

Course discipline/number/title: BIOL 2020: Introduction to Molecular Biology Methods**A. CATALOG DESCRIPTION**

1. **Credits:** 4
2. **Hours/Week:** 2 lecture, 2 lab
3. **Prerequisites (Course discipline/number):** BIOL 1220 and CHEM 1127
4. **Other requirements:** College-level reading and writing
5. **MnTC Goals (if any):** NA

B. COURSE DESCRIPTION: This is a semester-long, lab-intensive course for students currently employed in or ultimately seeking employment in a clinical or research laboratory with a health care focus. This course is specifically designed for students in Biotechnology programs at RCTC. The goal of this course is to provide the student with both a conceptual and practical understanding of basic lab techniques with particular emphasis on developing the skills to perform these specific techniques independently upon completion of the course. College-level reading and writing.

C. DATE LAST REVISED (Month, year): November, 2022

D. OUTLINE OF MAJOR CONTENT AREAS:

1. Introduction to Biotechnology Methodologies
 - a) Laboratory safety
 - b) Documentation - setting up a legal scientific notebook
2. Basic Biology for the Biotechnician
 - a) Characteristics of model organisms
 - b) Using a compound light microscope
3. Basic Chemistry for the Biotechnician
 - a) Measuring small volumes
 - b) Measuring mass
 - c) Making solutions
 - i. mass/volume
 - ii. % mass/volume
 - iii. molarity
 - iv. dilutions
4. DNA Isolation and Analysis
 - a) Preparing solutions for DNA isolation
 - b) Making media for bacterial cell culture
 - c) Sterile technique and pouring plates
 - d) Bacterial cell culture
 - e) DNA extraction from bacteria
 - f) Making agarose gels and pouring gels
5. Recombinant Protein Production
 - a) Creation of an expression plasmid
 - b) Transformation of E. coli (bacteria)
 - c) Growing and monitoring bacterial cultures
 - d) Miniprep (miniprep)
 - e) Restriction enzyme digestion
6. Protein Product Purification and Analysis
 - a) Harvesting protein from bacterial cultures
 - b) Separation of proteins using column chromatography
 - c) Identification of proteins using PAGE (polyacrylamide gel electrophoresis)

C. OUTLINE OF MAJOR CONTENT AREAS: Continued. . . .

7. PCR (Polymerase Chain Reaction)
 - a) Designing primers
 - b) Optimizing reactions
 - c) Analyzing PCR products
8. Tissue culture
 - a) Making solutions/media for tissue culture
 - b) Maintaining cell cultures – feeding, washing, counting and splitting/passing cell cultures
 - c) Sterile techniques
9. Journal Club
 - a) Analyze and interpret findings in selected scientific articles
 - b) Prepare a presentation to discuss findings

E. LEARNING OUTCOMES (GENERAL): The student will be able to:

1. Compile an accurate and legally-sufficient laboratory notebook.
2. Perform laboratory procedures with regard for the special safety concerns in a biotechnology laboratory.
3. Explain the basic properties of DNA, RNA, and proteins.
4. Demonstrate proper use and care for a standard compound light microscope.
5. Perform accurate mass measurements using standard and analytical balances.
6. Perform accurate measurements of small volumes using a pipettor.
7. Use calculations to accurately prepare solutions of varying concentrations (mass/volume, molarity, dilutions, etc.).
8. Prepare solutions and media from a standard recipe.
9. Demonstrate basic sterile techniques.
10. Prepare an agarose gel.
11. Analyze a simple restriction enzyme digestion.
12. Prepare and maintain bacterial cell cultures.
13. Prepare and maintain tissue cultures.
14. Demonstrate an understanding of basic protein chemistry.
15. Design primers for PCR.
16. Perform basic PCR and analyze PCR product.
17. Analyze, interpret, and present findings in an article from a refereed scientific journal.

F. LEARNING OUTCOMES (MNTC): NA

G. METHODS FOR EVALUATION OF STUDENT LEARNING: Methods may include but are not limited to:

1. Lecture and laboratory exams
2. Skill demonstration for each technique
3. Cumulative application and evaluation of laboratory skills

H. RCTC CORE OUTCOME(S). This course contributes to meeting the following RCTC Core Outcome(s):
Critical Thinking. Students will think systematically and explore information thoroughly before accepting or formulating a position or conclusion.

I. SPECIAL INFORMATION (if any):

The initial lab session explains and familiarizes the student with general safety hazards and safety equipment in the lab. Before each lab, the hazardous characteristics of any materials and equipment used during the lab are discussed. Students are required to wear the necessary protective equipment, including lab coats, protective eyewear and gloves. A copy of Material Safety Data Sheets for all chemicals used is available.