Biocore 486: Principles of Physiology Lab (2 credits H)

Canvas Course URL: https://canvas.wisc.edu/courses/104771

Requisites: Biocore 485 or concurrent enrollment

Required Resources

1. Biocore 486 Custom Lab Manual 2019 - available on Canvas and for print at Student Print)
2. Biocore Writing Manual 2018-19 -available on Canvas, at Student Print, and online through Pressbooks)
3. Biocore Statistics Primer- available on Canvas in .pdf, and online through Pressbooks

Short course description:
Students experience the process of science by collaborating on two multi-week independent experiments to investigate their own questions about animal and plant physiology. Emphasis is on critical thinking required in designing and conducting experiments, analyzing and interpreting data, and communicating findings orally and in writing.

Course Designations, Instructional Mode, and Attributes:
Biocore 486 is a 2-credit Honors intermediate level lab course that meets face-to-face and includes one 3-hour lab class meeting each week over the fall semester led by course chair Dr. Michelle Harris. It also includes a weekly fact-to-face 50-minute discussion section led by a graduate Teaching Assistant (TA) accompanied by 1-2 undergraduate TAs (uTAs). Lab and discussion sections enroll ~16 students. Discussion sections are a significant component of the course that are separate from the lab yet guided by the learning objectives introduced in lab. During discussion section, you will work together with your research team and the guidance of a TA to develop your research projects, do peer review, consult with instructors on experimental design and data analysis, do statistics workshops and other activities that enhance your knowledge of the process of science and your study system. Biocore 486 carries the expectation that students will work on course learning activities (literature review, research team meetings, some data collection, writing, presentation preparation) for a minimum of 3 hours out of classroom for every class period. Credit for this course counts towards Biological Science (which also meets the Natural Science) breadth requirements, and Honors credit that can be applied towards Honors in an array of majors. See below and the course schedule on Canvas for more information about expectations for student work.

Class Meeting Location: All Lab and Discussion Sections meet in 355 Noland unless otherwise noted

<table>
<tr><td colspan="5">Instructors
All instructors welcome student emails and hold office hours as listed or by appointment</td></tr>
<tr><td></td><td colspan="4">Dr. Michelle Harris (Course Chair)
307 Noland Hall, maharris@wisc.edu, 608-262-7363, website
Make an appointment or stop by- Open Door!</td></tr>
<tr><td></td><td colspan="4">Seth McGee (Biocore Lab Manager)
339 Noland Hall, seth.mcgee@wisc.edu, 608-262-6189
Make an appointment or stop by- Open Door!</td></tr>
<tr><td>Lab</td><td>Disc Time</td><td>Lab Time</td><td>Teaching Assistants / uTAs</td><td>Office Hours</td></tr>
<tr><td>1</td><td>Mon 11:00-11:50am</td><td>TUESDAY
(1:20-4:20pm)</td><td>Gavin Dehnert
dehnert2@wisc.edu

uTAs
Ryan Gassner gassner2@wisc.edu
Macy Peterson mpeterson34@wisc.edu</td><td>TBA</td></tr>
<tr><td>2</td><td>Mon 1:20-2:10pm</td><td>WEDNESDAY
(1:20-4:20pm)</td><td>Emily Foran
foran2@wisc.edu

uTAs
Natalie Haag
nhaag2@wisc.edu
Vienne Seitz
vseitz@wisc.edu</td><td>TBA</td></tr>
<tr><td></td><td></td><td></td><td>uTAs on Call
Olivia Aviles
oaviles2@wisc.edu
Maddy Gehin
mgehin@wisc.edu
Stella Ma
sma86@wisc.edu</td><td>TBA</td></tr>
</table>

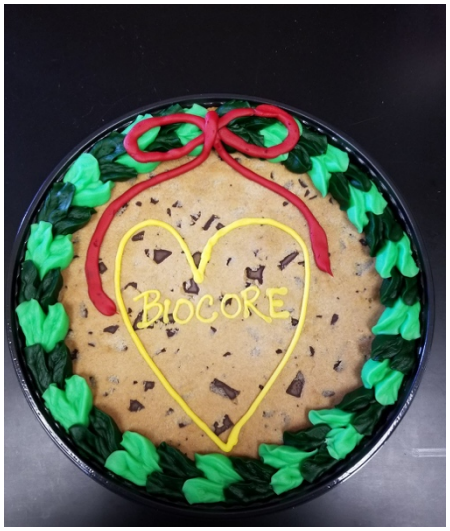
Dr. Harris has an open-door policy to talk about the course (the Biocore program more generally or other academic work) and will hold additional office hours during particularly busy weeks for consultation on lab projects, writing, data analysis and interpretation. Seth McGee, Biocore Lab Manager, will be available to support your development of projects and provide essential feedback as you gather materials, schedule experiments, learn techniques, and collect data. Graduate TAs will assist you during lab, facilitate discussion sections, send out timely information in weekly emails, and will grade and provide feedback on your written and oral presentation work. Our course instructional team also includes four undergraduate TAs (two for each lab section) plus three uTAs-on-call who will provide extra support to you by providing feedback in peer reviewing papers and practicing oral presentations.

We are delighted to have you join our Biocore 486 learning community, and we are eager to support your learning in Biocore 486! We recognize your prior experience and build upon it as you deepen your understanding of the process of science and use it to investigate your own questions. We have a very dedicated teaching team assembled to help you (see our contact information below). Perhaps most importantly, you are surrounded by amazing peers that will significantly and positively influence your development as a scientist and collaborator.

Learning Goals & Outcomes

Building on your experience in the previous Biocore 382 and/or 384 laboratories, the overall learning goals of this lab are to:

1. Appropriately utilize Biocore 485 **lecture concepts** in an applied setting.
2. Engage in the **process of science,** including the problem-solving involved in designing and executing experiments, and the critical thinking required to carefully analyze and interpret results.
3. Work with **tools & procedures** to investigate biology.
4. Concisely, clearly, and precisely communicate your plans and findings to others using written and oral communication
5. Utilize quantitative reasoning skills (statistical analysis skills).
6. Work as a member of a **productive, collaborative research team.**
7. Build on, apply, and **integrate concepts & skills** that you learn in other Biocore courses.
8. Contribute to a safe, sustainable, socially and ethically responsible learning environment.



We recognize that you will not master all of these learning outcomes right away. We expect that your level of achievement will improve from your previous Biocore lab experience and grow as you progress through this fall semester. You can see by the syllabus assignment weightings that your work is worth more as the semester progresses. We do this so that you have time to achieve the learning outcomes and so that your improvement over time is appropriately reflected in your final grade.

As a member of a permanent 3-5 person research team, you will work each week on some stage of designing or carrying out your own experiments on plant or animal physiology. During the semester your team will have 2 opportunities to develop an experiment to test a hypothesis based on a novel research question. Research topics will likely (but not necessarily) be chosen from concepts taught concurrently in the Principles of Physiology Biocore 485 lecture course. During the semester your research team will report your findings through oral team presentations and by writing, peer-reviewing, and revising your work in the format of scientific papers and posters.

You will continue to practice the various elements of experimental design (development of good questions, review of relevant literature, hypothesis formation, protocol development, analysis (data manipulation, graphing, statistical tests, comparison with previous findings), and making logical, evidence-based conclusions. You will hone your analytical and critical thinking skills through the process of peer review, paper revision, and literature review.

Based on our previous experiences, we hypothesize that you will have more than a little fun, and learn some pretty important life skills as you achieve these learning outcomes this semester. ☺

Opportunities to Demonstrate the Learning Outcomes

Assessment	Due Date	Weight
Unit 1 Statistics assignment	9-16-2019	2
Unit 1 Intro & Methods + peer review	9-20/21-2019	7
Unit 1 Biological Rationale figure	9-26/27-2019	1
Unit 1 Research Proposal + peer review	10-18/19-2019	12
Unit 1 Formal Presentation	10-29/30-2019	14
Unit 1 Final Paper + peer review	11-8/9-2019	17
Unit 2 Research Proposal + peer review	11-25-2019	12
Unit 2 Biological Rationale figure	12-3/4-2019	2
Unit 2 Final Poster Presentation	12-10/11-2019	13
Unit 2 Final Poster or Paper	12-13/14-2019	13
*Participation		7
	Total	100

***** Your Participation grade will be determined by a variety of inputs such as your attendance, participation in class discussions (e.g., the Q&A following feedback and formal presentations), presence and participation in research with teammates, completion of check assignments, and feedback from your GEA (Group Effort Analysis) forms as well as the GEA form feedback from your permanent team members. Your Participation grade will be weighted as **7%** of your final semester grade.

Diversity & Inclusion

Diversity is a source of strength, creativity, and innovation for UW-Madison. We value the contributions of each person and respect the profound ways their identity, culture, background, experience, status, abilities, and opinion enrich the university community. We commit ourselves to the pursuit of excellence in teaching, research, outreach, and diversity as inextricably linked goals.

The University of Wisconsin-Madison fulfills its public mission by creating a welcoming and inclusive community for people from every background – people who as students, faculty, and staff serve Wisconsin and the world.
https://diversity.wisc.edu/

Biocore's Statement on Creating an Inclusive Classroom

In Biocore, we strive for the utmost equity for all students, TAs, and faculty/ staff, regardless of race, ethnicity, gender, sexual orientation, (dis)ability, socioeconomic status, country of origin, or religious affiliation. Our community and our science depend on engaging and embracing different perspectives and this starts with each of us understanding and recognizing our own biases. It takes a great deal of awareness and self-work to recognize bias. Most of us stumble at times, so we all need to practice.

If you experience or notice bias
Share when you first experience or notice bias. If you are further offended and continue to experience bias, do not hesitate to bring this to your instructor's attention and/or report the case through UW Madison's Bias Incident Reporting system

If you mistakenly say or do something you wish you hadn't—apologize, say 'I'm sorry' and take ownership when you have offended someone, even if it was unintentional.
Discrimination and bias are not OK. Saying nothing perpetuates inequality. Speaking up reminds us of our inclusive classroom goal. It takes everyone to create a safe, supportive and productive learning environment. If even one of us feels stifled or unaccepted, we all lose out.

Academic Integrity

By enrolling in this course, each student assumes the responsibilities of an active participant in UW-Madison's community of scholars in which everyone's academic work and behavior are held to the highest academic integrity standards. Academic misconduct compromises the integrity of the university. Cheating, fabrication, plagiarism, unauthorized collaboration, and helping others commit these acts are examples of academic misconduct, which can result in disciplinary action. This includes but is not limited to failure on the assignment/course, disciplinary probation, or suspension. Substantial or repeated cases of misconduct will be forwarded to the Office of Student Conduct & Community Standards for additional review. For more information, refer to studentconduct.wiscweb.wisc.edu/academic-integrity/

Biocore Statement of Academic Integrity

We trust you to do your own, best work on all individual assignments, and that all team members will equivalently contribute to all group assignments. Remember, you formally agreed to this when you signed the Biocore Honor Code last fall (the six principles of the Biocore Honor Code are below). If you have exceptional circumstances that prohibit you from doing your own, best work, please see us to talk about it.

What is academic integrity and why are we promoting it? Academic integrity ***means being honest about your intellectual work*** which is fundamental to the pursuit of knowledge. We ask you to sign this honor code as a pact between you and the Biocore Program faculty/staff to abide by the academic rules of conduct laid out by the University. Without these rules of conduct our institution would be severely limited in its capacity to function as community of higher learning.

As a UW-Madison student, it is your responsibility to be informed about what constitutes academic misconduct, how to avoid it and what happens if you decide to engage in it. For more information, see https://conduct.students.wisc.edu/academic-integrity/
These guidelines protect both you and the university if an infraction has occurred. Ignorance of these regulations is not a defense in cases of infringement. So.. Just DON'T Do It!

Definition of Academic Dishonesty

Academic misconduct is governed by state law, **UWS Chapter 14** (PDF)
Misconduct includes the following, but is not limited to this list:

- Seeks to claim credit for the work or efforts of another without authorization or citation (plagiarism)
- Uses unauthorized materials or fabricated data in any academic exercise (using notes for a closed-book online exam)
- Forges or falsifies academic documents or records (having a friend sign you in for attendance when you're absent)
- Intentionally impedes or damages the academic work of others (tampering with another student's experiment)
- Engages in conduct aimed at making false representation of a student's academic performance (altering test answers and submitting the test for regrading)
- Assists other students in any of these acts

Examples include but are not limited to: cutting and pasting text from the web without quotation marks or proper citation; paraphrasing from the web without crediting the source; using notes or a programmable calculator in an exam when such use is not allowed; using another person's ideas, words, or research and presenting it as one's own by not properly crediting the originator; stealing examinations or course materials; changing or creating data in a lab experiment; altering a transcript; signing another person's name to an attendance sheet; hiding a book knowing that another student needs it to prepare an assignment; collaboration that is contrary to the stated rules of the course, or tampering with a lab experiment or computer program of another student."

Consequences for Academic Dishonesty

To determine whether academic dishonesty has occurred, the instructor and Biocore administrators will meet with the student. In Biocore, students who commit acts of academic misconduct will write a letter describing what they did and, if appropriate, apologize to individuals who were involved in the incident. In alignment with the penalties listed in the University's UWS14, Student Academic Disciplinary Procedures we recognize three levels of consequences (1) An oral reprimand; and (depending on the severity of the case) written reprimand presented only to the student; or an appropriate assignment to be evaluated by the instructor or Biocore administrative staff, (2) a lower or failing grade on the assignment, exam, or course; removal of the student from the course or program; and a written reprimand included in the student's university disciplinary file, (3) recommendation for disciplinary probation for up to 2 years, suspension, or expulsion from the University.

Biocore Honor Code

You will be asked to sign a statement upon entering the Biocore program during the first week of class in Biocore 381. In order to participate in the Biocore Program you must agree to the following principles:

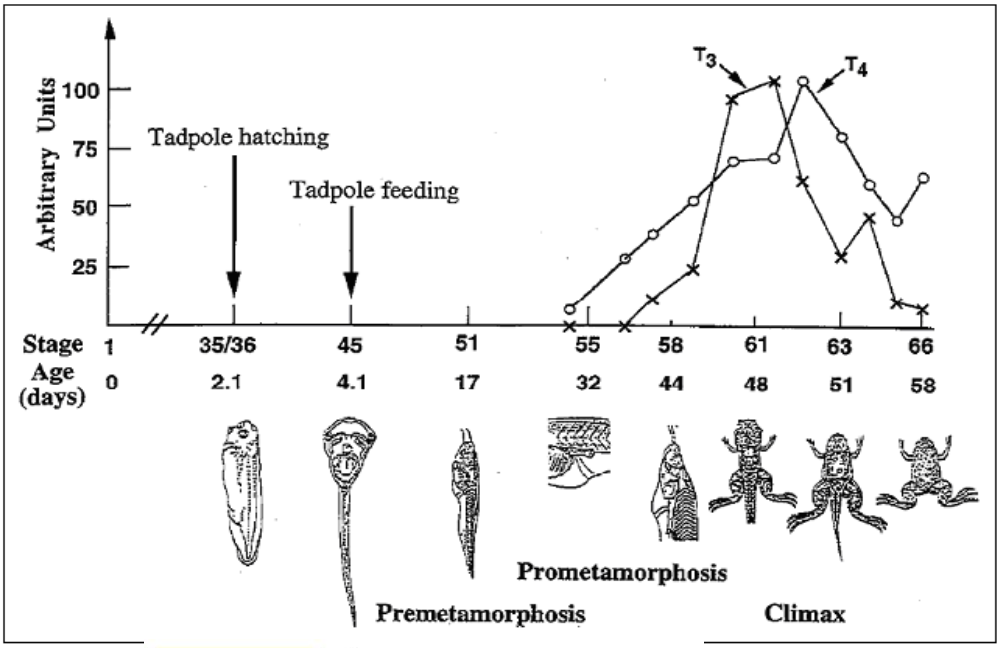
1. I will report laboratory data honestly and accurately. Under no circumstances will I fabricate data or change data to fit what I think it should be.
2. All work that I submit under my name will be my own. I will not copy or paraphrase from another student presently or previously enrolled in this course.
3. For projects where collaboration is explicitly permitted, I will list the names of students with whom I worked.
4. I will not allow another student to copy or "borrow" my laboratory reports or other assignments.
5. I will not forge or falsify academic documents including graded assignments and examinations
6. I will strive to make Biocore a community that is based on honesty and integrity.

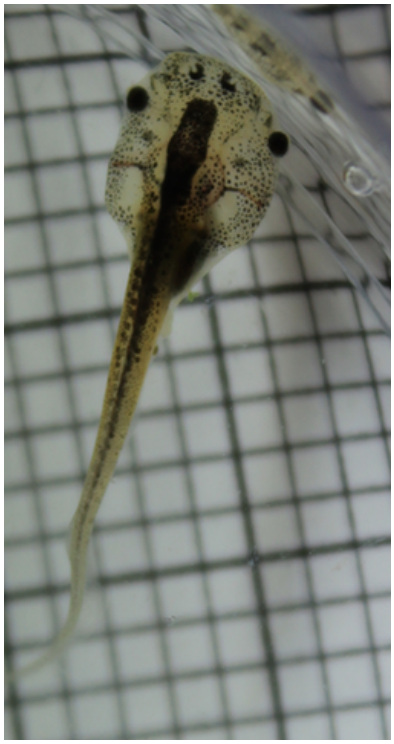
General Course Information

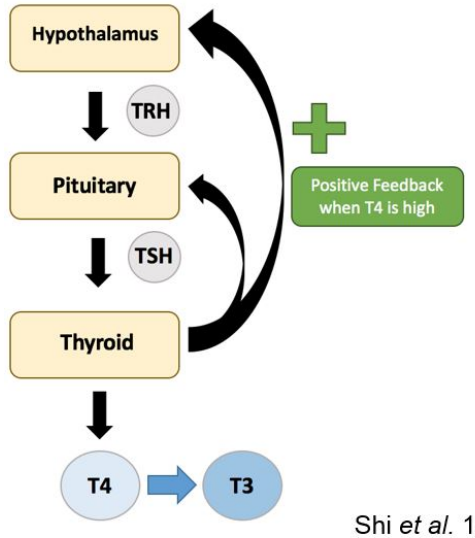
"Living organisms are historical entities representing the successful outcomes of millions of years of environmental testing applied to different phenotypes and genetic backgrounds."

Schwenk et. al. (2009) Grand challenges in organismal biology. Integrative and Comparative Biology 49(1):7-14

Graph shows plasma thyroid hormone level changes during *Xenopus laevis* metamorphosis. Figure 2.2 in Yun-Bo, S. (2000). *Amphibian metamorphosis: from morphology to molecular biology*. Wiley-Liss, New York.







Shi *et al.* 1996
Wright *et al.* 2002

Biocore 486 Schedule Fall 2019

Week	Date	Lab Activity OR Discussion Activity	Assignment Type	Weight (%)
1 (LAB)	9/3 - 6	Intro to Biocore 486 lab course: course info, teamwork & experimental design expectations Intro to Unit 1: Animal Physiology: human and animal model systems • √ *Assignment : attend evening lab open house to examine potential model systems and practice using equipment*	Individual	√
2 (Disc)	9/9 - 13	Refining Unit 1 project; prepare PPT proposal slides		
2		Informal PPT feedback presentation of Unit 1 research plan uTAs: "Peer Review Do's and Don'ts" • *Assignment: Choosing Stats for Unit 1 anticipated data* • *Assignment: Unit 1 Intro w/BR figure + Methods (w/DMP); choose peer review partners**	Team	√
3 (Disc)	9/16 – 20	***Unit 1 Statistics assignment due beginning of discussion*** Groups come to consensus and then summarize their statistical plan to class	Individual	2
3		Peer review Unit 1 Intro w/ BR figure + Methods Biorationale flowchart exercise + Refresher: Data Management Plans (DMP's) Unit 1 pilot studies ***Unit 1 Introduction w/ BR figure + Methods (w/DMP) (6%) + peer review (1%) + author's response due 72 hours after lab***	Individual Individual	√ 7
4 (Disc)	9/23– 27	Teams work on consensus BR figure w/ references & weekly plan Schedule week 6 individual conference with TA *(485 practice exam Sept. 23)*	Individual	√
4		Unit 1 pilot studies/data collection ***Team consensus BR figure w/ references + weekly plan– due 48 hours after lab***	Team	1
5 (Disc)	9/30-10/4	Team work time *(485 evening Exam 1 Sept. 30)*		
5		Unit 1 pilot studies/data collection		
6 (Disc)	10/7- 11	Refining Unit 1 project; prepare PPT proposal slides Practice presentation with uTAs	Team	√
6		Formal PPT *practice* presentations: preliminary results *Assignment: Unit 1 Proposal paper; students choose peer review partners*	Team	√
7 (Disc)	10/14 - 18	Peer review Unit 1 proposal paper Graded Unit 1 Intro w/ BR figure + Methods w/DMP returned	Individual	√
7		Unit 1 data collection Pig/sheet heart, kidney, lung dissections (optional) Team – instructor meetings to discuss estimated PPT presentation grades & stats ***Unit 1 proposal paper w/ DMP (11%) + peer review (1%) + author's response + GEA due 72 hours after lab***	Individual	12
8 (Disc)	10/21 - 25	*(485 evening Exam 2 Oct. 21)* Mid-semester feedback evaluation Symmetry of Introduction & 5 key components of Discussion section		
8		Statistics worksheet: finalizing Unit 1 data analysis Complete Unit 1 data collection	Team	√

9 (Disc)	10/28 – 11/1	Teams finalize PPT slides Practice Unit 1 formal presentations with uTAs Graded Unit 1 proposal papers returned	Team	√
9		**Team formal PPT presentations of Unit 1 projects** *Assignment: Unit 1 final paper; students choose peer review partners*	Team	14
10 (Disc)	11/4- 8	Peer review Unit 1 final paper	Individual	√
10		**Intro to Unit 2: Plant Physiology** ***Unit 1 final paper (16%) + peer review (1%) + author's response to TA + GEA due 72 hours after lab***	Individual	17
11 (Disc)	11/11 - 15	Refining Unit 2 project; prepare PPT proposal slides		
11		Informal PPT feedback presentation of Unit 2 research plan Teams complete Plant Unit Materials form and give to Seth by end of lab. *Assignment: Unit 2 Proposal paper; students choose peer review partners*	Team Team	√ √
12 (Disc)	11/18 - 22	Teams finalize Unit 2 weekly plan and upload to Canvas by end of discussion. *(485 evening Exam 3 Nov. 18)*	Team	√
12		Peer review of Unit 2 proposal papers Unit 2 pilot studies/data collection		
13 (Disc)	11/25 - 27	***Unit 2 proposal paper w/ DMP (11%) + peer review (1%) + author's response due beginning of discussion*** Unit 2 data collection/analysis	Individual	12
No labs meet - Happy Thanksgiving!				
14 (Disc)	12/2 - 6	Workshop: poster design principles + creating interactive posters with hyperlinks Graded Unit 2 proposal papers returned Teams work on consensus biorationale figure		
14		***Team consensus biorationale figure due beginning of lab*** Complete Unit 2 data collection/analysis Team-instructor data analysis consultations *Assignment: Unit 2 formal electronic poster presentation*	Team	2
15 (Disc)	12/9 – 11	Teams finalize Unit 2 electronic POSTER Practice poster presentations with uTAs	Team	√
15		**Team formal POSTER presentations of Unit 2 projects** *Unit 2 formal poster OR revised paper assigned*	Team	13
Finals week		***Unit 2 final paper/poster OR revised proposal paper/poster + GEA form due @ noon Friday Dec. 13 (Tuesday lab) or Saturday Dec. 14 (Wednesday lab)*** *(485 Final Exam Tuesday Dec. 17, 2:45-4:45pm)*	Team or Individual	13
	All	***Team & Class Participation***	Individual	7

*At least one paper must be peer reviewed by uTA or uTA-on-call during the semester to fulfill this check (√) assignment.

Collaboration on assignments

All of your in-class work this semester will be done in permanent research teams. We expect you to discuss ideas and work through problems and analyses with your classmates, especially your teammates. You will do two formal team presentations, one using PowerPoint slides and the other using an electronic Poster, but you must write proposal and final papers on your own. Your final Unit 2 project can be summarized either within a team poster or as an individually prepared final paper; you and your teammates will

decide. Note that because of the team assignments and the possible Unit 2 team poster, somewhere between **30- 43%** of your final semester grade results from "Team" efforts.

Your Team & Class Participation grade will be determined by a variety of inputs such as your attendance, participation in class discussions (e.g., the Q&A following feedback and formal presentations), interactions with your instructors and teammates, completion of check assignments, and feedback from your GEA (Group Effort Analysis) forms. Your Team & Class Participation grade will be weighted as **7%** of your final semester grade.

Papers
Final unit papers are to be written in the form of a scientific research paper or grant proposal and are graded using Biocore rubric criteria. Collaborators must be listed on documents submitted by a research team.

Statistics
You and your team are expected to use appropriate statistical tests given your experimental design and hypothesis. The Biocore Statistics Primer is available on Canvas. Other statistical resources should be appropriately cited.

Presentations
You and your team will give 2 formal, 15-minute presentations to summarize your respective research projects. One presentation will use PowerPoint slides, while the second presentation will use a research poster format. (See the Biocore Writing Manual and the Presentation rubric in the appendix of this lab manual for our expectations.) Each member of the team is expected to make an equivalent contribution to the presentation and to the Q&A following the presentation. You will be given a team grade for these presentations. Your team will also prepare and present PowerPoint proposal feedback presentations as you plan your Unit projects. These presentations are not graded, but will allow you to receive valuable feedback from your instructors and peers.

Peer review grade
You will have 4 opportunities to be a peer reviewer (and have your papers reviewed) this semester. You will turn in a copy of the review you received with each paper along with an author's response form that briefly explains major revisions as well as what advice you took and did not take from your reviewer, and why. Your peer review grades will be based on your efforts in filling out *both the peer review and author's response sheets*. Collectively the peer reviews are worth 4**%** of your total semester grade.

Check Assignments
Check (√) assignments are scored simply adequate or inadequate. These include at least one peer reviewed paper by an undergraduate TA and scheduled practice run-throughs of PowerPoint/ poster team presentations with undergraduate TAs. Completion of check assignments will be taken into account as part of your Team & Class Participation grade.

Logbook
You will keep a logbook of your research activities throughout the semester (see logbook content expectations handout in this 486 lab manual for further details). You may use an electronic logbook or any bound notebook; a used carbonless chemistry notebook with plenty of empty pages will work. We reserve the right to look at your logbook at any point this semester.

Late Assignment Policy
Papers & assignments must be handed in on time unless you have contacted your TA or Michelle *ahead of time* to request an extension due to emergency or extenuating circumstances. Otherwise, we will deduct one grade per weekday it is late from the grade you would have received (*e.g.*, A→AB for one day late). Note that even an F paper (one week late) counts more than 0 (not handed in at all) when we total the final grades at the end of the semester. Late papers should be given directly to your TA or Michelle Harris or submitted electronically. If you know of a religious observance or other commitment this semester that will keep you from attending class, let your TA and Michelle Harris know by **September 18th**.

Accommodations
The University of Wisconsin-Madison supports the right of all enrolled students to a full and equal educational opportunity. The Americans with Disabilities Act (ADA), Wisconsin State Statute (36.12), and UW-Madison policy (Faculty Document 1071) require that students with disabilities be reasonably accommodated in instruction and campus life. Reasonable accommodations for students with disabilities is a shared faculty and student responsibility. Students are expected to inform Michelle Harris of their need for instructional accommodations by the end of the third week of the semester, or as soon as possible after a disability has been incurred or recognized. Michelle Harris will work either directly with the student [you] or in coordination with the McBurney Center to identify and provide reasonable instructional accommodations. Disability information, including instructional accommodations as part of a student's educational record, is confidential and protected under FERPA.
http://mcburney.wisc.edu/facstaffother/faculty/syllabus.php

Questions regarding classroom accommodations can be directed to the McBurney Disability Resource Center (mcburney@studentlife.wisc.edu, 608/263-2741).

Mindfulness

As in previous Biocore lab courses, we will begin each lab session with a brief mindfulness exercise where we will ask you to relax and quietly focus on your breathing for a minute or two. Previous Biocore students have reported that this breathing exercise helps them to transition and focus before beginning lab. The University Health Service has several mindfulness audio files that you may find helpful: *https://www.uhs.wisc.edu/wellness/relaxation/*

Think about publishing your research

The Journal of Undergraduate Science and Technology (JUST) is a biannual research journal written, edited, and published by UW undergraduates with the missions of supporting undergraduate researchers and making science accessible to the public. Biocore students have the option of submitting their papers as manuscripts to JUST to showcase their efforts in undergraduate research. Recognition in JUST is not only a great way to gain publication reputation, but also an excellent way to inform the community of the wonderful research happening on-campus. The deadline for the Spring issue is typically around early February. More information can be found at justjournal.org/submissions; the submission link, justjournal.org/submit/."

How you earn your final grade

We use an absolute grading scale in 486 lab (no curves!). All assignments will be evaluated and given a letter grade. Each assignment is weighted as stated in the syllabus above and converted to a percentage score. Your final grade will be determined from the sum of your letter grade assignments.

Your final percentage score is converted to a final letter grade as follows:

Final Assignment %	Letter Grade
90-100	A
80-89.9	B
70-79.9	C
60-69.9	D
<60	F

*For those few individuals that are on the borderline at the end of the semester, we will assign intermediate grades (AB and BC) based on graded assignments and our evaluation for your participation (in both lab AND discussion).