CELL BIOLOGY AND GENETICS

BIOL 145

Spring 2025

BIOMOLECULES

MOLECULAR GENETICS

CELLULAR PROCESSES

CELL COMMUNICATION

INHERITANCE

MWF 9:45-10:35AM

MBH 317

CELL BIOLOGY AND GENETICS

In this introduction to modern cellular, genetic, and molecular biology we will explore life science concepts with an emphasis on their integral nature and evolutionary relationships. Topics covered will include cell membrane structure and function, metabolism, cell motility and division, genome structure and replication, the regulation of gene expression and protein production, genotype to phenotype relationship, and basic principles of inheritance. Major concepts will be illustrated using a broad range of examples from plants, animals, and microorganisms. Current topics in biology will be integrated into the course as they arise.

Professor: Greg Pask, Ph.D.
Please call me: Greg or Dr./Prof. Pask (he/him)
Ask me about: Anything related to the course, navigating your major, getting started in research, graduate school or other future plans, being a Division III athlete, outdoor spaces in VT, insects, board games, the Marvel Universe, cooking, and building/creating fun stuff.

Preferred Contact: Direct message through Slack
Office Hours: TW 1:30-3 or by appointment
Office: MBH 315
Email: gpask@middlebury.edu

ACADEMIC INTEGRITY

I believe that Academic Honesty and Integrity is of the utmost importance, so the language from the Honor Code in the Middlebury Handbook (section B.1.a.) resonates with my values. Please include the Honor Code Pledge ("I have neither given nor received unauthorized aid on this assignment.") on all assignments for this course. If you are unsure of whether a specific action in this course would violate the Academic Honesty Policy in this course, I urge you to check with me beforehand. Any suspected instances of the Academic Honesty Policy will be brought to the attention of the judicial affairs officer.

DISABILITY ACCESS AND ACCOMMODATION

Students who have Letters of Accommodation in this class are encouraged to contact me as early in the semester as possible to ensure that such accommodations are implemented in a timely fashion. For those without Letters of Accommodation, assistance is available to eligible students through the Disability Resource Center (formerly called Student Accessibility Services). Please contact the ADA Coordinators Jodi Litchfield (litchfie@middlebury.edu, 802-443-5936) or Peter Ploegman (pploegman@middlebury.edu, 802-443-2382) for more information. All discussions will remain confidential.

LEARNING OBJECTIVES

At the completion of this course, students will be able to:

Apply foundational knowledge of cell and molecular biology to larger biological contexts, such as physiology, evolution, and biodiversity

Design experiments, evaluate data, and draw conclusions in cell and molecular biology fields

Review primary research in cell biology and genetics and predict new frontiers in the field

Understand how genetic mutations can alter the function of proteins, cells, and beyond to create new and observable phenotypes

HOW YOU WILL PROGRESS TOWARD THESE GOALS

Biweekly Reading Reflections

Biweekly Take Home Problem Sets

In-class Group Work

Interview a Biologist Project

Paper Discussion Entry Tickets

Cumulative Exit Questions

COURSE MATERIALS

Textbook: Freeman et al, *Biological Science*, 8th edition (but 7th or 6th is OK too!)
Slack Workspace: biol145s25.slack.com for all course materials and communication

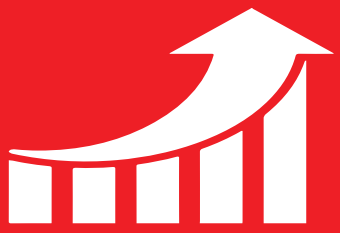
HOW I WILL ASSESS YOUR PROGRESS

This course will use a labor-based grading approach that centers on feedback, improvement, integrative thinking, idea development, and effective communication. I strongly believe that traditional assessment practices focus too much on "the grade" and can increase stress and/or decrease risk-taking. Instead, your grade will be based on all the work (learning) you'll be doing this semester.

If you put in significant effort into an assignment and submit it on time, you get full credit for your work.

Only critical feedback is given frequently with a focus on self-improvement.

Larger assignments will involve multiple stages of work spread throughout the semester, and all this effort counts!



I reserve the right to deem any work unacceptable. If the amount of effort is insufficient or it is submitted late, you will not receive any credit for doing it. We will then work to figure out the best practices to optimize your labor-based learning.

EXPECTATIONS

BE ENGAGED

BE CURIOUS

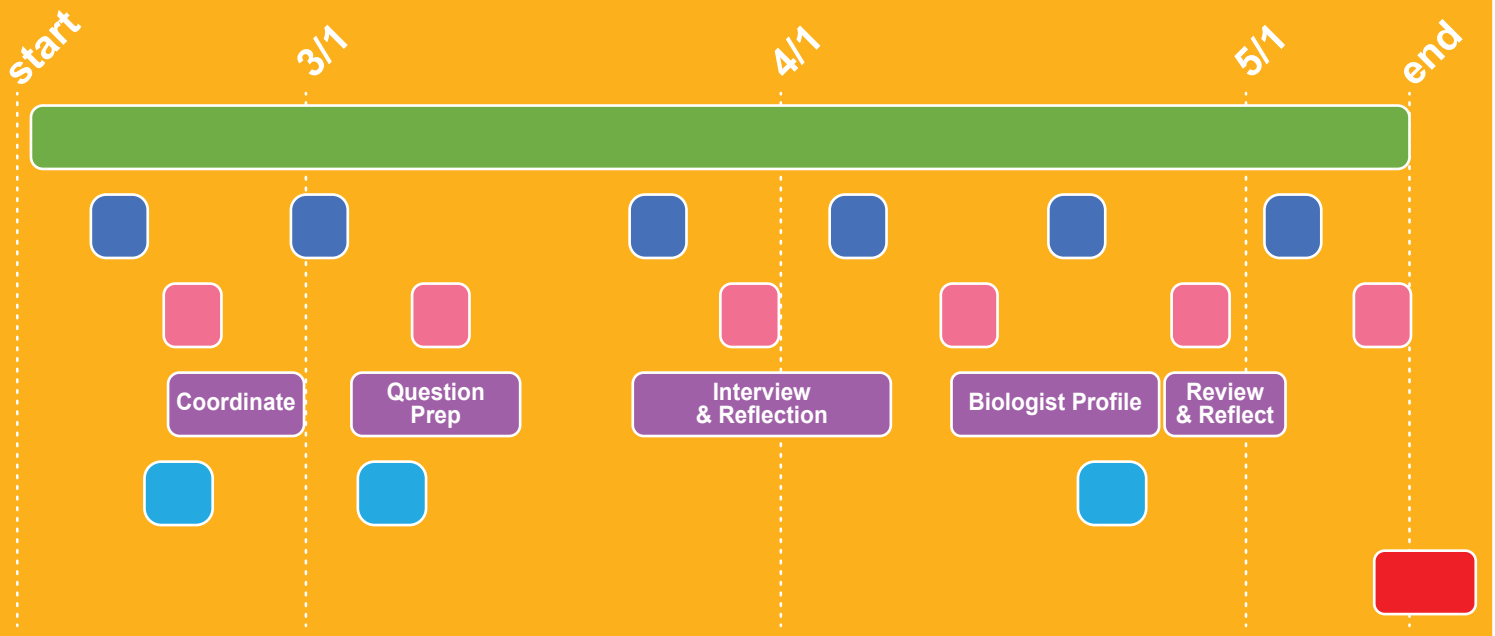
WORK HARD

YOU'VE RECEIVED 3 FLEXIBILITY TOKENS!

You can spend one of these to:

- receive a 48-hour extension on an assignment
- resubmit an assignment that did not earn credit

ASSIGNMENT TIMELINE



Please see the most recent Course Schedule on our Slack Workspace for exact due dates.
All work must be submitted before or on the due date.

LECTURE SECTION ASSIGNMENTS

In-Class Group Work
100 pts

Take Home Problem Sets
90 pts

6 @ 15 pts each

Interview a Biologist Project
70 pts

coordinate 5 pts
question prep 15 pts
interview & reflection 10 pts
biologist profile 25 pts
review & reflect 15 pts

Reading Reflections
60 pts

6 @ 10 pts each

Cumulative Exit Questions
50 pts

Paper Discussion Entry Tickets
30 pts

FINAL GRADE

Lecture Grade 400 pts + Lab Grade

Many thanks to David Aja's Hawkeye #14 cover for graphical inspiration.

Week	Monday	Wednesday	Friday
1	2/10 *Topic:* Introduction to Course, Technology, and Expectations *Preparation:* Listen to "Making the Grade" Podcast and Join Slack Workspace	2/12 *Topic:* Intro to Cells and Processes *Preparation:* Read Freeman 1.1-1.5	2/14 *Topic:* Proteins *Preparation:* Read Freeman 3.1-3.3
2	2/17 *Topic:* DNA and RNA *Preparation:* Read Freeman 4.1-4.3 ***Assignment Due:*** **Reading Reflection 1**	2/19 **Proteins/Nucleic Acids Group Work**	2/21 *In-Depth Look:* Amazing Proteins and Luciferase Paper Discussion *Preparation:* Read Freeman 3.4 and Explore This + Read McElroy 1947 *PNAS* "The Energy Source for Bioluminescence in an Isolated System" ***Assignment Due:*** ***Paper Discussion Entry Ticket #1***
3	2/24 *Topic:* Carbs and Lipids *Preparation:* Read Freeman 5.1-5.3; 6.1 ***Assignment Due:*** **Take Home Problem Set 1**	2/26 **Membranes Group Work** *Preparation:* Read Freeman 6.2-6.3	2/28 *In-Depth Look:* Membrane Proteins! *Preparation:* Read Freeman 6.4 ***Assignment Due:*** **Interview a Biologist: Coordinate**

4	3/3 *Topic:* Cell Biology *Preparation:* Read Freeman 7.1-7.3 ***Assignment Due:*** **Reading Reflection 2**	3/5 **Cell Biology: Transport and Structure Group Work** *Preparation:* Read Freeman 7.4-7.6	3/7 *In-Depth Look:* Discovery of Aquaporins Paper Discussion *Preparation:* Read Preston et al 1992 *Science* "Appearance of Water Channels in Xenopus Oocytes Expressing Red Cell CHIP28 Protein" ***Assignment Due:*** ***Paper Discussion Entry Ticket #2***
5	3/10 *Topic:* Metabolism *Preparation:* Read Freeman 8.2-8.4 ***Assignment Due:*** **Take Home Problem Set 2**	3/12 **Metabolism Group Work** ***Assignment Due:*** **Interview a Biologist: Question Prep**	3/14 *In-Depth Look:* Deciphering Metabolic Pathways *Preparation:* Read Freeman 8.5; 16.1
3/17-3/21 *Spring Term Recess – no class*			
6	3/24 *Topic:* Respiration *Preparation:* Read Freeman 9.1-9.5 ***Assignment Due:*** **Reading Reflection 3**	3/26 **Respiration Group Work**	3/28 *In-Depth Look:* Fermentation, Breads, and Booze *Preparation:* Read Freeman 9.6 and This
7	3/31 *Topic:* Cellular Communication *Preparation:* Read Freeman 11.1-11.3 ***Assignment Due:*** **Take Home Problem Set 3**	4/2 **Cell Communication Group Work**	4/4 *Topic:* Mitosis *Preparation:* Read Freeman 12.1-12.4

8	4/7 *Topic:* Meiosis *Preparation:* Read Freeman 13.1-13.3 ***Assignment Due:*** **Reading Reflection 4**	4/9 **Mitosis/Meiosis Group Work** ***Assignment Due:*** **Interview a Biologist:** **Interview & Reflection**	4/11 **Spring Student Symposium** *no class*
9	4/14 *Topic:* Inheritance *Preparation:* Read Freeman 14.1-14.4 ***Assignment Due:*** **Take Home Problem Set 4**	4/16 **Transmission Genetics Group Work**	4/18 *In-Depth Look:* Beyond Mendel *Preparation:* Read Freeman 14.5
10	4/21 *Topic:* Mutations and CRISPR Gene-Editing *Preparation:* Read Freeman 16.2-16.4 ***Assignment Due:*** **Reading Reflection 5**	4/23 *In-Depth Look:* Hummingbird Taste Evolution Paper Discussion *Preparation:* Read Baldwin et al 2014 Science "Evolution of sweet taste perception in hummingbirds by transformation of the ancestral umami receptor" *and* This Nat Geo article about the paper ***Assignment Due:*** ***Paper Discussion Entry Ticket #3***	4/25 *Topic:* DNA Replication and Repair *Preparation:* Read Freeman 15.2-15.5 ***Assignment Due:*** **Interview a Biologist:** **Biologist Profile**

11	4/28 **DNA Replication Group Work**	4/30 *In-Depth Look:* PCR and Sequencing *Preparation:* Read Freeman p.40 (PCR); p.41 (Dideoxy Sequencing); 20.5 ***Assignment Due:*** **Take Home Problem Set 5**	5/2 *Topic:* Transcription and RNA Processing *Preparation:* Read Freeman 17.1-17.2 ***Assignment Due:*** **Interview a Biologist: Review & Reflect**
12	5/5 *Topic:* Translation *Preparation:* Read Freeman 17.3-17.5 ***Assignment Due:*** **Reading Reflection 6**	5/7 *Topic:* Regulating Gene Expression *Preparation:* Read Freeman 18.1-18.2	5/9 **Gene Expression Group Work** *Preparation:* Read Freeman 19.1-19.3; 19.6
13	5/12 Course wrap-up ***Assignment Due:*** **Take Home Problem Set 6**	5/19 - *Finals Week* ***Assignment Due:*** **Cumulative Exit Questions**	