

BME 105: Genetics in the Genomics Era Syllabus (Spring 2025, MWF 12:00PM-1:05PM)

Course Website: canvas.ucsc.edu (BME 105, 2025 Spring Quarter)

Lectures: JBE 152

Recordings will be made available through Lecture Capture. Should be available through Canvas

Instructor	Shelbi Russell (she/her), Assistant Professor, Department of Biomolecular Engineering Angela Brooks (she/her), Professor, Department of Biomolecular Engineering
Email	shelbilrussell@gmail.com , Please include BME 105 in the subject of the email. anbrooks@ucsc.edu , Please include BME 105 in the subject of the email.
Office Hours	Shelbi Russell: Friday 2-3 pm, Sinsheimer 427 (unavailable April 18th) Angela Brooks: Fridays 4-5pm, PSB 305 (starting April 18)
Office Hours, by appointment	Email with "BME 105 Office Hour Request" in the subject line for available appointments

TAs	Julian Lucas and Samira Vera-Choqueccota, Graduate Students, Department of Biomolecular Engineering
Email	lveracho@ucsc.edu , juklucas@ucsc.edu
Office Hours: Time and Location	Julian: Thursday 10-11am, Science & Engineering Library Room 332 Samira: Wednesday 4-5 pm, Science & Engineering Library Room 332 , Room 330 (only 04/09)

Sections	TA	Schedule	Location
Section 1	Samira Vera-Choqueccota	M 9:20AM-10:25AM	PhysSciences 114
Section 2	Julian Lucas	M 10:40AM-11:45AM	N. Sci Annex 101

Tutor	Scott Crittendon, Undergrad
Email	scritten@ucsc.edu
Office Hours: Time and Location	In-person: Tuesday 2-3 pm, Science & Engineering Library Room 330 Remote: Thursday 11:30am-12:30pm, Zoom Link

Prerequisites:

BIOL20A

Majors:

Enrollment is restricted to bioengineering, biomolecular engineering and bioinformatics, biotechnology, bioinformatics, and microbiology majors and proposed majors and bioinformatics minors.

Textbook:

From Genes to Genomes, 6th edition by Lee Hartwell et al., Reserve copies of the textbook and solutions to textbook problems are available at the Science & Engineering Library: [BME 105 Course Reserves list](#)

DRC Statement:

UC Santa Cruz is committed to creating an academic environment that supports its diverse student body. If you are a student with a disability who requires accommodations to achieve equal access in this course, please affiliate with the DRC. I encourage all students to benefit from learning more about DRC services to contact DRC by phone at 831-459-2089 or by email at drc@ucsc.edu. For students already affiliated, make sure that you have requested Academic Access Letters, where you intend to use accommodations. You can also request to meet privately with me during my office hours or by appointment, as soon as possible. I would like us to discuss how we can implement your accommodations in this course to ensure your access and full engagement in this course.

Course format:

Students are expected to attend lectures and sections. Problem Sets questions will be assigned in the “Quizzes” section of Canvas. These questions can be attempted multiple times until the correct answers are given. You are encouraged to discuss in-class questions with others. There will be 4 exams and one final exam.

Exam format:

You are expected to take the exams in-person on the scheduled date and time, unless otherwise indicated. Exams will be closed book, closed notes. Genetics is primarily a problem-solving course, so you will be expected to be able to solve new problems that you have

not come across. You cannot obtain answers to exam questions from any source or be coached through answers by any source during the exam time (Please see “Academic Honesty and Academic Integrity” for more information). CELL PHONE USAGE IS NOT ALLOWED.

You are highly encouraged to form study groups to go over the material and problem sets with other students.

Grading:

Problem-sets 100 points (25%)

Exam 1, 50 points

Exam 2, 50 points

Exam 3, 50 points

Exam 4, 50 points

Exams Total*, 150 points (37.5%)

*Lowest score from the four exams is dropped

Cumulative Final Exam, 130 points (32.5%)

Lecture Attendance 11 points (Attend at least 22/24 lectures (2 freebies): 0.5 points/lecture)

Discussion Section Attendance 9 points (9 discussion sections: 1 point/discussion)

Total 400 points

Strict percentage:

As: 90-100%

Bs: 80-89.9%

Cs: 70-79.9%

Ds: 60-69.9%

Fs: <59.9%

Because the Final exam is cumulative, if you pass the Final, you pass the class. Passing the Final exam is 70% or 105/150 points correct.

In other words, if you happened to have done poorly in the exams or problem sets such that your Total point (400 points) percentage is not passing, but you pass the Final, your final grade will be a C. For all others, your Final grade will be based on the strict percentage of your Total 400 points.

Sick policy:

If you are feeling sick, please do not attend class and no need to inform the instructors, unless this applies to the final exam. The lowest exam score can be dropped and missing a few lectures due to illness, or otherwise, is accounted for in the attendance policy.

Course schedule and overview**Expectations**

You should bring your own laptop to class every day. You might be fine with using the Canvas app on your phone to do the problem sets in class. If you do not have access to a laptop computer, please contact the instructor as soon as possible.

Information on laptop loans through UCSC libraries: <https://guides.library.ucsc.edu/borrowing/lendingcode>

Additional exam policies

No make-up exams will be given. ~~If you miss a midterm, the percentage you receive on the next exam will count toward the missed midterm. For example, if you miss Midterm 1, the percentage on Midterm 2 will count toward your Midterm 1 points. If you miss Midterm 2, the percentage on your Final Exam will count toward your Midterm 2 points.~~ Please inform the instructor, in advance, if you are missing an exam.

In only extreme circumstances will there be accommodations for a missed final exam and this will be handled on a case-by-case basis.

Academic Honesty and Academic Integrity

In recent years, there have been an increased number of cheating incidents in many UC campuses, and unfortunately, UCSC is no exception. The School of Engineering has a zero tolerance policy for any incident of academic dishonesty. If cheating occurs, there may be consequences within the context of the course, and in addition, every case of academic dishonesty is referred to the students'

college Provost, who then sets the disciplinary process in motion. Cheating in any part of the course may lead to failing the course and suspension or dismissal from the university.

Examples would include copying another student's exams. Although you may discuss Problem Sets with fellow students, your collaboration must be at the level of ideas and explaining concepts only. Legitimate collaboration ends when you "lend", "borrow", or "trade" written or electronic solutions to problems, or in any way share in the act of writing or electronically sharing your answers.

What is Academic Integrity? This question is better answered with how we violate academic integrity. One prime example is fabrication.

Fabrication:

In any academic exercise, submitting falsified data including bibliographic resources and experimental data, or altering graded coursework/exams and resubmitting to the instructor for a higher score.

Another example of violating academic integrity is Facilitating Academic Dishonesty:

One form of this is answering questions on someone else's exam or doing someone else's homework for them.

Another form is helping another student take a test (allowing them to cheat from you).

Student accommodations

UC Santa Cruz is committed to creating an academic environment that supports its diverse student body. If you are a student with a disability who requires accommodations to achieve equal access in this course, please submit your Accommodation Authorization Letter from the Disability Resource Center (DRC) to me by email, preferably within the first two weeks of the quarter. I would also like us to discuss ways we can ensure your full participation in the course. I encourage all students who may benefit from learning more about DRC services to contact DRC by phone at 831-459-2089 or by email at drc@ucsc.edu.

CARE Statement

Title IX prohibits gender discrimination, including sexual harassment, domestic and dating violence, sexual assault, and stalking. If you have experienced sexual harassment or sexual violence, you can receive confidential support and advocacy at the Campus Advocacy Resources & Education (CARE) Office by calling (831) 502-2273. In addition, Counseling & Psychological Services (CAPS) can provide confidential, counseling support, (831) 459-2628. You can also report gender discrimination directly to the University's Title IX Office, (831) 459-2462. Reports to law enforcement can be made to UCPD, (831) 459-2231 ext. 1. For emergencies call 911.

Helpful resources

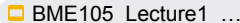
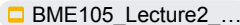
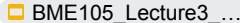
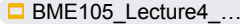
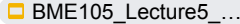
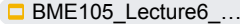
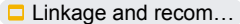
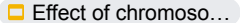
Educational videos on genetic concepts are available on JoVE, which is available through your UCSC account:

<https://www.jove.com/education/biology>

Learn.Genetics

<https://learn.genetics.utah.edu/>

Lecturer annotated by date: Shelbi (aqua), Angela (purple), guest lecturer (orange)

Week	Day	Date	Topic	Lecture slides	Problem Sets (Canvas Quiz)	2022 Book Chapter, supplemental materials	Suggested problems from book (not graded)	Discussion section activity	UCSC Faculty with related research (PBSE, EEB, GI, SJRC). This is not a comprehensive list.	
1	M	3/31/25	Genes, alleles, and Punnett squares		PS1: Course introduction, independent assortment	Chapter 2	Chapter 2: Solved Problems I, II. Problems: Vocabulary, 5,8,13,14,16,22, 35, 36, 42, 46, 47	no discussion section in the first week	Most faculty	
	W	4/2/25	Sum and Product Rule and pedigrees		PS2: Sum and product rules and introduction to pedigrees				Most faculty	
	F	4/4/25	Conditional probabilities and more pedigrees		PS3: Pedigrees and conditional probability	Chapter 4.6, 4.7			Vaske	
2	M	4/7/25	Identifying genetic variants		PS4: Identifying genetic variation	Chapter 9.1, 9.3, 9.4	Chapter 11: Vocabulary 1, Problems 11, 22: Solved Problems I, Vocabulary, 2,3,6,7,11,13,19	probability theory exercises	Many faculty, especially in the Genomics Institute	
	W	4/9/25	Genetic variant detection with high-throughput sequencing		PS5: High-throughput sequencing	Chapter 11 (except 11.4)			Genomics Institute	
	F	4/11/25	Chromosomes, ploidy, mitosis, meiosis, genetic linkage and recombination		PS6: Chromosomes, ploidy, mitosis, meiosis	Chapter 4.1-4.5			Miga, Bhalla, Greider, Kamakaka, Kellogg, Shariati, Sullivan	
3	M	4/14/25	EXAM 1						review for exam + genetic counselor role play	Corbett-Detig, Russell,
	W	4/16/25	Genetic linkage and recombination		PS7: Linkage and Recombination	Chapter 5.1-5.2	Chapter 5: 3, 7			
	F	4/18/25	Chromosomal rearrangements: detection, phenotype, and their effects on meiosis		PS8: Chromosomal rearrangements	Chapter 13.1, 13.2, 3.1	Chapter 13: Solved Problem III, Problems 13, 22, Chapter 3: 5, 9,	Miga, Paten		

							12		
4	M	4/21/25	Dominance relationships, lethality, pleiotropy	☐ Extensstions for sing...	PS9: Extension of Mendel for single-gene inheritance			meiotic recombination activity	Salama, Brooks, Vaske, Vollmers
	W	4/23/25	Two-gene interactions, pathways, complementation	☐ Two gene interactions	PS10: Two-gene interactions	Chapter 3.2, Chapter 8	Chapter 3: Solved Problem II, 20, 26, 29, 32, 36, Chapter 8: 26, 34, 41, 44, 51		
	F	4/25/25	Protein coding and non-coding mutations, genetic suppressors	☐ Protein coding and ...	PS11: Protein coding and non-coding mutations, suppressors				
5	M	4/28/25	Loss-of-function and gain-of-function	☐ Types of mutations:...	PS12: Types of mutations: Loss-of-function and gain-of-function			exam review + genotyping by DNA sequencing activity	
	W	4/30/25	GWAS	☐ GWAS	PS13: GWAS	Chapter 22.2, Chapter 12.1, 12.3, Chapter 17.1, 17.2, 17.3	Chapter 22: 21, 22, 29, 30, Chapter 12: 6, Chapter 17: 21, 25		Brooks, Haussler, Vaske, Salama,
	F	5/2/25	EXAM 2						
6	M	5/5/25	Gene regulation, epigenetics,functional elements: genomics methods for detecting function of non-coding DNA	☐ BME105_Lecture15...	PS14: Gene regulation and epigenetics	Chapter 22.2, Chapter 21.1, 21.2	Chapter 21: 5, 9, 22	paper discussion on Mendelian inheritance	Brooks, Boeger, Haussler, Kamakaka, D. Kim, Lowe, Greider, Stewart, Sharma, Forsberg
	W	5/7/25	DNA methylation, imprinting, and high-throughput sequencing methods for epigenomic profiling	☐ Gene regulation par...	PS15: Gene regulation and Imprinting				
	F	5/9/25	Sex chromosomes, sex determination, and dosage compensation	☐ Sex determination, ...	PS16: Sex determination and dosage compensation	Chapter 4.2, 4.7, Chapter 12.3	None		
7	M	5/12/25	Transgenes, recombinant DNA, reporters, RNAi.	☐ Transgenes	PS17: Transgenes and recombinant DNA	Chapter 9.2, Chapter 17.4, Chapter 18	None		Most faculty
	W	5/14/25	Mouse genetics	☐ Mouse genetics	P18: Mouse genetics				Forsberg, Sharma, Sikandar, Hinck, E. Kim, Carpenter
	F	5/16/25	CRISPR-Cas9 genome editing	☐ cond_ko_crispr	P19: Gene editing			chromatin map activity	Carpenter, Brooks, Salama, Ares, Forsberg, Haussler, many others
8	M	5/19/25	EXAM 3					exam review + cloning and vector	

	W	5/21/25	Intro to population genetics	BME105_Lecture22...	PS20: Population Genetics	Chapter 15.1, 15.3, 15.4		design activity	Many EEB faculty, Corbett-Detig
	F	5/23/25	Natural selection and microbial symbiosis	BME105_Lecture23...	PS21: Natural selection and microbial symbiosis				Many EEB faculty, Corbett-Detig, Kilpatrick
9	M	5/26/25	MEMORIAL DAY						
	W	5/28/25	Ancestry, Guest lecture: Alex Ioannidis	Ioannidis_Ancestry....	PS22: Ancestry	Chapter 21.3	None		Green, Corbett-Detig, Ioannidis
	F	5/30/25	Phylogenetics and SARS-COV-2, Guest lecture: Russ Corbett-Detig	Phylogenetics_Gue...	PS23: Phylogenetics			no section	Corbett-Detig, Haussler, Kilpatrick
10	M	6/2/25	EXAM 4						
	W	6/4/25	Course review	Q&A	PS24: Genetic engineering in the present and future				
	F	6/6/25	Current and future developments of genetics and genomics	Genetics and geno...				exam review + population genetics activity	Faculty in SJRC in particular Reardon, Doucet-Battle
FINAL EXAM	M	6/9/25 4:00–7:00 p.m.	FINAL						