BIO105: Genetics

This introductory course provides an overview of the fundamental concepts in genetics for biology majors. The aim is to help students achieve an appreciation for genetics and learn about the possibilities and limitations of genetic approaches in research, medicine and industry.

This class covers classical and molecular approaches to understand the function of genes. The class will provide students with information and experimental approaches commonly used to address specific genetic questions.

The students will learn about the classic experiments of Mendel on peas and Morgan on Drosophila as well as the experiments of Beadle and Tatum in fungi. During these analysis students will learn about dominance relationships, how to query and interpret data from crosses and pedigrees, generate mutants and build complementation groups and linkage maps.

The second half of the course focuses on molecular approaches used in the study of genetic questions. Students learn about the nature of mutations, forward genetic screens, epistasis and suppressor analysis. They also learn about techniques such as cloning, sequencing, blotting, PCR, CRISPR, microarrays, SNP mapping and GWAS. They learn how these methods are used in health, agriculture and biotechnology. They also learn how these methods are used to study the human genome, analyze genetic variation amongst individuals and treat human diseases.

Students will be tested on numerous topics including their proficiency in key concepts, knowledge of important terms, formulas and facts. Students are expected to recall and use the correct method/approache/formula to analyze genetic data and answer specific questions regarding gene behavior and function.

A basic knowledge of molecular biology and statistics is necessary. All exams are closed book and no notes or other reference materials can be used. Final grades for the course may be curved and no strict grade cutoffs are predetermined.

Topics covered will include:

Basic Mendelian genetics

Chromosome theory of inheritance

Mitosis & meiosis

Medical genetics

Dominance relationships, multiple alleles

Linkage and recombination mapping

Mutation and gene rearrangements

Gene function, genotype to phenotype relationships- one gene/ one enzyme

Gene function, transcription, splicing & translation

Concepts and techniques in recombinant DNA

Concepts and approaches with genomics

Chromosomal organization and epigenetics

1: Introduction: Basic Mendelian Genetics Reading: 6th Ed: 2-1, 2-2, 2-3	2: DNA, Mitosis and Meiosis Chromosome Theory of Inheritance and Sex chromosome Reading: 6th Ed: 4-1, 4-2, 4-3, 4-4, 4-6, 4-7
3: Dominance Relationships Reading: 6th Ed: 3-1,	4: Linkage, Mapping, Recombination Reading: 6th Ed: 5-1, 5-2, 5-3, 5-4, 6-5(optional)
5: Transcription, Translation Mutations Reading: 6th Ed: 6-2, 6-3, 7-1, 7-2, 8-1, 8-2, 8-3, 8-4, 10-1, 12-1, 12-2, 16-1, 17-1, 17-2	6: Complementation Gene to Protein Relationship Epistasis-Genetic pathways Reading: 6th Ed: 7-4, 7-5, 3-2
7: Recombinant DNA Reading: 6th Ed: 9-1, 9-2, 9-3, 9-4, 10-1, 18-1, 18-2, 18-3, 18-4	8: Recombinant DNA Reading: 6th Ed: 9-1, 9-2, 9-3, 9-4, 10-1, 18-1, 18-2, 18-3, 18-4
9: Genetic Polymorphisms and Genomics Reading: 6th Ed: 11-1, 11-2, 11-3, 11-4	10: Epigenetics Reading: 5th Ed: 12-3, 17-3, 4-7