PELLISSIPPI STATE TECHNICAL COMMUNITY COLLEGE
MASTER SYLLABUS

GENERAL GENETICS
BIOL 2120

Class Hours: 3.0  Credit Hours: 4.0
Laboratory Hours: 3.0  Revised: Fall 2004

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 Course Materials:

I. Week/Unit/Topic Basis:

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
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<tbody>
<tr>
<td>1</td>
<td>Introduction, Mendelian Genetics</td>
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<tr>
<td>2</td>
<td>Mendelian Genetics, Mitosis and Meiosis</td>
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<tr>
<td>3</td>
<td>Extensions of Mendelian Analysis Test 1: chapters 1-4</td>
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<td>4</td>
<td>Sex Determination and Sex Chromosomes</td>
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<tr>
<td>5</td>
<td>Genetic Mapping in Eukaryotes</td>
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<td>6</td>
<td>Mapping in Eukaryotes and Prokaryotes</td>
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<tr>
<td>7</td>
<td>Mapping in Prokaryotes, Chromosomal Aberrations Test 2: chapters 5, 7-9</td>
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<tr>
<td>8</td>
<td>DNA Structure and Replication</td>
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<tr>
<td>9</td>
<td>Genetic Code, Transcription, Translation Test 3: chapters 10-13</td>
</tr>
</tbody>
</table>
10 Genomics, Proteomics

11 Mutation, Repair, Transposable Elements

12 Regulation of Gene Expression
   Test 4: chapters 14, 15, 18

13 Recombinant DNA, Biotechnology

14 Population Genetics

15 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. V.3, V.4

B. Apply critical thinking skills in analyzing genetic data and determining modes of inheritance. V.2

C. Develop skills in searching current and classic historical literature sources in genetics and evaluating the information in terms of scientific validity. V.3, VII.3, VII.4

D. Develop an appreciation of the techniques and potential of genetic engineering, as well as the responsibility for scientific integrity. V.1, V.5

*Roman numerals after course objectives reference TBR's general education goals.

III. Instructional Processes*:

Students will:

1. Locate and evaluate related scientific information in the ERC and on the World Wide Web. Technological Literacy Outcome

2. Use related equipment and tools for making biological measurements and observations. Natural Sciences Outcome

3. Read and critique scientific writings. Communication Outcome, Natural Sciences Outcome

4. Use Internet course list serve to share information pertaining to the course with classmates. Communication Outcome, Technological 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. Natural Sciences Outcome, Mathematics Outcome

6. Develop a vocabulary that allows them to communicate more effectively with their health care providers as well as in preparing for science-related professions. Natural Sciences Outcome, Transitional Strategies

7. Participate in laboratory exercises which develop teamwork, problem solving skills and data analysis. Natural Sciences Outcome, Active Learning Strategies

*Strategies and outcomes listed after instructional processes reference TBR’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 Biology. A, C

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: 38.5% of grade (500 points)

Four 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. The lowest of these exam scores may be replaced by doubling the final exam score.

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. The final exam MUST be taken.
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: 46.1% of grade (600 points)

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

Probability Lab 40 points
Formal Lab Report on Drosophila Genetics 150 points
Molecular Techniques Lab 25 points
Hemoglobin Studies
  Annotating gene 15 points
  Rasmol exercise 30 points
Genetic Code 75 points
PCR Labs
  DNALC reading and summary 20 points
  Interpretation of results 20 points
Restriction Mapping Lab
  Worksheet 25 points
  Data analysis 25 points
Protein Reports 50 points
Lab Practical 100 points
  Technique, teamwork, effort, safety 20 points
Total: 600 points

**Laboratory Exercises:** Students must purchase the instruction manual for Biology Labs Online, Genetics Version. This manual contains the code and license to access the software from the Internet. Instruction and/or assignment sheets for each lab (including these computer simulations) will be provided the week prior to the laboratory exercise. Students are expected to read the material and answer questions pertaining to the theory behind the experiments prior to the lab. (These will be assigned at the time the handout is given.) Data collection and analysis will be done during the laboratory period. Some time will be required outside of lab to complete the analysis of these worksheets. Due dates will be given in class; no late assignments will be accepted.

**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!! Additional resources for writing the lab report will be posted in WebCT.

**Protein Reports:** Each student will be assigned an enzyme/substrate or enzyme/inhibitor complex to analyze in Rasmol. At the conclusion of the semester, students will present their findings in a 10 minute talk in lab. Additional information on this project will be provided when students learn to use Rasmol.
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.

**Technique, teamwork, effort, safety:** Students will be evaluated throughout the semester on their ability to work with others in a team as well as their technique in the laboratory exercises. It is not expected that students enter the lab knowing molecular biology techniques, but that proficiency is developed during the course of the semester. Students who continually need to be reminded of proper safety procedures or who come to lab wearing clothing that is inappropriate (open toed
shoes, bare legs) will not earn the points for safety. Effort points will be based on whether students are in class, on time, and willing to attempt to learn (whether they are successful or not).

C. Field Work: 15.4% of grade (200 points)

Additional worksheets and discovery based learning exercises will be completed during the course of the semester. Point values are as follows:

- Mendelian Genetics Worksheets: 20 points
- Pedigree Analysis: 20 points
- Mapping Genes Worksheet: 30 points
- Sequence Similarity and Alignment: 20 points
- Open Reading Frames Worksheet: 20 points
- Student Selected Explorations (2 x 35 points): 70 points
- Class Participation: 20 points

Total: 200 points

Worksheets: 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 may 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.

Student Selected Explorations: Now that the human genome has been sequenced, interpreting the results has opened a wide variety of applications, from analysis of disease to drug development and comparison with other species. After students have been exposed to the basic techniques of comparing genes, they will be allowed to select two from a series of exploratory exercises, which will be posted in WebCT. After completing their explorations, students will write a two page, typed, double-spaced summary of what they have learned in their explorations. These summaries must be written in their own words. Students may choose a third exploration to complete as an extra credit assignment.

Class participation: Students are expected to have read the assigned material prior to coming to class. Class time will focus more on covering the ‘tricky’ points or discussing the implications of the material, rather than ‘covering everything that will be on the test.’ Class participation will be determined based on 1) attendance (and timeliness), 2) preparedness, and 3) participation in the conversation or group activities. If it appears that students are not prepared for class, pop quizzes may be employed to better assess and encourage preparation.

D. Other Evaluation Methods:

N/A

E. Grading Scale:

The final grade will be based on the total points earned, out of 1200 points possible.

<table>
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<tr>
<th>Points Range</th>
<th>Grade</th>
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<tbody>
<tr>
<td>1170-1300</td>
<td>A</td>
</tr>
<tr>
<td>1131-1169</td>
<td>B+</td>
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<tr>
<td>1040-1130</td>
<td>B</td>
</tr>
<tr>
<td>1001-1039</td>
<td>C</td>
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<tr>
<td>910-1000</td>
<td>C</td>
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<tr>
<td>780-909</td>
<td>D</td>
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<tr>
<td>Below 780</td>
<td>F</td>
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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.
If a student is absent from class, it is the student's responsibility to make up the missed material prior to the next class period.

B. Academic Dishonesty:

Academic misconduct committed either directly or indirectly by an individual or group is subject to disciplinary action. Prohibited activities include but are not limited to the following practices:

- Cheating, including but not limited to unauthorized assistance from material, people, or devices when taking a test, quiz, or examination; writing papers or reports; solving problems; or completing academic assignments
- Plagiarism, including but not limited to paraphrasing, summarizing, or directly quoting published or unpublished work of another person, including online or computerized services, without proper documentation of the original source
- Purchasing or otherwise obtaining prewritten essays, research papers, or materials prepared by another person or agency that sells term papers or other academic materials to be presented as one's own work
- Taking an exam for another student
- Providing others with information and/or answers regarding exams, quizzes, homework or other classroom assignments unless explicitly authorized by the instructor
- Any of the above occurring within the Web or distance-learning environment.

All forms of academic dishonesty will be handled according to school policy, as stated on pages 62 and 63 of the current catalog.

C. Accommodations for disabilities:

If you need accommodation because of a disability, if you have emergency medical information to share, or if you need special arrangements in case the building must be evacuated, please inform the instructor immediately. Privately after class or in the instructor's office.

To request accommodations students must register with Services for Students with Disabilities: Goins 127 or 131, Phone: (865) 539-7153 or (865) 694-6751 Voice/TDD.

D. Other Policies:

Cell phone usage:
Use of cell phones in the classroom is inconsiderate and disruptive. If cell phones must be brought into the classroom, they need to be turned off or on silent mode. During exams, all cell phones must be turned off and stored out of sight in backpacks or bags.

Late assignments:
All assignments are due at the beginning of the class period. Late assignments will only be accepted as indicated above; 10% per day late penalties will be deducted from the grade, including the day the assignment is due.