**BISC 403 FALL 2021 ADVANCED MOLECULAR BIOLOGY**
Lectures: Tues-Thurs 12:30 – 1:50 CPA 101  
Sections: Tues 4-5.50 THH 112 OR Weds 2-3:50 SGM 226

**Professors:**

<table>
<thead>
<tr>
<th></th>
<th>Prof. Susan Forsburg,</th>
<th>Prof. John Tower</th>
<th>TA: TBA</th>
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<tbody>
<tr>
<td>Office</td>
<td>Office: RRI 104C</td>
<td>Office: RRI 219C</td>
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<tr>
<td>Office hours</td>
<td>Thurs 2-3, and by appointment</td>
<td>Tues 10-12 and by appointment.</td>
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<tr>
<td>Tel/vox:</td>
<td>(213) 740-7342,</td>
<td>(213) 740-5384</td>
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<tr>
<td>email:</td>
<td><a href="mailto:forsburg@usc.edu">forsburg@usc.edu</a></td>
<td><a href="mailto:jtower@usc.edu">jtower@usc.edu</a></td>
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**Prerequisites:** BISC 320L (Molecular Biology) is a firm prerequisite for this course. BISC325 recommended.

**Overview:** Our course objective is to consider a few topics in Molecular Biology in depth. Topics are chosen by the faculty and generally represent active areas of current research. A key part of this course develops skills reading primary research papers in discussion.

**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 all levels of biological organization, including the molecular, cellular, organismal, and systems levels.
- Understand the processes that underlie development, cellular differentiation, and ageing.
- Understand the synthesis, structure, and function of nucleic acids and regulation by epigenetics.
- Understand the principles of epigenetic inheritance from molecular mechanisms to population consequences.
- Understand the flow of genetic information in populations and the relationship between genetics and evolutionary theory.
- Understand the functioning of organisms, at the molecular, cellular, organ, and organismal levels.

**Format:** There is no required textbook for this course. You will receive digital copies of lecture handouts and reading materials. Resources and review articles will also be uploaded to Blackboard (blackboard.usc.edu). Background reading in any general Genetics, Cell Biology, or Molecular Biology textbook may be helpful.

**Discussion Sessions:** Participation is required for full points in the course. Each week the instructor will assign a relevant research paper related to that week’s lectures. Students should be prepared to participate in a journal club about that paper, which will require reading the paper and any background prior to discussion. Students should come to section with the discussion worksheet filled out, and prepared to state the “take home message” of the paper, describing particular strengths and weaknesses. Did they prove their point? Students will be randomly called upon to present background materials, or discuss any figure of the paper or method employed, and credit will be awarded for this presentation. Additional points will be awarded for active participation in discussion. **Discussion sections will account for 20% of your grade.**
<table>
<thead>
<tr>
<th>Date</th>
<th>Lecturer</th>
<th>Topic</th>
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<tr>
<td><strong>SECTION 1: EPIGENETICS</strong></td>
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<tr>
<td>Week 1:</td>
<td>Forsburg</td>
<td>Introduction to Chromosomes, histones, nucleosomes</td>
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<tr>
<td>24 August</td>
<td>Forsburg</td>
<td>2-Nucleosome assembly; Methods of analysis, Chaperones</td>
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<tr>
<td>26 August</td>
<td>Forsburg</td>
<td>2-Nucleosome assembly; Methods of analysis, Chaperones</td>
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<td><strong>Week 1 Additional reading:</strong></td>
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<td>Week 2:</td>
<td>Forsburg</td>
<td>chromatin remodeling</td>
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<tr>
<td>31 Aug</td>
<td>Forsburg</td>
<td>histone modifications</td>
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<tr>
<td>2 Sept</td>
<td>Forsburg</td>
<td>histone modifications</td>
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<tr>
<td><strong>Week 2 Background reading</strong></td>
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<tr>
<td><strong>Discussion paper:</strong> Allfrey VG, Faulkner R, Mirsky AE. Acetylation and methylation of histones and their possible role in the regulation of RNA synthesis. Proc Natl Acad Sci U S A. 1964 May;51:786-94.</td>
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<td>Week 3:</td>
<td>Forsburg</td>
<td>binding motifs , Histone variants.</td>
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<tr>
<td>7 Sept</td>
<td>Forsburg</td>
<td>RNAi &amp; CRISPR</td>
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<tr>
<td>9 Sept</td>
<td>Forsburg</td>
<td>RNAi &amp; CRISPR</td>
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<td>Week 4:</td>
<td>Forsburg</td>
<td>MIDTERM 1</td>
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<tr>
<td>14 Sept</td>
<td>Forsburg</td>
<td>MIDTERM 1</td>
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### Background reading Week 4

**Discussion paper:**

### Week 5
#### 21 Sept Forsburg
**Case study: Centromeres and chromosome segregation**

#### Background reading Week 5
Misteli, T. The Self-Organizing Genome: Principles of Genome Architecture and Function

**Discussion paper:**

#### 23 Sept Forsburg
**Case Study: Genome organization**

### Background reading Week 6

**Discussion paper:**
Background for this paper: http://www.asbmb.org/asbmbtoday/201506/Features/DIPG/

### Week 7
#### 5 Oct Forsburg
**Case Study: Epigenetics and the environment**

#### 7 Oct MIDTERM 2
### Background reading Week 7

**discussion paper:**
TBD

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<tr>
<th>Week 8</th>
<th>12 Oct</th>
<th>Tower</th>
<th><strong>Evolutionary theories of aging</strong></th>
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**SECTION 2: AGING**

| 14 Oct | FALL RECESS |

#### Week 8 Background reading:


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<tr>
<th>Week 9: 19 Oct</th>
<th>Tower</th>
<th><strong>Mechanistic theories of aging</strong></th>
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<tr>
<td>21 Oct</td>
<td>Tower</td>
<td><strong>Mechanistic theories of aging</strong></td>
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#### Week 9 Background reading:


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<tr>
<th>Week 10: 26 Oct</th>
<th>Tower</th>
<th><strong>Gene expression during aging</strong></th>
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<tr>
<td>28 Oct</td>
<td>Tower</td>
<td><strong>Oxidative stress and damage</strong></td>
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#### Week 10 Background reading:

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<th>Week 11: 2 Nov</th>
<th>Tower</th>
<th><strong>Mitochondria</strong></th>
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<tr>
<td>4 Nov</td>
<td>MIDTERM 3</td>
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#### Week 11 Background reading:


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<th>Week 12: 9 Nov</th>
<th>Tower</th>
<th><strong>Stem cells</strong></th>
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<tbody>
<tr>
<td>11 Nov</td>
<td>Tower</td>
<td><strong>Stem cells</strong></td>
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#### Week 12 Background reading:


| Week 13: | Tower | **Cellular senescence, telomeres** |
**Grading:**
Midterm I 100 pts  
Midterm II 100 pts  
Midterm III 100 pts  
Final 100 pts (non cumulative)  
Discussion participation: 100 pts  
TOTAL = 500 pts

Letter grades are based upon total points. We do not generally curve the course.

**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.

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**Week 13 Background reading:** None  

**Week 14:**  
**23 Nov** Tower  
**25 Nov** THANKSGIVING

**Week 14 Background reading:** None  
**Week 14 Discussion paper:** No discussion this week.

**Week 15:**  
**30 Nov** Tower  
**2 Dec** Tower

**Week 15 Background reading:**  

**Week 15 Discussion paper:** Camus et al. (2015) Single Nucleotides in the mtDNA Sequence Modify Mitochondrial Molecular Function and Are Associated with Sex-Specific Effects on Fertility and Aging. Current Biology 25:2717-2722

**Final**  
Date and time in the course catalogue
4. Final exams will be kept in Dr. Forsburg’s office for the required period.

5. It may be necessary to make some adjustments in the syllabus during the semester.

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

7. 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.

8. 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
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
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.