

Syllabus & Class Policies for Bio 59: Genetics. Fall 2024

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Textbook: OER.
Lab Manual: OER.

Description and Prerequisites: BIO 05900-- GENETICS (4 crs. 6 hrs.)

For Biology majors, this course examines the transmission of genetic material, molecular genetics and the genetics of populations. Topics considered in both lecture and laboratory include: Mendelian genetics, quantitative analyses of linkage in prokaryotes and eukaryotes, extranuclear inheritance, molecular structure and replication of genetic materials, gene expression and regulation of gene expression, chromosomes structure and variation in chromosome structure and number, mutations, gene amplification; DNA extraction; DNA "fingerprinting", and changes in prokaryotic genetic material by viral vectors. Current biotechnology techniques are emphasized. This course satisfies the Biology major elective requirement. Prerequisites: BIO 14, CHM 11

COURSE OUTCOMES

1. Demonstrate knowledge of major concepts in transmission, molecular, population and evolutionary genetics
2. Solve problems involving Mendelian inheritance and linkage
3. Demonstrate ability to correctly use a light microscope
4. Design and execute genetic studies through data collection, analysis and interpretation
5. Write a formal scientific report

ADDITIONAL MATERIALS

You are expected to purchase a **knee length lab coat, dissecting kit, goggles and nitril gloves**, and bring them to each lab session. Students without lab coats or those wearing open-toed shoes will not be allowed to attend the labs.

ATTENDANCE

You are expected to attend all lectures and labs. EXCESSIVE ABSENCES MAY RESULT IN AN F (Fail) or WU (Unauthorized Withdrawal) grade regardless of legitimacy. Participation in lab activities is paramount in successfully completing lab quizzes or even lecture exams. If a student is doing passing work and would potentially pass the course after completing the final exam, an INC (Incomplete) will be assigned for incomplete major assignments, exams, and/or other significant work.

STUDENTS WITH DISABILITIES

Please contact Kingsborough Community College's Access-Ability Office (Room D205) to provide me with the necessary paperwork.

CUNY POLICY ON ACADEMIC INTEGRITY AND CIVILITY

You are expected to adhere to Kingsborough's Academic Integrity Policy with respect to cheating and plagiarism. Please carefully read the material found at <http://www.kbcc.cuny.edu/subregistration/>

[Pages/catalog.aspx](#) . The following is quoted from the Spring 2012 catalogue: “Academic Dishonesty is prohibited in The City University of New York and is punishable by penalties, including failing grades, suspension, and expulsion, as provided herein. Cheating is the unauthorized use or attempted use of material, information, notes, study aids, devices or communication during an academic exercise. Plagiarism is the act of presenting another person’s ideas, research or writings as your own. Internet plagiarism includes submitting downloaded term papers or parts of term papers, paraphrasing or copying information from the internet without citing the source, and “cutting & pasting” from various sources without proper attribution.” In addition, “Kingsborough Community College is committed to the highest standards of academic and ethical integrity acknowledging that respect for self and others is the foundation of educational excellence. Civility in the classroom and respect for the opinions of others is very important in an academic environment. Therefore, in this classroom, any acts of harassment and/or discrimination based on matters of race, gender identity and expression, sexual orientation, religion, ethnicity, national origin, age, veteran status, and/or disability are not acceptable. Whether we are students, faculty, or staff we have a right to be in a safe environment, free of disturbance, and civil in all aspects of human relations.”

CLASS ETIQUETTE

I encourage you to ask questions during lectures as well as laboratory session. If you have a question or comment, and you wish to share it while I am lecturing, quietly raise your hand, and wait until called upon. Turn your cell phones, pagers, and other potentially noise making gadgets on vibrate. Do not talk to your classmates even if the topic pertains to the lecture, as this is disrupting behavior. I cannot stress how important it is to avoid conversations while lecture is in session. Generally, any disruptive behavior will result in my asking you to leave the classroom. You are expected to arrive to all lectures and labs on time, and leave only after the last question has been fully addressed. Do not be late, and do not leave early. Should you need to go to the restroom, do so very quietly and in a manner that causes the least disturbance.

BLACKBOARD

Blackboard is an online system that allows you access to my course materials. You will need to use blackboard to download my syllabus, lectures, and assignments and to get pertinent information and announcements about this course. Please use your portal login information (used for registration etc.) to login. Please visit www.cuny.edu, or <http://www.kbcc.cuny.edu/bb/> or contact Student Help Desk at L-117 phone: 718-368-6679. You can also go to the following locations for help with Blackboard: 1. CYBER LOUNGE, Mac Building, M200, 2. LIBRARY COMPUTER LAB, 1st Fl. 3. STUDENT HELP DESK, Library, 1st Fl. - L106, 4. M-224, Mac Building, 2nd Fl.

LEARNING OBJECTIVES

The goal of this course is to teach you the following topics. By the end of this course students should be able to:

1. Transmission Genetics

- Describe the distinction and relationship between genes and traits
- Describe the wider implications of genetics: i.e. fields of genetics
- Explain Mendel's experiments and define Mendel's laws of inheritance
- Define terminology used in transmission genetics such as phenotypes, genotypes, homozygous, heterozygous, dominant, recessive, recombination
- Explain formation of gametes, and use this knowledge using Punnett squares to do monohybrid and dihybrid crosses
- Use Chi-Square statistics in the context of genetics and genetics problem solving
- Use pedigrees and use pedigree analysis to deduce modes of inheritance
- Describe basic principles in cell structure and function
- Explain and analyze a karyotypes
- Explain reproduction in bacteria, and how eukaryotic cell cycle and cell division (Mitosis) occur
- Define asexual reproduction and list and describes steps in meiosis and recombination
- Describe the chromosomal basis of inheritance and distinguish between autosomes and sex chromosomes
- Know sexual determination as exemplified using *Drosophila*
- Describe different types of mutations and genetic polymorphism
- Define and know examples of extensions of Mendelian inheritance such as:
 - Incomplete dominance
 - Incomplete penetrance and expressivity
 - Overdominance
 - Multiple alleles
 - Co-dominance
 - X-linked inheritance
 - Sex-influenced inheritance
 - Sex-limited inheritance
 - Lethal alleles
 - Pleiotropy
- Explain polygenic inheritance and epistasis
- Describe quantitative traits using a case study: Rheumatoid arthritis
- Define maternal inheritance and explain whether it is different from Mendelian inheritance
- Describe epigenetic inheritance
- Explain extranuclear inheritance i.e. inheritance of mitochondria and chloroplasts
- Describe and use Mendelian inheritance, meiosis, Chi-square statistics
- Explain the importance of genetic mapping in plants and animals
- Define and diagram out crossing over, recombination
- Describe how linkage might influence independent assortment
- Determine frequency of recombination and calculate of distance between two genes
- Determine gene order and calculate of distance between three genes
- Solve genetic problem sets
- List and describe the three modes of transfer of genetic material in bacteria
- Define conjugation, F factor, and high frequency of recombination (Hfr strains)
- Detail and diagram out a bacteriophage's life cycles
- In detail describe transduction
- In detail describe transformation
- Describe chromosome structure and variation in chromosome structure
- Identify and diagram out and label the structure of a typical chromosome and variants with respect to centromere location

- Explain other variations in chromosome structure including
 - o deletions
 - o duplications
 - o inversions
 - o translocations
- Explain variation in chromosome number i.e. euploidy and aneuploidy
- Describe the mechanisms and consequences of euploidy and aneuploidy

2. Molecular Genetics

- Describe the DNA as genetic material through an experimental perspective
- Explain the Hershey-Chase and other pertinent experiments
- Describe and diagram and label the molecular structure of DNA
- Explain Chargaff's rule, and Watson and Crick's double helix
- Identify important features of the double helix
- Explain, diagram and label the molecular structure of RNA
- Describe and diagram and label RNA folding and explain its significance
- Describe the genomes of:
 - o Viruses
 - o Bacteria and explain the bacterial chromosomes
 - o Eukaryotes and explain eukaryotic chromosomes
- List different histones and explain chromatin compaction in eukaryotic organisms through words and diagrams
- Explain the three proposed models for replication of DNA
- Describe DNA replication in bacteria
- Describe DNA replication in eukaryotes
- In detail describe and diagram out the stages of transcription in both
 - o bacteria
 - o eukaryotic organisms
- Identify and describe the importance of post-transcriptional modifications
- Know how to use the genetic code
- Ribosome assembly and function
- In detail describe the stages of translation and diagram it out
- Identify and describe the significance of post-translational processes
- Explain the regulation of gene expression through transcriptional regulation- i.e. the *lac* and *arabinose* operons
- Describe translational and post-translational regulation of gene expression and highlight its significance
- Describe the importance of transcription factors in eukaryotic organisms
- Describe the regulation of gene expression via changes in chromatin structure
- Describe and draw out the types of mutations and explain the consequences of mutations
- Outline the different causes of mutations
- Explain DNA damage repair
- Identify current techniques used in biotechnology and know the principles behind them

3. Population and Evolutionary Genetics

- Explain and use the principles of the Hardy-Weinberg Equilibrium
- Explain variation in chromosome number i.e. euploidy and aneuploidy
- Describe the mechanisms and consequences of euploidy and aneuploidy
- Define molecular evolution and explain its significance in our current understanding of evolution

TENTATIVE LECTURE OUTLINE

The list of topics covered in this course is based on OER and is tentative. These topics will be revealed in class or on Blackboard a week ahead, along with readings and slides for lectures. The instructor may add additional topics as needed. **Some topics are taught based on the instructor's research/expertise and are not covered in the OER. It is your responsibility to note these changes by attending lectures.**

TENTATIVE LAB OUTLINE

The lab activities will be provided on a weekly basis. Please refer to the class schedule for a list of activities.

EXAMS AND GRADING

For the lecture component, there are two lecture exams each worth 10% of your final grade. Lecture assignments contribute to 10% while the CUMULATIVE final exam constitutes 20% of your final grade. This totals 50% of your final grade. Lab assessments account for the remaining 50% of your final grade. You will complete 4 lab quizzes worth 40% of your final grade. Additionally, you will complete two lab assignments also worth 10% of your final grade. The table below summarizes your grading:

Lecture Component	% of Final grade	Lab Component	% of Final grade
1st lecture exam	10	Lab quizzes	40
2nd lecture exam	10	Lab assignment 1	5
Cumulative final exam	20	Lab assignment 2	5
Lecture assignment 1	5		
Lecture assignment 2	5		
Total	50	Total	50

Important notes:

- If you miss a quiz, your upcoming quiz grade will be counted twice to cover for the missed quiz. If you miss a second quiz, it will be assigned a **zero**.
- If you miss a lecture exam, your final exam grade will be counted twice for the missed exam. The second missed exam will be assigned a **zero**.
- There is no late submission of any assignment. If you do not submit an item on the date and time said assignment is due, the item will be assigned a **zero**.

The dates for the exams and other work can be found in the course schedule and calendar and are **tentative**. Possible changes to dates will be announced during course meetings.

Final Grading

Final grades will be assigned according to the following table:

[**Note:** KCC official grading policies and letter grade assignment can be found on our Blackboard course shell along with calculation of GPA under announcements]

Final grades	
A+	97%
A	93%
A-	90%
B+	87%
B	83%
B-	80%
C+	77%
C	73%
C-	70%
D+	67%
D	60%
F	<60%