

SPRINGFIELD TECHNICAL COMMUNITY COLLEGE

ACADEMIC AFFAIRS

Course Number: BIOL 360 Department: Biology

Course Title: Genetics Semester: Fall Year: 1998

Objectives/Competencies

Course Objective	Competencies
1. Understand the relationship and organization of the three major areas of Genetics	1. Explain the level of investigation used in Classical, Molecular and Evolutionary Genetics
2. Understand the molecular (DNA) basis of Heredity	1. Explain the rationale and the design of the classical experiments demonstrating DNA as hereditary material
3. Understand the structure of the DNA molecule	1. Diagram and predict structure of hypothetical DNA molecules based upon simple observable features of the molecule. 2. Explain how the structure of DNA is critical for its role in heredity
4. Understanding of the process of DNA Replication	1. Explain the process of DNA replication 2. Interpret results of experiments performed to determine the nature of the replication process 3. Design experiments to investigate the mechanism of DNA replication

Course Objective	Competencies
5. Understand the chromosomal basis of heredity	<ol style="list-style-type: none"> 1. Track the assortment of genes on chromosomes through the processes of Mitosis and Meiosis 2. Predict the types and ratios of gametes produced through Meiosis based upon genetic composition
6. Understand the work of Gregor Mendel and Classical Genetic Analysis	<ol style="list-style-type: none"> 1. Describe the design and interpretation of Mendel's first experiments 2. List and describe each of Mendel's three principles of inheritance 3. Describe how each principle allows for the prediction of phenotypic ratios among offspring 4. Solve problems based upon the observation of traits amongst parental, first and second generation organisms
7. Understand the application of statistics to the analysis of genetic systems	<ol style="list-style-type: none"> 1. Apply simple probability rules to solve problems 2. Implement Chi-square analysis to determine validity of a set of data
8. Understand how alterations to Mendelian principles affect the inheritance of observable traits	<ol style="list-style-type: none"> 1. Analyze data and determine if traits display discontinuous variation, continuous variation, sex-linkage, aneuploidy, or polypoidy based upon the numbers and ratios of organisms displaying a given phenotype.

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9. Understand the mechanisms responsible for producing abnormalities associated with ploidy number	<ol style="list-style-type: none">1. Summarize key events in meiosis (I or II) which can result in the alteration of chromosome number during gamete production.2. Compare and contrast the effects of variation in ploidy number for given autosomes and sex chromosomes
10. Understand the mechanisms responsible for producing alterations in DNA structure and the production of new alleles.	<ol style="list-style-type: none">1. Summarize the different agents which can cause DNA mutation2. Summarize the processes involved in DNA repair, including the enzymes involved and how their effectiveness is limited3. Describe the process of DNA recombination4. Describe how DNA recombination can lead to enhanced genetic diversity5. Explain the theories behind the reliance organisms place on genetic diversity for survival
11. Understand the process of Genetic Recombination and the use of Genetic Mapping	<ol style="list-style-type: none">1. Analyze recombinant patterns and determine the sequence and distance between a set of genes.2. Predict the effect of mapping distances on the production of new phenotypes in a cross

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12. Understand the genetics of Cancer	<ol style="list-style-type: none">1. Summarize the relationship between key regulatory elements in the cell cycle2. Describe the effects of altering the effectiveness of a regulatory element3. Predict the mode of inheritance of hypothetical cancer genes
12. Understand the key principles in the field of Population Genetics	<ol style="list-style-type: none">1. Apply the Hardy-Weinberg law to determine whether alleles within a population are in equilibrium2. Predict the effects on the frequency of a particular allele in two population if the populations were mixed3. Summarize the assumptions which must be made to apply Hardy-Weinberg to a particular population4. Predict the effects of violating one of the H-W assumptions on allele frequency in a population
13. Understand the impact of modern technology on the field of Genetics	<ol style="list-style-type: none">1. Summarize the benefits of computer technologies, molecular technologies and medical technologies for understanding the genetics of disease2. Design hypothetical experiments and/or drugs to combat certain genetic diseases3. Describe the qualities which make a genetic disease ideal for fighting with genetic technology (e.g. Gene Therapy)

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14. Master laboratory procedures used in genetic analysis	<ol style="list-style-type: none">1. Proficiency with the purification of DNA and the ability to transform the phenotype of an organism using DNA2. Skill in the analysis of phenotypic ratios amongst offspring to determine the mechanism of inheritance for particular genes (or traits)3. Proficiency in the use and implementation of the Virtual Fruit Fly Lab to analyze the inheritance patterns of several key traits in <i>Drosophila</i> fruit flies4. Explain and demonstrate the difference between monogenic and polygenic modes of inheritance in human traits5. Proficiency in performing molecular genetic analysis (DNA fingerprinting and PCR analysis)6. Proficiency in performing pedigree analysis to determine the mode of inheritance of human diseases and calculating probability of propagation of the disease in subsequent generations7. Skill in performing and analyzing genetic recombination in fungi8. Skill in assaying the effects of mutagenesis on the phenotype of bacterial cells