Biology 341.001 - Genetics
Dr. Robert J. Wiggers, Dept. Biology

Laboratory Manual (Required): Lab manual available on D2L
Publisher Website Access (Required): Pearson Mastering Genetics
Supplemental Materials (Suggested): Class notes & additional readings on D2L
Class Time & Place: Lecture – MWF 11 – 11:50 am in S233 / Lab – T 9:30 – 12:20 or 1:30 – 4:20 pm in S216
Office: Room 204 Miller Science Bldg
Office phone: 468-2147 / rwiggers@sfasu.edu
Office hours: MWF: 10 – 11, MW: 1 - 2; R: 1 – 3; by appointment

Course Description: Four semester hours, three hours lecture, three hours lab per week. An introduction to modern genetic principles including inheritance patterns, chromosome structure and function, gene expression and regulation, DNA replication and repair, and the behavior of genes in populations. Required lab fee.

Pre-requisites: Bio 130, 131, 133, Che 133, 134
Co-requisites: Bio 341L

Program Learning Outcomes: PLO #1, PLO #3

Student Learning Outcomes:

- Be able to qualitatively and quantitatively apply Mendel’s rules in the analysis of transmission genetics.
- Beginning with the DNA molecule, describe the structure and function of chromosomes and the processes of molecular biology.
- Be familiar with, understand the principles behind, and know the potential and limitations of, the tools and techniques of recombinant DNA technology and biotechnology.
- Beginning with defined conditions, calculate the genetic parameters of a population, as well as predict the effect of evolutionary forces on the above genetic parameters.
# Course Calendar & Content

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About this class

Genetics is one of the fastest moving fields in science today. If you take the time to look, you can find articles in either the popular press or scientific journals on an almost daily basis describing a new advance or discovery in the area of genetics. Genetics makes us what we are. It controls our development, it dictates to a large degree whether we will suffer from illness or stay well, and it can be used to greatly improve the quality of life through medical technology, agricultural advances, and even through industrial applications. For these reasons, genetics occupies a central position in the broad field of biology.

Because of its large scope, genetics is traditionally divided into four subdivisions: transmission genetics, cytogenetics, molecular genetics, and population genetics. Within each sub-division, there a number of individual areas of study, as can be seen from the syllabus. Below is a brief description of each sub-division and what you will be learning in each one:

(1) **Transmission genetics**: this is concerned with the passage of traits from generation to generation. Family studies form the backbone of this sub-discipline. Transmission genetics began with the ground-breaking work of Gregor Mendel and continues today as families afflicted with genetic disorders provide the first clues to isolating the gene responsible for the condition. By the time we finish our coverage of transmission genetics, you should be able to:

- Properly use genetic terminology as it pertains to transmission genetics
- Explain the significance of Mendel’s two laws with regards to basic inheritance mechanisms
- Using basic probabilities, calculate odds of certain traits appearing in progeny
- Be able to read pedigrees and ascertain modes of inheritance
- Understand variations on the basic inheritance patterns deduced by Mendel
- Apply your understanding of inheritance patterns and basic probabilities to solving problems
- Understand linkage and how to calculate the effects of genetic linkage

(2) **Cytogenetics**: this is the study of chromosomes - their behavior and structure. A number of pre-natal diagnostic tests depend on cytogenetics and the procedures developed by cytogeneticists. It is also playing an important role in the early phases of searches for human disease causing genes. By the time we finish our coverage of cytogenetics, you should be able to:

- Properly use genetic terminology as it pertains to cytogenetics
- Describe the basic composition and structure of the chromatin found in eukaryotic chromosomes
- Understand the chromosomal basis of sex determination in humans (and by extension mammals).
- Understand chromosome variability in both number and structure
- Be familiar with human disorders caused by chromosome variability and how to diagnose them
- Apply your understanding of cytogenetics to solving problems

(3) **Molecular genetics**: this is the fastest moving area of genetics. It involves the study of DNA at a chemical and cellular level. How do genes work? What controls them? What makes a cell a liver cell instead of a neuron? How can we correct, at the level of the gene, inherited disorders? How can we manipulate DNA (genetic engineering)? By the time we finish our coverage of molecular genetics, you should be able to:

- Properly use genetic terminology as it pertains to molecular genetics
- Understand the fundamental structure of DNA & RNA molecules and how the genome is organized
- Understand the process of DNA replication as well as mechanisms that safeguard the integrity of the DNA molecule from various types of damage, both spontaneous and induced
- Understand the mechanics of gene expression and differences in pro- vs. eukaryotes
- Understand the mechanisms of gene regulation and the differences in pro- vs. eukaryotes
- Be familiar with tools of recombinant DNA technology and how those tools may be employed in practical applications

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(3) Population genetics: concerns itself with the behavior of genes in populations as opposed to individuals, the amount of genetic variation in natural populations and how it is maintained, and how evolutionary forces shape the genetic constitution of populations. Population genetics finds itself increasingly important as conservationists try to save endangered species. It also comes into play as scientists attempt to develop DNA-based forensics and anthropologists attempt to determine the origins of various ethnic groups and modern humans as a whole. By the time we finish our coverage of population genetics, you should be able to:

- Properly use genetic terminology as it pertains to population genetics
- Understand and be able to calculate the basic population variables measured in population genetics
- Understand how evolutionary forces affect the genetic structure of populations and how to predict and or calculate these changes

The syllabus indicates in which sub-division each book chapter falls. You will note that for some topics, there is overlap.

Due to the amount of material we need to cover (almost the entire book) and the limited time frame to accomplish this (one semester) we will, of necessity, move pretty quickly. **YOU MUST KEEP UP WITH BOTH READING AND PROBLEM ASSIGNMENTS.** It will do you no good to start studying a day before the exam. Lectures will form a framework that you must fill out with information from the text. We will not cover in lecture all the material you need for this class - you **MUST** read the text. In fact, you won't be able to work many of the suggested problems without reading the book. **DON'T RELY COMPLETELY ON LECTURE MATERIAL.** Additionally, you will find that I will give you a lot of information that is not in the book. **EXPECT ME TO COVER ONLY 50 – 75% OF WHAT YOU NEED TO KNOW IN LECTURE / LAB. YOU ABSOLUTELY MUST READ THE TEXT.**

Whenever possible I will use human examples to illustrate genetic principles but this may not always be feasible. A lot of genetic principles and mechanisms have been discovered and extensively characterized in bacteria or other lower organisms and nowhere else. Please bear with me during these discussions - they are important. As situations warrant, we will also discuss plant genetics. I know it seems like we will be covering a lot of material and we will. Despite this there is a lot of information in areas we will not be able to cover due to time - immunogenetics, developmental genetics, and large amounts of the available info about medical and biotech applications of genetics to name a few.

This is an introductory genetics course for biology and science majors. It will be your only exposure to genetics before you enter the job market, begin medical school or other professional program, or go to graduate school. **IT IS VITAL THAT YOU UNDERSTAND THE TERMINOLOGY AND CONCEPTS INTRODUCED IN THIS CLASS.** Because this genetics course **IS** the only one that all biology majors will take, it is taught at a “high level” – **I must provide each student with enough information that they can do everything from teach K-12, be a sales representative for a biological supply firm, or go to medical school.** This course is hard, I won't lie to you – it will require a lot of work on your part. If, at any point during the semester, you find yourself struggling with the material, **PLEASE COME SEE ME** - don't wait to get help because the topics build on one another; If you get lost at the beginning of the course, it won't get any better in the later chapters. Please don't hesitate to ask a question in class if there is something you don't understand; I will do my best to answer it – if it is a question that may take an in depth explanation, I may ask you to speak to me after class.
Rules for conduct in biology 341

1. Attendance is expected but not mandatory; no penalty is associated with chronic absence (other than the fact that chronic absences will probably result in a failing grade).

2. I expect each person to be ON TIME; while you are free to skip class if you wish, you ARE NOT FREE to be late, as tardy students are distracting to both me and those who made it on time and are trying to follow the lecture. If, for some reason, you are late, I expect you to enter the room quietly and sit in the first seat you come to; DO NOT walk across the room or down an aisle.

3. Once you are in class and lecture has begun, DO NOT GET UP AND LEAVE; I expect you to be present during the entire class period. If you DO decide to leave, DON’T COME BACK – the lecture hall is not grand central station and students coming and going are distracting for everyone. If you MUST leave lecture early (due to unavoidable circumstances), inform me before class begins and sit on the outside edge of an aisle.

4. Once an exam has begun, you will not be allowed to leave the room for any reason. If you leave, you are done with the exam.

5. If you arrive late for an exam, one of two things will happen: If no one has yet completed the exam and left the room, you will be allowed to take the exam in the time remaining; if any students have left the room, you will not be allowed to take the exam and a grade of “0” will be recorded – tardiness is not an excused absence (see below).

6. Make-up exams will only be allowed in the case of a University approved absence (illness with a Doctor’s note, a family crisis with verification from another family member, or a religious holiday). YOU MUST NOTIFY ME WITHIN 24 HOURS OF A MISSED EXAM TO BE ELIGIBLE FOR A MAKE UP EXAM. If you will miss an exam due to a University sponsored outing, you must notify me before the exam date. All make-up exams will be essay in nature and given during your last scheduled lab period during dead week. The only exception to this is if know you are going to miss class (e.g. University outing or field trip) – then, with prior arrangement, you can take the exam a day or two early. As per University policy, if you miss three weeks of class (9 days), you will NOT BE ALLOWED TO MAKE UP ANY SUBSEQUENTLY MISSED WORK, EVEN IF THAT PARTICULAR ABSENCE IS EXCUSED.

7. Any student who creates a major disruption during class will be asked to leave the room. You will not be allowed to return to class until you have met with me and we have discussed your class conduct. Major disruptions are any behaviors that detract from my ability to deliver a lecture or your classmates from following a lecture. These behaviors include but are not limited to: excessive talking to your neighbors, text messaging during class, speaking on a cell phone during class, reading newspapers during lecture, or the passing of notes (class related or not).

8. All cell phones must be turned off or set to silent mode before entering this class. If your cell phone rings, I get to answer it. Furthermore, cell phones must be kept off the desks during class time – if I see anybody with a cell phone out during lecture, I will assume you are text messaging.
Grading

**Homework.** Homework assignments are associated with each chapter. These assignments are accessed via Pearson’s “Mastering Genetics” website; there is a Pearson’s “My Lab and Mastering” widget on the D2L homepage for this course (lower right corner); all access to Mastering Genetics should go through this widget. You should have purchased access with your text or you can purchase access from the Mastering Genetics site itself. Due dates for each assignment are indicated in the “Assignment List” on the Mastering Genetics site. Grading policy is also spelled out on this site. Each homework will be graded and contribute equally to your homework grade. Your homework grade will constitute 35% of your final BIO 341 course grade.

**Exams.** There are 3 one hour exams and one final scheduled. Each hour exam is worth 100 points, as is the final. All exams will be multiple choice & T/F; you will need to bring a scantron (Form 30423) and a #2 pencil on exam day. If you do not bring a scantron, you will be allowed to go purchase one and come back to take the exam in the remaining time. You will be tested on vocabulary and general knowledge as well as problem solving ability. The “final” is not a comprehensive final – it merely covers material delivered in lecture from exam (3) until the end of the semester.

* Exam (1) – Feb. 12;
* Exam (2) – March 16;
* Exam (3) – April 15;
* Final – May 6 (Wed. @ 10:45 am)

Once the exams have been graded, grades will be posted on D2L. We will go over the questions, the correct answers, and the logic behind those answers during the next laboratory period. Make up exam policy is explained above in the “Rules For Conduct” section.

Your scores on the (4) exams will be averaged to give you and “exam score”; this will constitute 40% of your BIO 341 course grade.

**Lab.** Your laboratory grade will consist of worksheets (see laboratory syllabus), lab quizzes, and lab assignments found on Mastering Genetics. A detailed explanation of these can be found in the laboratory portion of this syllabus. Your laboratory grade will constitute 25% of your BIO 341 course grade.

**Course Grade Calculation:** To determine your final course grade for BIO 341, the following weighting will be used:

\[(\text{Homework average})(0.35) + (\text{Exam average})(0.40) + (\text{Lab grade})(0.25)\]

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<th>Final Percentage</th>
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<td>90 – 100%</td>
<td>A</td>
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<td>80 – 89%</td>
<td>B</td>
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<td>70 – 79%</td>
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<td>60 – 69%</td>
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<td>0 – 59%</td>
<td>F</td>
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E-mail & phone policy

I will be periodically communicating with you via e-mail. I use your student accounts & addresses for this purpose. It is your responsibility to check your e-mail regularly and, if you have your student account forwarded to some secondary account, to be certain that this is not full and can receive any messages (the relevant University policy can be read here). Due to security and privacy issues, I will not discuss via e-mail any issue regarding class performance (grades, attendance, questions about your exam answers, etc.). Additionally, it can be very hard to answer questions about the chapter end assignments via e-mail; the explanations required often don’t lend themselves to an e-mail response. For any of the above types of questions, please come and see me. I check my e-mail once a day – between 8 & 8:30 when I arrive. I will answer e-mail queries, if appropriate (I have over 200 students and simply can’t answer all e-mail queries), during the next scheduled office hours block. I do not check e-mail in the evening or on weekends. If you wish to speak with me over the phone, call during office hours as I do not return phone calls.

Academic Integrity

Academic integrity is a responsibility of all university faculty and students. Faculty members promote academic integrity in multiple ways including instruction on the components of academic honesty, as well as abiding by university policy on penalties for cheating and plagiarism.

Definition of Academic Dishonesty
Academic dishonesty includes both cheating and plagiarism. Cheating includes but is not limited to (1) using or attempting to use unauthorized materials to aid in achieving a better grade on a component of a class; (2) the falsification or invention of any information, including citations, on an assigned exercise; and/or (3) helping or attempting to help another in an act of cheating or plagiarism. Plagiarism is presenting the words or ideas of another person as if they were your own. Examples of plagiarism are (1) submitting an assignment as if it were one's own work when, in fact, it is at least partly the work of another; (2) submitting a work that has been purchased or otherwise obtained from an Internet source or another source; and (3) incorporating the words or ideas of an author into one's paper without giving the author due credit.

The University’s definitions of academic dishonesty as well as penalties for violations can be found in the larger Student Code Of Conduct.

Withheld Grades

Ordinarily, at the discretion of the instructor of record and with the approval of the academic chair/director, a grade of WH will be assigned only if the student cannot complete the course work because of unavoidable circumstances. Students must complete the work within one calendar year from the end of the semester in which they receive a WH, or the grade automatically becomes an F. If students register for the same course in future terms the WH will automatically become an F and will be counted as a repeated course for the purpose of computing the grade point average. You may read the complete policy here.

Students with Disabilities

To obtain disability related accommodations, alternate formats and/or auxiliary aids, students with disabilities must contact the Office of Disability Services (ODS), Human Services Building, and Room 325, 468-3004 / 468-1004 (TDD) as early as possible in the semester. Once verified, ODS will notify the course instructor and outline the accommodation and/or auxiliary aids to be provided. Failure to request services in a timely manner may delay your accommodations.

For additional information, go to http://www.sfasu.edu/disabilityservices/.

Acceptable Student Behavior

Classroom behavior should not interfere with the instructor’s ability to conduct the class or the ability of other students to learn from the instructional program. Unacceptable or disruptive behavior will not be tolerated. Students who disrupt the learning environment may be asked to leave class and may be subject to judicial, academic or other penalties. This prohibition applies to all instructional forums, including electronic, classroom, labs, discussion groups, field trips, etc. The instructor shall have full discretion over what behavior is appropriate/inappropriate in the classroom. Students who do not attend class regularly or who perform poorly on class projects/exams may be referred to the Early Alert Program. This program provides students with recommendations for resources or other assistance that is available to help SFA students succeed. You may read the student code of conduct here.