Welcome to Biocore 384- Cellular Biology Lab!

We would like to begin by introducing the teaching and learning strategy we will be using in Biocore labs that is based on the process of scientific inquiry.

Process of Scientific Inquiry

You may be familiar with the model for scientific investigations known as the "Scientific Method." The model presents a logical sequence of steps leading from an initial observation to experimentation and interpretation of data. Although the model outlines important components, few scientists actually carry out investigations according to rigidly defined steps. Instead, scientists move fluidly and cyclically among these important activities to generate new knowledge that forms the basis for new investigations.

1. **Observing and classifying:** *Observation* is the use of senses to obtain information about the world. We hope to help you enhance and build confidence in your powers of observation this semester. *Classification* is the process of ordering and connecting information in meaningful ways.
2. **Formulating hypotheses:** Forming hypotheses requires stating tentative explanations for some observed phenomenon. A hypothesis is not simply an educated guess or a prediction. It must have explanatory power and make predictions that can be tested. Researchers test hypotheses by designing experiments or making careful systematic observations and then evaluate the actual outcome against their prediction. Hypotheses are supported, rejected, or modified based on the results of the experiment. You have not failed or made a mistake if your experiment leads you to reject your hypothesis. Nor have you "proven" your hypothesis if your data supports your prediction. You have simply supported or accepted your hypothesis—under this specific situation. With more precise measurement, different statistical tests, or repeated experimentation in different environmental conditions with different organisms etc... you data may force you to reject your hypothesis. This should lead you to a new, more sophisticated hypothesis as you increase your knowledge about the system.
3. **Designing an investigation:** This process includes planning the methods and procedures for gathering data to answer a question, evaluate a hypothesis, or challenge a theory.
4. **Conducting investigations:** Investigations can be systematic observations or manipulative in nature. Both types of investigations are based on questions you ask as an investigator, your knowledge of the study system, the general "knowledge" available in the scientific literature
5. **Interpreting data and generating conclusions:** Investigators attempt to find patterns and provide meaning for data collected in a particular context. When working with data in this class, we will emphasize the need to make connections between your data, the concepts and context underlying the project, and the assumptions you are making in your experiment. During this process you will construct tentative explanations and infer cause-effect relationships for a generalized phenomenon based on the results of experimentation. Scientist's don't always agree on the interpretation of data—which is an important intellectual exercise. Although you will work as a team, we expect that you will critique each other's interpretations, challenge ideas, and generate new questions to push the research forward.

How this Applies to Biocore 384

Our goals for this course are to:

- Give you experience working with the concepts discussed in Biocore 383 in an applied setting
- Engage you in the process of science as described above
- Give you experience working with the tools and procedures of cellular and molecular biology
- Improve your writing skills and quantitative reasoning skills [this is a CommB course, with emphasis on data analysis and statistics]
- Build on, apply and integrate concepts and skills you have learned in your previous Biocore courses.
- Continue to improve your capacity to work as a member of a productive, collaborative research team.
- Contribute to a safe, sustainable, socially and ethically responsible learning environment.

Note these are the same goals as Biocore 382 now applied to cell biology.
These are higher-level cognitive skills that develop over time.

As you work to achieve these goals, we hope you will begin to see your instructors as people who bring special skills and experiences to complement the class rather than as authorities who know all the answers. We hope this and the Organismal Biology Lab (486) that follows next fall will give you a real sense of the nature and excitement of scientific inquiry! Students are only required to take two of the three Biocore labs. Many choose to take all three!

At the end of two (or three) semesters of Biocore labs, students should be able to:

1. Make careful, systematic observations
2. Ask testable, relevant, creative scientific questions
3. Search, sort and gather relevant background information from texts, primary literature, and the web.
4. Make predictions and formulate clear, testable hypotheses
5. Develop protocols that test hypotheses
6. Evaluate assumptions associated with experimental design and the biological system
7. Analyze data and make logical conclusions utilizing statistical reasoning
8. Write and communicate about scientific research
9. Give effective oral presentations
10. Do productive group work

Four Strategies for Doing Well in Biocore Labs

1. **Be prepared.** Do Pre-lab assignments and read the relevant section of the lab manual carefully ahead of your laboratory meeting time and be sure you understand the question(s) the project is attempting to answer and the approach you will be taking to answer these questions. Careful preparation will save you a great deal of time both during lab and in writing assignments. Pre-lab assignments are designed to help in this process.
2. **Make the most of the time you have in lab.** Collect the necessary data and make detailed notes in your lab notebook. In many cases we have allowed time in class for you to begin analyzing and discussing your data, preparing presentations and getting feedback from peers and instructors. Take advantage of this opportunity and resist the temptation to leave early. This is where the most learning takes place.
3. **Start writing your lab papers well before the deadline and pay attention to the many hints in the lab manual, handouts, and *Biocore Writing Manual*.** We emphasize writing in this course not only because communicating your ideas is part of the scientific process, but also because writing about a subject helps you understand more clearly and at greater depth. This takes time. Many times during the semester you will have the opportunity to have your paper reviewed by a peer before turning it in for a grade. This is an excellent opportunity to remedy problems before turning in a final copy. If your peers cannot understand what you have written it is unlikely that the instructor will understand.
4. Cultivate a relationship with your Biocore peers. **Your peers are an incredible resource and have much to offer you in the way of support and advice in this course. These are the people you can depend on for the next three semesters!**

Important Note: We have had some problems in labs with students fabricating or changing data. We consider this a serious violation not only of ethics but also of scientific principle. Some students have argued that though they wouldn't fudge "real" experimental data, fudging data in a lab course is not unethical because we aren't doing anything "real." We strongly disagree with the assumption that we are not doing "real" science. Real science happens any time you observe, ask questions, look for possible answers, or carry out an experiment. **It is absolutely essential that you report your data honestly and accurately.** You agreed to this when you signed the Biocore Honor Code. You are not graded on your results but rather on how you analyze your data. You will NOT be penalized for data that are difficult to explain. You will be penalized harshly for violations of the Biocore Honor Code, including fabricating data.

Instructors- Open Door policy
Janet Batzli (course chair) 363 Noland Hall, jcbatzli@wisc.edu
Michelle Harris (course chair) 307 Noland Hall, maharris@wisc.edu
Seth McGee (lab manager) 339 Noland Hall, samcgee@wisc.edu

Lab	Disc Time	Lab Time	Teaching Assistants
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Attendance and Time Management
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Lab Etiquette

For use of 341 and 334 lab rooms: Access and independent use of lab rooms is a key component of our Biocore learning environment and community, but it comes with **responsibility**. You may use 341 for group or quiet study when no classes or meetings are in session. Use 334 for doing experiments and meeting with lab research teams. Non-Biocore students will be asked to leave unless they are accompanied by a Biocore student. Both 341 and 334 lab rooms have key lock boxes that you will be given access to after the start of the semester. If there is any misuse or suspected misuse of the rooms, if the rooms are not cared for or left untidy or down right dirty (remember the CLAW!), or if equipment/ books/ furniture are out of place or missing we will no longer be able to allow student access to these rooms outside of class time hours. In short, be good Biocore citizens and take care of your lab rooms!

Use of computers: You will have access to 11 PC laptops in room 341 Noland. You may check out a computer (with your student ID) -- ask your instructors. Do not download applications to these computers and do not store your valuable files on the hard drive (the drives are wiped clean regularly).

During presentations by your peers or instructors: Your presence and participation in class is extremely important for your learning and the establishment of a positive, effective learning environment for everyone (students and instructors). With this in mind, please do not use any electronic devices or study for other courses during our class meeting time.

Group work & Participation All of your in-class work this semester will be done in research teams assigned by your instructors. We expect you to discuss ideas and work through problems and analyses with your classmates, especially your teammates. However, you must write two research proposals, final Enzyme paper and worm proposal mini-poster on your own. Note that the final Worm mini-poster and Signal Transduction PPTs are group grades (**30%** of your final semester grade). **5%** of your final semester grade is based on team work, the quality of your check assignments, attendance, and participation in class discussions, peer review conferences, and research team efforts. This grade is determined by input from both your instructors and from your teammates' GEA (Group Effort Analysis). The 5% class participation and team work grade is guided by the GEA rubric and often plays heavily into borderline grades at the end of the semester. Work hard on creating a positive learning environment for your research team and for the course in general—it will help everyone AND your grade!

Papers, Posters & Presentations (Formal & Informal)

As a Writing Intensive/ CommB course, Biocore 384 provides a number of opportunities for you to improve your written and oral communication skills about science. Papers are to be written in the form of a scientific research paper and posters and are graded using the rubric criteria described in the Biocore Writing Manual. You and your research teams will prepare and present ungraded *informal feedback presentations* in the format of a research proposal when you are planning your research projects (similar to what graduate students do in their research labs). Feedback presentations will allow you to receive essential and valuable feedback from your instructors and peers prior to you doing your experiment AND prior to writing a research proposal. Although not graded, feedback presentations are where a great deal of learning happens- for both the presenters and the audience. You and your team will also give one graded *formal presentation* at the end of the semester to summarize your 'capstone' signal transduction project. You will have the opportunity to incorporate audience feedback in the form of a narrated PPT team presentation that is due during finals week. This requires presenters to focus on both the scientific rigor of the project as well as how it is presented to the audience. (See the Biocore Writing Manual for our expectations and oral presentation rubric.)

Peer review

You will have 2 opportunities to be a peer reviewer (as well as to have your work reviewed) this semester. You will turn in a copy of the review you received with each assignment, 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 reading/ reviewing your peer's writing and filling out *both the peer review and author response sheets*. Collectively the peer reviews are worth **4%** of your total semester grade. Even when not required, we strongly encourage you to use the peer review process before turning in papers or posters.

Late Assignment Policy

Papers & assignments must be handed in on time unless you have contacted your TA *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. If you know of a religious observance or other commitment this semester that will keep you from attending class, let your TA, Janet Batzli and Michelle Harris know as soon as possible.

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.

Honor and Honesty, Ethics and Social Responsibility is essential
It is absolutely essential that you report your data honestly and accurately: The validity and accuracy of scientific findings are open to review. Your data are NOT PERSONAL, nor are they correct/incorrect or good/bad. Therefore, data are not to be associated with a personal value judgment. We have had some problems in labs with students fabricating or changing data. We consider this a serious violation not only of ethics but also of scientific principle. You are not graded on your results but rather on how you analyze your data.
Plagiarism: We have had several instances where students have copied segments or whole sections of classmate's papers, changed the wording/order a little, and claimed the work as their own, either in drafts for peer review and final papers or in pre-lab assignments. Not only is this **plagiarism**, claiming credit for the intellectual work of others is highly disrespectful and erodes trust within our Biocore learning community. If you find yourself tempted (especially late at night just hours before a paper is due—we've all been there) **JUST DON'T DO IT**. It is much better to ask for an extension, receive a slightly lowered grade for a late paper, or even receive a zero for a missing assignment than to plagiarize your classmates or someone else's work. You agreed to this when you signed the Biocore Honor Code during the first week of Biocore 381and will be held accountable for violations according to UW Academic Code of Conduct 14.03 http://students.wisc.edu/doso/acadintegrity.html.

How you earn your final grade
We use an absolute grading scale in 384 (no curves!). Assignments, due dates, and assignment weight in percent are detailed in the schedule above. Pre-lab assignments are graded on a point percentage basis. Papers and posters are graded using rubric criteria described in the *Biocore Writing Manual* and reported to you as a letter grade (A&, A, AB, B&, B, B-, BC, C…). Letter grades are converted to numeric values when final grades are tallied at the end of semester (e.g. AB=89, B+=87). Check (√) assignments are scored simply adequate or inadequate.

Your final grade will be determined from the sum of your letter grade assignments and pre-lab assignments, after each assignment is weighted as stated in the syllabus above and converted to a percentage score. 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

*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 our evaluation of your participation (in both lab AND discussion), teamwork and your effort.

Biocore 384: Cellular Biology Laboratory - Spring 2017 Schedule

Your grade will be based on the assignments listed below. Check (√) assignments are scored simply adequate or inadequate; papers, posters and presentations are graded using rubric criteria described in the *Biocore Writing Manual*.

Week/ (date)	*Topic*	*Activities*	*Weight* *(due at start of class unless specified)*
1 (Jan. 17-20)	**Tools and Techniques**	***Disc*** None this week	
		Lab Equipment stations; Cell/tissue observations and cell counts √ By end of Lab: Pipetting, water bath and spectrophotometry, centrifuge –demonstrate to instructor in lab	
2 (Jan. 23-27)	**Enzyme I:** Alkaline Phosphatase & Kinetics	***Disc*** Intro to Enzyme catalysis & calculations; decide final [S] **Enzyme Pre-lab**	**2%**
		Lab Enzyme kinetics experiment √ By end of Lab: hand-drawn AP standard curve; graphs & calculations for K_m, V_{max}	
3 (Jan 30 - Feb 3)	**Enzyme II:** Literature Search/ Bioinformatics/ Statistics	***Disc*** Literature search techniques √ Read Enzyme lab manual Part B, complete NCBI BLAST and Jmol tutorials & turn in answers to questions	
		Lab Preparing to do enzyme research • Data analysis (generating histograms and using t-tests to compare means) • Building a biorationale: examining AP physical models • Generate list of top 3 tentative questions that team is interested in (1/team) **Data Analysis pre-lab Part I**	**2%**
4 (Feb. 6-10)	**Enzyme III:** Proposal Feedback Presentation / Pilot Studies	***Disc*** Feedback presentation slide prep √ Bring at least one relevant literature source & share w/ team **Data Analysis pre-lab Part II**	**2%**
		Lab Enzyme feedback presentation (1/team); Tutorial on making stock solutions √ Materials and schedule sheet- (1/team due 48h after lab) **Enzyme Research Proposal & GEA** due Sat. Feb. 11 or Sun. Feb. 12	**8%**
5 (Feb. 13-17)	**Enzyme IV:** Final Experiment	***Disc*** Focus on Peer Review & writing expectations: reverse outline sample paper	
		Lab Teams collect data and begin data analysis; Schedule TA writing conference √ Statistics consultation with instructors	
6 (Feb. 20-24) *Biocore 383 Exam Feb. 21*	**Molecular Genetics I:** *C. elegans*, heat shock proteins, RNAi / GFP	***Disc*** Formal peer review; Constructive & Destructive group behavior exercise	
		√ concept map due beginning of lab ***Lab*** Investigating *C. elegans* gene expression: identifying unknown heat treated groups **Final Enzyme paper & GEA** due Sun 2/26 **Peer Review & Author's response**	**12%** **2%**
7 (Feb 27-Mar 3)	**Molecular Genetics II:** Developing *C. elegans* experiment	***Disc*** Mid-semester eval; finding relevant info on WormBase and WormBook websites Planning for worm experiments √ Bring at least one relevant literature source & share w/ team	
		Lab Workshop: Chi Square Test of Independence & 2-Factor ANOVA; Practice quantifying worm fluorescence & isolating eggs through bleaching √ Lab: Begin worm Experimental Design Worksheet (1/team)	

8 (Mar 6-10)	**Molecular Genetics III:** Worm experiment	***Disc*** Feedback presentation slide prep **Worm Chi-Square Data Analysis pre-lab** ***Lab*** Worm proposal feedback presentations (1/team) √ Experimental Design Worksheet (1/team) due beginning of lab √ Materials and schedule sheet (1/team) due 48h after lab Start worm experiments - pilot studies, RNAi set up; sign up for final data collection (outside class)	**2%**
9 (Mar 13-17)	**Molecular Genetics IV:** Data Collection	***Disc*** **Worm research proposal mini-poster & GEA** Biocore 486 preview; Check worms/apply treatment ***Lab*** Final worm data collection (time varies); Statistics consultations with instructor	**12%**
		March 20-24 ***Spring Break***	
10 (Mar 27 – 31)	**Molecular Genetics V:** Data Analysis, Conclusion and Posters	***Disc*** √ Visual summary of raw data & analysis (individual) & receive GEA feedback ***Lab*** Data interpretation, integration, and stats feedback presentation: *Making appropriate conclusions based on evidence* √ Results/discussion feedback presentations **Worm mini-posters (1/team) & GEA** due 48h after lab	**12%**
11 (Apr. 3-7) Biocore 383 Exam April 4	**Signal Trans-duction I:** Intro to Yeast System	√ Mini concept map due beginning of discussion? ***Disc*** Signal transduction intro; Construct pathway activity/ Concept mapping exercise Read Signal Transduction Lab Manual ***Lab*** Introduction to cell shape, B-gal, and Western blot assays √ Generate tentative question for Sign. Trans project (1/team)	
12 (Apr. 10-14)	**Signal Trans II:** Present Proposals	***Disc*** Feedback presentation slide prep √ Bring at least one relevant literature source to share **Signal Transduction Prelab** ***Lab*** Signal transduction proposal feedback presentations (1/team) √ Materials and schedule sheet (1/team due 48 hr after lab)	**4%**
13 (Apr. 17-21)	**Signal Trans III:** Pilot Studies & Your Experiment	***Disc*** Formal Peer Review ***Lab*** Data collection I (time varies)*[Do expt during week days- No weekends]* **Signal Transduction proposal paper** due Sat. April 22 or Sun. April 23 **Peer Review & Author's Response**	**17%** **2%**
14 (Apr. 24-28)	**Signal Trans IV:** Data Analysis	***Disc*** Team – instructor data consultation meetings; conclusions & titles ***Lab*** Data collection II (time varies) In class: Discussion section formatting: card sorting exercise	
15 (May 1-5)	**Signal TransV:** Final Present	***Disc*** Group Peer Review final presentation ***Lab*** Formal presentations; Final course evaluation **Signal transduction formal PPT presentation (1/team)**	**10%**
		Response to Reviewers & GEA (1/team)	**8%**
Biocore 383 Final Exam Wednesday May 10			
		Team work, class participation and check assignments	**5%**

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Peer review
You will have 2 opportunities to be a peer reviewer (as well as to have your work reviewed) this semester. You will turn in a copy of the review you received with each assignment, 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 reading/ reviewing your peer's writing and filling out *both the peer review and author response sheets*. Collectively the peer reviews are worth **4%** of your total semester grade. Even when not required, we strongly encourage you to use the peer review process before turning in papers or posters.

Late Assignment Policy
Papers & assignments must be handed in on time unless you have contacted your TA *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. If you know of a religious observance or other commitment this semester that will keep you from attending class, let your TA, Janet Batzli and Michelle Harris know as soon as possible.

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.

Honor and Honesty, Ethics and Social Responsibility is essential
It is absolutely essential that you report your data honestly and accurately: The validity and accuracy of scientific findings are open to review. Your data are NOT PERSONAL, nor are they correct/incorrect or good/bad. Therefore, data are not to be associated with a personal value judgment. We have had some problems

in labs with students fabricating or changing data. We consider this a serious violation not only of ethics but also of scientific principle. You are not graded on your results but rather on how you analyze your data.
Plagiarism: We have had several instances where students have copied segments or whole sections of classmate's papers, changed the wording/order a little, and claimed the work as their own, either in drafts for peer review and final papers or in pre-lab assignments. Not only is this **plagiarism**, claiming credit for the intellectual work of others is highly disrespectful and erodes trust within our Biocore learning community. If you find yourself tempted (especially late at night just hours before a paper is due—we've all been there) **JUST DON'T DO IT**. It is much better to ask for an extension, receive a slightly lowered grade for a late paper, or even receive a zero for a missing assignment than to plagiarize your classmates or someone else's work. You agreed to this when you signed the Biocore Honor Code during the first week of Biocore 381and will be held accountable for violations according to UW Academic Code of Conduct 14.03 http://students.wisc.edu/doso/acadintegrity.html.

How you earn your final grade
We use an absolute grading scale in 384 (no curves!). Assignments, due dates, and assignment weight in percent are detailed in the schedule above. Pre-lab assignments are graded on a point percentage basis. Papers and posters are graded using rubric criteria described in the *Biocore Writing Manual* and reported to you as a letter grade (A&, A, AB, B&, B, B-, BC, C…). Letter grades are converted to numeric values when final grades are tallied at the end of semester (e.g. AB=89, B+=87). Check (√) assignments are scored simply adequate or inadequate.

Your final grade will be determined from the sum of your letter grade assignments and pre-lab assignments, after each assignment is weighted as stated in the syllabus above and converted to a percentage score. 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

*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 our evaluation of your participation (in both lab AND discussion), teamwork and your effort.