BIOL 251
Genetics
4 Credits

Community College of Baltimore County
Common Course Outline

Description

BIOL 251 – 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.

Pre-requisites: MATH 083 and BIOL 110 with a minimum grade of C. CHEM 131 is recommended but not required.

Overall Course Objectives

Upon completion of this course, students will be able to:

1. predict the genotype, phenotype, and probability of progeny as a result of mono-, di-or tri-hybrid crosses;
2. explain how the chemical composition of DNA relates to its structure and function;
3. explain 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. compare the processes of genetic transmission by viruses in prokaryotic and eukaryotic cells;
6. predict the impact of genetic mutations on gene expression, gene-product function, and viability;
7. distinguish between the key historical experiments that led 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. estimate the map location and distance of linked and unlinked genes using complementation analysis and meiotic mapping;
10. evaluate genetic evidence of species and population evolution;
11. compare and contrast prokaryotic and eukaryotic gene structure, organization, regulation, and expression;
12. describe mutagenesis, the impact of mutations, and the ways in which induced mutations can be used to study genetics;
13. examine genetic variability and gene transfer within and among populations; and
14. discuss the impact of genetics on population dynamics and evolution.

Major Topics

I. Nucleic Acid Structure
    a. Deoxyribonucleic Acid
    b. Ribonucleic Acid
    c. Chemical Composition
    d. Watson and Crick
    e. Double-stranded Helix
II. Chromosomes
    a. Chromosomal Structure
    b. Human Karyotypes
    c. Genetic Loci on Chromosomes
    d. Chromosomes and the Cell Cycle
    e. Cell Division
        i. Mitosis
        ii. Meiosis
    f. Chromatin Structure and Function
        i. Telomeres
        ii. Nucleosomes
        iii. Centromeres
III. Mendelian Genetics
    a. Multiple Alleles and Codominance
    b. Sex Linkage
    c. Penetrance
    d. Sex Determination
    e. Dosage Compensation
    f. Probability
    g. Chi Square
    h. Dihybrid and Trihybrid Crosses
    i. Genetic Mapping and Recombination Frequency
IV. Bacterial/Prokaryotic Genetics
V. Gene Action
    a. Replication
    b. Transcription
    c. Translation
    d. Mutation and Repair
    e. Transposable Elements
    f. Regulation
VI. Genetics and Cancer
    a. Cell Signaling
    b. Apoptosis
VII. Recombinant DNA Technology
VIII. Evolutionary Genetics

Course Requirements

Grading will be determined by the individual faculty member, but shall include the following, at minimum:

- 2 unit exams
- 4 quizzes
- A research paper or project
- A cumulative final exam

Written assignments and research projects: Students are required to use appropriate academic resources in their research and cite sources according to the style selected by their professor.

Other Course Information

This course is an approved 4–credit General Education course in the Biological and Physical Sciences but does not fulfill the laboratory requirement

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