2020

Principles of Genetics

North Carolina Agricultural and Technical State University

NORTH CAROLINA AGRICULTURAL AND TECHNICAL STATE UNIVERSITY

COURSE SYLLABUS

College Name: College of Science and Technology
Department Name: Biology
Course Name: Genetics

COURSE INFORMATION

- Course Number/Section: BIOL 366
- Term:
- Semester Credit Hours: 3
- Times and Days:
- Class Location:

INSTRUCTOR CONTACT INFORMATION

- Instructor:
- Office Location:
- Office Phone:
- Email Address:

Faculty must notify students of the approximate time and method they can expect to receive an answer to all communications (e.g., email, phone, course messages). Excluding holidays, the response should be provided within 48 hours.

If there is a graduate teaching assistant assigned to work with this course, please include their names(s).

STUDENT HOURS

These are times students may visit the professor without an appointment to request the assistance they need.

NOTE: Students are responsible for reading, understanding and following the syllabus.

: AM ☐ / PM ☐ – : AM ☐ / PM ☐

Monday ☐ Tuesday ☐ Wednesday ☐ Thursday ☐ Friday ☐

COURSE PREREQUISITES

BIOL 221, CHEM 107 and 117.

COURSE DESCRIPTION

This course is a study of the traditional, classical areas of genetics as well as an introduction to gene action at the molecular level, including DNA and RNA structure, function and interactions in cellular systems.

STUDENT LEARNING OBJECTIVES/OUTCOMES (SLO)

Learning outcomes should be specific, measurable and focused on the content knowledge the students are expected to master and not what the faculty will teach.

SLO 1: EVOLUTION - The diversity of life evolved over time by processes of mutation, selection, and genetic change.

a. Describe how errors in DNA replication led to mutations.
b. Describe the mechanisms by which variation arises and is fixed (or lost) in a population over time.
c. Example Application: The sickle cell allele arose as a germline mutation and created genetic variation upon which natural selection could act. This allele is harmful in homozygous state, giving rise to sickle cell anemia. However, in the heterozygous state, it is beneficial to individuals who live in regions endemic to malaria because those individuals do not get infected with malaria as easily. Thus, evolutionary pressure has kept the sickle cell allele present in those who have ancestry from malaria endemic regions.

SLO 2: STRUCTURE and FUNCTION - Basic units of structure define the function of all living things.

a. Describe the type of coding and non-coding DNA, and their organization on chromosomes and how the packaging of DNA affects gene expression.
b. Defend how most cells can have the same genetic content and yet have different functions in the body.
c. Discuss the potential roles of DNA modification, histone modification, and non-coding RNA in epigenetic inheritance, both somatic and germline
d. Predict the most likely effects on protein structure and function of null, reduction-of-function, overexpression, dominant-negative and gain-of-function mutations
e. Example Application. The relationship between structure and function can help students connect the structural change of a single amino acid substitution in sickle cell anemia to the functional change in the mutated hemoglobin protein

SLO 3: INFORMATION FLOW, EXCHANGE, and STORAGE - The growth and behavior of organisms are activated through the expression of genetic information in context.

a. Compare and contrast mitosis and meiosis and describe the fidelity of genetic information transmission in each case.
b. Contrast the mechanisms of inheritance of nuclear and organellar genetic information
c. Using pedigrees, distinguish between dominant, recessive, autosomal, X-linked, and cytoplasmic modes of inheritance.

d. Defend the assertion that genetic testing will play a central role in the diagnosis and treatment of cancer in the future.
e. *Example Application: Inheritance of DNA transmits information from parent to child; yet the influence of the environment also influences phenotype. This explains how identical twins don't always look absolutely identical and have different incidences of diseases like diabetes or hypertension*

SLO 4: Apply the Process of Science. Read and critique primary literature as well as generate hypotheses, perform experiments, and analyze data.

SLO 5: Use Quantitative Reasoning. Analyze genetics data using mathematical reasoning and statistical analysis

SLO 6: Use Modeling and Simulation. Create a hypothesis about how a biological system works, test it with modeling and then verify in nature. Large data sets and bioinformatics are now a critical component of genetic analysis.

SLO 7: Tap into the interdisciplinary nature of science. Utilize chemical, physical, and mathematical relationships to explain genetic phenomena. Consider how the social sciences intersect with genetics.

SLO 8: Communicate and Collaborate. Develop oral and written communication skills to participate in diverse cross-disciplinary working communities as well as discuss science with lay individuals.

SLO 9: Understand the Relationship between Science and Society. Critically evaluate ethical issues related to science, from genetic engineering to evolution to vaccines.

REQUIRED TEXTBOOKS AND MATERIALS

Any course-level subscriptions and tools linked in Blackboard Learn learning management system (LMS) should be listed here. The Blackboard LMS must have links to their student data privacy statement.

REQUIRED TEXTS:

Mark F. Sanders and John L. Bowman (2018). *Genetic Analysis: An Integrated Approach Plus Modified Mastering Genetics* (3rd ed.,). Pearson
ISBN: 9780134839639 (e-text with Modified Mastering) OR
ISBN: 9780135218754 (loose leaf with Modified Mastering)

REQUIRED MATERIALS:

Modified Mastering Genetics (can be purchased with text)
Respondus Lockdown Browser.
https://download.respondus.com/lockdown/download.php?id=922833142
Webcam
Microphone

SUGGESTED COURSE MATERIALS

SUGGESTED READINGS/TEXTS:

SUGGESTED MATERIALS:

GRADING POLICY

ASSIGNMENTS AND GRADING POLICY

94% and above	A		76% - 74%	C
93% - 90%	A-		73% - 70%	C-
89% - 87%	B+		69% - 67%	D+
86% - 84%	B		66% - 64%	D
83% - 80%	B-		63% - 0%	F
79% - 77%	C+			

GRADING ALLOCATION

Course grades are based on a weighted grading scale of 100%. The breakdown for the course is as follows: *[Faculty, please adjust according to your course.]*

Category	# of Activities	Points per assignment	Total Points and Weight
Self-Introduction DB	1	10	10 (1%)
Discussion Boards	6	30	180 (18%)
Mastering Genetics Assignments	12	10	120 (12%)
Recitation Assignment/ Case Study / Problem Set changed to Case Study	14	20	280 (28%)
Projects & Presentation	4	varies	170 (17%)
Quizzes	6	40	240 (24%)
Total	**44**		**1000 (100%)**

COURSE POLICIES

USE OF BLACKBOARD AS THE LEARNING MANAGEMENT SYSTEM

Blackboard is the primary online instructional and course communications platform. Students can access the course syllabus, assignments, grades, and learner support resources. Students are encouraged to protect their login credentials, complete a Blackboard orientation and log in daily to course.

Note: Uploading assignments through Blackboard presents a challenge for Chromebook users in locating the files for submission. If you use a Chromebook, please be sure you also have access to a Mac computer or Windows computer so you can fully participate in your Blackboard class. For more information about student computer recommendations, please visit https://hub.ncat.edu/administration/its/computer-recommendations.php.

MAKE-UP EXAMS

See << Update Academic Year >>*Undergraduate Bulletin:*

https://www.ncat.edu/provost/academic-affairs/bulletins/index.php

EXTRA CREDIT

LATE WORK

SPECIAL ASSIGNMENTS

Recitation Practie Problems & Case Studies: Practice problems are the best way to study for genetics. Reading the book is important for understanding the foundational content. However, to master genetics, you must also practice APPLYING that content. Case studies are used to help students apply conceptual genetic content to real world scenarios. You will complete a recitation practice problem set or a case study each week.

Mastering Genetics: Mastering Genetics is an interactive digital platform that engages students through learning and assessment tools. Although some of the activities include videos and animations to help you learn, others are focused more on assessment of your learning. As such, you should complete all other unit activities, except for quizzes, prior to completing this assignment. You will complete a mastering genetics assignment almost each week.

Genetics is Awesome Project: The goal of this project is for you to be able to relate your classroom learning about Genetics to real-world application of these concepts. Learning doesn't stop once you leave the classroom. I want you to be able to find fun and exciting articles related to genetics that make you want to learn more. I also want to provide an opportunity for your to practice reading primary scientific literature and interpreting data. Finally, you will create an oral presentation of your work to present to your classmates. This semester long project will improve your reading comprehension, your communication skills, and your critical thinking skills as well as provide you with topics with which you can discuss science with friends / family / faculty members / interviewers. Regardless of your future career, mastering these skills can help you become a competitive applicant. This project will have several components over the course of the semester.

CLASS ATTENDANCE

Students are expected to attend class and participate on a regular basis in order to successfully achieve course learning outcomes and meet federal financial aid requirements (34 CFR 668.22). Class attendance in online courses is defined as active participation in academically-related course activities. Active participation may consist of course interactions with the content, classmates, and/or the instructor. Examples of academically-related course activities include, but are not limited to:

- Completing and submitting assignments, quizzes, exams, and other activities within Blackboard or through Blackboard (3rd-party products).

- Participating in course-related synchronous online chats, discussions, or meeting platforms such as Blackboard Collaborate in which participation is tracked.

CLASSROOM CITIZENSHIP

Courtesy, civility and respect must be the hallmark of your interactions.

COMPLIANCE WITH THE AMERICANS WITH DISABILITIES ACT

North Carolina A&T State University (N.C. A&T) is committed to following the requirements of the Americans with Disabilities Act Amendments Act (ADAAA) and Section 504 of the Rehabilitation Act.
If you need an academic accommodation based on the impact of a disability, you must initiate the request with the Office of Accessibility Resources (OARS) and provide documentation in accordance with the Documentation Guidelines at N.C. A&T. Once documentation is received, it will be reviewed. Once approved, you must attend a comprehensive meeting to receive appropriate and reasonable accommodations. If you are a student registered with OARS, you must complete the Accommodation Request Form to have accommodations sent to faculty.

OARS is located in Murphy Hall, Suite 01 and can be reached at 336-334-7765, or by email at accessibilityresources@ncat.edu. Additional information and forms can be found on the internet at https://www.ncat.edu/provost/academic-affairs/accessibility-resources/index.php.

Please note: Accommodations are not retroactive and begin once the Disability Verification Form is provided to faculty.

TITLE IX

North Carolina A&T State University is committed to providing a safe learning environment for all students—free of all forms of discrimination and harassment. Sexual misconduct and relationship violence in any form are inconsistent with the university's mission and core values, violate university policies, and may also violate federal and state law. Faculty members are considered "Responsible Employees" and are required to report incidents of sexual misconduct and relationship violence to the Title IX Coordinator. If you or someone you know has been impacted by sexual harassment, sexual assault, dating or domestic violence, or stalking, please visit the Title IX website to access information about university support and resources https://www.ncat.edu/legal/title-ix/index.php. If you would like to speak with someone confidentially, please contact the Counseling Services at 336-334-7727 or the Student Health Center at 336-334-7880.

TECHNICAL SUPPORT

If you experience any problems with your N.C. A&T account, you may call Client Technology Services (formerly Aggie Tech Support and Help Desk) at 336-334-7195, or visit https://hub.ncat.edu/administration/its/dept/ats/index.php.

FIELD TRIP POLICIES / OFF-CAMPUS INSTRUCTION AND COURSE ACTIVITIES

If applicable:

Off-campus, out-of-state, and foreign instruction and activities are subject to state law and university policies and procedures regarding travel and risk-related activities. Information regarding these rules and regulations may be found at https://www.ncat.edu/campus-life/student-affairs/index.php.

STUDENT HANDBOOK

https://www.ncat.edu/campus-life/student-affairs/departments/dean-of-students/student-handbook.php

STUDENT TRAVEL PROCEDURES AND STUDENT TRAVEL ACTIVITY WAIVER

https://hub.ncat.edu/administration/student-affairs/staff-resources/studen_activity_travel_waiver.pdf

OTHER POLICIES *(e.g., Copyright Guidelines, Confidentiality, etc.)*

STUDENT HANDBOOK

https://www.ncat.edu/campus-life/student-affairs/departments/dean-of-students/student-handbook.php

Graduate Catalog

SEXUAL MISCONDUCT POLICY

https://www.ncat.edu/legal/title-ix/sexual-harassment-and-misconduct-policies/index.php

FAMILY EDUCATIONAL RIGHTS AND PRIVACY ACT (FERPA)

https://www.ncat.edu/registrar/ferpa.php

STUDENT COMPLAINT PROCEDURES

https://www.ncat.edu/current-students/student-complaint-form.php

STUDENT CONDUCT AND DISCIPLINE

North Carolina A&T State University has rules and regulations that govern student conduct and discipline meant to ensure the orderly and efficient conduct of the educational enterprise. It is the responsibility of each student to be knowledgeable about these rules and regulations.

Please consult the following about specific policies such as academic dishonesty, cell phones, change of grade, disability services, disruptive behavior, general class attendance, grade appeal, incomplete grades, make up work, student grievance procedures, withdrawal, etc.:

- Undergraduate Bulletin
  https://www.ncat.edu/provost/academic-affairs/bulletins/index.php
- Graduate Catalog
  https://www.ncat.edu/tgc/graduate-catalog/index.php
- Student Handbook
  https://www.ncat.edu/campus-life/student-affairs/departments/dean-of-students/student-handbook.php

ACADEMIC DISHONESTY POLICY

Academic dishonesty includes but is not limited to the following:

1. Cheating or knowingly assisting another student in committing an act of cheating or other academic dishonesty;
2. Plagiarism (unauthorized use of another's words or ideas as one's own), which includes but is not limited to submitting exams, theses, reports, drawings, laboratory notes or other materials as one's own work when such work has been prepared by or copied from another person;
3. Unauthorized possession of exams or reserved library materials; destroying or hiding source, library or laboratory materials or experiments or any other similar actions;
4. Unauthorized changing of grades, or marking on an exam or in an instructor's grade book or such change of any grade record;
5. Aiding or abetting in the infraction of any of the provisions anticipated under the general standards of student conduct;
6. Hacking into a computer and gaining access to a test or answer key prior to the test being given. N.C. A&T reserves the right to search the emails and computers of any student suspected of such computer hacking if a police report of the suspected hacking was submitted prior to the search; and
7. Assisting another student in violating any of the above rules.

A student who has committed an act of academic dishonesty has failed to meet a basic requirement of satisfactory academic performance. Thus, academic dishonesty is not only a basis for disciplinary action but may also affect the evaluation of a student's level of performance. Any student who commits an act of academic dishonesty is subject to disciplinary action.

In instances where a student has clearly been identified as having committed an act of academic dishonesty, an instructor may take appropriate disciplinary action, including a loss of credit for an assignment, exam or project; or awarding a grade of "F" for the course, **subject to review and endorsement by the chairperson and dean**.

ASSIGNMENTS AND ACADEMIC CALENDAR

Include topics, reading assignments, due dates, exam dates, withdrawal dates, pre-registration and registration dates, all holidays and convocations.*

The Week of MM/DD/YY	Subject	Unit Learning Objectives	Reading in Text, activity, homework, exam
	Unit 1: Central Dogma	ULO 1: Describe the physical location of genes within a cell (consider subcellular organization and non-nuclear organelles). (SLO 2) ULO 2: Explain how allele, genotype, and phenotype are related. (SLO 2) ULO 3: Describe the structure of individual DNA nucleotides and explain how they are organized within a strand of DNA. Consider functional groups, polarity of the molecules, bonds within a strand of DNA and bond between two strands of DNA, etc. (SLO 2) ULO 4: Draw the components of a gene including promoter, transcription start site, exons, introns, transcription termination site. (SLO 2) ULO 5: Transcribe a DNA sequence (when the template strand is provided) into messenger RNA. (SLO 2) ULO 6: Translate mRNA into a polypeptide sequence using the help of a codon table. (Identify start and stop codons) (SLO 2) ULO 7: Define genomics, transcriptomics, proteomics, and metabolomics. Give an example of how study at this level relates to systems biology (as opposed to molecular biology). (SLO 2) ULO 8: Relate Darwin's three principles of populations to what we know today about DNA, genes, alleles, mutations and heritable transmission. (SLO 1) ULO 9: List the four processes of evolution that result in changes to the frequencies of alleles in populations over time. (SLO 1)	**Read:** Chapter 1 **Complete:** Discussion Board #Self-Introduction **Complete:** Problem Set / Case Study #1 Insulin Case Study (ULO 2, 3, 5, 6, 9) **Complete:** Assignment #1 Mastering Genetics Chapter 1 (ULO 1-9)

	Unit 2: Monohybrid and Dihybrid Crosses (Chapter 2)	ULO 1: Identify examples of the relevance of genetics to real world issues. (SLO 9) ULO 2: Recognize mechanisms by which scientists communicate information to lay individuals. (SLO 8) ULO 3: Consider how genetics intersects with other disciplines outside of Biology. (SLO 7) ULO 4: Define heredity, trait, gene, allele, locus, chromosome, genotype, and phenotype. Explain how each is related to the others. (SLO 2) ULO 5: Explain what is meant by a "true-breeding" plant in terms of its character and traits. (SLO 2) ULO 6: Define how many alleles for each gene are present in an individual and in a population. (SLO 2) ULO 7: Explain the difference between an organism that is homozygous for an allele versus heterozygous. (SLO 2) ULO 8: Draw a family tree to relate how P, F1, and F2 generations related to each other. (SLO 3) ULO 9: Describe the circumstances under which a geneticist would want to perform a testcross, including the genotype for the known partner within the cross (homozygous dominant, heterozygous, or homozygous recessive). (SLO 3) ULO 10: Compare and contrast dominant and recessive alleles. (SLO 2) ULO 11: Discuss how dominance and recessiveness relate to the frequency of an allele in a population (e.g., are dominant allele present in a higher frequency than recessive alleles? Think about evidence that supports or refutes your idea.) (SLO 2) ULO 12: Compare and contrast the genotype of individuals to the gamete they produce including the number of alleles in each individual and gamete. (SLO 3) ULO 13: Draw a Punnett square for both monohybrid and dihybrid crosses and	**Read:** Chapter 2 **Complete:** Discussion Board #1 GIA Part 1 (ULO 1-3) **Complete:** Recitation Assignment / Case Study #2 Mono- and Dihybrid Crosses (ULO 4-15) **Complete:** Assignment #2 Mastering Genetics Chapter 2 Part 1 (ULO 4-15) **Complete:** Project & Presentation # 1 GIA Part 1 (ULO 1-3)

The Week of MM/DD/YY	Subject	Unit Learning Objectives	Reading in Text, activity, homework, exam
		calculate the predicted ratio of traits in offspring. (SLO 3,5) ULO 14: Determine the genotype of parents given a ratio of offspring phenotypes. (SLO 3,5) ULO 15: Relate the laws of independent assortment and segregation to the formation of gametes. (SLO 3,5)	
	Unit 3: Probability and Chi-Squared (Chapter 2)	ULO 1: Communicate ideas and opinions supported by scientific evidence. (SLO 8) ULO 2: Use the multiplication and addition rules to determine the probability of particular outcomes from genetic crosses. (SLO 5) ULO 3: Describe the circumstances under which a Chi-square test is a useful tool for geneticists and explain what is meant by the null hypothesis. (SLO 4,5,6) ULO 4: Calculate and interpret data from a Chi-square test. This includes defining the null hypothesis, calculating the p value, explaining whether the null hypothesis would be accepted or rejected, and how that relates to the predicted genetic cross. (SLO 4,5,6)	**Read:** Chapter 2 **Complete:** Discussion Board #2 Comment on GIA1 (ULO1) **Complete:** Recitation Assignment / Case Study #3 Probability and Chi-Squared (ULO2-4) **Complete:** Assignment #3 Mastering Genetics Chapter 2 Part 2 (ULO2-4) **Complete:** Quiz #1 (Unit 1 ULO 1-9) (Unit 2 ULO 3-15)

The Week of MM/DD/YY	Subject	Unit Learning Objectives	Reading in Text, activity, homework, exam
	Unit 4: Pedigrees	ULO 1: Identify symbols and conventions used in drawing human pedigrees. (SLO 3,6,9) ULO 2: Define “carrier” in relation to recessive genetic traits. (SLO 3) ULO 3: Draw a human pedigree using information on family relationships of affected and unaffected individuals. (SLO 3,6,9) ULO 4: Evaluate the likelihood that a pedigree reflects autosomal dominant or autosomal recessive inheritance. (SLO 3,6,9) ULO 5: Identify primary scientific journal articles related to Genetics. (SLO 4) ULO 6: Describe the types of genetic testing performed on humans (carrier, pre-symptomatic, newborn, prenatal). (SLO 9) ULO 7: Discuss the ethical, legal, and social implications (ELSI) of genetic testing. (SLO 7,9)	**Read:** Chapter 2 and Applications A & B **Complete:** Problem Set / Case Study #4 Pedigrees (ULO 1-4) **Complete:** Assignment #4 Mastering Genetics Ch02 Part 3 (ULO 1-4) **Complete:** Project & Presentation # 2 GIA Part 2 Primary Journal Article (ULO5)

The Week of MM/DD/YY	Subject	Unit Learning Objectives	Reading in Text, activity, homework, exam
	Unit 5: Mitosis and Meiosis	ULO 1: Compare and contrast gametes with somatic cells. (SLO 3) ULO 2: Compare the presence of a gene versus the expression of a gene in various cell types. (e.g., which cells contain the gene for eye color vs which cells express the gene for eye color?) (SLO 2) ULO 3: Identify the number of and differences between autosomes and sex chromosomes in humans. (SLO 3) ULO 4: ULO 1: Draw and explain what happens in each stage of the cell cycle (G0, G1, S, G2, and Mitosis: Prophase, Prometaphase, Metaphase, Anaphase, Telophase, and Cytokinesis. (SLO 3) ULO 5: Explain the relationship between sister chromatids, non-sister chromatids, centromere, homologous chromosomes and non-homologous chromosomes. (SLO 3) ULO 6: Identify the mechanisms by which sexual reproductions leads to genetic variation. (SLO 1) ULO 7: Draw and explain what happens in each stage of Meiosis: Prophase I and II, Metaphase I and II, Anaphase I and II, Telophase I and II, and Cytokinesis. (SLO 3) ULO 8: Compare and Contrast Mitosis with Meiosis. (SLO 3)	**Read:** Chapter 3 **Complete:** Problem Set / Case Study #5 Mitosis/Meiosis (ULO 1-8) **Complete:** Assignment #5 Mastering Genetics Ch03 Part 1 (ULO 1-8) **Complete:** Quiz #2 (Unit 1 ULO 1-9) (Unit 2 ULO 3-15) (Unit 3 ULO 2-4) (Unit 4 ULO 1-4)

The Week of MM/DD/YY	Subject	Unit Learning Objectives	Reading in Text, activity, homework, exam
	Unit 06: Sex-linked Inheritance	ULO 1: Compare and contrast sex-linked inheritance with autosomal inheritance. (SLO 3) ULO 2: Predict the probability of particular outcomes from genetic crosses involving sex-linked traits. (SLO 5) ULO 3: Evaluate the likelihood that a pedigree reflects autosomal / sex-linked / dominant / recessive inheritance. (SLO 3) ULO 4: Explain how human sex determination occurs and the consequences of alterations in that process. (SLO 2) ULO 5: Explain the mechanism for dosage compensation. (SLO 2) ULO 6: Explain how genetic evidence supports or refutes the basis for race as a social construct rather than a genetic one. (SLO 7-9)	**Read:** Chapter 3 **Complete:** Discussion Board #3 Genetics and Race (ULO 6) **Complete:** Problem Set / Case Study #6 Sex-linked Inheritance (ULO 1-5) **Complete:** Assignment #6 Mastering Genetics Ch03 Part 2 (ULO 1-5)

The Week of MM/DD/YY	Subject	Unit Learning Objectives	Reading in Text, activity, homework, exam
	Unit 07: Relationships between alleles	ULO 1: Compare and contrast loss-of-function (null/amorphic, leaky/hypo-morphic, and dominant negative) and gain of function (hypermorphic, neo-morphic) mutations. (SLO 2) ULO 2: Compare and contrast incomplete dominance with codominance. (SLO 2) ULO 3: Compare and contrast incomplete penetrance with variable expressivity. (SLO 2) ULO 4: Predict the impact of epistasis or lethal alleles on inheritance patterns. (SLO 3) ULO 5: Explain the genotype and phenotype patterns of human blood types and how that relates to inheritance patterns. (SLO 3) ULO 6: Predict the probability of inheritance patterns based on traits that follow nonmendelian mechanisms. (SLO 2) ULO 7: Explain how the environment can influence the phenotype of an organism. (SLO 2) ULO 8: Analyze complementation data to assign mutants to a series of genes in a biosynthetic pathway. (SLO 2)	**Read:** Chapter 4 **Complete:** Problem Set / Case Study #7 Relationships between alleles (ULO 1-8) **Complete:** Assignment #7 Mastering Genetics Ch04 (ULO 1-8) **Complete:** Quiz #3 (Unit 1 ULO 1-9) (Unit 2 ULO 3-15) (Unit 3 ULO 2-4) (Unit 4 ULO 1-4) (Unit 5 ULO 1-8) (Unit 6 ULO 1-5)
	Unit 08: Linkage and Recombination Frequency	ULO 1: Compare and contrast genotypic and phenotypic ratios between two genes that A) assort independently or B) are linked. (SLO 2,3) ULO 2: Draw parental and recombinant gametes that result from crossing over during meiosis. (SLO 2) ULO 3: Calculate recombination frequency and distance between two genes. (SLO 5) ULO 4: Determine the order of genes on a chromosome based on recombination frequencies. (SLO 5) ULO 5: Critique primary scientific literature and explain its role in society. (SLO 1,9)	**Read:** Chapter 5 **Complete:** Problem Set / Case Study #8 Linkage and Recombination Frequency (ULO 1-4) **Complete:** Assignment #8 Mastering Genetics Ch05 (ULO 1-4) **Complete:** Project & Presentation # 3 GIA Part 3 Critique Primary Journal Article (ULO 5)

The Week of MM/DD/YY	Subject	Unit Learning Objectives	Reading in Text, activity, homework, exam
	Unit 09: Chromosomal Alterations	ULO 1: Explain how nondisjunction leads to aneuploidy. (SLO 3) ULO 2: Compare and contrast aneuploidy and polyploidy. (SLO 2) ULO 3: Compare and contrast the impact of chromosomal rearrangements: deletion, duplication, inversion, translocation (balanced and unbalanced). (SLO 2) ULO 4: Compare and contrast euchromatin with heterochromatin. (SLO 2) ULO 5: Describe the organization of DNA in a chromosome. (SLO 2) ULO 6: Explain how position effect variegation and other forms of chromosomal compaction impact gene expression. (SLO 2)	**Read:** Chapter 10 **Complete:** Problem Set / Case Study #9 Chromosomal Alterations (ULO 1-6) **Complete:** Assignment #9 Mastering Genetics Ch10 (ULO 1-6) **Complete:** Quiz #4 (Unit 1 ULO 1-9) (Unit 2 ULO 3-15) (Unit 3 ULO 2-4) (Unit 4 ULO 1-4) (Unit 5 ULO 1-8) (Unit 6 ULO 1-5) (Unit 7 ULO 1-8) (Unit 8 ULO 1-4)
	Unit 10: DNA Mutations	ULO 1: Predict the protein function consequences of DNA coding sequence mutations (silent, missense, nonsense), indels (insertions/deletions, and frameshift). (SLO 2) ULO 2: Explain how DNA mutations arise (DNA replication, DNA lesions, chemical mutagens, radiation). (SLO 2) ULO 3: Interpret the results of an Ames test for mutagenic substances. (SLO 4,9) ULO 4: Find examples of genotype-phenotype mismatches in everyday life. (SLO 9)	**Read:** Chapter 11 **Complete:** Discussion Board #4 Phenotype-Genotype Examples (ULO 4) **Complete:** Problem Set / Case Study #10 Chromosomal Alterations (ULO 1-3) **Complete:** Assignment #10 Mastering Genetics Ch11 (ULO 1-3)

The Week of MM/DD/YY	Subject	Unit Learning Objectives	Reading in Text, activity, homework, exam
	Unit 11: Gene Expression	ULO 1: Explain the type of regulation that occurs during transcription, post transcriptional processing, translation and post-translational processing. (SLO 3) ULO 2: Define and explain the relationship between the following terms: Promotor, Enhancer, Silencer, Insulator, Transcription factor, Repressor protein, RNA polymerase, DNA, Chromatin, Histone. (SLO 2) ULO 3: Predict the impact of mutations that occur in each of the regulatory regions / molecules. (SLO 1) ULO 4: Describe how alternative splicing impacts protein expression. (SLO 2)	**Read:** Chapter 13 **Complete:** Problem Set / Case Study #11 Gene Expression (ULO 1-4) **Complete:** Assignment #11 Mastering Genetics Ch13 (ULO 1-4) **Complete:** Quiz #5 (Unit 1 ULO 1-9) (Unit 2 ULO 3-15) (Unit 3 ULO 2-4) (Unit 4 ULO 1-4) (Unit 5 ULO 1-8) (Unit 6 ULO 1-5) (Unit 7 ULO 1-8) (Unit 8 ULO 1-4) (Unit 9 ULO 1-6) (Unit 10 ULO 1-3)
	Unit 12: Epigenetics	ULO 1: Explain how chromatin remodeling impacts gene expression. (SLO 2,3) ULO 2: Describe the action of histone writers and histone erasers in the acetylation / deacetylation and methylation / demethylation of histones. (SLO 2) ULO 3: Compare and contrast pioneer transcription factors with other transcription factors. (SLO 2) ULO 4: Describe epigenetic heritability. (SLO 3) ULO 5: Explain how long noncoding RNAs impact chromatin remodeling. (SLO 3) ULO 6: Predict the impact of miRNA and siRNAs on protein expression. (SLO 3) ULO 7: Discuss the ethics of human genome modification (SLO 7,8,9)	**Read:** Chapter 13 **Complete:** Problem Set / Case Study #12 Epigenetics (ULO 1-6) **Complete:** Discussion Board #5 Genome modification Ethics (ULO 7)

The Week of MM/DD/YY	Subject	Unit Learning Objectives	Reading in Text, activity, homework, exam
	Unit 13: Genome Modification	ULO 1: Describe how CRISPR/CAS9 can edit the genome. (SLO 2,4) ULO 2: Describe how homologous recombination can create a gene knockout / loss-of-function allele. (SLO 2,4) ULO 3: Explain how RNAi can reduce gene activity. (SLO 2,4) ULO 4: Describe how transgenic organisms impact human health. (SLO 9) ULO 5: Discuss the pros and cons of gene therapy. (SLO 9) ULO 6: Discuss the ethical implications of genome modification. (SLO 7,8,9)	**Read:** Chapters 14-15 **Complete:** Problem Set / Case Study #13 Genome Modification (ULO 1-6) **Complete:** Assignment #12 Mastering Genetics Ch14-15 (ULO 1-4) **Complete:** Quiz #6 (Unit 1 ULO 1-9) (Unit 2 ULO 3-15) (Unit 3 ULO 2-4) (Unit 4 ULO 1-4) (Unit 5 ULO 1-8) (Unit 6 ULO 1-5) (Unit 7 ULO 1-8) (Unit 8 ULO 1-4) (Unit 9 ULO 1-6) (Unit 10 ULO 1-3) (Unit 11 ULO 1-4) (Unit 12 ULO 1-6)
	Unit 14: Genetics is Awesome Presentations	ULO 1: Communicate scientific information to a lay audience. (SLO 8) ULO 2: Demonstrate scientific literacy by interpreting a data figure from primary research article. (SLO 4,5,6) ULO 3: Discuss the value of genetic research to everyday life. (SLO 7,9)	**Complete:** Project & Presentation # 4 GIA Presentation (ULO 1-3)

The Week of MM/DD/YY	Subject	Unit Learning Objectives	Reading in Text, activity, homework, exam
	Unit 15: Genetics and Society	ULO 1: Identify the ten hallmarks of cancer cells. (SLO 2) ULO 2: Compare and contrast oncogenes and tumor suppressors. (SLO 2) ULO 3: Evaluate the difference between the inheritance of risk of developing cancer versus a diagnosis of cancer. (SLO 3) ULO 4: Discuss how personal genetic information can impact treatment decisions. (SLO 3,5,6,9) ULO 5: Discuss the evidence for human evolution in response to environmental changes. (SLO 1,9) ULO 6: Critique scientific presentations. (SLO 8)	**Read:** Applications C and D **Complete:** Problem Set / Case Study #14 Genetics and Society (ULO 1-5) **Complete:** Discussion Board #6 GIA Presentation Critiques (ULO 6)

** These descriptions and timelines are subject to change at the discretion of the instructor.*