

## **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 (Course director) |
| Myron Goodman Professor             | mgoodman@usc.edu                 |
| Derrick Morton, Assistant Professor | mortond@usc.edu                  |
| Xianrui Cheng, Assistant Professor  | xianruic@usc.edu                 |

**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.

| <b>Week</b> | <b>Date</b>      | <b>Topic</b>                                | <b>Topics</b>                                      |
|-------------|------------------|---|--|
| 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 | <b>HOLIDAY</b>                              |  |
|             | 3 Sept           |   | Genetic interactions                               |
| 3           | 8 Sept           |   | Minimal synthetic genomes                          |
|             | 10 Sept          |   | Probing gene regulation through synthetic genomics |
| 4           | 15 Sept          | <b>EXAM</b>                                 |  |
|             | 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            | <b>EXAM</b>                                 |  |

|    |                     |  |  |
|----|---------------------|--|--|
|    | 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:**

- 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.
- 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.
- No special assignments for extra credit are given.
- Final exams will be kept in Dr. Cheng's office for the required period.
- 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](http://policy.usc.edu/scampus-part-b). See additional information in SCampus and university policies on

scientific misconduct, [policy.usc.edu/scientific-misconduct](http://policy.usc.edu/scientific-misconduct).

## **2. Support Systems:**

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

[engemannshc.usc.edu/counseling](http://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](http://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](http://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](http://equity.usc.edu), [titleix.usc.edu](http://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](http://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](http://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/ssa](http://studentaffairs.usc.edu/ssa)

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](http://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](http://dps.usc.edu), [emergency.usc.edu](http://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](http://dps.usc.edu)

Non-emergency assistance or information.

