GENERAL GENETICS
BIOL 2120

Class Hours: 3.0 Credit Hours: 4.0
Laboratory Hours: 3.0 Date Revised: Spring 01

Catalog Course Description:

Mendelian genetics, chromosomal inheritance, modified Mendelian ratios, chromosome mapping, linkage, gene and chromosomal mutations, recombination, gene expression, recombinant DNA technology, transposable elements, extranuclear genome, population genetics, and quantitative genetics. Course includes three hours of lecture and three hours of laboratory applications each week.

Entry Level Standards:

The student should have a good understanding of basic biology and chemistry. Reading and writing at the college level is expected. Basic math skills (arithmetic, determining ratios) are needed as well.

Prerequisites:

BIOL 1110 and 1120 or two years of high school biology, and CHEM 1110 and 1120; or consent of instructor. All remedial/developmental courses must be completed before taking this course.

Textbook(s) and Other Reference Materials Basic to the Course:


I. Week/Unit/Topic Basis:

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
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<tbody>
<tr>
<td>1</td>
<td>Lecture: Introduction, Mendelian Genetics&lt;br&gt;Lab: Probability (handout); Pedigree I (BioLabs On-Line)</td>
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<td>2</td>
<td>Lecture: Mitosis and Meiosis, Sex Linkage&lt;br&gt;Lab: FlyLab (BioLabs On-Line)</td>
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<tr>
<td>3</td>
<td>Lecture: Extensions of Mendelian Analysis; Test 1&lt;br&gt;Lab: FlyLab (BioLabs On-Line)</td>
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<tr>
<td>4</td>
<td>Lecture: Genetic Mapping in Eukaryotes&lt;br&gt;Lab: Pedigree II (BioLabs On-Line)</td>
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<tr>
<td>5</td>
<td>Lecture: Mapping in Eukaryotes; Biotechnology and yotes and Prokaryotes</td>
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Lab: Molecular Techniques (micropipettes, gel electrophoresis)

Lecture: Mapping in Prokaryotes, Mutations; Test 2
Lab: TranslationLab (BioLabs On-Line)

Lecture: Mutations, Gene Control of Proteins
Lab: Restriction Mapping (Edvotek 212)

Lecture: DNA Structure, Genetic Code
Lab: Plasmid Preparation (Edvotek 202)

Lecture: Replication, Transcription, Translation; Test 3
Lab: Cloning I (Edvotek 300)

Lecture: Genetic Engineering
Lab: Cloning II (Edvotek 300)

Lecture: Regulation in Prokaryotes
Lab: Southern Blot (Edvotek 207)

Lecture: Regulation in Eukaryotes, Mutation; Test 4
Lab: Southern Blot (Edvotek 207)

Lecture: Transposable Elements, Extranuclear Inheritance
Lab: PCR (Edvotek 329)

Lecture: Population Genetics
Lab: PCR (Edvotek 329)

Lecture: Quantitative Genetics
Lab: Lab Final

Lecture: Comprehensive final exam

II. Course Objectives*:

A. Gain knowledge and appreciation of the complex and dynamic processes of storing and retrieving genetic information within the cell. I.5

B. Apply critical thinking skills in analyzing genetic data and determining modes of inheritance. III.1, VI.1

C. Develop skills in searching current and classic historical literature sources in genetics and evaluating the information in terms of scientific validity. III.2

D. Gain knowledge and skills in biotechnology and develop an understanding of the potential of genetic engineering, as well as the responsibility for scientific integrity. I.5, III.1

*Roman numerals after course objectives reference goals of the university parallel program.

III. Instructional Processes*:

Students will:

1. Locate and evaluate related scientific information in the ERC and on the World Wide Web. 
   Information Literacy Outcome, Technological literacy Outcome
2. Use related equipment and tools for making biological measurements and observations. *Technological Literacy Outcome*

3. Read and critique scientific writings. *Communication Outcome, Personal Development Outcome*

4. Use Internet course list serve to share information pertaining to the course with classmates. *Communication Outcome, Technological Literacy Outcome, Information Literacy Outcome*

5. Collect data, generate graphs and tables of the collected data, summarize the data, draw conclusions from the data, and apply these conclusions to related situations. *Numerical Literacy Outcome*

6. Develop a vocabulary that allows them to communicate more effectively with their health care providers as well as in preparing for health care professions. *Transitional Strategies*

7. Participate in laboratory exercises which develop teamwork, problem solving skills and data analysis. *Problem Solving and Decision Making Outcome; Active Learning Strategies*

8. Utilize skills and procedures developed in the laboratory to design an implement plan to identify unknown microorganisms. *Personal Development Outcome, Problem Solving and Decision Making Outcome*

*Strategies and outcomes listed after instructional processes reference Pellissippi State’s goals for strengthening general education knowledge and skills, connecting coursework to experiences beyond the classroom, and encouraging students to take active and responsible roles in the educational process.*

**IV. Expectations for Student Performance***:

Upon successful completion of this course, the student should be able to:

1. Predict the outcome of crosses involving autosomal traits, sex-linked traits, multiple alleles, and incomplete dominance. A, B

2. Explain the connection between the chromosomal theory of inheritance and predictions of outcomes of crosses based on Mendelian genetics. A, B

3. Explain deviations in Mendelian ratios based on multiple alleles, lethal alleles, multiple genes, penetrance, expressivity and linkage. A, B

4. Compare results of genetic crosses with predicted ratios and evaluate significance of deviations using chi square analysis. B

5. Distinguish between mutations in somatic versus germ line cells and their impact on the individual and species. A

6. Predict the impact of silent, frameshift, deletion and insertion mutations within a gene. A, B

7. Compare and contrast mutations affecting chromosomal structure and number. A

8. Distinguish among various methods of genetic recombination in microorganisms: conjugation, transformation, transduction. A

9. Discuss the use of recombination in microorganisms as a tool in mapping both prokaryotic and eukaryotic genomes. A, B

10. Explain the interactions among DNA, RNA and proteins in the Central Dogma of Molecular
11. Discuss the steps involved in recombinant DNA techniques: restriction enzyme digestion, gel electrophoresis, restriction mapping, cDNA libraries, DNA libraries, Southern, Northern and Western blotting, cloning, DNA sequencing, RFLP mapping, DNA fingerprinting and PCR. A, B, D

12. Compare and contrast the structure of prokaryotic and eukaryotic DNA. A

13. Identify factors involved in changing allelic frequencies in populations: natural selection, mutation, inbreeding, genetic drift, immigration. A, B

14. Calculate allelic frequencies using Hardy-Weinberg equilibrium. B

15. Discuss the role of transposable genetics elements in retroviruses, bacteria and eukaryotes. A

16. Identify sources of extrachromosomal inheritance and discuss classic examples of mitochondrial and chloroplast genes. A, C

17. Gather, organize and interpret genetic data, presenting the results in a formal laboratory report. B, C

*Letters after performance expectations reference the course objectives listed above.

V. Evaluation:

A. Testing Procedures: 500 points

Five exams, each worth 100 points, will be given during the semester. If an exam is missed, there will be no make-up exam. The student will receive a 0 for a missed exam. A final exam, worth 100 points, will also be given. This will be a comprehensive exam, though new material not covered on previous exams will be weighted more heavily. In addition, students may use the final exam to replace a lower exam score by having it count double. Exams will consist of a combination of essay, short answer, problem solving, matching and multiple choice questions. Essays will be evaluated on organization as well as content. Calculators may be used in the exams.

B. Laboratory Expectations: 450 points

Participation in laboratory exercises is mandatory. The laboratory grade will be determined as follows:

- Probability lab data sheet 40 points
- Pedigree analysis 20 points
- Pedigree lab data sheet 40 points
- Skills lab worksheet 20 points
- Formal lab report on Drosophila genetics 100 points
- Informal lab report on restriction digest 40 points
- Informal lab report on plasmid preparation 30 points
- Informal lab report on cloning 30 points
- Informal lab report on Southern blot 20 points
- Informal lab report on PCR 30 points
- Lab practical 50 points
- Technique, teamwork, effort, safety + 30 points
FlyLab Report: Students will be required to submit a formal lab report on the FlyLab in addition to their original data sheets. It is absolutely essential that a lab log be maintained. The lab report should include a title, introduction (in which the purpose of the experiment is explained), materials and methods, results and a discussion. Appendices must be included for data sheets and calculations. Plagiarism of others' work will not be tolerated. ANY LAB REPORT THAT IS LATE WILL BE DOCKED 10% CREDIT PER DAY, INCLUDING WEEKENDS!!

Informal Lab Reports: Informal lab reports will be required for the laboratory exercises involving molecular techniques. The purpose of these lab reports is to highlight the techniques used. You will find these reports very useful as the beginning of a portfolio of techniques to add to your resume and school applications. The procedure in these lab reports should focus on an overview rather than a step by step protocol, particularly on the purpose of each step or chemical involved and will comprise the bulk of these reports. Details of the format of these reports will be discussed in lab.

Additional Laboratory Exercises: Data sheets for the remaining laboratory exercises are to be completed in lab. ALL information is to be completed unless otherwise specified in lab. These should be completed in pen, and must be legible to receive credit. These sheets will be removed from the lab handouts and turned in at the beginning of lab the week following completion of the lab.

Lab Practical: The laboratory practical will consist of questions involving analysis of data and interpretation of results. There will be a number of genetics problems on the exam, including mapping of genes and restriction site mapping. These problems will be similar to assignments completed in lab. Calculators are permitted during the laboratory practical.

C. Field Work: 50 points

Problem sets and library assignments will be given throughout the semester. These will be due at the BEGINNING of class on the due date. Unless otherwise indicated, late assignments will be docked 10% per day, including the day the assignment is due. These assignments will be worth a total of 50 points.

Problem Sets: Genetics is a field which can best be understood through analysis of data and problem solving. It requires active involvement rather than passive learning. To ensure that students have a solid grasp of the concepts, problems from the book and other sources will be assigned. Frequently assignments will be made at the end of one class and will be due at the beginning of the next class period. Students who miss a class are responsible for obtaining and completing the assignment before the next class period. Late assignments will not be accepted.

Library Assignments: There will be occasional reading assignments from books or journals which will be placed on reserve in the library. Students will be asked to write a summary of the article and frequently will be asked to respond to the information as well.

D. Other Evaluation Methods:

N/A

E. Grading Scale:

The final grade will be based on the accumulation of points from both lecture and lab, which will then be divided by the total number of points (1000).

90 - 100 A
87 - 89 B+
80 - 86 B
VI. Policies:

A. Attendance Policy:

Pellissippi State Technical Community College expects students to attend all scheduled instructional activities. As a minimum, students in all courses must be present for at least 75 percent of their scheduled class and laboratory meetings in order to receive credit for the course.

B. Academic Dishonesty:

Plagiarism is any form of using another person’s words or ideas without giving proper credit. Plagiarism includes, though is not limited to, the following:
- Copying sentences from a source without putting them in quotes and citing the source.
- Borrowing a sentence from another author and simply substituting a few synonyms or rearranging the order of the sentence.
- Copying from another student.

Plagiarism is a form of mental laziness and will not be tolerated. Any plagiarized assignments will receive an automatic 0 and may not be dropped or replaced by resubmitting the assignment. Second offenses will result in an automatic failure of the course.

C. Other Policies:

Late Assignments: Unless otherwise noted, late assignments will be docked 10% per day.
Use of E-mail: Consistent with PSTCC’s mission to utilize technology in the classroom, review sheets for exams, extra credit assignments and other class announcements will be sent to your school e-mail address. It is to your advantage to learn to utilize your school e-mail account. Should you have a computer and modem at home, and you wish to either forward your school mail to your home computer or access your school account from home, you may obtain instructions in the open computer lab (ERC 315). The technician at the front desk can also provide direction if you have never used your school account. If you experience continuing problems with accessing your account, please see the instructor.