Tompkins Cortland Community College

Master Course Syllabus

Course Discipline and Number: BIOL 206 **Year: 2018-2019**

Course Title: Molecular Genetic Techniques **Credit Hours: 1**

Attendance Policy: *To maintain good grades, regular attendance in class is necessary. Absence from class is considered a serious matter and absence never excuses a student from class work. It is the responsibility of all instructors to distribute reasonable attendance policies in writing during the first week of class. Students are required to comply with the attendance policy set by each of their instructors. Students are not penalized if they are unable to attend classes or participate in exams on particular days because of religious beliefs, in accordance with Chapter 161, Section 224-a of the Education Law of the State of New York. Students who plan to be absent from classroom activity for religious reasons should discuss the absence in advance with their instructors. See college catalog for more information.*

Services for Students with Disabilities: *It is the College's policy to provide, on an individual basis, appropriate academic adjustments for students with disabilities, which may affect their ability to fully participate in program or course activities or to meet course requirements. Students with disabilities should contact the Coordinator of Access and Equity Services, to discuss their particular need for accommodations. All course materials are available in alternate formats upon request.*

Course Description

This laboratory module provides hands-on experience with modern molecular techniques employed in today's society. The project requires recloning a gene from a prokaryotic expression vector into an eukaryotic vector and demonstrating exression in vitro. The course is designed for the Biotechnology program, but is also applicable to biological, natural, forensic, and agricultural science majors who want to augment their skill set and/or retrain for job advancement in their field. Prerequisites: Previous laboratory course; BIOL 101 or BIOL 104 or work-related experience; MATH 095 or MATH 098 and RDNG 116 if required by placement testing; prior completion or concurrent enrollment in ENGL 101. 1 Cr. (3 Lab.) Fall semester.

Course Context/Audience

Molecular Genetic Techniques is a co-requisite to BIOL 205 - General Genetics for students pursuing an A.S. degree in Biotechnology. This lab experience is generally not encountered until the junior/senior year at 4-year institutions, hence conveying a competitive advantage to our transfer students. The modular lab exercise format also entices students from non-science degree programs to continue learning in the science, technology, engineering and mathematics (STEM) curriculum.

Basic Skills/Entry Level Expectations

Writing: WC College level writing skills are required. See course co-requisites or pre-requisites.

Math: M3 MATH 095 or MATH 098 if required by placement testing.

Reading: R4 Before taking this course, students must satisfactorily complete RDNG 116 or have assessment indicating that no reading course was required.

Course Goals

As a result of completing this course, the student will be able to:

1. Isolate DNA.
2. Transform bacteria.
3. Identify recombinant clones.
4. Run PCR.
5. Apply RFLP to distinguish between genotypes.
6. Detect genes and monitor expression.
7. Keep notebooks according to cGLP.

Course Objectives/Topics

Objective/Topic	% Course
Basic Techniques- DNA Isolation Purification	10%
Restriction Enzymes and Agarose Gel Electrophoresis	10%
Plasmid Transformation and Identification	10%
Plasmid Recombination and Identification	10%
Restriction mapping of linear and circular chromosomes	10%
Southern/Northern Blot Hybridization	10%
DNA Sequencing	10%
Polymerase Chain Reaction	10%
Quantitative Techniques and Gene Expression	10%
Human DNA Fingerprinting/RFLP Polymorphism	10%

General Education Goals - Critical Thinking & Social/Global Awareness

CRITICAL THINKING OUTCOMES	HOW DOES THE COURSE ADDRESS THE OUTCOMES (Include required or recommended instructional resources, strategies, learning activities, assignments, etc., that must or could be used to address the goal/outcomes)
Students will be able to ➢ develop meaningful questions to address problems or issues. ➢ gather, interpret, and evaluate relevant sources of information. ➢ reach informed conclusions and solutions. ➢ consider analytically the viewpoints of self and others.	Students must propose a hypothesis and employ current tools of cell biology to address the problem at hand. A project that requires the student to decide which technique to apply to answer his/her query should be assigned. Students complete experimental procedures and evaluate data to determine whether the technology yielded adequate results. The instructor should have students seek their own methods from published material (lab manuals web reference, SOP's, etc.); always train students on new technology; and show proper procedures and typical data analysis. Based on the validity of experimental results the student must decide to repeat or progress to the next step of experimentation. The instructor should have students evaluate their data in comparison to prototype or a positive control. They must assess whether there were problems in technique or the hypothesis was falsified. Based on expected and actual results students learn to trouble shoot problems in experimental procedures, relying on their own lab experience and of other's success. Depending on the aptitude of the students, the instructor should have the more skilled begin mentoring others in technique, analysis, and trouble shooting.

SOCIAL/GLOBAL AWARENESS OUTCOMES	HOW DOES THE COURSE ADDRESS THE OUTCOMES (Include required or recommended instructional resources, strategies, learning activities, assignments, etc., that must or could be used to address the goal/outcomes)
➢ Students will begin to understand how their lives are shaped by the complex world in which they live. ➢ Students will understand that their actions have social, economic and environmental consequences.	Students work on projects designing and creating new recombinant organisms, learning how to manipulate DNA to control living organisms. The instructor should have students manipulate plasmid DNA (sub-cloning) to create a 'new' recombinant DNA construct. They should be able to transform bacterial cells to alter the genotype and expressed phenotype. Students learn to apply molecular techniques to trace hereditary factors and analyze the results in regard to paternity and disease susceptibility. The instructor should have students work extensively on PCR to understand implications of the analysis; are family members related (mom, dad (?), siblings) and what would one do knowing they possess a predisposition to disease? Students become aware of the vast array of diagnostic tools based on molecular techniques and analysis and the industries that support these ventures. As students search for methods, the instructor should have them look up catalog prices on the reagents they will be using. Encourage them to read the professional journals that advertise diagnostic testing. Students are lectured on the ethical rules in molecular biology and the guiding principles in the field to reduce risk of environmental catastrophe. The instructor should make available the "NIH Guidelines on recombinant DNA Materials" so students learn there are Federal Regulations that must be adhered to, even on materials used for "educational purposes".

Instructional Methods

Molecular Genetics Techniques is a laboratory course designed to provide students with hands-on experience. A brief introductory lecture should outline the activities, location of required materials, and expected outcomes. Students should be expected to follow a written protocol to complete the laboratory exercises. They should also be required to keep notebooks according to cGLP. Class discussion on outcomes and interpretation of data should demonstrate how to trouble shoot problems that arise, and how to come to rational conclusions based on scientific principles.

Methods of Assessment/Evaluation

Method	% Course Grade
Participation in laboratory exercises	25%
Completion of laboratory exercises	25%
Notebooks/Record keeping	25%
Lab Reports	25%

Text(s)

Laboratory DNA Science, Mark V. Bloom, Greg A. Freyer and David A. Micklos., Latest Edition, © 1996 Benjamin/Cummings Publishing, Inc.

Bibliography

Molecular Cloning, A Laboratory Manual. Sambrook, Fritch, and Maniatis. Cold Spring Harbor Laboratory Press.

Current Protocols in Molecular Biology. Ausobel, Brent, Kingston, Moore, Seidman, Smith, and Struhl, eds. John Wiley & Sons, © 2004.

Laboratory DNA Science. Bloom, Freyer, and Micklos, The Benjamin/Cummings Publishing, Inc., © 1996

Other Learning Resources

Audiovisual No resources specified
Electronic National Center for Biotechnology Information data base at http://www.ncbi.nlm.nih.gov/ BIOLINK http://www.bio-link.org/index.htm
Other A course management web site such as ANGEL should be implemented to post the course syllabus, outline, course materials, and related links.