Biology 3325: Genetics
Seattle Pacific University
Winter Quarter, 2017

Instructor: Jenny Tenlen, Ph.D.

Office: Eaton 113
Phone: 206-281-2007
Email: tenlenj@spu.edu

Office hours:
MWF 11:00 am - 12:00 pm, or by appointment, or feel free to stop by at any time

Course Information:

Lecture: MWF, 9:30 – 10:50 am, Cremona 102

Labs: Tues, 8:00 am – 10:50 am, Eaton 134
Tues, 12:00 pm – 2:50 pm, Eaton 134
Thurs, 8:00 am – 10:50 am, Eaton 134

Lab TAs: Elizabeth Knodel, Skyler Muchmore, Braeden Wiebe

"Seattle Pacific University seeks to change the world and engage the culture by graduating students of competence and character, cultivating people of wisdom, and modeling a grace-filled community."
[SPU Mission Statement]

Textbooks and other materials

Required textbook:

Hartwell, et al. (2015) *Genetics: From Genes to Genomes*, 5th edition
http://highered.mheducation.com/sites/0073525316/student_view0/index.html

(The 4th edition of the text is acceptable, but may not include some material new to the 5th edition.)

Other materials:

I will post other class readings, assignments and lab materials on the course Canvas site. For lab, you will need goggles, and are required to bring your own Sharpie pen (either extra-fine or ultra-fine tip) since you will be labeling a lot of tubes and plates. You can purchase pens from the ACS student group during the first week of lab (3rd floor stockroom), or from the bookstore.

Course Description

Welcome to Genetics! Genetics is the study of heredity – the nature of genes, and how specific traits are passed on from parent to offspring. This course has three areas of focus:

First, we will focus on the experiments in heritability and variation that have lead to our current understanding of the field. Starting with Gregor Mendel's pioneering experiments in peas, we will uncover the core principles of genetics, and analyze the data that informed these principles.

Second, you will have the opportunity to participate in an original research project that aims to identify new genes that affect embryo development in a classic model organism, the nematode *Caenorhabditis elegans*. This research project will allow you to apply concepts

learned in class to a specific research question, and to gain experience with common techniques in genetics and molecular biology.

Finally, we will discuss the ethical and social implications of genetics research. With the explosion of data from the Human Genome Project, the ever-increasing availability of genetic testing, and the emergence of new technologies, it is critical that we examine issues in genetics in a manner that integrates our scientific knowledge with our moral and faith-based values.

An understanding of these foundations will not only help you to understand the broad field of genetics, but will teach you to integrate information across disciplines within the logical framework provided by the scientific method. This ability will allow you to apply what you have learned in your courses to real world problems and to make informed critical decisions that will affect your future and that of our world. As Christians who seek to '*engage the culture and change the world,*' it is our mandate to hone these skills, a process that will begin during your college career and hopefully continue throughout your lives.

(Course description from the SPU catalog) "Prerequisites: A C- or better in BIO 2101 and MAT 2360, BioCore Placement level 3 and student must be accepted into a major. Introduces inheritance of specific traits through the study of transmission genetics. Focuses on the biology of gene transmission, nucleic acids, chromosome structure, regulation, epigenetics, genetic disease and biotechnology. Research methods are stressed throughout the course."

Course Learning Objectives

1. Describe fundamental principles of inheritance, and explain how perturbations of genetic mechanisms affect human health.
2. Explain how key experiments in genetics contributed to our understanding of the field.
3. Connect genetic principles, moral and faith-based values in resolving ethical dilemmas in genetics.
4. Learn to read and analyze primary scientific literature, both classic and modern.
5. Apply the scientific method of acquiring data and presenting information to a specific research question.
6. Learn to work effectively in collaborative groups.
7. Acquire, synthesize and present new information in both written and oral venues.

Biology Department: The objectives of the Biology Department can be found online at: http://spu.edu/academics/college-of-arts-sciences/biology/about/mission-goals-and-objectives. We will specifically address these objectives:

1. Science as a way of knowing about the natural world.
2. Science as a process.
3. Science as a human endeavor requiring competence, character, and wisdom.
4. Unifying themes recognized as pervading all of biological science.
5. Fundamental concepts associated with cellular and molecular biology.
6. Fundamental concepts associated with heredity and evolution.
7. Research methodologies applied in the study of biological science.
8. Practical applications of biological science through research projects, internships, practical, and field studies.

University Objectives: The mission statement and goals of Seattle Pacific University can be found online at: http://www.spu.edu/info/informationaboutspu.html.

Assignments and Assessments

Problem Sets: There will be 6 problem sets, designed to help you practice applying the concepts and skills learned in class to different scenarios and problems. In order to receive full credit, you must explain how you arrived at your answer. For example, if you are asked to determine the genotypes of possible offspring of a mating, your answer should include a Punnett Square showing all possible genotype combinations.

Position Papers: Whether in our professional or personal lives, we will all face ethical dilemmas related to some aspect of genetics (such as prenatal genetic testing, being tested for markers of a particular disease, etc.) As part of the course, we will examine three case studies that will help you to make decisions that are grounded in science and consistent with your moral and faith-based values. For each case study, you will write a short (2-page) paper that discusses the issue from the point of view of a stakeholder. Additional instructions will be provided separately.

In-class activities: There will be multiple in-class activities designed to reinforce and extend concepts discussed in lecture. These activities include problem-solving, examination of data from the primary scientific literature, quizzes, and discussion of reading assignments. Some of these activities may be graded.

Exams: There will be three exams, two during the quarter and 1 final exam. These tests will assess your mastery of the concepts presented in class, and will include questions from reading assignments, lecture, in-class activities, and lab. For the final exam, about 75% of the points will be specific to the material covered after the 2nd exam, and 25% of the points will based on cummulative questions.

Lab notebook: You are required to keep an electronic lab notebook. Because you will be participating in a real research project, with the potential for publication, it is critical that your notebook is (1) accurate, (2) up-to-date, and (3) detailed. Instructions on setting up and maintaining your notebook will be included in the lab manual posted on Canvas.

Lab participation: Attendance in lab each week is essential. In some weeks, you will also need to come in outside of lab to monitor experiments and maintain your nematode cultures. Absence from scheduled lab, or failure to come in outside of lab as needed, will result in loss of participation points.

Lab assignments: Each week, you will be responsible for completing a pre-lab assignment to ensure that you are prepared for the lab's activities. These assignments will be detailed in the lab manual.

Lab report: At the end of the quarter, you will write a research paper that describes the results of your group's research project. Guidelines will be included in the lab manual on Canvas.

Lab oral presentation: On the last day of lab, each lab group will present their findings to the class, as research groups would during lab meetings. The class data will be compiled into a final summary that will be communicated to researchers at UNC-Chapel Hill.

Grading

Note: Point values and assignments may be altered during the course depending on available time and other course constraints.

Category	Points Possible
Tests (3 x 100 pts ea.)	300
Problem sets (6 x 15 pts ea.)	90
Position papers (3 x 15 pts ea.)	45
Class activities	var.
Lab prelab assignments	75
Lab notebook	50
Lab oral presentation	25
Lab report	100
total	**≥ 685**

Scale:

Percentage	Letter
93-100	A
90-92.9	A-
87-89.9	B+
83-86.9	B
80-82.9	B-
77-79.9	C+
73-76.9	C
70-72.9	C-
67-69.9	D+
60-66.9	D
0-59.9	E

Course Policies

Lab Safety: Participation in the laboratory section is mandatory for this class. Final point totals for the course are a combination of those from both laboratory and lecture. The laboratory component of this course includes an original research project. **Time will be required outside of the laboratory to prepare or complete laboratory experiments**. Students working in the lab outside of normal hours must be with a partner at all times. Food and drinks are NOT permitted inside the lab.

Lab safety training is required, and will be conducted during the first lab session. We will work with a variety of microorganisms during this course. While these organisms are not considered human pathogens in healthy adults, precautions are still necessary when working with them. Your instructor will inform you of safety issues and procedures on a daily basis. Please adhere to these guidelines and report any accident, no matter how small, to the instructor or TA immediately for evaluation

You must wear goggles, gloves and appropriate attire when working on your experimental protocols. Gloves must be worn at all times. The use of all lab equipment is subject to the following guidelines.

1. The first time you use ANY equipment in lab you must be instructed on its use and safety by the instructor or TA
2. The second time you use the equipment you must be directly observed by the instructor or TA

Once approved, you may use the equipment on your own.

Plagiarism and Academic Integrity: Plagiarism is the representation of someone else's work as your own. Neglecting to properly cite references is the most common example of this. Plagiarism and other breaches of academic integrity (e.g. cheating) will not be tolerated and will be dealt with severely. The first offense will result in a failing grade for the assignment or exam in question. The second offense will result in a failing grade for the course and your actions will be reported to the University registrar. Please ask questions IN ADVANCE if you are not sure about what constitutes plagiarism, at this stage it is simply a learning exercise (i.e., not a breach of academic integrity) and you will be able to rectify the situation. *Once a paper is submitted, however, you will be held to the above guidelines*. Since a significant part of your grade in this course will involve written research assignments it is a critical that you fully understand this policy.

Any instance of cheating or interfering with another student's ability to learn will not be tolerated. In either case, the guidelines from the Academic Integrity section of the Undergraduate Catalog will be followed.

While you will be working with a partner in lab, and will often work on in-class activities in groups, all work must be your own. As one example, you may not simply copy your lab partner's methods section and paste it into your own lab report. One of the learning objectives of this course is to develop skills to communicate in writing to a broad community of scientists. Simply copying from others cheats you of this opportunity to develop these skills. See the SPU undergraduate catalog (http://spu.edu/catalog/undergraduate/20167/academic-policies-procedures/integrity) for more information on academic integrity.

Attendance and participation: Students are expected to attend all class sessions. Due to the unusual nature of this course, it is essential that we all work together as a team and participate on a daily basis to ensure that effective progress is made. If you are not in class, you cannot participate. For this reason, chronic *unexcused* absences from the class will result in significant grade reductions (1-2 letter grades at the instructor's discretion will be given for four or more unexcused absences). If you plan to be absent due to a university-sanctioned event (e.g., grad-school interview, choir performance or athletic competition), please alert the instructor in advance. If you are unable to attend class due to a severe illness or other emergency, you must notify the instructor *before* class if possible. If you miss a graded in-class activity for an *unexcused* absence, you will not be able to make it up. If you miss a graded in-class activity for an *excused* absence, you may be asked to do a makeup assignment, at the instructor's discretion.

Classroom conduct: You are expected to help maintain a classroom environment that is conducive to learning by arriving on time, by minimizing distractions (texting, cellphones, laptops, food), and by respecting the rights of other students to ask questions and express their views.

Late work policy: All coursework (both lecture and lab) must be completed and turned in by the stated deadline. As stated above, you are responsible for completing all of your own work. All work must be turned in to the instructor in person unless an alternative has been arranged in advance. Points for late work, when accepted, will be reduced by 10% for each calendar day

the assignment is late. Exceptions may be made for illness and emergencies when the instructor has been notified and agrees in writing.

Note the date and time of all exams, including the final exam, and make your travel plans accordingly. Make-up exams will be considered only for extraordinary circumstances and only if the instructor has been notified in writing in advance (leaving early for vacation does not count as an extraordinary circumstance). The format of a makeup exam is the instructor's choice.

No late work will be accepted after the start of the final exam.

E-mail/Canvas: Course announcements will be posted on Canvas, and other information may be disseminated by email, so please check both regularly for any updates. I am happy to respond to emails. However, I generally do not check email in the evening (after 8pm) – please plan ahead if you have questions about the next day's class or lab (especially if there is a test scheduled, or an assignment due!)

Disabilities statement: All students have the right to learn, and I care very deeply that students feel supported and engaged in class. In accordance with Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1990, I encourage students with specific disabilities that qualify for academic accommodations to contact Disabled Student Services (DSS) in the Center for Learning (http://www.spu.edu/depts/cfl/dss/index.asp). DSS in turn will send a Disability Verification Letter to the course instructor indicating what accommodations have been approved.

Inclement weather: The University maintains an Emergency Closure Hotline (206-281-2800). In the event of inclement weather or an emergency that might close the university, please call the Hotline for the most up-to-date closure information or check the SPU website. Both will be updated before 6:00 a.m. In the event that class is cancelled unexpectedly, please check the course Canvas site for makeup information.

Emergencies: If an emergency requiring evacuation occurs during lecture, please exit the classroom in a calm and orderly fashion and meet as a group in the Ross parking lot. If an emergency occurs during lab, please meet in Tiffany Loop. Please do not leave this area, as the instructor needs to account for all students immediately following the evacuation. If possible, pair up with your nearest neighbor in an emergency and keep track of each other until the situation has been resolved. In the unlikely event of a lockdown, please stay in the classroom and follow the instructor's directions. Additional information is provided on the next page.

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Emergency Preparedness Information

Report an Emergency or Suspicious Activity
Call the Office of Safety and Security to report an emergency or suspicious activity by dialing 206-281-2911 or by pressing the call button on a campus emergency phone. SPU Security Officers are trained first responders and will be dispatched to your location. If needed, the SPU Dispatcher will contact local fire/police with the exact address of the location of the emergency.

SPU-Alert System
The SPU-Alert System is SPU's emergency notification system. It can send information via text message, email, electronic reader board, computer pop-ups (for SPU computers), loudspeaker, and recorded cell phone messages. Text messaging has generally proven to be the quickest way to receive an alert about a campus emergency. In order to receive text messages from SPU-Alert, you must provide SPU with your cell phone number through the Banner Information System on the web, https://www.spu.edu/banweb/. Select the Personal Menu then choose the Emergency Alert System tab. Contact the CIS Help Desk if you have questions about entering your personal contact information into the Banner Information System. Emergency announcements may also be made by SPU staff members serving as Building Emergency Coordinators ("BECs").

Lockdown / Shelter in Place – General Guidance
The University will lock down in response to threats of violence such as a bank robbery or armed intruder on campus. You can assume that all remaining classes and events will be temporarily suspended until the incident is over. Lockdown notifications are sent using the SPU-Alert System.

If you are in a building at the time of a lockdown:

- Stay inside and await instruction, unless you are in immediate visible danger.
- Move to a securable area (such as an office or classroom) and lock the doors.
- Close the window coverings then move away from the windows and get low on the floor.
- Remain in your secure area until further direction or the all clear is given (this notification will be sent via the SPU-Alert System).

If you are outside at the time of a lockdown:

- Leave the area and seek safe shelter off campus. Remaining in the area of the threat may expose you to danger.
- Return to campus after the all clear is given (this notification will be sent via the SPU-Alert System).

Evacuation – General Guidance
Students should evacuate a building if the fire alarm sounds or if a faculty member, a staff member, or the SPU-Alert System instructs building occupants to evacuate. In the event of an evacuation, gather your personal belongings quickly and proceed to the nearest exit. Most classrooms contain a wall plaque or poster on or next to the classroom door showing the evacuation route and the assembly site for the building. Do not use the elevator.

Once you have evacuated the building, proceed to the nearest evacuation assembly location. The "*Stop. Think. Act.*" booklet posted in each classroom contains a list of assembly sites for each building. Check in with your instructor or a BEC (they will be easily recognizable by their bright orange vests). During emergencies, give each BEC your full cooperation whenever they issue directions.

Additional Information
Additional information about emergency preparedness can be found on the SPU web page at http://www.spu.edu/info/emergency/index.asp or by calling the Office of Safety and Security at 206-281-2922.

Last updated 9/10/16

Succeeding in Genetics

Genetics is an intense subject, in part because it is so focused on problem-solving. On the course Canvas site, I created a "Helpful Resources" tab with links to useful websites and articles that you may find helpful as you move through the course. Here are a few general tips that I encourage you to follow:

1. Attend all class sessions and labs! Classes will include different types of activities, including lecture, discussion, problem-solving, brainstorming, etc. These activities are designed to help you practice applying concepts introduced in lecture to real-world genetic problems. When you miss class, you miss out on these learning opportunities.

2. Ask for help! I want all of you to succeed. If you have questions about something we covered in class or lab, or are unsure of how to approach a genetics problem, please come talk to me, so I can help you.

3. Form a study group with your classmates to share notes, pick each other's brains, and review concepts. The study area on the main floor of Eaton includes a white board that students are free to use during their studies.

4. The 3Rs: Read, Review, Re-write

    a. Read the assigned chapters or articles before class, and identify the key concepts. Note any questions you have about the material.
    b. Review class materials and lectures. I will try to make lectures available after class through TechSmith Relay.
    c. Re-write your lecture notes after each class – the sooner, the better, since it will still be fresh in your mind. Re-writing your notes will not only allow you to reorganize them, but there is extensive research demonstrating the "hand-brain connection" – writing and re-writing help you to process concepts and information, and move it from short-term to long-term memory.

Syllabus

- *Please note: additional readings not listed here may be assigned. Text reading assignments refer to the 5th edition. Please see Canvas for 4th ed. equivalents. The syllabus is subject to change. Any changes will be communicated verbally and on Canvas.*

Date	Topic	Readings & Assignments
Wed., 1/4	Introduction to course; Mendelian genetics	**Text:** Ch. 1; 2.1-2.2
Fri., 1/6	Pedigree analysis & extensions to Mendel	**Text:** Ch. 2.3, 3.1
Mon., 1/9	Introduction to research project	**Text:** Article on Canvas **Due:** Syllabus Quiz (Canvas)
Wed., 1/11	Beyond Mendel	**Text:** Ch. 3.1-3.2 **Due:** Problem Set #1
Fri., 1/13	Epistasis	**Text:** Ch. 3.2; article (Canvas)
Mon., 1/16	***MARTIN LUTHER KING, JR. DAY - NO CLASS***	
Wed., 1/18	Chromosome Theory of Inheritance	**Text:** Ch. 4.1-4.2, 12.4 (review 4.3-4.5)
Fri., 1/20	Chromosome Theory of Inheritance	**Text:** Ch. 4.6-4.7 **Due:** Problem Set #2
Mon., 1/23	non-Mendelian inheritance	**Text:** Ch. 14 (all)
Wed., 1/25	***EXAM 1***	
Fri., 1/27	Genetics and Society: Case Study #1	**Due:** Position Paper #1
Mon., 1/30	**Video conference**: Jenny Heppert, UNC-Chapel Hill	**Due (1/29):** three questions for Jenny Heppert (Canvas)
Wed., 2/1	Gene linkage and recombination	**Text:** Ch. 5.1-5.2
Fri., 2/3	Gene linkage and recombination	**Text:** Ch. 5.3-5.4
Mon., 2/6	Molecular basis for recombination	**Text:** Ch. 6.4-6.5 **Due:** Problem Set #3
Wed., 2/8	Mutant analysis & complementation	**Text:** Ch. 7.1-7.2
Fri., 2/10	Mutant analysis & complementation	**Text:** Ch. 7.3-7.4
Mon., 2/13	Genetics and Society: Case Study #2	**Due:** Position Paper #2
Wed., 2/15	Evidence for the Genetic Code	**Text:** Ch. 6.1-6.2, 8.1 **Due:** Problem Set #4
Fri., 2/17	***EXAM 2***	
Mon., 2/20	***PRESIDENT'S DAY - NO CLASS***	
Wed., 2/22	Prokaryotic gene regulation	**Text:** Ch. 13.4-13.5
Fri., 2/24	Prokaryotic gene regulation	**Text:** Ch. 15.1-15.2 (review Ch. 8.2-8.5)
Mon., 2/27	Prokaryotic gene regulation	**Text:** Ch. 15.1-15.2 **Due:** Problem Set #5
Wed., 3/1	Eukaryotic gene regulation	**Text:** Ch. 16.1-16.2
Fri., 3/3	Eukaryotic gene regulation	**Text:** Ch. 16.1-16.2
Mon., 3/6	Guest lecture: Dr. Minna Roh-Johnson, FHCRC	**Text:** Article on Canvas
Wed., 3/8	Genetics and Society: Case Study #3	**Due:** Position Paper #3
Fri., 3/10	Epigenetics	**Text:** Ch. 11.1-11.3; 16.3-16.4 **Due:** Problem Set #6
Mon., 3/13	Epigenetics	**Text:** Ch. 16.3-16.4 **Due (11:59 pm):** Lab report
Thurs., 3/16	***FINAL EXAM*** ***8:00 AM - 10:00 AM*** ***Cremona 102***	

Lab Schedule

Week	Dates	Activities
1	1/10 & 1/12	• Pre-lab assignment: read RNAi review article and answer questions • Lab safety training and drawer check-in • Lab lecture: introduction to research project; discuss RNAi article • Practice aseptic technique. • Learn how to pick, manipulate and observe worm strains • Record observations and compare/contrast wild-type (N2) and mutant (*mes-1*) strains
2	1/17 & 1/19	• Pre-lab assignment: Bei et al (2002) article and questions • Lab lecture: discussion of Bei et al paper • Practice picking worms, and maintain strains • Pick a colony from your assigned RNAi feeding strain plate to grow an overnight culture
3	1/24 & 1/26	• Pre-lab assignment: DNA sequencing • Isolate plasmid DNA from bacterial cultures • Quantification of DNA using NanoDrop • Set up DNA sequencing reactions (to be completed by FHCRC) • Practice picking worms, and maintain strains
4	1/31 & 2/2	• Pre-lab assignment: BLAST and WormBase search • Day before lab: set up fresh overnight culture of RNAi clone • Gel electrophoresis & analysis of DNA sequencing • Practice scoring plates for dead embryos and viable larvae • Seed first set of RNAi plates (for practice run-through) • Practice picking worms, and maintain strains
5	2/6 - 2/10	• Pre-lab assignment: Literature search results • Wed.: set up fresh overnight culture of RNAi clone • Thurs.: Seed second set of RNAi plates (for Trial 1) • Practice run-through of RNAi experiment • Maintain strains
6	2/13 - 2/17	• Pre-lab assignment: Questions about experimental procedures • Wed.: set up fresh overnight culture of RNAi clone • Thurs.: Seed second set of RNAi plates (for Trial 2) • RNAi experiment, Trial 1 • Maintain strains
7	2/20 - 2/24	• Pre-lab assignment: Data table summarizing Trial 1 results • RNAi experiment, Trial 2
8	2/28 & 3/2	• Pre-lab assignment: Data table summarizing both Trial 2 and cumulative results • Statistical analysis of data • New discussion of Bei et al paper
9	3/7 & 3/9	• Pre-lab assignment: Reflection questions • Oral presentations