BIOLOGICAL SCIENCES 435 (ADVANCED BIOCHEMISTRY)
SPRING SEMESTER 2024

Lecture: TuTh 9.30-10:50 am, ZHS 163, Discussion: Th 4:00-5:50 pm, DMC 205; THH 112
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Text: Berg, Tymoczko&Stryer, Biochemistry 8thed, 2015 (or 7th ed, 2012)
Online resources (syllabus, lecture notes, etc):Blackboardhttp://blackboard.usc.edu

Week	Date	Lecturer	Lecture Topics	Text Chapter
Week 1	Jan 9	MFG	DNA Polymerases& Mutations	
	Jan 11	MFG	Base Substitution Mutations & Pol Fidelity	
Week 2	Jan 16	MFG	Thinking about Kinetics & Pol Fidelity Models Mutation Pathways, T4 & Proofreading	
	Jan 18	MFG	Correcting Spontaneous Errors – Proofreading & MMR	
Week 3	Jan 23	MFG	Correcting Induced Errors - BER	
	Jan 25	MFG	Okazaki Fragments – "Ancient" History Breathing can be Bad for Your Health	
Week 4	Jan 30	MFG	Correcting UV Damage – NER	
	Feb 1	FP	Restriction Enzymes, Biotech Applications, Molecular Specificity, Biophysical Methods	5.0-5.2; 8.6; 9.3
Week 5	Feb 6	FP	DNA scanning and Target search	Assignedpapers
	Feb 8	MFG	AID-DNA Scanning – Human Hypermutation	
Week 6	Feb 13	MFG	Bacterial Hypermutation and/or CRISPR-Cas	
	Feb 15	FP	Control of gene expression in eukaryotes by DNA packaging	32-32.3+ Assigned paper
Week 7	Feb 20	EXAM	MIDTERM I	
	Feb 22	FP	Control of gene expression in eukaryote by specific DNA recognition	32-32.3 + Assigned paper
Week 8	Feb 27	FP	Eukaryotic transcription machinery: RNA pol II, initiation, elongation	29 (intro), 29.1 (861-864), 29.2 + assigned paper
	Feb 29	FP	Transcription in Eukaryotes: termination, mRNA processing, splicing and export	29.3 + assigned paper
Week 9	Mar 5	FP	Protein Synthesis: Ribosomes and Translation initiation and elongation	30-30.3 + assigned paper
	Mar 7	FP	Protein Synthesis: Translation termination and inhibition. Secretory and membrane proteins	30.3, 30.5-30.6
	Mar 10-17		SPRING BREAK	
Week 10	Mar 19	FP	Biophysics of cell membrane: Lipid interactions and phase diagrams	Review 12 + assigned paper
	Mar 21	FP	Biophysics of cell membrane: Lipid microdomains	assigned paper
Week 11	Mar 26	EXAM	MIDTERM II	
	Mar 28	XC	Structural Biology: Protein X-Ray	

			Crystallography	
Week 12	Apr 2	XC	Structural Biology: Protein X-Ray Crystallography	
	Apr 4	CG	Structural biology: Cryo-Electron Microscopy	
Week 13	Apr 9	XC	Covid19: Infectious diseases, Viruses, and Pandemics	
	Apr 11	XC	Principle of Relating Structure & Function: SARS-CoV-2 virus cell entry, Receptor recognition, and principle of membrane fusion;	
Week 14	Apr 16	XC	SARS-CoV-2 RNA genome replication and viral gene expression.	
	Apr 18	XC	Structural and function of DNA/RNA modifying enzyme:APOBEC Deaminases and Function	
Week 15	Apr 23	XC	Principle of Molecular Motor: Helicases for DNA replication and repair	
	Apr 25	XC	DNA mutases, eukaryotic DNA repair pathways,and Precision medicine	
Week 16	April 30	NO CLASS	STUDY DAYS	
	May 7		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– 2023) research article on an interesting, well-described topic for a 30 min oral presentationand 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:
Journal of Biological Chemistry, Biochemistry, Proceedings of the National Academy of Sciences (USA), Science, Nature, Cell, Journal of Molecular Biology, Nucleic Acids Research.

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 theIntroduction, 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 is 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