

**JEFFERSON COLLEGE**

**COURSE SYLLABUS**

**BIO201**

**GENETICS**

4 Credit Hours

Prepared By:  
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Revised By:  
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Minor Revision or Update by: Fran Moore  
Per Curriculum Committee Process Change: April 25, 2018

Ms. Constance Kuchar, Interim Division Chair, Math & Science  
Ms. Shirley Davenport, Dean, Arts & Science Education

## BIO201 Genetics

### I. CATALOG DESCRIPTION

- A. Prerequisites:
- BIO101, BIO205, or BIO206
  - CHM111
  - Reading proficiency
- B. 4 semester hours credit (3 credit hours lecture, 1 credit hour lab)
- C. Genetics explores the molecular basis for life. The structure/ function and means of expression of the gene and its basis as the unit of heredity are included. Classical Mendelian genetics, as well as modern molecular biological techniques and interpretations of genetic data will be considered, particularly as they apply to humans, plants, and animals. Laboratory time is required. (D)
- D. Curricular alignment: Elective course applies toward AA or AAT degree.

### II. EXPECTED LEARNING OUTCOMES/CORRESPONDING ASSESSMENT MEASURES

Expected Learning Outcomes	Assessment Measures
Outline the process by which the genetic information stored in DNA is actualized in protein	Homework, quizzes, and exams
Diagram the cell cycle and list the different general steps that occur during meiosis and mitosis	Homework, quizzes, and exams
Given sufficient numbers of alleles, perform Mendelian monohybrid, di-hybrid, and tri-hybrid crosses	Homework, quizzes, and exams
Interpret the significance of non-Mendelian phenotypic ratios with regard to, but not limited to such factors as linkage and co-dominance	Homework, quizzes, and exams
Discuss the role that mutagens and teratogens play in DNA damage, oncogenesis, and human disease, as well as the DNA repair mechanisms commonly utilized by organisms to correct such genetic damage	Homework, quizzes, and exams
Discuss different possible means of gene regulation such as those found in the lac and TRP operons	Homework, quizzes, and exams
Diagram the process of DNA cloning and explain how it relates to biotechnology	Homework, quizzes, and exams

### III. OUTLINE OF TOPICS

- A. Introduction
  - 1. Chemistry
    - a. Chemical bonds
    - b. Intermolecular forces
  - 2. Biomolecules (general)
  - 3. Classical breeding
  - 4. Biotechnology
  
- B. Cell cycle
  - 1. Mitosis
  - 2. Meiosis
  
- C. Classical genetics and variation
  - 1. Patterns of inheritance
    - a. Mono, di, and tri-hybrid crosses
    - b. Pedigrees
  - 2. Probability and chi-squared analysis
  
- D. Non-Mendelian genetic variation
  - 1. Allelic variations and phenotypic expression
    - a. Co-dominance
    - b. Incomplete dominance
    - c. Lethals
    - d. Sex-linkage
  - 2. Extranuclear inheritance
  
- E. Sex determination and sex chromosomes
  
- F. Polygenic inheritance
  
- G. Chromosomal mutations
  - 1. Chromosomal non-disjunction
    - a. Monosomy and Trisomy
    - b. Polyploidy
  - 2. Mutations due to structure and arrangement
    - a. Deletions
    - b. Duplications

- c. Inversions
  - d. Fragile sites
  
- H. Chromosome mapping and linkage
  - 1. Eukaryotes
    - a. Crossing over
    - b. Lod score analysis
  - 2. Prokaryotes and genetic recombination
    - a. Conjugation
    - b. Transformation
    - c. Transduction
  
- I. DNA structure and analysis
  - 1. Scientific developments leading to DNA a genetic material
    - a. Structure leads to function in DNA
    - b. RNA as material for heredity (retroviruses)
  - 2. Chromosomal structure
    - a. Bacterial and viral
    - b. Eukaryotic
  
- J. DNA replication and synthesis
  - 1. Semi-conservative model
  - 2. Controls in synthesis
  - 3. Replication in Prokaryotes
  - 4. Replication in Eukaryotes
  
- K. Transcription
  - 1. Discovery of the genetic code
  - 2. Mechanism of transcription
  
- L. Translation
  - 1. Prokaryotes
  - 2. Eukaryotes
  - 3. One gene, one enzyme, one polypeptide
  - 4. Post-translational modification of polypeptides
  
- M. Regulation of gene expression
  - 1. Prokaryotic systems
    - a. Lac ZYA operon
    - b. TRP operon

2. Eukaryotic systems
  3. Post transcriptional modification
- N. Mutation and DNA repair
1. Means of mutagenesis/mutagenic agents
  2. Mechanisms of DNA repair
    - a. Photo-reactivation repair
    - b. Excision repair
    - c. Mismatch repair
    - d. SOS repair
- O. Recombinant DNA technology
1. Construction of a clone
  2. Cloning in prokaryotes
  3. Cloning in eukaryotes
  4. Tools to facilitate cloning
- P. Applications and ethics in biotechnology
1. Pharmacogenomics
  2. Disease diagnosis
  3. Gene therapy
  4. Ethical concerns
- Q. Population genetics
1. Gene pools and allelic frequencies
  2. Hardy-Weinberg law
  3. Natural selection
  4. Genetic drift
- R. Genes and development

#### IV. METHODS OF INSTRUCTION

- A. Lecture
- B. Group discussion
- C. Video

- D. Assisted small group work
- E. Computer driven web-based exercises

V. REQUIRED TEXTBOOKS

Klug, William S.; *Essentials of Genetics*, (current edition), Pearson.

Mertens, Thomas R.; *Genetics Laboratory Investigations*, (current edition), Pearson.

VI. REQUIRED MATERIALS

Scientific calculator

VII. SUPPLEMENTAL REFERENCES

None

VIII. METHODS OF EVALUATION

- A. Exam 40%
- B. Quizzes 15%
- C. Term paper 10%
- D. Problem sets 15%
- E. Final 20%

IX. ADA AA STATEMENT

Any student requiring special accommodations should inform the instructor and the Coordinator of Disability Support Services (Library; phone 636-481-3169).

X. ACADEMIC HONESTY STATEMENT

All students are responsible for complying with campus policies as stated in the Student Handbook (see college website, <http://www.jeffco.edu>).

## XI. ATTENDANCE STATEMENT

Regular and punctual attendance is expected of all students. Any one of these four options may result in the student being removed from the class and an administrative withdrawal being processed: (1) Student fails to begin class; (2) Student ceases participation for at least two consecutive weeks; (3) Student misses 15 percent or more of the coursework; and/or (4) Student misses 15 percent or more of the course as defined by the instructor. Students earn their financial aid by regularly attending and actively participating in their coursework. If a student does not actively participate, he/she may have to return financial aid funds. Consult the College Catalog or a Student Financial Services representative for more details.

## XII. OUTSIDE OF CLASS ACADEMICALLY RELATED ACTIVITIES

The U.S. Department of Education mandates that students be made aware of expectations regarding coursework to be completed outside the classroom. Students are expected to spend substantial time outside of class meetings engaging in academically related activities such as reading, studying, and completing assignments. Specifically, time spent on academically related activities outside of class combined with time spent in class meetings is expected to be a minimum of 37.5 hours over the duration of the term for each credit hour.