

BISC 502a: Maintaining and transmitting genetic information - Fall 2025

Lectures: Mon and Wed 2-4 pm RR301.

Professors:

Ian Ehrenreich, Professor	ehrenrei@usc.edu
Irene Chiolo, Associate Professor	chiolo@usc.edu (<u>Course director</u>)
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Prerequisites: This course is designed for graduate students in the molecular biology PhD program. Graduate students in related fields with a strong background in Genetics, Molecular Biology, and Biochemistry may also be admitted at the discretion of the faculty.

Overview: This course is a **graduate** level survey of molecular biology and genetics focused on how information is stored and transmitted in the cell with particular emphasis on experimental methods and logic. This course assumes familiarity with molecular biology principles and methods. It is not appropriate for undergraduates or non-science students. ***This syllabus is subject to change!***

Learning Objectives:

- Develop the ability to think critically, analyze, synthesize, and use information to solve problems. Understand and apply the scientific method, including forming hypotheses, designing experiments to test hypotheses, and collecting, analyzing, interpreting, and reporting data.
- Develop the ability to evaluate primary scientific literature.
- Acquire an appreciation for many levels of biological organization, including the molecular, cellular, and organismal levels.
- Understand the main topics covered by lectures and journal clubs, including: genetics/genomics; DNA repair; DNA Replication; RNA; embryonic development.

Format and materials - This course will be taught from the primary literature in a mixed format of lectures and journal clubs. Each module will include an exam, problem set, or other evaluation of that material. Additional material will be posted on Brightspace. Background reading in any general Genetics, Cell Biology, or Molecular Biology textbook may be helpful.

Participation: All students are expected to attend the lectures in person. Additional material will be provided on Brightspace. Students are expected to monitor the Brightspace site for course announcements and new materials.

Office hours: Contact individual PIs to schedule office hours.

Week	Date	Topic	Topics
1	25 August	Ehrenreich: Genome to phenotype	Single gene inheritance and trait mapping
	27 August		Multi-gene inheritance and trait mapping
2	1 Sept Labor Day	HOLIDAY	
	3 Sept		Genetic interactions
3	8 Sept		Minimal synthetic genomes
	10 Sept		Probing gene regulation through synthetic genomics
4	15 Sept	EXAM	
	17 Sept	Chiolo: Nuclear architecture and DNA Repair	Lecture: Nuclear dynamics for DNA repair
5	22 Sept		Article discussion: Mine'-Hattab NCB, 2012
	24 Sept		Article discussion: Roukos, Science, 2013
6	29 Sept		Article discussion: Caridi, Nature, 2018
	1 Oct		Article discussion: Schrank, Nature, 2018
7	6 Oct	EXAM	

	8 Oct	Goodman: Enzymology of Replication, Repair, Recombination, & Mutagenesis	DNA polymerase enzymology
8	13 Oct		Enzyme Kinetics "Mini-module" & DNA pol fidelity
	15 Oct		3R (Replication, Repair, Recombination) in proks
9	20 Oct		3R defects & human disease
	22 Oct		The 'other' pandemic: bacterial drug resistance
10	27 Oct	EXAM	
	29 Oct	Morton: Regulation of RNA in gene expression	Transcription
11	3 Nov		Co-/Post-transcriptional Regulation of gene expression
	5 Nov		RNA Decay
12	10 Nov		Translation of mRNA
	12 Nov		Circular RNA biogenesis and disease
13	17 Nov	EXAM	
	19 Nov	Cheng: A systems biology view of embryonic development	Lecture1: Introduction to development
14	24 Nov		Lecture2: Maternal cues and maternal-to-zygotic transition
	26 Nov Thanksgiving	HOLIDAY	
15	1 Dec		Lecture3: Morphogenesis
	3 Dec		Lecture4: Systems biology of embryonic development
	TBD	EXAM	

Grading: Each Midterm and the final exam will be graded (100 pts/exam)
TOTAL = 500 pts

Letter grades are based upon total points.

Other Policies:

1. Exam dates are firm. If a student misses an exam due to a true emergency (with an acceptable written excuse; written information concerning a death in the family must be provided), we MAY schedule a make-up exam, or at our discretion MAY permit the use of the average of other exams in determining the course grade. No one will be admitted to an exam after the first student has left the exam.
2. Regrading of exams will be done only by the professor who wrote the question. Regrading can only be done within one week of the day the exam is initially returned to the class. We do not re-grade exams written in pencil.
3. No special assignments for extra credit are given.
4. Final exams will be kept in Dr. Cheng's office for the required period.
5. It may be necessary to make some adjustments to the syllabus during the semester. Students are responsible to monitor the changes on Brightspace.

Please advise the faculty ASAP of any known conflicts, any DSP provisions, or other relevant information.

1. Academic Conduct:

Plagiarism – presenting someone else's ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Other forms of academic dishonesty are equally unacceptable (cheating on exams, changing answers before requesting regrade, etc.) We have zero tolerance for academic misconduct. Please familiarize yourself with the discussion of plagiarism in SCampus in Part B, Section 11, "Behavior Violating University Standards" policy.usc.edu/scampus-part-b. See additional information in SCampus and university policies on

scientific misconduct, policy.usc.edu/scientific-misconduct.

2. Support Systems:

Student Health Counseling Services - (213) 740-7711 – 24/7 on call

engemannshc.usc.edu/counseling

Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

National Suicide Prevention Lifeline - 1 (800) 273-8255 – 24/7 on call

suicidepreventionlifeline.org

Free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week.

Relationship and Sexual Violence Prevention Services (RSVP) - (213) 740-4900 – 24/7 on call

engemannshc.usc.edu/rsvp

Free and confidential therapy services, workshops, and training for situations related to gender-based harm.

Office of Equity and Diversity (OED) | Title IX - (213) 740-5086

equity.usc.edu, titleix.usc.edu

Information about how to get help or help a survivor of harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants. The university prohibits discrimination or harassment based on the following protected characteristics: race, color, national origin, ancestry, religion, sex, gender, gender identity, gender expression, sexual orientation, age, physical disability, medical condition, mental disability, marital status, pregnancy, veteran status, genetic information, and any other characteristic which may be specified in applicable laws and governmental regulations.

Bias Assessment Response and Support - (213) 740-2421

studentaffairs.usc.edu/bias-assessment-response-support

Avenue to report incidents of bias, hate crimes, and microaggressions for appropriate investigation and response.

The Office of Disability Services and Programs - (213) 740-0776

dsp.usc.edu

Support and accommodations for students with disabilities. Services include assistance in providing readers/notetakers/interpreters, special accommodations for test taking needs, assistance with architectural barriers, assistive technology, and support for individual needs.

USC Support and Advocacy - (213) 821-4710

studentaffairs.usc.edu/sssa

Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student.

Diversity at USC - (213) 740-2101

diversity.usc.edu

Information on events, programs and training, the Provost's Diversity and Inclusion Council, Diversity Liaisons for each academic school, chronology, participation, and various resources for students.

USC Emergency - UPC: (213) 740-4321, HSC: (323) 442-1000 – 24/7 on call

dps.usc.edu, emergency.usc.edu

Emergency assistance and avenue to report a crime. Latest updates regarding safety, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible.

USC Department of Public Safety - UPC: (213) 740-6000, HSC: (323) 442-120 – 24/7 on call

dps.usc.edu

Non-emergency assistance or information.

