This course will be taught ON-LINE via Blackboard and Zoom.

**Professors:**

| Prof. Susan Forsburg,  
| Open Office hours: Thurs 2-3 via zoom, and by appointment  
| email: forsburg@usc.edu | Prof. John Tower  
| Office hours: Tues 10-12 and by appointment.  
| Tel/vox: (213) 740-5384  
| email: jtower@usc.edu | TA: TBD |

**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.
### SECTION 1: EPIGENETICS


<table>
<thead>
<tr>
<th>Date</th>
<th>Lecturer</th>
<th>Topic</th>
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<tbody>
<tr>
<td>Week 1:</td>
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<tr>
<td>18 August</td>
<td>Forsburg</td>
<td>1-Introduction to Chromosomes, Histones, nucleosomes</td>
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<tr>
<td>20 August</td>
<td>Forsburg</td>
<td>2-Nucleosome assembly; Methods of analysis, Chaperones</td>
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**Week 1 Additional reading:**


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<thead>
<tr>
<th>Date</th>
<th>Lecturer</th>
<th>Topic</th>
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<tr>
<td>Week 2:</td>
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<tr>
<td>25 Aug</td>
<td>Forsburg</td>
<td>3- chromatin remodeling</td>
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<tr>
<td>27 Aug</td>
<td>Forsburg</td>
<td>4- histone modifications</td>
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**Week 2 Background reading**
Tyagi M, Imam N, Verma K, Patel AK. Chromatin remodelers: We are the drivers!! Nucleus. 2016 Jul 3;7(4):388-404

**Discussion paper:**

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<thead>
<tr>
<th>Date</th>
<th>Lecturer</th>
<th>Topic</th>
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<tbody>
<tr>
<td>Week 3:</td>
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<tr>
<td>1 Sept</td>
<td>Forsburg</td>
<td>5- binding motifs, Histone variants</td>
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<tr>
<td>3 Sept</td>
<td>Forsburg</td>
<td>6- RNAi &amp; CRISPR</td>
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**Week 3 Background reading**
Unravelling the structural and mechanistic basis of CRISPR-Cas systems.

**Discussion paper:**

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<thead>
<tr>
<th>Date</th>
<th>Lecturer</th>
<th>Topic</th>
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<tbody>
<tr>
<td>Week 4:</td>
<td></td>
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<tr>
<td>8 Sept</td>
<td>Forsburg</td>
<td>MIDTERM 1</td>
</tr>
<tr>
<td>10 Sept</td>
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<td>7- Case study: heterochromatin and silencing</td>
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**Background reading Week 4**

**Discussion paper:**

<table>
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<tr>
<th>Week 5:</th>
<th>Forsburg</th>
<th>8-Case study: Centromeres and chromosome segregation</th>
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<tr>
<td>15 Sept</td>
<td>Forsburg</td>
<td>9-Case study: DNA methylation &amp; Imprinting</td>
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<td>17 Sept</td>
<td>Forsburg</td>
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**Background reading Week 5**

**Discussion paper:**

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<tr>
<th>Week 6:</th>
<th>Forsburg</th>
<th>10-Case Study: Epigenetics and cancer</th>
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<tbody>
<tr>
<td>22 Sept</td>
<td>Forsburg</td>
<td>11- Case Study: Epigenetics and the environment</td>
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<td>24 Sept</td>
<td>Forsburg</td>
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**Background reading Week 6**

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

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<tr>
<th>Week 7:</th>
<th>Forsburg</th>
<th>MIDTERM 2</th>
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**SECTION 2: AGING**
1 Oct Tower Evolutionary theories of aging

**Background reading Week 7**
Entomol. 50:421-45.

Discussion paper:

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<thead>
<tr>
<th>Week 8:</th>
<th>Tower</th>
<th>Evolutionary theories of aging</th>
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<tbody>
<tr>
<td>6 Oct</td>
<td>Tower</td>
<td>Mechanistic theories of aging</td>
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Week 8 Background reading:


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<thead>
<tr>
<th>Week 9:</th>
<th>Tower</th>
<th>Mechanistic theories of aging</th>
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<tr>
<td>13 Oct</td>
<td>Tower</td>
<td>Gene expression during aging</td>
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<tr>
<th>Week 10:</th>
<th>Tower</th>
<th>Oxidative stress and damage</th>
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<tbody>
<tr>
<td>20 Oct</td>
<td>Tower</td>
<td></td>
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<tr>
<td>22 Oct</td>
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<td>MIDTERM 3</td>
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<tr>
<th>Week 11:</th>
<th>Tower</th>
<th>Mitochondria</th>
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<tr>
<td>27 Oct</td>
<td>Tower</td>
<td>Stem cells</td>
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<tr>
<th>Week 12:</th>
<th>Tower</th>
<th>Cellular senescence, telomeres</th>
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<tr>
<td>3 Nov</td>
<td>Tower</td>
<td>Progerias</td>
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<td>5 Nov</td>
<td>Tower</td>
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<tr>
<th>Week 13:</th>
<th>Tower</th>
<th>Sirtuins, Dietary restriction (DR), and Insulin/IGF1-like signaling (IIS)</th>
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<tbody>
<tr>
<td>10 Nov</td>
<td>Tower</td>
<td>Sleep and circadian rhythms</td>
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<tr>
<td>12 Nov</td>
<td>Tower</td>
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END OF INSTRUCTION

19 Nov Final, 11am-1pm | Tower |
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.

4. Final exams will be kept by Dr. Forsburg or Dr Tower 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**
engemannhsc.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/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.