

**BIO K260: Principles of Genetics, Spring 2016**  
**Three Rivers Community College, Norwich, CT**

**Instructor: Sarah B. Selke, Ph.D.**

**Office Hours (C214): Mondays 1:15pm – 2:45pm, Tuesdays 2:30pm – 4pm**

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**Required Text:** Essentials of Genetics, 9<sup>th</sup> edition. 2016. Klug, Cummings, Spencer & Palladino. Published by Pearson.

Access code to MasteringGenetics is required.

This course is a web-enhanced course and will use both the MasteringGenetics and Blackboard websites.

[www.masteringgenetics.com](http://www.masteringgenetics.com), Course ID is GENETICSSELKESPRING2016 (Genetics Selke Spring 2016, all CAPS, no spaces)

**Course Prerequisites:**

BIO 121, CHE 111 or CHE 112, ENG 101 or ENG 101S, MAT 137 or MAT 137S, all courses passed with a “C” grade or better.

**Course Description:**

This course is designed to cover the basic concepts of genetics including the theory of chromosomal inheritance, classical Mendelian inheritance, principles of human genetics, the genetic code, the role of nucleic acids in gene expression, genetic mutations, and topics in modern genetics in areas such as epigenetics, recombinant DNA, biotechnology, gene mapping and diagnosis of human genetic diseases.

Course Objectives: To aid the student in developing:

- Critical thinking skills.
- An understanding of basic genetic principles.
- An understanding of some important implications of genetics on the welfare of the human individual.
- An understanding the interaction between the inheritance of genetic traits and environmental influences.
- An understanding of the vast amount of research that is being done in the field of genetics.
- To encourage students to become more knowledgeable about the interrelationship between genetics and other phases of biology.

Upon completion of this course, the student will be able to recognize terminology, specific biological facts, and utilize general principles associated with the genetic organization of living things. This course also stresses critical thinking skills which are designed to allow the student to: develop more meaningful learning beyond rote memorization; extend beyond lower levels of learning (knowledge and comprehension) to higher levels of learning (application, analysis, synthesis and evaluation); apply concepts and principles to real world experience and situations; and enhance problem solving skills.

### **Attendance Policy:**

Attendance at all class sessions is required. If a class is missed due to circumstances beyond your control, please be sure to notify your instructor and make the necessary arrangements **with a classmate** for obtaining the notes. **You will be responsible** for the material.

Electronic devices (cell phones, pagers etc.) will be put in “Silent Mode” or turned off while class is in session.

### **Grading Overview:**

Your final course grade will be based on:

4 midterm exams @ 100 points each

1 paper (Special Topics)

12 homework assignments (Primary Content) @ 20 points each

Total points = 740 points

**No individual extra credit assignments will be given.**

- **Primary Content Homework Assignments (240 points)**

There is a homework assignment on MasteringGenetics for each Primary Content chapter (Chapters 1 – 7, 9 – 15, 21 and 22). You are required to complete 12 of the 16 assignments. If you complete more than 12 assignments, I will count the 12 assignments with the highest grades. Assignments are completed online at MasteringGenetics, the textbook website. Assignments **are open-book and time-unlimited**. You will see your grade and the correct answers after the assignment due date.

- **Tests (400 points)**

There are four tests worth 100 points each for a total of 400 points. Each test will consist of a variety of types of questions including multiple-choice questions, short answer, true and false and essay questions.

There is no final exam for this course.

**A #2 pencil is required for each test.** This item will not be supplied in class.

- **Special Topics paper (100 points)**

You will write a paper on one of the following topics:

- Genetics of Cancer, Recombinant DNA Technology, Genomics, Bioinformatics & Proteomics, Genetic Engineering and Biotechnology, Applications and Ethics of Genetic Engineering and Biotechnology, Epigenetics, DNA Forensics, Genomic and Personalized Medicine, Genetically Modified Food, Gene Therapy, Stem Cells, CRISPR
- Or other topic approved by the instructor

All topics must be approved in advance by the instructor. Paper topics are due Tuesday, 3/29. Preference will be given to topics NOT covered in lecture. Two students may not select the same topic.

An outline worth 10 points is due Tuesday 4/26. The paper (worth 90 points) is due Thursday, 5/5,

### **How to calculate your grade:**

To determine your grade, I suggest creating 2 columns of scores. The first is the number of points each assignment is worth; the second is the points you earned on that assignment. To determine your grade, add up each column and divide **your points** by the **total points**.

A partial example:

<b>Maximum number of points</b>	<b>Points I earned</b>
20 (homework assignment)	18
100 (test)	84
Total = 120	Total = 102

$$102/120 = 0.85 = 85\% = B$$

### **Make-ups:**

Make-up exams will be granted on an individual basis only following a conference with the instructor. **All make-up tests must be completed within a week of the original exam date.** Please be aware that the format of any makeup exam is at the discretion of the instructor. The format could be the same, oral, essay or other, depending on the circumstances. It may not be the same exam taken by the rest of the students in the class.

### **Final Grade:**

93.5-100.0 = A	77.5-79.4 = C+
89.5-93.4 = A-	73.5-77.4 = C
87.5-89.4 = B+	69.5-73.4 = C-
83.5-87.4 = B	63.5-69.4 = D+
79.5-83.4 = B-	59.5-63.4 = D
	00.0-59.4 = F

### **College Withdrawal Policy:**

The last day to withdraw is **May 9<sup>th</sup>**. Students who do not withdraw but stop attending class **will receive** a grade of "F" for the final grade. **Verbal withdrawals cannot be accepted.**

### **Accommodations for Disabilities:**

If you need assistance or modification of class procedure owing to any type of disability, please let me know so that arrangements for accommodation can be made. In order to receive accommodations, you must register with one of the learning specialists in the Student Services Development Center.

### **Academic Misconduct:**

Academic dishonesty and plagiarism will not be tolerated. Plagiarism, cheating, or any form of academic dishonesty is **prohibited**. Plagiarism includes any instance of copying words or ideas from another person (ie. another student, author of a book, internet resource etc.) without properly acknowledging the source. Students guilty of academic dishonesty directly or indirectly will receive a **zero** for an exercise or exam and may receive an **F** for the course in addition to

other possible disciplinary sanctions that maybe imposed through the regular institutional procedures.

**Blackboard Learn & your TRCC email address:**

Your Blackboard Learn courses are automatically connected to your college-provided email account. For more information about this email account, visit the college home page and click the "New student email" button. This email account is the only official electronic means that the college will communicate course and non-emergency information to you. Make sure that you check it weekly at a minimum. Another option is to set up to forward your email from the college address to your preferred address. **Important class information is frequently communicated through the Blackboard Learn email function.**

**myCommNet Alert:**

myCommNet Alert is a system that sends text messages and emails to anyone signed up in the event of a campus emergency. Additionally, TRCC sends messages when the college is delayed or closed due to weather. All students are encouraged to sign up for myCommNet Alert. A tutorial is available on the Educational Technology and Distance Learning Students page of the web site.

[http://www.trcc.commnet.edu/div\\_it/educationaltechnology/Tutorials/myCommNetAlert/MIR3.html](http://www.trcc.commnet.edu/div_it/educationaltechnology/Tutorials/myCommNetAlert/MIR3.html)

**Digication:**

As a student you will maintain an online learning portfolio using a college-designed template in Digication. Through this electronic tool you will have the opportunity to monitor your own growth in college-wide learning. It may even help you determine a major that is best suited to you. You will be able to keep and maintain your learning portfolio after graduation. A Three Rivers General Education Assessment Team will select and review random works to improve the college experience for all. If your work is selected and reviewed for assessment purposes, it will remain anonymous and private. Digication provides a "place" where you will connect your learning from the classroom, college, and life in general. Sometimes when you review all of the work you have done and think about it, you end up learning something different and perhaps unexpected. Please review your course outlines to determine what assignments to upload into the TRCC Digication template and please post your own choices, as well. Have fun in learning!

**BIO 260 Genetics Spring 2016 Class Schedule\***

<b>Day</b>	<b>Date</b>	<b>Topic</b>	<b>Textbook Chapter</b>	<b>Organization of course material</b>
1	R 1/21	Introduction	1	<p><b><u>16 areas of primary content</u></b></p> <ul style="list-style-type: none"> <li>Chapters 1 – 7, 9 – 15, 21 &amp; 22</li> <li>Begin Day 1, complete no later than Day 23</li> </ul>
2	T 1/26	Mitosis & Meiosis	2	
3	R 1/28	Mendelian Genetics	3	
4	T 2/2			
5	R 2/4			
6	T 2/9			
7	R 2/11			
8	T 2/16	<b>TEST 1</b>		
9	R 2/18			
10	T 2/23			
11	R 2/25			
12	T 3/1			
13	R 3/3			
14	T 3/8			
15	R 3/10			
16	T 3/15	<b>TEST 2</b>		
17	R 3/17			
		SPRING BREAK		
18	T 3/29	<b>Paper topic due</b>		
19	R 3/31			
20	T 4/5			
21	R 4/7			
22	T 4/12			
23	R 4/14	Latest day to complete primary content		
24	T 4/19	<b>TEST 3</b>		
25	R 4/21	Latest day to begin special topics		
26	T 4/26	<b>Outline of paper due</b>		
27	R 4/28			
28	T 5/3			
29	R 5/5	<b>Paper due</b>		
30	T 5/10			
31	R 5/12	<b>TEST 4</b>		

\* Changes to this schedule will be announced in class.

## **Course Objectives: BIO 260 Genetics**

At the end of this course, the student will

1. be able to describe the scientific method through examples.
2. develop an understanding of Genetics as it relates to other sciences and its relevance to human civilizations.
3. demonstrate knowledge of the cell cycle of growth and the phases of mitosis.
4. be able to define meiosis and explain its purpose as related to inheritance.
5. be able to relate the process of meiosis to gametogenesis in both plant and animal cells.
6. demonstrate knowledge of the chromosome and gene chemistry.
7. be able to explain the role of genes in inheritance and how they are passed from one generation to the next.
8. demonstrate knowledge of the Mendelian Laws of Genetics.
9. be able to explain the relationship between genetics and probability.
10. demonstrate knowledge of various forms of gene interaction.
11. be able to describe how chromosomes control the inheritance of sex.
12. demonstrate knowledge of qualitative and quantitative inheritance.
13. be able to describe the patterns of sex-linked traits.
14. be able to explain the relationship between linked genes and crossing over.
15. be able to define chromosomal variation and explain their effects on inheritable traits.
16. be able to define non-disjunction and explain its consequences.
17. be able to define the role of DNA and RNA in inheritance.
18. be able to explain gene regulation in eukaryotic/prokaryotic cells.
19. be able to describe forms and effects of genetic modifications and mutations.
20. be able to describe the relationship of genetics to the development, evolution and physiology of eukaryotes/prokaryotes.
21. demonstrate knowledge of extra chromosomal inheritance.
22. gain an understanding of the human impact on natural selection.
23. gain an understanding of population genetics.
24. be able to discuss some common forms of human genetic diseases.
25. be able to describe the theories of recombinant DNA.

## BIO 260 Principles of Genetics - TOPICAL OUTLINE

Note: This outline matches the content, but not the organization of our textbook this semester. Numbers in parentheses refer to chapters in Essentials of Genetics, 9<sup>th</sup> edition by Klug et al.

### Unit One

#### I) Introduction (**Chapters 1, 2, 9, 11**)

- A) What is Genetics? (**Chapter 1**)
  - 1. Genetics and the Geneticist
  - 2. Early beliefs about heredity
  - 3. Common questions about heredity
- B) Cells, Genes and Chromosomes
  - 1. Prokaryotic cells (**Chapter 2**)
  - 2. Eukaryotic cells (**Chapter 2**)
  - 3. The Chemistry of DNA (**Chapter 9**)
  - 4. The Chemistry of RNA (**Chapter 11**)
  - 5. Nucleoproteins
  - 6. Genes
  - 7. Chromosomes (**Chapter 2**)
    - a) euchromatic region
    - b) heterochromatic region
    - c) centrosome
    - d) centromeres
    - e) telomeres

#### II) The Physical Basis of Heredity (**Chapter 2**)

- A) The Cell and Mitosis
  - 1. The Cell's nucleus
  - 2. The Cell's cycle of growth
    - a) growth phase 1 (G<sub>1</sub> phase)
    - b) synthesis phase (S phase)
    - c) growth phase 2 (G<sub>2</sub> phase)
  - 3. Mitosis defined
  - 4. The purpose of mitosis
  - 5. Interphase
  - 6. The phases of mitosis
    - a) prophase
    - b) metaphase
    - c) anaphase
    - d) telophase
  - 7. The daughter cells

III) Cells with a Sex Life (**Chapter 2**)

- A) Sex Development
- B) Meiosis defined
- C) Reduction Division (Meiosis I)
  - 1. Prophase I
  - 2. Metaphase I
  - 3. Anaphase I
  - 4. Telophase I
  - 5. Interphase
- D) Equational Division (Meiosis II)
  - 1. Prophase II
  - 2. Metaphase II
  - 3. Anaphase II
  - 4. Telophase II
  - 5. Daughter cells
- E) Gametogenesis

IV) How Traits are Inherited (**Chapter 3**)

- A) Mendel's studies
- B) The Law of "Segregation of Gametes"
- C) Monohybrid crosses
  - 1. Homologous Chromosomes
  - 2. Genes (alleles)
  - 3. Genotype – Homozygous genes (alleles)
  - 4. Genotype – Heterozygous genes (alleles)
  - 5. Dominant genes
  - 6. Recessive genes
  - 7. The punnett square
  - 8. Parent or P<sub>1</sub> generation
  - 9. First filial or F<sub>1</sub> generation
  - 10. Second filial or F<sub>2</sub> generation
  - 11. Genotypical and Phenotypical ratios
  - 12. Human heredity
    - a) genes in families
    - b) inborn errors of enzyme function
    - c) hemoglobin synthesis and development
    - d) isozymes
- D) The Law of "Independent Assortment"
- E) Dihybrid Crosses
  - 1. Gamete classes
  - 2. The punnett square
  - 3. Phenotypical ratio
  - 4. Genotypical ratio
- F) Probability
- G) Chi-square



## Unit Two

### I) Varieties of Gene Expression (**Chapter 4**)

- A) Incomplete or intermediate dominance
- B) Codominance
- C) Epistasis and Epistatic genes
  - 1. Single recessive epistasis
  - 2. Duplicate recessive epistasis
  - 3. Single dominant epistasis
  - 4. Duplicate dominant epistasis
  - 5. Intermediate epistasis
- D) Complementary genes
- E) Supplementary genes
- F) Lethal genes
- G) Environmental modification of gene expression

### II) Sex Determination and Sex Linked Traits (**Chapter 5**)

- A) Sex determining chromosomes
  - 1. The genetic basis for sex determination
  - 2. Sex chromosomal configuration in representative diploid forms
- B) Sex-linked Traits
  - 1. Patterns of inheritance of sex linked traits
  - 2. Autosomal traits that are influenced by sex (gender).
- C) Abnormal sex types in Humans
  - 1. Klinefelter's syndrome
  - 2. Turner's syndrome
  - 3. Androgen insensitivity syndrome
  - 4. Other types

### III) The Measurements of Gene Expression (**Chapters 4 and 21**)

- A) Qualitative inheritance
- B) Quantitative inheritance
  - 1. Polygenetic inheritance (**Chapter 21**)
  - 2. Multiple alleles (**Chapter 4**)
    - a) Genetics of human blood groups
    - b) Other examples of traits determine by multiple alleles

IV) Autosomal Linkage, Crossing Over and Chromosome Mapping (**Chapter 7**)

- A) Linked genes
- B) Gene linkage and recombination
- C) Chromosomes and double crossing over
- D) Three point test cross
- E) The use of linkage maps
- F) Linkage in Humans
- G) Cytological proof of crossing over
- H) Crossing over in somatic cells

V) Chromosomal Variation (**Chapter 6**)

- A) Rearrangement involving fragments of chromosomes
- B) Deletions
- C) Duplications
- D) Inversions
- E) Translocations

VI) Abnormalities in Species Specific Chromosome Numbers (**Chapter 6**)

- A) Euploid cells
- B) Aneuploidy
  - 1. Monosomic cells
  - 2. Trisomic cells
- C) Polyploidy
- D) Mosaics

VIII) Human Genetic Disorders Caused by Chromosomal Aberrations and Abnormal Numbers of Chromosomes (**Chapter 6**)

## Unit Three

### I) The Molecular Basis for Genetics (**Chapters 9, 10, 11, 12, 14**)

#### A) Nucleic Acids (**Chapters 9, 10, 11, 12**)

1. The molecular structure of a nucleotide
2. The molecular structure of DNA
3. The double helix
4. DNA replication
5. DNA and the gene
6. The molecular structure RNA
7. RNA replication

#### B) Genetic Mutations (**Chapter 14**)

1. Mutation at the molecular level
2. Source and frequency of point mutations
3. Various types of mutations
4. Suppressor mutations
5. Induced mutations
6. Mutators and mutable genes

### II) The Mechanism of Gene Expression (**Chapters 12, 13, 15**)

#### A) How the gene works (**Chapter 12**)

1. DNA
2. RNA
  - a) ribosomal RNA
  - b) messenger RNA
  - c) transfer RNA
3. Protein Synthesis (**Chapter 13**)
  - a) transcription of RNA
  - b) types of transcribed RNA
  - c) the triplet code (codon)
  - d) the translation of mRNA into protein
  - e) factors that affect gene regulation in eukaryotic cells (**Chapter 15**)

### III) Extra Chromosomal (Non-Nuclear) Inheritance (**Chapter 11**)

- A) Maternal effects
- B) Mitochondrial DNA
- C) Chloroplast DNA
- D) Cytoplasmic inheritance

- IV) Genetics of Populations (**Chapter 22**)
  - A) Hardy-Weinberg
  - B) Natural selection
  - C) Fitness and the coefficient
  - D) Zygotic selection
  - E) Migration or gene flow
  - F) Genetic drift
  - G) Inbreeding, out breeding, heterosis, and selection
  
- V) Population, Pedigrees and Twins – Methodology in Human Genetics (**Chapter 21**)
  - A) The study of populations
  - B) The study of families
  - C) Studies of cells and chromosomes
  - D) The study of twins
  - E) Genetics and race
  - F) Genetic counseling and eugenics
  
- VI) Special Topics in Genetics
  - A) The Genetics of Cancer (**Chapter 16**)
  - B) Recombinant DNA Technology (**Chapter 17**)
  - C) Genomics, Bioinformatics, and Proteomics (**Chapter 18**)
  - D) Applications and Ethics of Genetics Engineering and Biotechnology (**Chapter 19**)
  - E) Epigenetics (**Special Topics 1**)
  - F) DNA Forensics (**Special Topics 2**)
  - G) Genomics and Personalized Medicine (**Special Topics 4**)
  - H) Genetically Modified Foods (**Special Topics 5**)
  - H) Gene Therapy (**Special Topics 6**)