

Common Course Outline
BIOL 257
Genetics Laboratory
2 Semester Hours

The Community College of Baltimore County

Description

Genetics Laboratory

Illustrates the principles of genetics through student experiments; utilizes classical genetic techniques as well as molecular techniques to study the nature of genetic material. BIOL 257 meets for six hours per week. Students may enroll in BIOL 257 Genetics Lab concurrently or subsequent to successful completion of BIOL 251.

Prerequisites: BIOL 251 (conc.) and CHEM 123 (conc.) and CHEM 124 (conc.).

Overall Course Objectives

The objective of this course is to facilitate student understanding of genetic principles by involving them directly in hands-on genetic experiments. In conducting these experiments, students employ the scientific method to learn relevant laboratory techniques, gain the ability to design and carry out controlled experiments, and analyze and interpret data. Students will also have the opportunity to design original experiments as well as repeat historical experiments that demonstrate the principles of heredity discussed during the lecture portion of the course.

Upon successful completion of this course the student will be able to:

1. Analyze maize and *Drosophila* phenotypes following genetic crosses to determine genotype, gene expressivity, gene loci and to use Chi Square analysis to evaluate data based on predicted Mendelian ratios for mono-, di- and tri-hybrid crosses.
2. Prepare and analyze human karyotypes to identify chromosomal pairs, determine gender, identify chromosomal abnormalities, and utilize standard nomenclature to describe a variety of karyotypes.
3. Study complementation, mating types, prototrophy, and auxotrophy in yeast by generating and screening diploids using selective media.
4. Conduct meiotic mapping in yeast.
5. Analyze mutations (nonsense, missense, and frameshift,) in yeast and bacteria..
6. Transform various yeast and bacterial strains with extrachromosomal plasmids and select for transformants.
7. Perform basic molecular biology techniques such as genomic and plasmid DNA isolation, cloning, restriction mapping and digestion, polymerase chain reaction, plasmid preparation.
8. Study the *lac* operon and use the blue/white color screening to identify plasmids into which a DNA fragment has been successfully cloned.
9. Study transposable elements, repetitive DNA sequences, and analyze DNA collected from cheek epithelial cells to determine the presence of Alu insertions. Conduct population study of Alu insertions using the Cold Spring Harbor Alu insertion World-Wide Database.
10. Design an experiment with appropriate controls and experimental methods.
11. Analyze and interpret data using a variety of methods including statistical analysis.
12. Demonstrate an understanding of laboratory safety and safe practices including sterile technique.
13. Demonstrate the ability to maintain a laboratory notebook and standard operating procedure using industry standards.

Major Topics

- A. Mendelian Genetics
Mono-, di- and tri-hybrid crosses in maize and *Drosophila*
- B. Principles of Probability and The Chi-Square Test
- C. Principles of Inheritance
Meiosis
Sex Chromosomes and Gene Transmission
Human Chromosomes and Karyotypes
Linkage Mapping
Tetrad Analysis and Random Spore Analysis
Human Pedigree Analysis

- Yeast Prototrophy and Auxotrophy
- Screening and Selection Mechanisms
- D. Molecular Genetics
 - Isolation of Genomic and Plasmid DNA
 - Restriction Endonuclease Digestion and Gel Electrophoresis
 - Transformation of yeast and *E. coli*
 - Gene Action: The *Lac* operon and the *Trp* operon
 - Bacterial and Yeast Mutagenesis
 - Phage Genetics
 - Gene Therapy
- E. Population Genetics
 - The Hardy-Weinberg Principle
 - The Effects of Selection and Genetic Drift
 - Applied Human Genetics

Course Requirements

Prerequisites: BIOL 110, CHEM 123-4 (which may be taken concurrently) and BIOL 251 (which may be taken concurrently) with an earned grade of “C” or better.

Grading/exams: Grading procedures will be determined by the individual faculty member but may include exams, quizzes, laboratory notebook, laboratory reports and laboratory projects.

Other Course Information

Individual faculty members who teach this course may include additional course objectives and topics or exclude some of these course objectives and topics. It is expected that a majority of these topics will be covered.

Date Revised: 3/30/00