COURSE OUTLINE

BIOL-201

Genetics

3 Semester Hours

Science Core Course

HOWARD COMMUNITY COLLEGE

Description

Following successful completion of Biology 201, the student will be able to describe the principles of inheritance in terms of the structure and function of genetic material in viruses, bacteria, and higher organisms; the transmission and expression of genetic information; sex determination and sex chromosomes; extrachromosomal inheritance; gene mutation; recombination and regulation; genetic control of metabolism, development and behavior; and recombinant DNA techniques. The student will also utilize the principles of inheritance to solve real and simulated problems in human genetic counseling and in plant and animal breeding. For genetics lab, see BIOL-202. Prerequisite: BIOL-101 and MATH-070. (3 hours lecture)

Statement on General Education and Liberal Learning

A liberal education prepares students to lead ethical, productive, and creative lives and to understand how the pursuit of lifelong learning and critical thinking fosters good citizenship. General education courses form the core of a liberal education within the higher education curriculum and provide a coherent intellectual experience for all students by introducing the fundamental concepts and methods of inquiry in the areas of mathematics, the physical and natural sciences, the social sciences, the arts and the humanities, and composition. This course is part of the general education core experience at Howard Community College.

Overall Course Objectives

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

1. Identify the significant structures and events in mitosis and meiosis, and apply to problem solving situations.
2. Analyze Mendel's research and his Principles of Segregation and Independent Assortment, and predict phenotypic and genotypic outcomes of dihybrid crosses.
3. Solve genetics problems involving absence of dominance, codominance, and epistasis. Describe the underlying biochemical mechanisms involved in these types of inheritance.
4. Solve inheritance problems involving X-linked genes, and analyze the mechanisms of sex determination in humans and Drosophila.
5. Apply binomial expansion to prediction of genetic probabilities and analyze inheritance data utilizing the chi-square goodness-of-fit test.
6. Determine the map distance between genes, and order of genes of eukaryotic diploid organisms and ascomycetes given appropriate inheritance data.
7. Describe the history of the discovery of the existence, structure, and function of DNA, including key scientists and research strategies.
8. Identify the major features of DNA structure and replication, and explain the Sanger method of DNA sequencing.

9. Describe the major techniques for the isolation and characterization of DNA fragments.
10. Identify the molecular organization of chromosomes.
11. Describe the major abnormalities of chromosome number and structure in plants and humans and their outcomes.
12. Identify the laboratory approaches to identification of bacterial mutants, and describe the three modes of bacterial transfer of genetic material.
13. Identify the major features of protein structure, transcription and translation.
14. Describe the major mechanisms of gene regulation in eukaryotes and prokaryotes.
15. Identify the principal molecular mechanisms of mutations and DNA repair.
16. Apply the Hardy-Weinberg equilibrium equation to problem-solving situations.
17. Identify examples of cytoplasmic inheritance and cytoplasmic influence.
18. Describe the major procedures used in DNA technology and genetic engineering.
19. Read and interpret research articles which utilize modern DNA technology to carry out genetic analysis.
20. Apply all of the above to problem-solving situations.

Major Topics

I. Overview
II. Mendelian Genetics
III. The Chromosomal Basis of Heredity
IV. Linkage and Mapping
V. Karyotypes and Chromosomes
VI. DNA Structure, Replication, and Manipulation
VII. DNA Mutation
VIII. Genetics of Bacteria and their Viruses
IX. Gene Expression
X. Gene Regulation
XI. Genetic Engineering and Functional Genomics
XII. Development
XIII. Cancer
XIV. Population Genetics and Evolution
XV. Complex Traits

Course Requirements

Grading/exams: Grading procedures will be determined by the individual faculty member but will include the following:

Final grades will be calculated on the basis of exams and homework. This course includes a comprehensive final exam.

Other Course Information

This course is a Science core course, a Science elective, and an Arts and Science elective.