### MCB 297 A
### Fall 2019
### Schedule

(class topics later in the course are subject to change)

<table>
<thead>
<tr>
<th>Session</th>
<th>Date</th>
<th>Assigned reading before class meeting and other notes</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Sep. 9</td>
<td>Schedule, Honors Paper, Grading and Point Breakdown, How to Read Critically, Additional thoughts on reading, writing and reviewing</td>
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<tr>
<td>2</td>
<td>Sep. 23</td>
<td>Finish Pardee et al.</td>
</tr>
<tr>
<td>4</td>
<td>Oct. 7</td>
<td>Finish Raffaelle et al.</td>
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<tr>
<td>6</td>
<td>Oct. 21</td>
<td>Finish Smith &amp; Johnson.</td>
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<tr>
<td>8</td>
<td>Nov. 4</td>
<td>Peer Review. Students should submit (email to <a href="mailto:gjo@illinois.edu">gjo@illinois.edu</a> by 6:00 PM) a list of three publications as potential subjects for their Honors Paper (<em>i.e.</em>, Term Paper).</td>
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<tr>
<td>11</td>
<td>Nov. 25</td>
<td>Fall Break, no class</td>
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<tr>
<td>12</td>
<td>Dec. 2</td>
<td>Finish Brack et al.</td>
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<td></td>
<td>Dec. 13</td>
<td>Final papers are due by 4:30 PM (email to <a href="mailto:gjo@illinois.edu">gjo@illinois.edu</a>)</td>
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Office hours:
383 Morrill Hall (if the door is closed, please knock)
Wed. 4:00 – 6:00 PM, or by arrangement
Email: gjo@illinois.edu
MCB 297 A – Grading Policies

Letter grades for MCB 297 A will be assigned according to the following grade scale:

<table>
<thead>
<tr>
<th>200 Point Scale</th>
<th>Grade</th>
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<tbody>
<tr>
<td>200–184</td>
<td>A+</td>
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<tr>
<td>183–180</td>
<td>A</td>
</tr>
<tr>
<td>179–177</td>
<td>A–</td>
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<tr>
<td>176–170</td>
<td>B+</td>
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<tr>
<td>169–157</td>
<td>B</td>
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<tr>
<td>156–150</td>
<td>B–</td>
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<td>149–143</td>
<td>C+</td>
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<td>142–137</td>
<td>C</td>
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<tr>
<td>136–130</td>
<td>C–</td>
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<tr>
<td>129–123</td>
<td>D+</td>
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<tr>
<td>122–117</td>
<td>D</td>
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<tr>
<td>116–110</td>
<td>D–</td>
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<tr>
<td>109–0</td>
<td>F</td>
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Discussion worksheets: 50 points

We will discuss published research papers starting with the second meeting of class. In preparation for each class you should (i) read and analyze the assigned paper(s) and (ii) print out and complete the worksheet for that class. Completed worksheets should be turned in at the beginning of the class period.

There will be a total of 10 worksheets, each of which will be graded on a scale of 0–5 points. You may use any resources at your disposal to answer the questions on the worksheet, but all responses must be stated in your own words. If you need to quote the assigned paper or any other source, use quotation marks and provide the reference being cited. You are free to discuss the questions with other students, but again, the answers you submit must be your own. Above all, reading the answer of another student and then paraphrasing it is not acceptable; you get none of the benefits of discussing and thinking about the basis for the answer.

When we tackle a new paper, the first two questions on the associated worksheet will be:

1. What is the authors' main purpose for performing the experiments presented in this paper? What is their hypothesis?
2. How do the authors intend to test their hypothesis?

Answer these questions thoughtfully, don't just copy sentences out of the text. A major goal of higher education is to learn how to summarize complex ideas in your own words, and in this class we will practice that skill as it relates to scientific inquiry. And since we will be attempting to summarize what are often intricate experiments, we ask that you answer these two questions in the space provided on the worksheet and not use additional pages.

Individual worksheets will contain additional questions that are specific to the subject matter and experimental methodology of the paper in question.

Preparedness/Participation: 100 points

Your oral contribution to the honors discussion section will account for one–half of your grade. Please note that you are permitted only one unexcused absence from discussion. If you need to miss more than one class meeting due to illness or other factors outside your control, you must obtain the instructor's permission in a timely fashion.
In addition to summarizing the goals and experimental approach of the assigned papers, you should come to class prepared to answer the following questions:

1. What background information is presented that prompted the authors to come up with the question(s) being addressed by their hypothesis?
2. How did the authors present and interpret their results?
3. How do the authors’ results support/refute their hypothesis?
4. What are the authors’ conclusions based on their results?

For most or all of the papers, you and one or more of your classmates will also be assigned in advance to explain to the rest of the class one or more of the following: background information, particular experimental methods, particular data and/or the authors' conclusions. Some experiments will involve methodologies that fall outside your past experience — when this happens, do your best to use books, the internet, and your peers to research and understand the technique. Use the office hours. But don't get too caught up in details ... the ultimate goal is to understand what can and can't be concluded from the results that the authors obtained.

Your participation score for the semester will be determined at the semester's end by the instructor, in general accordance with the following scale:

- **100 pt** Demonstrates a clear understanding of the hypotheses or the papers, the approaches used, and the conclusions. Routinely able to explain and interpret individual experiments in detail. Regularly participates in discussion of questions posed to the class as a whole.
- **90 pt** Can summarize the important features for the majority of papers, and can explain and interpret the details of most individual experiments. Usually participates in discussion of questions posed to the class as a whole.
- **80 pt** Generally understands the hypothesis and approach of papers, but has some difficulty summarizing major points. Can explain the central features of experiments, but often unable to address details or has trouble with interpretation. Sometimes participates in discussion of questions posed to the class as a whole.
- **70 pt** Can explain major points about the paper, but does not fully understand the goals or conclusion. Displays a superficial understanding of individual experiments, and often cannot explain details. Occasionally participates in discussion of questions posed to the class as a whole.
- **60 pt** Can explain major points about some papers, but not all. Displays a superficial understanding of experiments; cannot explain details, nor interpret results. Participates in discussion of questions posed to the class infrequently.
- **50 pt** Has significant difficulty summarizing papers or understanding experiments. Cannot explain the interpretation of results. Rarely participates in discussion of questions posed to the class as a whole.

**Honors Paper (Term paper): 50 points**

One-quarter of the points in this course will be awarded on the basis of a final term paper, which you must submit by 4:30 PM on Dec. 13th, the first Friday of finals week (i.e., the end of the non-combining Final Exam period for this class).

Your term paper will be graded by the professor according to the requirements detailed in the accompanying document.
Honors credit requires a written report describing in detail a scientific paper (or two) on a chosen topic. The goal is for you to choose a biological process related to Molecular Genetics, and to summarize the key elements of a research paper that has contributed to the present state of knowledge on the subject.

For topics, you may choose from the list below, or you may propose an alternative topic that relates to the subject matter of MCB 250. For a given topic, you need to pick a specific research paper as the subject of your paper. You will need to propose 3 alternative papers, they can be from the same topic area, or different topic areas. See below for a suggested strategy for identifying possible research papers in a topic area using the NCBI PubMed database. Google Scholar is also a great resource for finding research papers on a topic.

Make sure that the papers are molecular in nature, and that they are focused on mechanism, versus describing a phenomenon or a method. Review papers\(^1\) are not appropriate; we want primary literature papers that present a focused body of experimental work. Most genome sequence papers, molecular structure papers, computational biology papers, methods papers and epidemiological studies are too descriptive (phenomenological); this does not mean that these cannot be used in the paper, but they should not be the focus of the paper.

I will approve your proposed paper(s) before you write in earnest. You need to propose (at least) three papers on topics that are related to the course contents of MCB 250. Send me (email) by the deadline below your list of papers, including for each the authors, title, reference information (journal, year, volume & pages), and (if possible) the PubMed ID. At this stage, you do not need to read these papers in the detail required to actually write your paper. Just pick papers that interest you. I will email you an approval for one (or more) of your proposed papers (or let you know what the problem is with your proposals).

Your paper. The objective is to review the historical context, the goals, the experimental approaches, the key results, and the overall conclusions of a scientific study. This is largely the same as what we will be doing during our in-class discussions of papers. Your term paper should be 4–5 pages, single-spaced, 12-point font, 1" margins (2400–3000 words). References are not included in the page/word count. Use the following format (label the sections):

**Background.** Give the technical and historical perspective. What was the state of knowledge in the field at the time the experiments were done? What led to these experiments, that is, what gap in knowledge did the researchers seek to fill? What does your reader need to know to understand the experiments? We would like you to gain an appreciation of the historical context of the given topic (in other words read or skim some older papers in the field, particularly those cited in the authors' introduction).

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\(^1\) How to identify a review article: It often says "Review" on the NCBI PubMed summary page. It often says "Review" on the first page of the paper. The introduction often includes statements to the effect that the authors will summarize ... (e.g., our current understanding of ...). There is usually no "Materials and Methods" section in the paper. This course is not about the discoveries *per se*, but the research methods and reasoning by which the discoveries are made.
Experimental. Cover the experiments in the paper, but don’t just regurgitate the paper. What was the experimental strategy? What is a given experiment intended to reveal, and how is that reflected in their experimental results. Be sure to discuss the controls. Be critical — are there other interpretations of the data? Are there flaws? Generally, you should not repeat the gory details experiments (as described in the authors' Materials and Methods), but instead focus on what the individual experiments reveal to the authors, and to us. You should not reproduce figures or tables in your paper.

Discussion. How do the results and conclusions fit into the larger body of our knowledge? What questions might be addressed next?

References. Any work that you refer to in your paper should include a literature citation in the body of the paper, and the corresponding reference information in this section. This includes both the paper(s) that you are reviewing, as well as papers and/or WWW sites that you refer to in your background, experimental descriptions, and discussion. For the in-text citation, I strongly prefer an "(author(s), year)" format, as it makes it much easier on the reader. For the list of references at the end, you may use any standard journal reference style, but be sure to include the title of the article.

A couple additional thoughts: you will likely need to go back in time (and perhaps forward in time) and read additional papers or reviews to understand the overall story. You are welcome to use what others have said about the paper that you are reviewing, just be sure to properly attribute the views. You need not read these other papers in detail — just enough to get a feel for the bigger picture. You might even want to review/compare two papers on the same topic, to get a more complete story.

The allocation of points is:

10 pt  Background  Do you provide a summary of what was known at the time, and how that stimulated this research? Do you make clear the authors' question or hypothesis?
20 pt  Experimental  Do you make clear the motivations for the experiments, how the methods used provide the appropriate data, how the data are interpreted and how this helps the authors answer their overall question?
10 pt  Discussion  Do you provide a clear summary of the authors' conclusions? Do you describe the broader implications of the work, and where it might lead (even if that is new questions that arise)?
5 pt   References  Are the references provided appropriate? Do they help the reader to identify the sources of your information (or help the reader find more details on the topics that you discuss)?
5 pt   Presentation  Is the paper well written, well organized and understandable?

Timeline Summary

Nov. 4th, 6:00 PM — Deadline for submitting 3 proposed topics with associated paper information (authors, title, and publication information; it is easiest for me if you include the PubMed ID (PMID); you are welcome to send me your proposed papers sooner.

2 For one author: (Author, year); for two authors: (Author1 & Author2, year); For more than two authors: (Author1 et al., year).
Nov. 8th — I will email you feedback on your proposed papers (i.e., which would be most appropriate for this course).

Dec. 13th, 4:30 PM, the end of the non-combining Final Exam period for this class — Papers are due by email to the course instructor, gjo@illinois.edu. I will verify that I can read your document, and send you an email acknowledging that I received it.

**Additional Suggestions for Finding Papers on a Topic**

Go to [http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?holding=uiuclib](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?holding=uiuclib) (Or you can use Google Scholar, but the details below pertain to PubMed). The "uiuclib" stuff at the end filters for journals to which UIUC subscribes, so you will be able to get the full text of the paper for free. Start by searching for a topic that interests you and add "review": e.g., “growth rate regulation coli review” (without the quotation marks). Search terms are implicitly joined with "AND".

Based on the titles returned, follow the links to look at the abstracts of papers that look interesting. For a given review article, the "Similar Articles" links will take you to research papers on the corresponding subject. And, in most cases there will be a link to the review article itself in the upper-right corner of the abstract-containing page. You can access the review article and skim it for papers that they cite that look interesting to you. (Do not propose to write a paper on the review article itself.)

You could also look through some recent issues of the journals *Science* and/or *Nature* for interesting topics or specific papers. All journals subscribed to by the UIUC can be found at:

[http://www.library.illinois.edu/](http://www.library.illinois.edu/) (under the "Journals & Databases" tab)
**Some Possible Topic Areas:** These are just suggestions, they are not meant to limit your choices, but the papers must be directly related to the subject matter of MCB 250.

Chromatin remodeling
Chromosomal nondisjunction in meiosis
CRISPRs
DNA replication / initiation / termination
Epigenetics
Error-prone polymerases
Gene conversion
Gene silencing
Immunoglobulin gene rearrangement
Mechanisms of homologous recombination
Repair of DNA lesions
Replication fork restart
Retrotransposons in the human genome
Site-specific recombination
Xist/X chromosome inactivation

Alternative RNA splicing
Independent domains of activators
Locus control regions
Nonsense-mediated mRNA decay
Polyadenylation
Quorum sensing
Regulation by small RNAs
Regulation of ribosomal protein S15
Riboswitches – leader RNAs that sense small molecules
Ribozymes
RNA degradation and stability
RNA splicing (introns)
RNAi
Self-splicing introns
Sigma factor cascades
Transcription termination / antitermination
Transcriptional insulators
Two component regulatory systems

Double sieve model for aminoacyl-tRNA synthetases
Protein degradation pathways
Protein splicing (inteins)
Regulation of growth rate – rRNA transcription in *E. coli*
Ribosome assembly and export from the nucleus
Ribosome structure and function
Selenocysteine incorporation
SsrA-SmpB ribosome rescue
Translational efficiency
Translation in mitochondria
tRNA modification and regulation