

Common Course Outline
BIOL 251
Genetics
4 Semester Hours

The Community College of Baltimore County

Description

Genetics

Presents current principles of heredity at the molecular, cellular and organismic level; discusses fundamental information concerning prokaryotic and eukaryotic gene structure, gene expression, gene organization, gene regulation, gene transfer, cancer, recombinant DNA technology, human heritable diseases and population genetics. BIOL 251 meets for four hours per week. Students may enroll in BIOL 257 Genetics Lab concurrently or subsequent to successful completion of this course. Prerequisite: BIOL 110 and CHEM 123, CHEM 124, conc.

Overall Course Objectives

The objective of this course is to enable students to demonstrate an understanding of the genetic basis of inheritance at the cellular and molecular level; the principles of gene expression, regulation and interaction; the mechanisms and impact of gene transfer within and among populations; and the historically significant experiments that lead to a better understanding of prokaryotic, viral, and eukaryotic genetic principles.

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

1. Predict the genotype, phenotype and probability of progeny as a result of mono-, di- or tri-hybrid crosses.
2. Describe the chemical composition of DNA.
3. Describe the processes of gene transcription, gene translation, and gene regulation at the level of transcriptional, translational, and post-translational control.
4. Predict the incidence or probability of transmission of human genetic diseases.
5. Describe the process of genetic transmission to prokaryotic and eukaryotic cells by viruses.
6. Describe the causes and predict the impact of genetic mutations on gene expression, gene-product function, and viability.
7. Describe key historical experiments which lead to our current understanding of the principles of heredity.

8. Explain the chromosomal location of known human genes and predict the risk of disease in the offspring of parents with mutations in these known genes.
9. Describe the way in which complementation analysis and meiotic mapping is used to determine the map location and distance of linked and unlinked genes.
10. Discuss genetic evidence of species and population evolution.
11. Compare and contrast prokaryotic and eukaryotic gene structure, organization, regulation and expression.
12. Describe mutagenesis and discuss the impact of mutations as well as the ways in which induced mutations can be used to study genetics.
13. Describe genetic variability and gene transfer within and among populations and discuss the impact of genetics on population dynamics and evolution.

Major Topics

- A. Nucleic Acid Structure
Deoxyribonucleic Acid and Ribonucleic Acid – Chemical Composition
Watson and Crick and the Double-Stranded Helix
- B. Chromosomes
Chromosomal Structure
Human Karyotypes and Genetic Loci on Chromosomes
Chromosomes and the Cell Cycle
Cell Division – Mitosis and Meiosis
Chromatin Structure and Function – Telomeres, Nucleosomes, Centromeres
- C. Mendelian Genetics
Multiple Alleles and Codominance
Sex Linkage
Penetrance
Sex Determination and Dosage Compensation
Probability and Chi Square
Dihybrid and Trihybrid Cross
Genetic Mapping and Recombination Frequency
- D. Bacterial/Prokaryotic Genetics
- E. Gene Action
Replication
Transcription
Translation
Mutation and Repair
Transposable Elements
Regulation
- F. Genetics and Cancer
Cell Signaling
Apoptosis

- G. Recombinant DNA Technology
 - Drug Discovery
 - Gene Therapy
 - Cloning
 - Agricultural Technology
- H. Population Genetics
 - Genetic Transfer
 - Phylogenetic Analysis
 - Evolution

Course Requirements

Prerequisites: BIOL 110, CHEM 123-4 (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, a paper, or a project.

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