Fall 2016

Bio 256
General Genetics

Faculty Name: Bryan Schaubach, Ph.D.

Program Head: Enter Program Head Here

Dean's Review:

Dean's Signature: _____Date Reviewed: ___/___/_____

Revised: Fall 2016

VIRGINIA WESTERN COMMUNITY COLLEGE
PO Box 14007
Roanoke, VA 24038
(540)-857-7273

Bio 256
General Genetics

COURSE OUTLINE

Prerequisites:

Bio 101 and Bio 102 or equivalent

Course Description:

Explores the principles of genetics ranging from classical Mendelian inheritance to the most recent advances in the biochemical nature and function of the gene. Includes experimental design and statistical analysis.

Semester Credits: 4 **Lecture Hours: 3 Lab/Recitation Hours: 3**

Course Outcomes

At the completion of this course, the student should be able to:

- Applying the process of science as it relates to genetics
- Correctly utilize the language associated with Mendelian Genetics, Molecular Genetics, and Genetic Technologies
- Using quantitative approaches to understand basic statistical techniques as they apply to the genetics of individuals and populations
- Develop the ability to use sound scientific argumentation
- Critical usage of online resources and tools
- Practicing the communication of science through a variety of formal and informal written, visual, and oral methods (aligning with Brewer, Carol A., and Diane Smith. "Vision and change in undergraduate biology education: a call to action." American Association for the Advancement of Science, Washington, DC (2011)).

VIRGINIA WESTERN COMMUNITY COLLEGE
PO Box 14007
Roanoke, VA 24038
(540)-857-7273

Bio 256, General Genetics

Required Materials:

Textbook:

1. *Genetics, Analysis & Principles*, R. J. Brooker, 5E, McGraw Hill Education
   ISBN: 9780073525341
2. Access to McGraw-Hill Connect website.

VIRGINIA WESTERN COMMUNITY COLLEGE
PO Box 14007
Roanoke, VA 24038
(540)-857-7273

Bio 256, General Genetics

Topical Description:

Part I – Mendelian Genetics

Chapter 2: Mendelian Inheritance (Week 1)

- Mendel's Study of Pea Plants
- Law of Segregation
- Law of Independent Assortment
- Studying Inheritance Patterns in Humans

Chapter 3: Chromosome Transmission During Cell Division (Week 1-2)

- General Features of Chromosomes

Chapter 4: Extensions of Mendelian Inheritance (Week 2)

- Dominant and Recessive Alleles
- Environment Effects on Gene Expression
- Incomplete Dominance, Overdominance, and Codominance
- X-linked Inheritance
- Sex-Influenced and Sex-Limited Inheritance
- Lethal Alleles
- Pleiotropy
- Gene Interactions

Chapter 5: Non-Mendelian Inheritance (Week 3)

- Maternal Effect
- Epigenetic Inheritance
    - Dosage Compensation
    - Genomic Imprinting
- Extranuclear Inheritance

Chapter 6: Genetic Linkage and Mapping in Eukaryotes (Week 3-4)

- Overview of Linkage
- Relationship between Linkage and Crossing Over
- Genetic Mapping in Plants and Animals
- Genetic Mapping in Haploid Eukaryotes

VIRGINIA WESTERN COMMUNITY COLLEGE
PO Box 14007
Roanoke, VA 24038
(540)-857-7273

- Mitotic Recombination

Chapter 8: Variation in Chromosome Structure and Number (Week 5)

- Microscopic Examination of Eukaryotic Chromosomes
- Changes in Chromosome Structure: An Overview
- Deletions and Duplications
- Inversions and Translocations
- Changes in Chromosome Number
- Variation in the Number of Chromosomes Within a Set: Aneuploidy
- Variation in the Number of Sets of Chromosomes
- Natural and Experimental Mechanisms That Produce Variation in Chromosome Number

Part II – Molecular Genetics

Chapter 9: Molecular Structure of DNA and RNA (Week 6)

- Identification of DNA as the Genetic Material
- Overview of DNA and RNA Structure
- Nucleotide Structure
- Structure of a DNA Strand
- Discovery of the Double Helix
- Structure of the DNA Double Helix
- RNA Structure

Chapter 10: Chromosome Organization and Molecular Structure (Week 7)

- Structure of Eukaryotic Chromosomes in Non-dividing Cells
- Structure of Eukaryotic Chromosomes During Cell Division

Chapter 11: DNA Replication (Week 7-8)

- Structural Overview of DNA Replication
- Bacterial DNA Replication: The Formation of the Two Replication Forks at the Origin of Replication
- Bacterial DNA Replication: Synthesis of New DNA Strands
- Bacterial DNA Replication: Chemistry and Accuracy
- Eukaryotic DNA Replication

Chapter 12: Gene Transcription and RNA Modification (Week 8)

- Overview of Transcription
- Transcription in Bacteria
- Transcription in Eukaryotes
- RNA Modification
- A Comparison of Transcription and RNA Modification in Bacteria and Eukaryotes

Chapter 13: Translation of mRNA (Week 8-9)

- The Genetic Basis for Protein Synthesis
- The Relationship Between the Genetic Code and Protein Synthesis
- Experimental Determination of the Genetic Code
- Structure and Function of tRNA
- Ribosome Structure and Assembly
- Stages of Translation

Chapter 14: Gene Regulation in Bacteria (Week 10)

- Overview of Transcriptional Regulation
- Regulation of the lac Operon
- Regulation of the trp Operon
- Translation and Post-Translational Regulation
- Riboswitches

Chapter 15: Gene Regulation in Eukaryotes I (Week 10-11)

- Regulatory Transcription Factors
- Chromatin Remodeling, Histone Variation, and Histone Modification
- DNA Methylation
- Insulators

Chapter 16: Gene Regulation in Eukaryotes II (Week 11-12)

- Overview of Epigenetics
- Epigenetics and Development
- Epigenetics and Environmental Agents
- Regulation of RNA Splicing, RNA Stability, and Translation

Chapter 17: Genetics of Viruses (Week 12-13)

- Virus Structure and Genetic Composition
- Overview of Viral Reproductive Cycle
- HIV Reproductive Cycle

Chapter 18: Gene Mutation and DNA Repair (Week 14)

- Effects of Mutations on Gene Structure and Function
- Random Nature of Mutations
- Spontaneous Mutations
- Induced Mutations
- DNA Repair

Chapter 21: Biotechnology (Week 15)

- Uses of Microorganisms in Biotechnology
- Genetically Modified Animals
- Reproductive Cloning and Stem Cells
- Genetically Modified Plants
- Human Gene Therapy

Laboratory Topics

- Week 1: Introduction, Review of Mitosis, Meiosis, Cell Division, etc.
- Week 2: Statistics and Probability
- Week 3: Online Resources (PubMed, OMIM, etc.)
- Week 4: Recitation in Epigenetics
- Week 5: Exploring DNA Technologies
- Week 6: Medical Genetics and Cancer
- Week 7: Medical Genetics and Cancer
- Week 8: CRISPR
- Week 9: Recitation
- Week 10: Recitation
- Week 11: Population Genetics
- Week 12: Recitation
- Week 13: Project Preparation and recitation
- Week 14: Student Presentations
- Week 15: Student Presentations

VIRGINIA WESTERN COMMUNITY COLLEGE
PO Box 14007
Roanoke, VA 24038
(540)-857-7273