

Biology 205 - Cell & Molecular Biology
Term 4, 2018

LECTURE SCHEDULE

| <u>Day</u> | | <u>Lecture Topic</u> | <u>Reading</u> |
|------------|----|--|----------------|
| M Nov 26 | | Cells and their Properties Lab Introduction (1:00 PM) | Ch 1 |
| T | 27 | Biological Molecules Protein Structure | Ch 2 Ch 3 |
| W | 28 | Protein Function | Ch 3 |
| Th | 29 | Protein Function <u>Critique Article Must Be Approved</u> | Ch 3 |
| F | 30 | Biological Energy Glycolysis & Gluconeogenesis <u>Lecture 9:45-11:00 AM & 12:30-1:30 PM</u> <u>Lab: 8:30-9:45 AM & 1:30-3:00 PM (1:30-2:00 Data Analysis)</u> | Ch 3 Ch 3 |
| M Dec 3 | | Glycolysis & Gluconeogenesis <u>Critique Due - 8:30 AM</u> | Ch 3 |
| T | 4 | Plasma Membrane Structure & Function (9:00 – 11:00 AM) <u>Molecular Lab Introduction 12:30-2:00 PM</u> | Ch 4 |
| W | 5 | <u>EXAM 1 (lectures & labs)</u> <u>Lab: 8:30-9:00 AM & 12:30-3:00 PM</u> | |
| Th | 6 | Plasma Membrane Structure & Function The Mitochondria & Aerobic Respiration <u>Lecture 9:00-11:00 AM & Lab 12:30-3:00 PM</u> | Ch 4 Ch 5 |
| F | 7 | Aerobic Respiration | |
| M | 10 | Chloroplast & Photosynthesis <u>Research Paper (Part 1) Due – 8:30 AM</u> | Ch 6 |
| T | 11 | Photosynthesis Gene Expression - Transcription and Translation <u>Lecture 10:00-11:00 AM & 12:30-2:00 PM</u> <u>Lab: 8:30-10:00 AM & 2:00-3:00 PM</u> | Ch 6 Ch 11 |
| W | 12 | <u>EXAM 2 (lectures & labs)</u> <u>Lab: 8:30-8:45 AM & 1:30-3:00 PM</u> | |
| Th | 13 | Gene Expression | Ch 11 |

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| F | 14 | Gene Expression DNA Replication | Ch 11 Ch 12.3 & 13 |
| M | 17 | DNA Replication | Ch 13 |
| T | 18 | Trafficking <u>Research Paper (Part 2) Due - 8:30 AM</u> | Ch 8 |
| W | 19 | <u>Exam 3 (lectures & labs)</u> | |

Course goals:

In the past two decades, we have witnessed an explosion of information in our understanding of the cell. One goal of this course is to provide you with a deeper appreciation of the chemical processes that occur in cells and how these processes are related to cell function. We will start by examining the fundamental principles that determine cellular organization and function. Another course goal is for you to understand and analyze current scientific research that has led to our current view of the cell. In order to accomplish this goal, you will write two literature critiques and we will discuss current biochemical and molecular tools used in research.

Course Learning Objectives

- Students will develop skills in critical reading of original scientific literature.
 - These skills will provide the tools necessary to read current professional literature in any field.
- Students will learn to participate actively in their own education by developing and conducting a research project.
 - Students will generate and interpret their own data.
 - Students will understand the relationship between their experiments and concepts covered in class.
- Students will understand the role of cellular and molecular biology in defining biological processes.
- Students will come to understand how their level of understanding of a biological process increases by using a historical approach to science.
- Students will appreciate that recent advances in cellular and molecular biology are due to our ever increasing depth of understanding of basic biological processes.
- Students will understand the language of cellular and molecular biology and effectively communicate principles in written form.
- Students will solve a variety of research problems using analytical skills.

This course supports the Educational Priorities and Outcomes of Cornell College with emphases on knowledge, inquiry, reasoning, communication, and vocation.

Instructors:

Lecture/Lab - Craig Tepper
Office - 201 Russell Science Center
Phone - 4376
Cell- (319) 213-4376

Lab - Shea Putz
Office - 113 West Science Center
Phone-4155

Meeting Times:

Lecture & Labs-8:45-11:00 AM & 12:30 - 3:00 PM

Textbook:

Cell and Molecular Biology editions 6, 7 or 8
Gerald Karp
John Wiley & Sons, Inc.

Slides:

Slides used in lecture and lab are posted on Moodle (BIO 205). They can also be found on the college's network. Open assignments on 'srv2'(K:), open CTepper, open 205 and finally open lecture.

Office Hours:

I have no organized office hours. I'm usually in my office by 8:00 a.m. and after class until about 6:00 p.m. I can also arrange to meet with you in the evenings and/or on weekends. If you are having problems with the class, come and see me as soon as possible.

Grades:

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|--------------------------|--------------|----------------|
| Paper critique. | M 12/3 | 40 pts. |
| Exam 1 (lectures & labs) | W 12/5 | 100 pts |
| Research Paper (Part 1) | M 12/10 | 50 pts |
| Exam 2 (lectures & labs) | W 12/12 | 100 pts |
| Research Paper (Part 2) | Tu 12/18 | 70 pts |
| Exam 3 (lectures & labs) | W 12/19 | 100 pts |
| | TOTAL | 460 pts |

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|---------|----|
| 90-100% | A |
| 85-89% | A- |
| 80-84% | B+ |
| 75-79% | B |
| 70-74% | B- |
| 65-69% | C+ |
| 60-64% | C |
| 55-59% | C- |

Exams:

All exams will last approximately 2 hours. The exams will be a combination of short answers (two questions per page) and essay questions. Scoring well on these exams will require that you understand the material and convey that understanding in a clear and concise manner. Practice exams can be found on my web page (<http://people.cornellcollege.edu/ctepper>)

Attendance:

Students are expected to attend all lectures and labs. If you are going to miss class (lecture or lab), e-mail me **before class begins**. If I receive an e-mail prior to the beginning of class, your absence will be excused. For each unexcused absence, 10 points will be deducted from your final grade. Attendance and effort in the lab will be taken into account when grades are assigned.

Paper Critique:

You are required to select one scientific journal article and write a critique of the research in the paper. The article must be about Rubisco. I suggest that you use the library's search engines or Google Scholar to locate an article in an appropriate journal. **Be sure you select an article that you can understand.** I recommend that you completely read the article before you decide to analyze it for your critique. Once you have found an article that interests you, bring a copy of the article to me for approval. **The article must be approved by Thursday, November 29th.**

The purpose of the critique is for you to read a research article critically, to uncover what questions the researchers were attempting to answer, to determine what techniques they used to obtain the answers and to evaluate how successful they were in answering the questions. After reading your article, you should describe the general and specific goals of the research in the first paragraph. Then select specific tables and/or figures in the paper for analysis. Describe and critically analyze the purpose, the methodology used, the specific results and the conclusions for each table and/or figure you have selected for analysis. Be sure to demonstrate that you understand the tables and figures you select for analysis. **Reading chapter 18** in your text should help you understand the methods' section of your paper. Do not comment on whether or not you enjoyed the paper, or found it to be well written; stick to an analysis of the science. It may be necessary to obtain other related papers in order for you to understand your articles. It is **not** necessary for you to describe every experiment in the article. Select the most important tables and/or figures and comment on these experiments. It is not necessary to launch an attack on the authors' work. Sometimes no weakness is apparent, other times your criticisms will be mild. Avoid direct quotations from the article. **Use your own words and express your own ideas.** Be sure to include a coherent conclusion. Your critique may not exceed 3 typed pages. The critique is due **Monday, December 3rd, at 8:45 a.m.** The critique is worth **40 points.** **SEE** <http://people.cornellcollege.edu/ctepper/BIO205Critique.htm> **FOR GRADING AND EVALUATION SCALE.**

Research Paper:

The laboratory grade for this course will be based on your effort in the lab, your understanding of our experiments, and **two** research papers reporting the results of our experiments. Format and writing styles for scientific research differ from those used in other disciplines. Your paper will consist of the following sections: **Introduction, Methods and Materials, Results and Discussion** (the subsection on Results and Discussion is a single combined subsection), and References. A useful guide for writing your paper will be the scientific journal articles you used for your critique. These articles use similar formats.

The **Introduction** establishes the framework for your entire paper. In this section, you should present the background information that leads to a clear statement of the specific issues that will be addressed in your paper. You must use a minimum of three journal articles for this part of your introduction. Your outside reading should provide you with information about Rubisco (catalytic mechanism, subunit structure and function, turnover number and binding affinity for its substrates) and the relevance and significance of Rubisco research conducted by other investigators. Describe why our study was undertaken, what questions were posed and the relevance of our work to the discipline of cell and molecular biology. Every statement of fact or opinion must be supported with a reference to its source. Don't footnote or use direct quotations. References are cited directly in the text by author and year of publication.

Results are meaningful in science only if they can be repeated. Unfortunately, the results depend on the methodology. The difficulty in writing the **Materials and Methods** section is in selecting the right level of detail. Students commonly give too much information. You do not need to copy the methods that I have given you; instead, these protocols can be summarized and properly referenced. Divide the methods

section into subsections. **BEFORE WRITING THE METHODS SECTION, SEE THE EXAMPLES AND INSTRUCTIONS FOR WRITING METHODS ON MY WEB SITE** (<http://people.cornellcollege.edu/ctepper/BIO205RubiscoMethods.pdf>).

In the **Results and Discussion** section, you will report the data from our experiments. **This section should also be divided into subsections.** Our experiments will take three weeks to complete, so be sure to keep a well-organized notebook that contains our experimental results. The class will be divided into a number of different groups and each group may work on different aspects of the same research problem. You are responsible for all data uncovered during the course, so it is important to understand what other groups are doing and what results they are obtaining. In this section, you should describe our findings. Tables and graphs are useful in organizing and presenting your results, but they do not replace a written explanation. Do not simply list the results; you must specifically analyze and interpret the results in this section. Start each subsection by explaining the purpose of the experiment. Next, describe the results for all controls. Then compare the experimental results to the controls and analyze the experimental results. End the subsection by drawing your conclusions and leading the reader to the next experimental subsection. Draw the reader's attention to the major observations and key trends in the data. Do not discuss how the experiments were performed (methods section) or discuss whether the results were expected, disappointing, or interesting.

At the end of the Results and Discussion section, you must arrive at the overall conclusions in context to the specific questions you asked in the introduction of the paper. You should consider the following relevant issues: 1. What did you find and why? 2. How did your results compare to those of other researchers? 3. How do you propose to rectify any problems with the results? (Do not simply say you plan to pipette better or run the experiment more carefully.) And 4, How might you test these potential explanations? You should also discuss the significance of our work and its relevance to Rubisco research. Do not write that "we learned a lot" or "our poor results were due to human error." Be specific rather than general.

In the **reference section** of your paper, you need to provide the **complete citation** for all factual material you refer to in the text of your paper. **One point will be deducted from your paper for each citation error if you do not provide a complete citation or the citation is incorrect in the text or bibliography.**

Reference Citation Examples

Single author:

In text citation – Lewis (2006)

Bibliography citation:

Lewis, J.B. 2006. Biology and ecology of the hydrocoral *Millepora* on coral reefs. *Advances in Marine Biology* 50:1-55.

Two authors:

In text citation – Dorado and Sánchez (2009)

Bibliography citation:

Dorado, D. and J.A. Sánchez. 2009. Internal transcribed spacer 2 (ITS2) variation in Gorgonian coral *Pseudopterogorgia bipinnata* in Belize and Panama. *Smithsonian Contributions to the Marine Sciences* 38:173-179.

Three or more authors:

In text citation - Pepper et al. (2012)

Bibliography citation:

Pepper, C.S. L. Squiers, C. Hay, D. Gorbach, D. Friend, B. Black, B. Greenstein, and K. Strychar. 2012. Cryptic species: A Mismatch between genetics and morphology in *Millepora*. *Marine Science* 2:57-65.

These research papers should represent your **best** work and should not be a first draft. It should be well organized, clearly written, and carefully **proofread**. Don't wait until the last minute to start your papers.

The first research paper is due on **Monday, December 10th at 8:45 AM** and must include an Introduction, Methods (through SDS PAGE) and Results and Discussion including all of the Rubisco isolation and purification work. This paper is worth **50 points**. (Introduction 20 points, Methods and Material 10 points and Results and Discussion 20 points). Your paper may not exceed **6** pages of text (the reference section, as well as tables and figures are not included in this 6 page limit). The paper must be double spaced and the font size must be 12.

The second research paper is due on **Tuesday, December 18th at 8:45 AM** and must include an Introduction, Methods (all of the DNA work) and Results and Discussion (all of the DNA work). This paper is worth **70 points**. (Introduction 25 points, Methods and Material 15 points and Results and Discussion 30 points). Your paper may not exceed **6** pages of text (the reference section, as well as tables and figures are not included in this 6 page limit). The paper must be double spaced and the font size must be 12.

How grades will be determined: <http://people.cornellcollege.edu/ctepper/BIOGrading.JPG>

Academic Honesty Expectations:

Cornell College expects all members of the Cornell community to act with academic integrity. An important aspect of academic integrity is respecting the work of others. A student is expected to explicitly acknowledge ideas, claims, observations, or data of others, unless generally known. When a piece of work is submitted for credit, a student is asserting that the submission is her or his work unless there is a citation of a specific source. If there is no appropriate acknowledgement of sources, whether intended or not, this may constitute a violation of the College's requirement for honesty in academic work and may be treated as a case of academic dishonesty. The procedures regarding how the College deals with cases of academic dishonesty appear in The Compass, our student handbook, under the heading "Academic Policies – Honesty in Academic Work."

Students with Disabilities:

Students who need accommodations for learning disabilities must provide documentation from a professional qualified to diagnose learning disabilities. For more information see <https://www.cornellcollege.edu/academic-support-and-advising/disabilities/index.shtml>

Students requesting services may schedule a meeting with the disabilities services coordinator as early as possible to discuss their needs and develop an individualized accommodation plan. Ideally, this meeting would take place well before the start of classes.

At the beginning of each course, the student must notify the instructor within the first three days of the term of any accommodations needed for the duration of the course.