University of Arkansas – Fort Smith
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General Syllabus

BIOL 3803 Genetics

Credit Hours: 3 Lecture Hours: 3 Laboratory Hours: 0

Prerequisite: BIOL 2003 Introduction to Cell Biology AND CHEM 1403/1401College Chemistry I/Laboratory and STAT 2503 Probability and Statistics or higher STAT, or MATH equivalent to ACT MATH score of 23 or higher.

Prerequisite or corequisite: BIOL 3801 Genetics Laboratory

Effective Catalog: 2018- 2019

I. Course Information

A. Catalog Description

Replication, transcription and translation are studied in detail at the molecular level. Differences between prokaryotes and eukaryotes are studied in how they express genetic traits. Heredity and inheritance patterns will be studied in detail including genetic defects, oncogenes and gene therapy. Recombinant DNA technology is examined thoroughly to develop an understanding of restriction enzymes and gel electrophoresis.

B. Additional Course Information

This course is a requirement for BIOL 4403 Evolutionary Biology, BIOL 4803/4801 Cell and Molecular Biology/Lab, BIOL 4001 Seminar in Biology and BIOL 4603/4601General Physiology/Lab

II. Student Learning Outcomes

A. Subject Matter

Upon successful completion of this course, the student will have:

1. Describe how DNA was discovered to be the hereditary material.
2. Explain the chemical make-up of DNA.
3. Demonstrate how traits are passed on by Mendelian principles.
4. Illustrate how proteins are synthesized by the processes of transcription and translation.
5. Explain the importance of molecular biology and genetic engineering in the modern

society.

6. Understand the relationship between DNA, Genetics, and the processes of Evolution.

B. University Learning Outcomes

BIOL 3803 Genetics enhances student abilities in the following areas:

Analytical Skills

Quantitative Reasoning: Students will learn to interpret data and predict how certain traits are passed in a population. This data will include information from hypothetical genetic crosses, DNA manipulation, and genetic disease transmission. Students will calculate percentages and perform statistical analyses of data collected. Students will utilize probability principles to predict outcomes of potential genetic crosses

Communication Skills (written and oral)

Students will communication proficiently. They will compose coherent reports, identifying facts from opinions, and read and write primary literature in accepted scientific format. Students will effectively communicate orally in a public setting.

Ethical Decision Making

The students will conduct themselves in an ethical manner and evaluate ethical considerations during discussions of genetic research activities and manipulations common to the discipline.

III. Major Course Topics

A. DNA structure and replication
   1. Experimental determination that DNA is the hereditary molecule
   2. Chemical structure of DNA
   3. Experimental determination that DNA replication is semi-conservative
   4. Proteins and DNA sequences involved in DNA replication

B. Transcription and RNA processing
   1. Proteins and DNA sequences involved in bacterial transcription
   2. Proteins and DNA sequences involved in eukaryotic transcription
   3. Post-transcriptional processing of RNA

C. Translation
   1. Amino acid and protein structure
   2. Experimental determination of the genetic code
   3. Structure of the prokaryotic and eukaryotic ribosomes
   4. Proteins and RNA sequences involved in initiation, elongation, and termination of translation
   5. Post-translational processing of prokaryotic and eukaryotic proteins

D. Transmission Genetics
   1. Experiments of Gregor Mendel and Mendel's laws
   2. Probability theory
   3. Chi-square analysis

E. Cell Division and the Chromosomal theory of heredity
    1. Mitosis
    2. Meiosis
    3. Experiments supporting the chromosomal theory of heredity
    4. Genetics of sex-determination
    5. Sex-linked inheritance
F. Inheritance patterns and gene interaction
    1. Dominance and recessiveness
    2. Incomplete dominance
    3. Multiple alleles and allelic series
    4. Lethal alleles
    5. Incomplete penetrance and variable expressivity
    6. Gene interactions in pathways
    7. Complementation testing
    8. Epistasis
G. Genetic Linkage and Mapping in Eukaryotes
    1. Crossing over
    2. Recombination mapping
H. Genetic Analysis and Mapping in Bacteria and Bacteriophages
    1. Conjugation
    2. Transformation
    3. Transduction
    4. Lateral gene transfer
I. Regulation of gene expression in Bacteria
    1. The Lac operon
    2. The Ara C operon
    3. The Trp operon
J. Regulation of gene expression in Eukaryotes
    1. DNA sequences and proteins involved in gene regulation
    2. Chromatin remodeling
    3. RNAi