• List and describe types of biotechnology and their applications.
• Provide some examples of historic and current applications of biotechnology and its products.
An Introduction to Genes and Genomes
• Compare and contrast eukaryotic and prokaryotic cells.
• Describe the structure of DNA and RNA.
• Describe the process of DNA replication and discuss the role of key proteins involved.
• Describe the process of translation and the roles of mRNA, tRNA, and rRNA.
• Understand why epigenetics is important.
• Name different types of mutations.</td></tr>
<tr><td>Discussion Board Posts:
Introductory Post Due,
No response Due</td><td>Assignments:
Assignment 1</td></tr>
<tr><td rowspan="2">12/30/19</td><td colspan="2">Modern Biotechnology
Recombinant DNA Technology and Genomics
• Define Recombinant DNA technology and explain how it is used to manipulate DNA.
• Explain how PCR and Gel Electrophoresis are used.
• Discuss how DNA libraries are created.
• Describe how genomes are sequenced.
• Describe the major findings of the Human Genome Project.
Proteins
• What are the uses of Proteins in industries?
• How are proteins studied in the laboratory?
• What is Proteomics and how can it treat diseases?
• What form do different protein structures take?</td></tr>
<tr><td>Discussion Board Posts:
Discussion 1 Due and
Response to Student Post 1 Due</td><td>Assignments:
Assignment 2</td></tr>
<tr><td>01/03/20</td><td colspan="2">Vaccinations & Microbial Biotechnology

Microbial Biotechnology
• Provide examples of how yeast and bacteria are used in Biotechnology
• Explain how alcohol and lactic acid fermentation processes can be used to produce common food and beverages.
• Describe the role microorganisms play in the development and production of different vaccines.
• Define bioterrorism, identify the microorganisms that may be used as bioweapons and discuss strategies to combat them.</td></tr>
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<tr><td></td><td>Biotechnology Regulations
Describe the Role of the U.S. Dept. of Agriculture and the EPA in regulating Biotechnology products.
Describe the FDA's role in regulating pharmaceutical products, including phase testing.
Explain how patents encourage discovery.
Describe the circumstances in which DNA sequences are patentable.</td></tr>
<tr><td></td><td><table><tr><th>Discussion Board Posts:</th><th>Assignments:</th></tr><tr><td>Discussion 2 Due and
Response to Student Post 2 Due</td><td>Assignment 3</td></tr></table></td></tr>
<tr><td>01/07/20</td><td>Biotechnology Feeds the Globe
Genetically Modified Organisms
Describe the impact of Biotechnology on the Agricultural Industry.
List and Describe Conventional and Modern Methods used in plant transgenesis.
List some genetically engineered crops.
Outline several ways biotechnology can reduce hunger and malnutrition.
Aquaculture
Discuss the goals of Aquaculture
Describe commonly used fish farming practices
Describe limitations of Aquaculture.
Discuss controversies surrounding aquaculture.</td></tr>
<tr><td></td><td><table><tr><th>Discussion Board Posts:</th><th>Assignments:</th></tr><tr><td>Discussion 3 Due and
Response to Student Post 3 Due</td><td>Assignment 4</td></tr></table></td></tr>
<tr><td>01/11/20</td><td>The Future of Biotechnology
Animal Biotechnology
List some of the medical advances made using animal research models.
Outline the process used the clone an animal.
List some biological products that have been produced using animals.
Explain why zebrafish are popular model organisms.
DNA Fingerprinting
Define DNA Fingerprinting
List some of the factors that can degrade DNA evidence.
Describe how polymerase chain reaction is used to produce a DNA fingerprint.
Explain how a DNA fingerprint can be used to exclude a suspect.
List some of the uses of DNA fingerprinting in Biological research.
Bioremediation
Explain what Bioremediation is and describe why it is important.
Describe the advantages of Bioremediation approaches.
Name the common pollutants that need to be cleaned up.
Discuss bioremediation at a wastewater clean-up plant.</td></tr>
<tr><td></td><td><table><tr><th>Discussion Board Posts:</th><th>Assignments:</th></tr><tr><td>No Discussion Board Posts, work on Final Project, Job Application</td><td>Assignment 5</td></tr></table></td></tr>
<tr><td colspan="2">Final Project due January 16, 2020 at Midnight</td></tr>
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CLASS POLICIES:

Assignments:

There will be 5 weekly assignments, which will take the form of true or false, multiple choice or short essay questions. Each assignment will be submitted electronically and cannot be submitted past the due date.

Final Project:

The final project will be a complete job application package. Students will be required to complete a job application as if applying for a job in the Biotechnology field. This will require a cover letter and a résumé. This will be competed in multiple parts.

Discussion Board Posts:

Students will be directed to make a post of their own, and to comment on other students' posts. Directions, including grading requirements, will be contained in the content area "Discussion Board Posts" will vary from week to week. Posts are expected to be grammatically correct and should generally be a short paragraph that is "information rich". That is, you are not using words to restate the question or make general comments (such as "gene editing is really interesting").

Your comments on other students' posts can be shorter but should also be meaningful (stay away from "good post, well written!"). Since students have 2+ days to make a post there will be no time extensions granted unless there are documented extenuating circumstances and the instructor is notified right away.

Please Note:

This is a condensed format course! Missed or late assignments, posts, or exams are not acceptable. Please intend on spending at least 20 to 15 hours a week on preparing for this course. You are EXPECTED to check Blackboard Learn at least every 2 to 3 days in order to complete exams and assignments appropriately.

Required Course Materials:

1. **Computer with Internet Access:** This course depends on you having access to a computer in good working order and access to the internet. This can be in your home, at the library or on campus. You are expected to have all of this worked out prior to the start of class and should make sure you can access Blackboard Learn. Please also have a "Plan B" if something should go wrong (your network is down, your computer malfunctions). You should always save copies of your work, even after submission; it's best to back-up your work on external memory or a cloud drive. Remember that most public libraries have public computers, and that there are computer labs on campus. Please note that Blackboard Learn is NOT optimized for tablet or mobile devices. The Blackboard Learn mobile application may miss function without warning.
2. **There is no required textbook for this course**.

Withdrawal Policy:

You may withdraw from this class any time before the end of the work day Wednesday, January 8th 2020 at 4:30PM. Either written permission from me (preferably) or a completed and signed withdrawal form must be on file in the Records Office in order to receive a "W" on your transcript. If you fail to complete this process on time, you will receive a letter grade at the end of the semester, which will include zeroes for any work not submitted. Course withdrawals may affect financial aid and veteran's benefits. Please make this decision carefully and with the help of your advisor. See the Academic Calendar and the College Catalog for specific dates and procedures regarding the withdrawal process. It is your responsibility to successfully complete the withdrawal process.

Grading Policy:

Assignment 1	100	Course Contract:	20	
Assignment 2	100	Introductory Post:	30	
Assignment 3	100	Discussion Board (50 pts each):	200	
Assignment 4	100	Final Project:	250	
Assignment 5	100			
Total (including (only the 3 highest)	500		500	1000

In the case where a particular assignment or exam is not given a letter grade, the following table shows the conversion from a numerical grade to a letter grade.

A	= 92.5-100%	B	= 82.5-86.4%	C	= 72.5-76.4%	D	= 62.5-66.4%
A-	= 89.5-92.4%	B-	= 79.5-82.4%	C-	= 69.5-62.4%	D-	= 59.5-62.4%
B+	= 86.5-89.4%	C+	= 76.5-79.4%	D+	= 66.5-69.4%	F	= 0-59.4%

Plagiarism & Academic Honesty:

At MXCC, we expect the highest standards of academic honesty. Academic dishonesty is prohibited in accordance with the Board of Trustees' Policy on Student Conduct in Section 5.2.1 of the Board of Trustees' Policy Manual. This policy prohibits cheating on examination, unauthorized collaboration on assignments, unauthorized access to examinations or course materials, plagiarism, and other proscribed activities. Plagiarism is defined as the use of another's idea(s) or phrase(s) and representing that/those idea(s) as your own, either intentionally or unintentionally. **Cheating of any kind will not be tolerated and will result in a grade of "F" for the course and immediate referral to the Academic Dean for further disciplinary action.**

COLLEGE POLICIES

IMPORTANT COLLEGE POLICIES!! PLEASE READ CAREFULLY!

For information about the college's policies and procedures regarding academic honesty, accessibility/disability services, attendance, audio-recording in the classroom, grade appeals, plagiarism, religious accommodations, weather and emergency closings, and more, please go to the following website:
https://mxcc.edu/catalog/academic-policies/syllabus/ or scan the QR code with your smart phone.
Also, please become familiar with the policies regarding nondiscrimination, sexual misconduct, and general student conduct at the following website: www.mxcc.edu/nondiscrimination/.