Bio 59: Genetics
Syllabus and Class Policies
Fall 2016
Kingsborough Community College

Instructor: Dr. E. Mulligan, Assistant Professor, Department of Biological Sciences
Office: S208
Email: elizabeth.mulligan@kbcc.cuny.edu
Phone: (718) 368-5404 (or X 5404)

Office Hours:  
Mon: 11:30 – 12:30
Tuesday 9:10 – 11:20
No appointment needed for above times
Other times by appointment only

Lecture:  
Mon: 9:10 - 11:20 AM
Tues: 8:00 - 9:00 AM

Lab:  
Thurs: 8:00 – 11:20 AM

Prerequisites: BIO 14, CHM 11

Program Outcomes
1. Demonstrate an understanding of genetics.
2. Demonstrate proficiency in quantitative reasoning as it relates to life science data.
3. Identify and apply the methods and process of life science.

Student Learning Outcomes
1. Demonstrate knowledge of major concepts in transmission, molecular, population & evolutionary genetics.
2. Solve problems involving Mendelian inheritance & linkage
3. Design and execute genetic studies through data collection, analysis, and interpretation.
4. Write a formal lab report.

Course Description
For Biology majors, this course examines transmission of the genetic material, molecular genetics and the genetics of population. Topics considered in both lecture and laboratory include: quantitative analyses of eukaryotic linkage; extranuclear inheritance; mutation studies; cytogenetical chromosomes studies; gene amplification; DNA extraction; DNA “fingerprinting”; and transformation of prokaryotic genetic material by viral vectors. Techniques developed and utilized in the Human Genome Project and genetic engineering are emphasized. Research papers and in-class presentations are required. This course satisfies the elective credit requirement for Biology majors.
Textbook:

Lab Manual:
- You will also need to bring knee length lab coat, and laboratory goggles to each lab. Students without proper lab coat or those wearing open-toed shoes in the laboratory will not be allowed to attend the labs.

BLACKBOARD
Online access to my course materials is through the Blackboard system. Through this system you will be able to download my lectures and assignments. Additionally I will use Blackboard for announcement or to upload other materials for this course. Please use your portal login information (the one used for registration etc.) to login to the Blackboard system. Please visit www.cuny.edu for access to the blackboard system. If you require help using the system please contact the Student Help Desk at L-117 phone: 718-368-6679 or visit the Cyber Lounge-Mac Building, M200, or the Student Help Desk/Library First floor -L106, or the Library Computer Lab-First Floor.

ATTENDANCE POLICY
Attendance is required to do well in the course. You are expected to attend all lectures and labs. Excessive absences will result in an F grade regardless of the legitimacy of the absence. As defined by the University Policy for Attendance a student is considered excessively absent if they have missed more than 15% of the total instructional hours for a class. Therefore if you miss more than 12 hours total, in any combination of lecture and/or lab, an F grade is automatically assigned.

CIVILITY & CLASS ETIQUETTE
Civility in the classroom and respect for the opinions of others is important in an academic environment. It is likely that you will not agree with everything that is said or discussed in the classroom. Courteous behavior and responses are expected. Therefore, in this classroom, any acts of harassment and/or discrimination based on matters of race, gender, sexual orientation, religion, ethnicity, national origin, age, veteran status and/or ability are not acceptable.

You are expected to conduct yourself in a manner that is respectful of yourself, your instructor, and your fellow students. You are expected to arrive on time to all lectures and labs, and to leave only when I have dismissed the class. Do not arrive late and do not leave early. If you need to use the bathroom, do so very quietly. Turn your cell phones, and any other potentially noise-making devices on vibrate.
I encourage you to ask questions in class. If you have a question, raise your hand and wait to be called upon. However, **do not talk to your classmates during a class, even if it pertains to the lecture, as this is disruptive behavior.** In general disruptive behavior will lead to expulsion from that day’s lecture (which counts as an absence).

**ACADEMIC INTEGRITY**

All work on tests, quizzes or any other assignment must be your own. You, or in the case of a group assignment, your group, must write them yourselves. Failure to adhere to this constitutes academic dishonesty. The following is taken from the Kingsborough Community College 2013-2014 college catalog: “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.”

**STUDENTS WITH DISABILITIES**

Please contact the Access-Ability office, D205 to provide me with the necessary paperwork.

**Exams and Grading**

**Lecture:**
- Exams (2 in class) 20%
- Lecture, Attendance, Behavior, & Assignment(s) 10%
- Semi-Cumulative Final Exam 20%

**Laboratory:**
- Quizzes 20%
- Formal Lab report 10%
- Assignment(s) 10%
- Lab Attendance, Participation, and Behavior 10%

Total 100%

**Grades**

- A+ 97 and above
- A 94-96
- A- 90-93
- B+ 87-89
- B 84-86
- B- 80-83
- C+ 77-79
- C 74-76
- C- 70-73
- D+ 67-69
- D 64-67
- D- 60-63
- F Below 60
Tentative Lecture Outline

The instructor may add additional topics and pages. It is your responsibility to note these changes by attending lectures.

**Week 1:**

Overview of Genetics (Ch. 1, pp. 1-25)
- Structure of DNA Suggests Mechanism for Replication
- DNA Transcription and Messenger RNA Translation Express Genes
- Evolution has a Molecular Basis

**Week 2:**

DNA & RNA Structure and DNA Replication (Ch. 7 pp. 227 – 266, Ch. 8, 267 -271)
- DNA is the Hereditary Molecule
- Structure of the Double helix
- Semiconservative DNA replication
- Replication Duplicates Genetic Material
- Molecular genetic analytical methods make use of DNA replication processes
- RNA Transcripts carry the Messages of Genes

**Week 3:**

Molecule Biology of Transcription and RNA Processing (Ch. 8, pp. 271 – 304)
- Bacterial Transcription
- Eukaryotic Transcription
- RNA modifications

**Week 4:**

Molecular Biology of Translation (Ch. 9, pp. 305 – 337)
- Polypeptides are composed of Amino Acids
- Three phases of Translation
- Wobble base, Universal Genetic code, and Transfer RNA specificity
- Post-translational processes

Chromosome Structure (Ch. 11, pp. 268 – 283)
- Organization of Bacterial Chromosomes
- Organization of Eukaryotic Chromosomes
- Chromatin Compaction Varies along the Chromosome
**Week 5:**

Gene Mutation, DNA Repair and Homologus Recombination (Ch 12, pp 391 – 429)
- Mutations Modify DNA Sequence
- Causes of Mutations
- Mutation repair
- Double Strand breaks and Homologus recombination

Gene Regulation in Bacteria and Bacteriophages (Ch. 14, pp. 472 - 489)
- Transcriptional regulation: the lac operon
- Transcriptional regulation the trp, operon

**Week 6:**

Mendelian Inheritance (Ch. 2, pp. 26 – 63)
- Mendel’s experiments and laws of inheritance
- Overview of the formation of gametes
- Punnett Squares
- Monohybrid crosses
- Dihybrid crosses
- Probability and Statistics used in Genetics
- Autosomal Inheritance

**Week 7:**

Cell Division and Chromosome Heredity (Ch. 3, pp. 64 – 103)
- Review of Mitosis and Meiosis
- Sex Determination
- Sex-Linked Inheritance
- Dosage Compensation of Sex-Linked Genes

**Week 8:**

Inheritance Patterns of Single Genes and Gene Interactions(Ch. 4 pp. 104– 143)
- Molecular Basis of Dominance
- Mutations and polymorphisms
- Incomplete dominance
- Incomplete penetrance and expressivity
- Multiple alleles
- Co-dominance
- X-linked inheritance
- Sex-limited inheritance
- Lethal Alleles
- Pleiotropy
- Polygenic inheritance and epistasis
Week 9:
Genetic Linkage and Mapping in Eukaryotes (Ch. 5, pp. 144 – 160)
- Linked Genes do not Assort Independently
- Genetic Linkage Mapping is based on recombination of Frequency between genes
- Three-Point Test-Cross Analysis Maps Genes.
- Problem sets and problem solving

Week 10:
Genetic Transfer and Mapping in Bacteria and Bacteriophages (Ch. pp. 186 – 226, and in class handouts)
- Modes of transfer of genetic material in bacteria
- Transformation
- Conjugation
- Bacteriophage life cycles and Transduction
- Lateral Gene Transfer alters genomes

Week 11:
Chromosome Aberrations and Transposition (Ch. 13, pp. 430 – 436, 450 – 460)
- Nondisjunction leads to Changes in Chromosome Number (pp. 430 – 436)
- Chromosome Breakage (pp. 440 – 449)
- Transposable Elements (pp. 450 – 460)

Week 12:
Population Genetics (Ch. 22, pp. 742 – 748, 753 – 760)
- Populations and Gene Pools
- Hardy – Weinberg Equilibrium
- Mutation Diversifies Gene Pools
- Gene Flow and Bottlenecks
- Inbreeding Alters Genotype
# Bio 59 Tentative Lab Outline

<table>
<thead>
<tr>
<th>Lab</th>
<th>Topic</th>
<th>Investigations</th>
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| 1   | Introduction  
ZOOB DNA | Handouts |
| 2   | Strawberry DNA Extraction  
λ-DNA Digestion | Handouts 14, 15 |
| 3   | Electrophoresis of λ-DNA Digest  
Cancer Detection | 14, 15 Handouts |
| 4   | Bacterial Transformation | 17, 18 |
| 5   | Chi-Squared analysis  
Corn Genetics | 1, 3 & $\chi^2$Table (pp. 34) |
| 6   | *D. melanogaster* sex and mutant identification  
Human Chromosomes | 1, 13, (Lab Booklets) 10 |
| 7   | Thin Layer Chromatography using mutant flies | 1, 13, 19 |
| 8   | *D. melanogaster* dihybrid cross | 1, 3, 8, 10, 11, 13 |
| 9   | Continuation of dihybrid cross  
Mitosis and Meiosis | 1, 3, 8, 10, 11, 13 4, 5, 6 |
| 10  | *Drosophyla virilis* salivary gland polytene  
Down’s Syndrome karyotype  
Banding patterns  
X inactivation | 7, 10 |
| 11  | Population Genetics  
Blood Kits  
Polygenic inheritance  
Fingerprints | 23, 24 Handouts 22 |
| 12  | Whose DNA is left behind? | 14, 15, 16, 25, 26 |