

BME 105: Genetics in the Genomics Era Winter 2026 Syllabus

Schedule: MWF 12:00PM-1:05PM

Location: PhysSciences 114

Course Website: canvas.ucsc.edu (BME 105, 2026 Winter Quarter)

Instructor	Shelbi Russell (she/her), Assistant Professor, Department of Biomolecular Engineering
Email	shlrusse@ucsc.edu , Please include BME 105 in the subject of the email.
Office Hours	Fridays 10:50-11:50 am, Sinsheimer 427
Office Hours, by appointment	Email with "BME 105 Office Hour Request" in the subject line for available appointments

TA	Jodie Jacobs, PhD Candidate, Department of Biomolecular Engineering
Email	jomojaco@ucsc.edu
Office Hours	Mondays 3-4pm, BE-153A

TA	Yulia Zybyna, PhD Student, Department of Biomolecular Engineering
Email	yzybyna@ucsc.edu
Office Hours	Wednesdays 9-10am, E2-370

Sections	TA	Schedule	Location
BME 105-01A (30509)		We 2:40PM - 3:45PM	Crown Clrm 208
BME 105-01B (30522)		We 4:00PM - 5:05PM	Cowell Com 134

Prerequisites: BIOL20A

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

Textbook: From Genes to Genomes - Either the 6th edition by Lee Hartwell et al. or the 8th edition by Goldberg and Fischer. Both are linked on the [UCSC Bookstore page](#). A pdf version of the [6th edition is available from the UCSC library](#). The older version is cheap/free, but does not come with the ebook option from the publisher - some students wanted this option, so we are allowing for either version (the cost-conscious vs convenient option).

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.

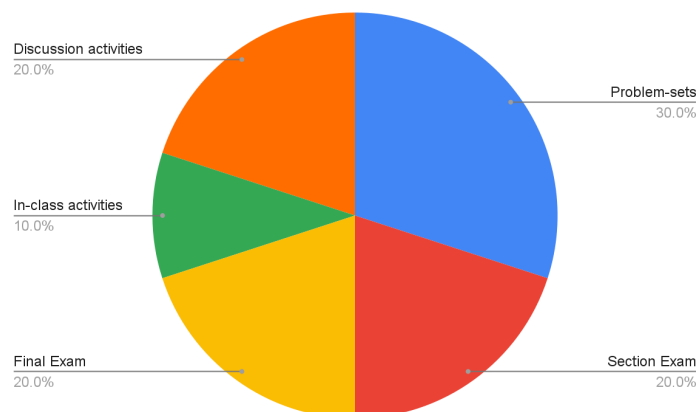
Lectures: Recordings will be made available through Lecture Capture, available through Canvas

Expectations: You should bring your own laptop to class every day. You might be fine with using the Canvas app on your phone or tablet 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>

Exam format: You are expected to take the exams at the scheduled date and time. Exams will be open book and note. However, Genetics is a problem-solving course, so you will be expected to be able to solve new problems that you have not come across. You must complete your exam by yourself - You cannot obtain answers to exam questions from others, work in groups, 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 also not allowed.

Grading:

- ☐ Problem-sets: 150 points (30%)
- ☐ Two unit exams (20%):
 - Exam 1 (covering 12 lectures), 100 points
 - Exam 2 (covering 12 lectures), 100 points
- *Lowest score from the two exams is dropped, not averaged
- ☐ Cumulative Final Exam, 100 points (20%)
- ☐ Discussion activities: 100 points (20%)
- ☐ In-class activities: 50 points (10%)



Total 500 points

- ☐ Optional lecture attendance: **Extra Credit +50 points (10%)**

The Final exam is cumulative. So, if you pass the Final, you pass the class. Passing the Final exam is 75% or 75/100 points correct. In other words, if you happen to have done poorly in the unit exams and/or problem sets, such that your Total point (500 points) percentage is not passing ($\leq C^-$), but you pass the Final, then your final grade will be a C. For all others, your Final grade will be based on the strict percentage of your Total 500 points, as outlined above.

Late policy: No make-up exams will be given. If an exam is missed for any reason, then that score will be the one that is not included in the final grade. No problem sets will be reopened for late submissions under any circumstances. Please use the week available to finish them.

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 will be dropped and missing a few lectures due to illness, or otherwise, is accounted for in the attendance policy.

Additional exam policies: No make-up exams will be given. 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.

Course schedule:

Wk	Day	Date	Topic	Lecture slides	Problem Sets (Canvas Quiz)	Hartwell 6th ed / Goldberg 8th ed 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	1/5/26	Genes, alleles, and Punnett squares	BME105_L...	PS1: Course introduction, independent assortment	Chapter 2 Chapter 1	Chapter 2: Solved Problems I, II. Problems: Vocabulary, 5, 8, 13, 14, 16, 22, 35, 36, 42, 46, 47 Chapter 1: Solved Problems I, II. Problems: Vocabulary, 5, 8, 13, 14, 16, 22, 35, 36, 40, 41, 45	no discussion section in the first week	Most faculty
	W	1/7/26	Sum and Product Rule and pedigrees	BME105_L...	PS2: Sum and product rules and introduction to pedigrees				Most faculty
	F	1/9/26	Conditional probabilities and more pedigrees	BME105_L...	PS3: Pedigrees and conditional probability	Chapter 4.6-4.7 Chapter 4.3-4.4			Vaske
2	M	1/12/26	Identifying genetic variants	BME105_L...	PS4: Identifying genetic variation	Chapter 9.1-9.4 Chapter 10.1-10.4	Chapter 11: Vocabulary 1, Problems 11, Chapter 22: Solved Problems I, Vocabulary, 2, 3, 6, 7, 11, 13, 19 Chapter 12: Vocabulary 1, Problems 11, Chapter 25: Solved Problems I, Vocabulary, 2, 3, 6, 7, 13, 19	DS1: Probability theory exercises TA: Jodie	Many faculty, especially in the Genomics Institute

	W	1/14/26	Genetic variant detection with high-throughput sequencing	BME105_L...	PS5: High-throughput sequencing	Chapter 11 (except 11.4) Chapter 12 (except 12.4)			Genomics Institute
	F	1/16/26	Chromosomes, ploidy, mitosis, meiosis	BME105_L...	PS6: Chromosomes, ploidy, mitosis, meiosis	Chapter 4.1-4.5 Chapter 3, 4.1, 4.2			Miga, Bhalla, Greider, Kamakaka, Kellogg, Shariati, Sullivan
3	M	1/19/26	MLK Day						
	W	1/21/26	Sex chromosomes, sex determination, and dosage compensation	BME105_L...	PS7: Sex determination and dosage compensation	Chapter 4.2, 4.7, 12.3 Chapter 4.1, 4.4, 13.3	None	DS2: Genetic counselor activity TA: Yulia	
	F	1/23/26	Genetic linkage and recombination	BME105_L...	PS8: Linkage and Recombination	Chapter 5.1-5.2 Chapter 5.1-5.2	Chapter 5: 3, 7 Chapter 5: 3, 7		
4	M	1/26/26	Chromosomal rearrangements: detection, phenotype, and their effects on meiosis	BME105_L...	PS9: Chromosomal rearrangements	Chapter 13.1-13.2 Chapter 14.1-14.2	Chapter 13: Solved Problem III, Problems 13, 22, Chapter 3: 5, 9, 12 Chapter 14: Solved Problem III, Problems 13, 22, Chapter 2: 5, 9, 12	DS3: Meiotic recombination activity TA: Jodie	Miga, Paten
	W	1/28/26	Dominance relationships, lethality, pleiotropy	BME105_L...	PS10: Extension of Mendel for single-gene inheritance	Chapter 3.1 Chapter 2.1			Salama, Brooks, Vaske, Vollmers
	F	1/30/26	Two-gene interactions, pathways, complementation	BME105_L...	PS11: Two-gene interactions	Chapter 3.2 Chapter 2.2	Chapter 3: Solved Problem II, 20, 26, 29, 32, 36 Chapter 2: Solved Problem II, 20, 30, 34, 39, 42		
5	M	2/2/26	Protein coding and non-coding mutations, genetic suppressors	BME105_L...	PS12: Protein coding and non-coding mutations, suppressors	Chapter 8 Chapter 9	Chapter 8: 26, 34, 41, 44, 51 Chapter 9: 10, 18, 28, 30, 39	DS4: Paper discussion on Mendelian inheritance	
	W	2/4/26	Unit 1 Exam @ class time						
	F	2/6/26	Linking genotype to phenotype with forward/reverse genetics	BME105_L...	PS13: Types of mutations: Loss-of-function and gain-of-function	Chapter 7.4-7.5 Chapter 7.1-7.2		TA: Yulia	
6	M	2/9/26	Gene regulation, epigenetics, functional elements: genomics methods for detecting function of non-coding DNA	BME105_L...	PS14: Gene regulation and epigenetics	Chapter 12.1-12.3, Chapter 17.1, 17.2 Chapter 13.1-13.3, Chapter 19.1, 19.2	Chapter 12: 6, Chapter 17: 21, 25 Chapter 13: 6, Chapter 19: 16, 30	DS5: Variant calling analysis TA: Jodie	Brooks, Boeger, Haussler, Kamakaka, D. Kim, Lowe, Greider, Stewart, Sharma, Forsberg

	W	2/11/26	DNA methylation, imprinting, and high-throughput sequencing methods for epigenomic profiling	BME105_L...	PS15: Gene regulation and Imprinting	Chapter 17.3 Chapter 20			
	F	2/13/26	Mapping phenotypes to genotypes: GWAS and QTL	BME105_L...	PS16: GWAS and QTL	Chapter 22.2 Chapter 25.2	Chapter 22: 21, 22, 29, 30 Chapter 25: 21, 22, 30, 34		Brooks, Haussler, Vaske, Salama,
7	M	2/16/26	No Class - President's Day						
	W	2/18/26	Transgenes, recombinant DNA, reporters, RNAi.	BME105_L...	PS17: Transgenes and recombinant DNA	Chapter 9.2, Chapter 17.4, Chapter 18 Chapter 10.2, Chapter 19.2, Chapter 21	None	DS6: Chromatin map analysis TA: Yulia	Most faculty Forsberg, Sharma, Sikandar, Hinck, E. Kim, Carpenter
	F	2/20/26	Model organism genetics	BME105_L...	P18: Model organism genetics				
8	M	2/23/26	CRISPR-Cas9 genome editing	BME105_L...	P19: Gene editing	Chapter 18.3 (if you haven't read it already)		DS7: CRISPR design TA: Jodie	Carpenter, Brooks, Salama, Ares, Forsberg, Haussler, many others
	W	2/25/26	Intro to population genetics	BME105_L...	PS20: Population Genetics	Chapter 21.1 Chapter 24.1	Chapter 21: 5, 9, 22 Chapter 24: 5, 9, 22		Many EEB faculty, Corbett-Detig
	F	2/27/26	Natural selection	BME105_L...	PS21: Natural selection	Chapter 21.2 Chapter 24.2			Many EEB faculty, Corbett-Detig, Kilpatrick
9	M	3/2/26	Microbial symbiosis: from endosymbiosis to microbiomes	BME105_L...	PS22: Microbial symbiosis	Chapter 15.1, 15.3, 15.4 Chapter 17.1, 17.3, 17.4		DS8: Experimental evolution TA: Yulia	
	W	3/4/26	Phylogenetics and SARS-COV-2	BME105_L...	PS23: Phylogenetics				Green, Corbett-Detig, Ioannidis
	F	3/6/26	Course review	Q&A					Corbett-Detig, Haussler, Kilpatrick
10	M	3/9/26	Unit 2 Exam @ class time						
	W	3/11/26	Ancestry, Guest lecture: Alex Ioannidis	Ancestry	PS24: Ancestry	Chapter 21.3 Chapter 24.3		Final exam review TA: Jodie	
	F	3/13/26	Current and future developments of genetics and genomics	BME105_L...	PS25: Genetic engineering in the present and future				Faculty in SJRC in particular Reardon, Doucet-Battle
11	T	3/17/26 12-3	Cumulative FINAL Exam @ class time						

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).

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 and request accommodations within the first two weeks of the course. All students who feel they will benefit from learning more about DRC services should contact the 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, where we can discuss how to implement your accommodations in this course while ensuring your full access and engagement.

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/>

Grade-Percent-Point Conversion:

A+	98-100%	4.0 points
A	93-97%	4.0 points
A-	90-92%	3.7 points
B+	88-89%	3.3 points
B	83-87%	3.0 points
B-	80-82%	2.7 points
C+	78-79%	2.3 points
C	73-77%	2.0 points
C-	70-72%	1.7 points
D+	68-69%	1.3 points
D	63-67%	1.0 points
D-	60-62%	0.7 points
F	0-59	0 points
Satisfactory (S)	equivalent to a C or better	NA
Unsatisfactory (U)	equivalent to a C- or worse	NA
Incomplete (I)		NA