Lecture: Tu Th 9:30-10:50 am, ZHS 163, Discussion: Th 4:00-5:50 pm, KAP 146
Professors: Myron F. Goodman, RRI 119C (213-740-5190, mgoodman@usc.edu)
Fabien Pinaud, RRI 119B (213-740-2262, pinaud@usc.edu)
Xiaojiang Chen, RRI 119A (213-740-5487, xiaojiac@usc.edu)
TA: TBA

Online resources (syllabus, lecture notes, etc): Blackboard http://blackboard.usc.edu

<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Lecturer</th>
<th>Lecture Topics</th>
<th>Text Chapter</th>
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<tr>
<td>Week 1</td>
<td>Jan 10</td>
<td>MFG</td>
<td>DNA Polymerases &amp; Mutations</td>
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<td></td>
<td>Jan 12</td>
<td>MFG</td>
<td>Base Substitution Mutations &amp; Pol Fidelity</td>
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<tr>
<td>Week 2</td>
<td>Jan 17</td>
<td>MFG</td>
<td>Thinking about Kinetics &amp; Pol Fidelity Models</td>
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<td>Jan 19</td>
<td>MFG</td>
<td>Correcting Spontaneous Errors – Proofreading &amp; MMR</td>
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<td>Week 3</td>
<td>Jan 24</td>
<td>MFG</td>
<td>Correcting Induced Errors - BER</td>
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<td>Jan 26</td>
<td>MFG</td>
<td>Okazaki Fragments – “Ancient” History</td>
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<td>Breathing can be Bad for Your Health</td>
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<td>Week 4</td>
<td>Jan 31</td>
<td>MFG</td>
<td>Correcting UV Damage – NER</td>
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<td>Restriction Enzymes, Biotech Applications, Molecular Specificity, Biophysical Methods</td>
<td>5.0-5.2; 8.6; 9.3</td>
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<td>Week 5</td>
<td>Feb 7</td>
<td>FP</td>
<td>DNA scanning and Target search</td>
<td>Assigned papers</td>
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<td></td>
<td>Feb 9</td>
<td>MFG</td>
<td>AID-DNA Scanning – Human Hypermutation</td>
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<td>Week 6</td>
<td>Feb 14</td>
<td>MFG</td>
<td>Bacterial Hypermutation and/or CRISPR-Cas</td>
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<td>Feb 16</td>
<td>FP</td>
<td>Control of gene expression in eukaryotes by DNA packaging</td>
<td>32-32.3 + Assigned paper</td>
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<td>Week 7</td>
<td>Feb 21</td>
<td>EXAM</td>
<td>MIDTERM I</td>
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<tr>
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<td>Feb 23</td>
<td>FP</td>
<td>Control of gene expression in eukaryote by specific DNA recognition</td>
<td>32-32.3 + Assigned paper</td>
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<tr>
<td>Week 8</td>
<td>Feb 28</td>
<td>FP</td>
<td>Eukaryotic transcription machinery: RNA pol II, initiation, elongation</td>
<td>29 (intro), 29.1 (861-864), 29.2 + assigned paper</td>
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<td>Mar 2</td>
<td>FP</td>
<td>Transcription in Eukaryotes: termination, mRNA processing, splicing and export</td>
<td>29.3 + assigned paper</td>
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<td>Week 9</td>
<td>Mar 7</td>
<td>FP</td>
<td>Protein Synthesis: Ribosomes and Translation initiation and elongation</td>
<td>30-30.3 + assigned paper</td>
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<td>Mar 9</td>
<td>FP</td>
<td>Protein Synthesis: Translation termination and inhibition. Secretary and membrane proteins</td>
<td>30.3, 30.5-30.6</td>
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<td>Mar 12-19</td>
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<td>SPRING BREAK</td>
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<td>Week 10</td>
<td>Mar 21</td>
<td>FP</td>
<td>Biophysics of cell membrane: Lipid interactions and phase diagrams</td>
<td>Review 12 + assigned paper</td>
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<td>Mar 23</td>
<td>FP</td>
<td>Biophysics of cell membrane: Lipid microdomains</td>
<td>assigned paper</td>
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<tr>
<td>Week 11</td>
<td>Mar 28</td>
<td>EXAM</td>
<td>MIDTERM II</td>
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<td></td>
<td>Mar 30</td>
<td>XC</td>
<td>Structural Biology: Protein X-Ray Crystallograph</td>
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**Week 12**  
**Apr 4**  
**XC**  
Structural Biology: Protein X-Ray Crystallography

**Apr 6**  
**CG**  
Structural biology: Cryo-Electron Microscopy

**Week 13**  
**Apr 11**  
**XC**  
Covid19: Infectious diseases, Viruses, and Pandemics

**Apr 13**  
**XC**  
Principle of Relating Structure & Function: SARS-CoV-2 virus cell entry, Receptor recognition, and principle of membrane fusion;

**Week 14**  
**Apr 18**  
**XC**  
SARS-CoV-2 RNA genome replication and viral gene expression.

**Apr 20**  
**XC**  
Structural and function of DNA/RNA modifying enzyme: APOBEC Deaminases and Function

**Week 15**  
**Apr 25**  
**XC**  
Principle of Molecular Motor: Helicases for DNA replication and repair

**Apr 27**  
**XC**  
DNA mutases, eukaryotic DNA repair pathways, and Precision medicine

**Week 16**  
**May 2**  
**NO CLASS**  
STUDY DAYS

**May 4**  
**FINAL EXAM**

**Discussion Sessions**: You need to examine current respected research journals* in Biochemistry and Molecular Biology found in Seaver Library, or online and select a recently published (2013 – 2020) research article on an interesting, well-described topic for a 30 min oral presentation and 15 min discussion of selected data using a computer presentation, e.g., Power Point. Your active participation (attendance, alertness, and interest in other presentations) indicated by the questions you ask, will be counted toward your discussion grade, in addition to your own oral presentation and printed handout. More information will be provided by Drs. Goodman, Pinaud, Chen at the first class meeting and discussion session.

**We suggest reading “Advice on reading and understanding a research article”, shown at the end of this syllabus.**

* Recommended journals whose research articles are refereed before publication:

**Grading:**

- Midterm 1 100 pts
- Midterm 2 100 pts
- Final 100 pts
- Discussion (your Oral Presentation and Questions) 100 pts
- TOTAL = 400 pts

Letter grades are determined by a curve based upon total points.

**Other Policies:**

1. Exam dates are firm. No one will be admitted to an exam after the first student has left the exam. 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). At the Professors’ discretion, use of the average of other exams may suffice in determining the course grade.

2. Regrading of exams will be done only by the professor(s) who wrote the question(s) and only within one week of the day the exam is returned to class. No exams written in pencil will be regraded.

3. No special assignments for extra credit are given.

4. Final exams will be kept in Dr. Chen’s office for the required period.
5. Academic integrity policies of the university will be strictly followed. Infractions can result in severe penalties. See SCampus for these policies.

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

7. Disability: Students requesting academic accommodations based on a disability are required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP when adequate documentation is filed. Please be sure the letter is delivered to one of the professors as early in the semester as possible. DSP is open Mon-Fri, 8:30 am-5:00 pm. in Room 120. Grace Ford Salvatori Hall, 2601 Watt Way; phone number (213)740-0776; FAX (213)740-8216; Email <ability@usc.edu>

Advice on reading and understanding a research article

“Advice” has been summarized from a blog article entitled “How to read and understand a scientific article” by Jennifer Raff published in 2018 and available at the following link: https://www.universityaffairs.ca/career-advice/career-advice-article/read-understand-scientific-article/

Reading a scientific paper is a completely different process from reading a blog or a newspaper article about science. Be patient with your reading and it is OK if you do not understand all the scientific jargon. We will ultimately have a detailed discussion of the article together in class, so that any misunderstanding will be clarified.

Most research articles are divided into the following sections: Abstract, Introduction, Methods, Results, and Discussion/Interpretations/Conclusions. Sometimes, Results and Discussion/Interpretation/Conclusions are bundled together. Sometimes, the Methods section appears after the Conclusion section. This varies between the different formats that different scientific journals adopt.

Here are some recommendations about reading a research article efficiently:

1- Start by reading the introduction, not the abstract
   The abstract is the very first paragraph of the article that summarizes the paper and the scientific findings. One way to avoid being bias in your analysis of the paper before reading it as a whole is to skip the abstract, because it contains the authors’ interpretation of the results. It is recommended to read the abstract once you are done reading the entire article.

2- In the Introduction, identify the big question that the article tries to answer and the scientific premises on which the article is built
   Find out what major problem in the scientific field the paper is trying to solve. Ask yourself: “Is this problem really important?”. Identify what previous knowledge is available about the problem, what the current state-of-the-art is on the big question, and what are the open scientific questions that remain unanswered.

3- In the Introduction, identify specific questions that the author will answer and how they will do it
   Find out what the authors are trying to answer specifically with their research and what scientific hypotheses they have. What techniques are they going to use to answer these specific questions? If mentioned, identify how the author’s approach/techniques are different from what has been done so far and what are the benefits of such approach/techniques toward answering the specific questions.
4- **Read the Method section carefully**
   Make sure you clearly understand how the data were acquired and analyzed.

5- **Read the section on Results**
   Results described in the text are summarized in the figures and tables. As you read the text description of the results, check out the corresponding figures and table and assess if the interpretation from the authors actually match the data. Some data are also provided in Supplementary Materials (additional figures, tables or movies available online together with the research article on the Journal’s website). So do not hesitate to read the Supplementary Materials file online. Ask yourself if you would have interpreted the results in the same manner. Determine if, in the light of the results presented, the authors’ interpretation is effectively correct. Could you come up with a different interpretation? It is totally fine if you change your mind about some interpretations as you go through the different scientific results provided. Pay attention to statistical analyses (do graph have error bars, is the sample size large enough, are there statistically significant difference between data set?).

6- **Read the Discussion/Interpretations/Conclusions section(s)**
   In this section, the authors take all the results presented and interpret them globally. They sometime provide a model or a mechanism that integrates all the current observations as well as previous observations on the scientific question studied. Ask yourself, “Do I agree with the final interpretation and conclusion/model? Are the discussion, interpretation and conclusion strongly supported by the scientific data presented in the article? Do I agree with the authors? Have the author missed something? Do the author identify weaknesses in their own study? How important are the results with respect to the field of study? Did the author answer some/all of the questions stated in the Introduction? Did new scientific questions arise following the authors’ work? What experiments would I design to try to answer these new questions.”

7- **Read the abstract**
   Does the abstract match what the authors said in the paper? Does it fit with your interpretation of the paper?

8- **Re-read the paper**