

Course discipline/number/title: BIOL 2300: Genetics

A. CATALOG DESCRIPTION

1. Credits: 4
2. Hours/Week: 3 hours lecture and 2 hours lab per week
3. Prerequisites (Course discipline/number): BIOL 1220 and either CHEM 1127 or PHYS 1117
4. Other requirements: None
5. MnTC Goals (if any): Goal 3/Natural Sciences

B. COURSE DESCRIPTION: This course presents the fundamental concepts of classical transmission genetics and modern molecular genetics. Topics include Mendelian genetics, linkage and mapping, chromosomal anomalies, population and evolutionary genetics, biotechnology and nucleic acid analysis.

C. DATE LAST REVISED (Month, year): December, 2021

D. OUTLINE OF MAJOR CONTENT AREAS:

1. Cell reproduction
 - a) Mitosis and the cell cycle
 - b) Meiosis and gametogenesis
2. Mendelian genetics
 - a) Mono- and dihybrid crosses
 - b) Probability
 - c) Allelic systems resulting in modified Mendelian ratios
3. Linkage and recombination
 - a) Three-point crosses
 - b) Gene mapping
4. Chromosome variations
 - a) Sex determination
 - b) Chromosome structure and number anomalies
5. Molecular genetics
 - a) DNA structure
 - b) Replication
 - c) Transcription
 - d) Translation
 - e) Mutation and mutagenesis
6. Biotechnology
 - a) Restriction enzymes
 - b) Gene cloning
 - c) Electrophoretic analysis of nucleic acids
 - d) DNA Sequencing
 - e) Polymerase chain reaction
 - f) CRISPR-Cas9 system
7. Population and evolutionary genetics
 - a) Allele frequencies, genotype frequencies, Hardy-Weinberg equilibrium
 - b) Evolutionary forces, including natural selection and random genetic drift
 - c) Speciation

E. LEARNING OUTCOMES (GENERAL): The student will be able to:

1. Solve one-, two- and three-factor crosses involving both linked and unlinked genes.
2. Apply the concepts of probability to the statistical analysis of cross data.

- E. **LEARNING OUTCOMES (GENERAL):** The student will be able to: Continued. . .
3. Describe the ways in which genes and gene products interact to produce phenotypes.
 4. Describe the molecular processes of DNA replication and of transcription and translation.
 5. Explain the basic methods of nucleic acid analysis and gene cloning.
 6. Evaluate the genetics of populations and the resulting evolutionary forces.
- F. **LEARNING OUTCOMES (MNTC):**
Goal 3/Natural Sciences: The student will be able to:
1. Demonstrate understanding of scientific theories.
 2. Formulate and test hypotheses by performing laboratory or simulation experiments requiring the collection of data and its graphical analysis; gain an appreciation of uncertainty and sources of error in data collection and analysis.
 3. Communicate their experimental findings, analyses, and interpretations both orally and in writing.
- G. **METHODS FOR EVALUATION OF STUDENT LEARNING:** Methods may include but are not limited to:
1. A lecture exam for each of the major units covered.
 2. A written laboratory report is required for several of the laboratory exercises
- H. **RCTC CORE OUTCOME(S).** This course contributes to meeting the following RCTC Core Outcome(s):
Critical Thinking. Students will think systematically and explore information thoroughly before accepting or formulating a position or conclusion.
- I. **SPECIAL INFORMATION (if any):**
The initial lab session explains and familiarizes the student with general safety hazards and safety equipment in the lab. During the pre-lab discussion, the hazardous characteristics of any materials used during the lab are discussed. In addition, if the lab involves any potentially infectious material, the students will be instructed on the proper use and disposal. The instructor will direct all students to wear necessary protective equipment while working with any hazardous chemicals. A copy of Material Safety Data Sheets for chemicals used is available in the online.