**Biology 3180 - Principles of Genetics**

Fall 2015, Section 002

TR 2:00 PM TO 3:15 PM

2239 Oxendine Science Building

**INSTRUCTOR Dr. Conner Sandefur**

 Email: conner.sandefur@uncp.edu

 Office Location: 2230 Oxendine Science Building

 Office Phone: 910-521-6870

 Office Hours: TR 9:00-10:30 AM; W 11:15 AM to 1:15 PM

 *I am also available by appointment.*

**BLACKBOARD blackboard.uncp.edu**

The Blackboard course site will have postings from lectures such as outlines, slide decks and supplemental material I mention in class. I will also post announcements to this site. *It is your responsibility to check it regularly.*

**TEXTBOOK** Concepts of Genetics. 11th Edition by Klug, Cummings, Spencer and Palladino

\*\*For this course you are also required to have access to **Modified MasteringGenetics**, the online activity and homework tool. This access comes included with a NEW physical textbook or ebook, but can be purchases separately if you buy a used book. If you have a used physical book, you can buy the **Modified MasteringGenetics** access card at the bookstore but be aware that the cost of the access and a used book may be greater than purchasing a new book. *Your access code must be for* ***Modified MasteringGenetics****. A regular Mastering Genetics access code will not work.*

**ADDITIONAL REQUIREMENTS**

Socrative device: please bring a laptop, tablet or smartphone for in-class use of Socrative (m.socrative.com). Individuals without access to laptop, tablet or smartphone should speak with me for alternative instructions.

**COURSE GOALS**

**1. To provide you with the core principles of genetics and a set of useful skills.** You will use the book and class time to gain the content knowledge you will need to work with. We will take a historical approach at times to see how famous experiments were performed. We will also examine the basic “rules” of genetics that may then be altered to account for more complex situations. Skills you will practice relate to building hypotheses to answer a specific scientific question, designing an experiment using an appropriate technique/assay to answer the question, and predicting results of their experiment; identifying and explaining the purpose of positive and negative controls in well-designed experiments; interpreting experimental data and inferring conclusions from the experimental results; calculating probabilities and using statistics to compare data sets; and giving examples of how advances in genetics, have changed the world.

**2. To gain higher level thinking skills.** To the right you can see the “Amended Bloom’s Taxonomy” pyramid. It was developed as a method of classifying educational goals for student performance evaluation. Many of you are likely well-equipped at Remembering facts and content with good study habits. I am looking for you to *Apply* and *Analyze*. I want you to rise above Remembering. How can we achieve this? I will have in-class questions to practice Applying and Analyzing immediately and you will have homework problems to practice on your own. We will also explore experiments as a way of practicing ways to think. While these may be new ways of thinking for you, practice is the most important way to gain these skills. These new ways of thinking will serve you well regardless of your career path.

**3. This course should excite you about basic science and its applications.** A foundation in genetic crosses with model organisms (basic science tool) allows you to understand human genetic diseases. A foundation in making recombinant DNA constructs (basic science tool) allows you to understand how plants are modified to be herbicide resistant or how recombinant proteins can be turned into medicines. Genetics provides many of the “tools” that other disciplines call upon in biological research. Plant biologists, evolutionary biologists, clinical researchers *etc*. all use these tools.

**COURSE POLICIES**

**Exams**: four exams will be given. Each of the four exams will cover all material presented since the last exam. The fourth exam will be during exam week. 64% of your grade will be determined by the four exams. *All students are expected to take all exams when they are scheduled*. Students who are unable to take an exam must request permission to use their final exam to replace one of their missed exams. Additionally, students are expected to notify the instructor prior to missing an exam. If you feel an error has been made in determining your exam score, you may submit the exam for a re-grade within 3 school days after the exam has been returned to the class. You must submit in writing you reasons for a re-grade. Staple the request to your exam and give it to your instructor. Legitimate reasons for a re-grade request include, for example, incorrect summation of scores and bona fide errors in grading a particular problem; *this does not include student judgments about the amount of partial credit deserved for incorrect answers*. Written responses to student requests will be returned in class.

**Homework** Our Modified MasteringGenetics course ID is SANDEFUR02698

Modified MasteringGenetics is where all homework assignments/due dates can be found. ***Late homeworks will receive a zero*** but you can still do them for credit. *Please do not ask me to make an exception to this rule*. This is a tool for you to gauge what you are learning from the reading and what you do and don’t know. Dishonesty on this work only hurts you later on exams. It is okay if you find these questions challenging at times, the idea is to figure out what you need more practice with. See the detailed class schedule (below) for all Modified MasteringGenetics assignments that are due. Assignments are **due by 2 AM on the day they are due**; they are due BEFORE class, as a way to prepare for class. See Blackboard for detailed instructions on how to register for Modified MasteringGenetics.

**Classroom Participation:** as an incentive to come to class and be engaged, 4% of your grade will come from a program called Socrative that you use through your laptop or smart phone. You can access Socrative at m.socrative.com or via the Socrative app. Detailed instructions are on Blackboard.

**Grading**

64% Four exams

12% Modified MasteringGenetics: homeworks and quizzes

4% Socrative in-class activities

20% Genetics Lab

**Expectations**

It is expected that you will spend up to 10 hours reading/working problems associated with each class each week. If you stay on top of your reading and homework, there will be no need to cram for an exam. This is not a class based on memorization of facts – you must think critically and solve logic-based problems. Practice, practice, practice. Do problems that are assigned and then do others that are not assigned. Use the internets or other textbooks from the library to find more problems if you run out from your textbook

You are expected to visit tutors and office hours for content questions and weekly review/help with problems. Successful students use these resources r**outinely**. Successful students don’t cram. They use classmates. Form study groups too.

The tutoring program of the Academic Support Center helps students achieve their academic goals by offering group or individual tutoring in all General Education and many upper-level courses; contact courtney.walters@uncp.edu or 910-775-4408.

**DIGITAL ETIQUETTE**

This course will require you to use your laptop, tablet or smartphone during class time. Please be respectful of your classmates and restrict your use of digital devices to course content. If I see that you or your peers are distracted, I will ask you to put your devices away and you may forfeit your ability to earn participation points that day. There will be times when you have completed your work or answered a poll question, but your peers have not. I ask that you assist your peers when appropriate or use the time to review your notes while you wait. I understand that your devices connect you to your friends and family (which is awesome!) but the classroom should be a place apart, however briefly, from the outside world and distractions. You will learn more if you concentration on the course while you are here and your classmates will thank you for not impeding their ability to learn.

**ACADEMIC HONOR CODE**

I expect each student in this course to abide by the highest standards of academic integrity as outlined by the UNCP honor code. Just as plagiarizing, falsifying data, or other forms of cheating are not tolerated in the professional world, they will not be tolerated here. Anyviolation of the honor code will result in a 0 on the assignment, will be reported to the University, and a note will be placed on your academic record, per UNCP policy (**http://www.uncp.edu/student-life/student-services/student-conduct/academic-honor-code**). Your grade is a reflection of your performance in this class, not a reflection of you. However, cheating is a reflection on you. If you look at/copy from another student’s test OR if you assist another student during a quiz or exam by allowing them to copy from you, I will consider you in violation of the honor code.

**RELIGIOUS HOLIDAY POLICY STATEMENT**

The University of North Carolina at Pembroke has a legal and moral obligation to accommodate all students who must be absent from classes or miss scheduled exams in order to observe religious holidays; we must be careful not to inhibit or penalize these students for exercising their rights to religious observance. To accommodate students’ religious holidays, each student will be allowed two excused absences each semester with the following conditions:

1. Students, who submit written notification to their instructors within two weeks of the beginning of the semester, shall be excused from class or other scheduled academic activity to observe a religious holy day of their faith. Excused absences are limited to two class sessions (days) per semester.
2. Students shall be permitted a reasonable amount of time to make up tests or other work missed due to an excused absence for a religious observance.
3. Students should not be penalized due to absence from class or other scheduled academic activity because of religious observances.

A student who is to be excused from class for a religious observance is not required to provide a second- party certification of the reason for the absence. Furthermore, a student who believes that he or she has been unreasonably denied an education benefit due to religious beliefs or practices may seek redress through the student grievance procedure.

**ADA STATEMENT**

Federal laws require UNCP to accommodate students with documented learning, physical, chronic health, psychological, visual or hearing disabilities.

In post-secondary school settings, academic accommodations are not automatic; to receive accommodations, students must make a formal request and must supply documentation from a qualified professional to support that request. Students who believe they qualify must contact the Accessibility Resource Center (ARC) in DF Lowry Building, Room 107 or call 910-521-6695 to begin the accommodation process. All discussions remain confidential. Accommodations cannot be provided retroactively. More information for students about the services provided by ARC and the accommodation process may be found at the following link: http://www.uncp.edu/arc

**ALTERNATIVE FORMAT STATEMENT**

This publication is available in alternative formats upon request. Please contact the Accessibility Resource Center in the D. F. Lowry Building, 521-6695.

**ABSENCES FOR UNIVERSITY-SANCTIONED EVENT**

If a student is representing the University in an official capacity (e.g.: academic conference, student government, course field trips, ROTC events, athletics, band) at an official University-sanctioned event, that absence shall be excused. Students are responsible for all coursework missed and must make up the work within three university business days after the student returns to campus. Any student who anticipates missing more than 15% of the course should not enroll in the course without prior approval from the instructor.

It is the responsibility of the student to communicate with the professor or instructor about classes missed for any reason, including University sanctioned events. *Students must provide official documentation of proposed University-sanctioned events that will result in excused absences during the first week of each semester*. Prior written documentation must be provided for each excused absence.

**NC-HCAP**

Located in Jacobs Hall Suite F, the Health Careers Access Program offers assistance to students seeking to be employed in healthcare through test preparation workshops, course tutoring, guidance during the application process for healthcare programs, job shadowing, internships, and advisement; contact hcap@uncp.edu or 910-521-6673.

**TRANSFER TRANSITION OFFICE**

The Transfer Transition Office, located in Jacobs Hall Suite H, provides student support services and academic resources for students transferring from community colleges and other institutions of higher education to the campus of UNC Pembroke; contact transfer.transition@uncp.edu or 910-521-6269.

**COURSE CALENDAR**

Instructor reserves the right to amend syllabus as needed depending on work accomplished and the needs of the class.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Date** | **Class** **#** | **Topic** | **Readings and Modified Mastering Genetics to complete BEFORE this lecture** | **Objectives for this class** |
| 8/20 R | 1 | Introduction | Guided Reading Questions (GRQs): 3.1 and 3.2Modified Mastering Genetics (MG): MG # 1Setup Socrative | * Introduce myself
* List the basic components of the course
* Define the terms gene and allele
* Setup and complete single gene autosomal crosses to determine dominance and phenotype
 |
| 8/25 T | 2 | Transmission Genetics | GRQs for 3.3-3.4 and “The Growing Menace of Superweeds” article on Blackboard MG #2 | * Setup two and three gene crosses (independent assortment) and determine the phenotypes and genotypes of offspring
* Predict the genotypes of the parents based on the phenotypes of the offspring of two-gene crosses
* Explain why it is advantageous to use true breeding organisms in crosses.
 |
| 8/27 R | 3 | Chi-Square | GRQs 3.7-3.8MG #3 | * Define “null hypothesis’
* Calculate a chi-square value and determine whether or not the null hypothesis is supported by a given set of data.
 |
| 9/1 T | 4 | Quantitative Traits | GRQs 3.9, 23.1-23.2MG #4 | * Draw a pedigree based on information in a story problem
* Define a complex trait, and distinguish continuous (quantitative), dichotomous, and threshold traits
* Among sources of phenotypic variation of a complex trait, distinguish between variation due to genotype, environment, genotype-by-environment interaction, and genotype-by-environment association
* For a trait whose phenotype if normally distributed within a population with a given mean and variance, calculate the range of phenotypes that are expected to include 95 percent of the population or 99 percent of the population
* For artificial selection of a quantitative trait, given the mean phenotype in a random-mating population, the threshold value of a phenotype to be included among the selected parents, and the narrow-sense heritability of the trait, calculate the expected value of the mean of the progeny in the next generation
 |
| 9/3 R | 5 | Cell Division | GRQs 2.3-2.4MG #5 | * Describe, using diagrams, the sequence of events involving DNA in meiosis from chromosome duplication through chromosome segregation.
* Distinguish between sister chromatids and homologous chromosomes.
 |
| 9/8 T | 6 | Chromosome Heredity | GRQs 3.5, 4.11, 7.5, 7.6MG #6 | * Demonstrate Mendel’s first and second laws using chromosome models of meiosis
* Determine if a given pedigree is consistent with X-linked recessive inheritance
* Describe the basic molecular mechanism for dosage compensation in mammals involving Xist
* Give two examples of dosage compensation
 |
| 9/10 R | 7 | In-class practice exam | Exam 1 Review |  |
| 9/15 T | Exam 1 Classes 1 – 7 |
| 9/17 R | 8 | Dominance relationships | GRQs 4.1-4.6MG #8 | * Predict outcomes of crosses involving traits with incompletely dominant, co-dominant, lethal, multiple, and temperature sensitive alleles
* Describe what kinds of genetic crosses should be setup to determine if inheritance patterns follow Mendelian or extensions of Mendelian genetics
 |
| 9/22 T | 9 | Gene Interaction | GRQs 4.7-4.9MG #9 | * Interpret the results of epistasis tests, comparing the phenotypes that result from single mutations in two different genes with the phenotype of the double mutant.
* Determine if two mutations affect the same gene using complementation tests, and explain the requirements and the basis for interpreting results from these tests.
 |
| 9/24 R | 10 | Genetic Linkage | GRQs 5.1-5.2MG #10 | * Determine gene linkage and genetic map distances from the frequencies of progeny with recombinant phenotypes from genetic crosses.
* Calculate the genotype/phenotype frequencies when given map distances between two genes
* Design an experiment to calculate the map distance between two genes
 |
| 9/29 T | 11 | DNA Structure | GRQs 10.1, 10.3, 10.6, 10.7, MG #11 | * Describe the historical experiments and the methodology used to conclude that DNA was the genetic material
* Name the chemical components of DNA
* Draw the structure of DNA
* Describe how DNA is purified and explain what the reagents do chemically to DNA
 |
| 10/1 R | 12 | DNA Replication | GRQs 11.1, 11.2, 11.3, 11.4, 11.7MG #12 | * Describe the differences between conservative, semiconservative and dispersive replication models
* Explain and draw how the Messelson & Stahl experiments supported only the semiconservative replication model
* Explain why the ends of chromosomes shorten with each round of replication and how telomerase prevents this
* Distinguish between cancer cells, germ cells, and somatic cells in their telomerase activity
 |
| 10/6 T | 13 | Transcription | GRQs 10.9, 13.9, 13.10, 13.11, 17.3, 13.12, 17.7MG #13 | * List and describe the function of the different kinds of RNA in cells.
* Decide which of the two strands of DNA serve as a template strand for a particular gene when given the direction of synthesis.
* Explain how RNA polymerase recognizes a gene and knows when to initiate transcription.
* Design an experiment that allows you to identify different cis-acting regulatory sequences.
* Explain how a single mRNA can encode multiple proteins
 |
| 10/8 R | EXAM 2 Classes 8 – 13 |
| 10/13 T | 14 | Translation | GRQs 14.1, 14.2, 14.4, 13.10, 13.2, 13.3, 14.10MG #14 | * Construct a story board that illustrates the three main steps of translation.
* Determine the minimal number of tRNAs needed to recognize a given amino acid sequence.
* Locate an open reading frame.
* Translate an mRNA sequence into a protein
* Diagram a typical eukaryotic gene and indicate the locations of (i) regions that are genic but not coding, (ii) regions that are transcribed but not translated and (iii) regions that are both transcribed and translated
 |
| 10/15 R | FALL BREAK |
| 10/20 T | 15 | DNA Organization into Chromosomes | GRQs 12.-12.6, 7.5MG #15 | * Describe the two principal mechanisms of bacterial DNA compaction
* Explain the functional significance of packaging DNA into chromosomes
* Calculate the number of nucleosomes in the nucleus of an organism’s cell given the genome size
 |
| 10/22 R | 16 | Gene Mutations | GRQs 15.1-15.4MG #16 | * Identify two general ways mutagens can alter DNA and give examples of these two mechanisms
* Explain, using diagrams, how nucleotide changes results in the alteration of protein activity
* Explain why some mutations do not affect protein structure or function.
* Describe how mutations arise and how environmental factors can increase mutation rate
 |
| 10/27 T | 17 | DNA Repair and Homologous Recombination | GRQs 15.6, 11.8MG #17 | * Describe the general nucleotide excision repair process
* Describe the general base excision repair process
* Explain the steps in homologous recombination repair of double-stranded breaks
 |
| 10/29 R | 18 | Chromosome Aberrations  | GRQs 8.1, 8.2, 7.3 & “The Problem with an Almost-Perfect Genetic World” and “Down Syndrome’s Extra Chromosome Silenced in Lab Cells” MG #18 | * Explain the gene dosage dilemma in aneuploidy and aberrant euploidy conditions
* Describe how errors in chromosome number can arise during meiosis, and why such alterations can be detrimental
* Compare and contrast the different types of pre-natal testing for trisomy 21 and discuss the ramifications for individuals in a society that utilize these tests
 |
| 11/3 T | 19 | Chromosome Breakage and Transposition | GRQs 8.4-8.8, 15.8MG #19 | * Describe three patterns of chromosome breakage and rearrangement
* Identify DNA sequences flanking a bacterial DNA sequence
 |
| 11/5 R | EXAM 3 Classes 14 – 19 |
| 11/10 T | 20 | Prokaryotic gene regulation | GRQs 16.1-16.7MG #20 | * Describe how the control of gene expression relates to the conservation of energy
* Differentiate between gain and loss of function mutations
* Predict how cis-acting and trans-acting mutations will affect gene expression
* Use an illustration to explain how a mutation could effect the lac operon
 |
| 11/12 R | 21 | Eukaryotic gene regulation | GRQs 17.2, 17.3, 17.4, 17.6, 17.8MG #21 | * Compare and contrast prokaryotic and eukaryotic gene regulation (cis-acting sequences in the DNA, regulatory proteins, pre vs. post transcriptional regulation, etc.)
* Describe how gene expression can be differentially regulated in different cell types
* Predict the results of a promoter swap
* Define the term “promoter” and explain its role in regulating gene expression
 |
| 11/17 T | 22 | Epigenetics | GRQs Special Topics in Modern Genetics IMG #22 | * Define epigenome and describe how it is influenced by the environment that we live in
* List a few examples from your everyday life that could potentially alter your epigenome
 |
| 11/19 R | 23 | Genomics:  | GRQs 21.1, 21.2, 21.3 MG #23 | * Describe the clone-by-clone sequencing and whole-genome shotgun sequencing approaches
* Diagram the general process used to annotate genomes using homologous protein information
 |
| 11/24 T | 24 | Personalized Medicine | GRQs Special Topics in Modern Genetics 4 MG #24 | * Differentiate between pharmacogenetics and pharmacogenomics
* Discuss the importance of both sequencing and gene expression profiles in personalized medicine
* Discuss two examples of how the cytochrome P450 protein affect drug responses
 |
| 11/26 R | THANKSGIVING BREAK |
| 12/1 T | 25 | Population Genetics and Evolution | GRQs 25.1-25.8M\MG #25 | * Apply the genotype proportion method and the allele-counting method to determine allele frequencies
* Determine the expected genotype frequencies under assumptions of the Hardy-Weinberg equilibrium
* Compare and contrast natural selection and genetic drift
 |
| 12/3 R | 26 | Catch up and review |  |  |
| 12/8 T | FINAL EXAM 1:30 – 4:00 PM Classes 21 - 26 |

**TIPS FOR SUCCESS:** The textbook is your source of content. Go back to the reading assignment after class and re-read the portions that were stressed during class. Invest time reviewing what we did in class—what problems did we cover? Did you get the Socrative questions correct? (Check your Socrative account regularly to review and check that you technology is working.) Recognize that your attendance to class is the only way to clearly grasp what I stress, because I may also present topics and material that are not necessarily in the book.

Take notes in class; reinforce what you learned. Don’t feel compelled to take notes on a computer—handwriting and solving problems with a pen is what most successful students still do. Learning is an active process. If you get confused during class, mark in your notes the point during the lecture where you became confused. Mark in your notes the point where your understanding returned (i.e. change of topic or new topic). This will allow you to clearly identify that part of class that you did not understand. Then go back to the assigned reading and seek clarification.

Immediate reinforcement is most effective directly after hearing the lecture. So, instead of leaving the classroom and immediately checking your cell phone for messages, think calmly to yourself as you walk to your next class “What are the main take home messages from today’s lecture?” Cramming is unlikely to be successful.

Ask questions and participate in class! Raise your hand, be engaged! Ask for clarifications from the class material; come to instructor office hours, study with other students. Discussions help reinforce the material we learn.

Do the homework on your own. A portion of the exam questions will be similar to the homework questions. Thus, **homework is like a practice exam**! So make sure you ***understand*** the answers. Do extra problems. More practice thinking in this way will make a difference. Use the end-of-chapter questions and as more practice besides assigned Modified Mastering Genetics problems.

Tutoring: The tutoring program of the Academic Support Center helps students achieve their academic goals by offering group or individual tutoring in all General Education and many upper-level courses. Students can sign up at www.uncp.edu/asc/study/tutoring\_request.html or contact jennifer.mcneill@uncp.edu or 910-775-4311.