

Instructor: Lisa McDonnell lmcdonnell@ucsd.edu *I try to respond within 24 hours M-F.*
Office: York Hall 3080D, office phone: 858-246-0890

Office Hours: Wed 2-3pm*, Wed 6-7pm (beginning Oct 5), Thurs 4-5pm, York 2300
*this one is BIMM 101 specific, the others may be attended by students in the other course I teach (genetics)

Instructional assistants: D01 Nicholas Liang niliang@ucsd.edu
D02 Regina Powers rmpowers@ucsd.edu

Lecture: Monday, Wednesday, Friday, 9-9:50am, PETER 104

Laboratory: Wednesday, Friday, 10am-1:50pm in York 3306 (D01) or York 3406 (D02)

Required materials: The BIMM101 Laboratory Manual + carbon sheets (bookstore), [knee-length laboratory coat](#), [and](#) UV-blocking safety glasses or [goggles](#) are required for the laboratory and are available at the bookstore. Long pants and closed-toe/heel shoes are required in lab. Sharpie (dark color) for labelling tubes in the lab. iClicker is required for lectures and should be [registered on TritonEd](#).

Course Schedule: Condensed schedule at the end of the syllabus. More detailed schedule on TritonEd site. Please check TritonEd site often for updates, deadlines.

Welcome to BIMM 101: Recombinant DNA Laboratory! BIMM101 aims to develop an understanding for research in molecular biology through inquiry-based laboratory experiments. We will work in groups to collect, analyze, and present research data while learning molecular and biological concepts and laboratory skills.

LEARNING GOALS

- Apply knowledge of molecular biology concepts and molecular techniques to plan experiments, explain and troubleshoot results
- Demonstrate proficiency at the basic molecular biology techniques used in the lab
- Explain the importance of proper controls in designing experiments and interpreting results
- Perform basic lab math skills, statistical analysis, and graphing
- Draw conclusions based on evidence and reasoning
- Use basic bioinformatics databases and applications
- Find, read, and evaluate primary literature
- Collaborate with one another to learn foundation biological concepts and laboratory skills

MAJOR COMPONENTS

- Class: Learn biological concepts related to the laboratory research projects, engage in discussions and review of primary literature
- Laboratory: Engage in collaborative research projects
- Out-of-class: Reading, assignments, reports

ACCESSIBILITY AND INCLUSION

<http://disabilities.ucsd.edu> | osd@ucsd.edu | 858-534-4382

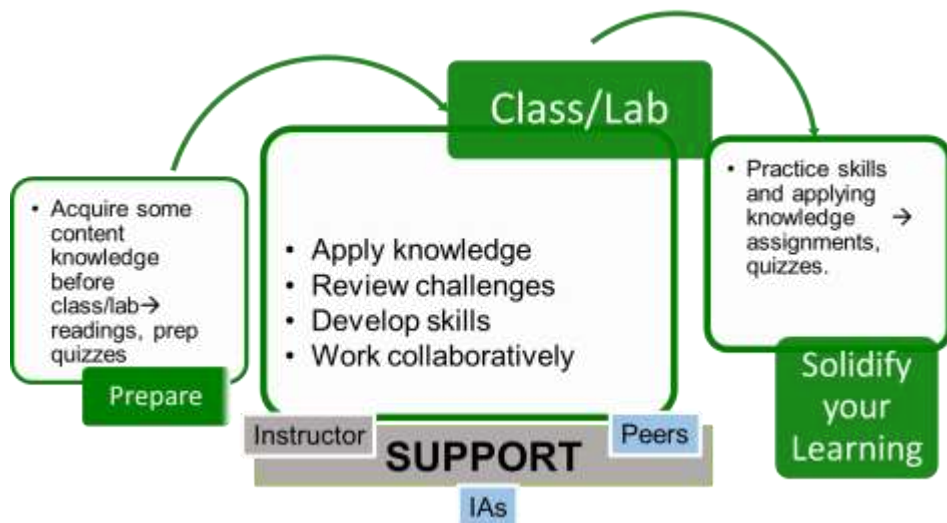
Any student with a disability is welcome to contact us early in the quarter to work out reasonable accommodations to support their success in this course. Students requesting accommodations for this course due to a disability must provide a **current** Authorization for Accommodation (AFA) letter issued by the Office for Students with Disabilities (OSD). Students are required to present their AFA letters to faculty and to the OSD Liaison in the Division of Biological Sciences **in advance** so that accommodations may be arranged.

Whenever possible, we will use universal designs that are inclusive. If you have feedback on how to make the class more accessible and inclusive, please get in touch!

LEARNING IN THIS COURSE

This course is designed to be a **collaborative** environment for everyone to learn together and construct a shared understanding of the material. **Active participation** both in class and in lab is expected. Being able to **communicate** understanding, and confusion, is critical to success in any discipline, and is very useful for learning¹. To encourage collaboration, class activities and discussions will be done in groups, and grades will not be assigned on a curve.

I use class time to work on applying our knowledge, troubleshooting difficult topics, and practice solving problems. There are often pre-class assignments to prepare for the material to come in class.



Instead of memorization, we will focus on developing an understanding of fundamental concepts as they apply to different examples. Therefore, quizzes will include questions that are based on solving problems in new contexts.

¹ Smith et al., 2009. <http://www.sciencemag.org/content/323/5910/122.short>

GRADING

BIMM101 has four grading components: participation & professionalism (20%), quizzes (35%), laboratory reports (35%). Because different people may excel in different aspects, the laboratory reports or quizzes, whichever is higher for each individual, will be scaled to 45% instead of 35%, bringing the total to 100%. The following grading scheme will be used. The course is **not** graded on a curve (i.e. 20% of students getting A, B, C, and such). Thus, the ability to do well in this course is not dependent on others doing poorly.

| | | | | | | | | | |
|----|---------|----|--------|----|--------|----|--------|---|-------|
| A+ | 97-100% | B+ | 87-90% | C+ | 77-80% | D+ | 67-70% | F | 0-60% |
| A | 93-97% | B | 83-87% | C | 73-77% | D | 63-67% | | |
| A- | 90-93% | B- | 80-83% | C- | 70-73% | D- | 60-63% | | |

There are no opportunities for extra credit beyond what is assigned as part of the course by the instructor.

Participation & Professionalism: Active participation both in lectures and in the laboratory is essential to learning. There will be many participation items, including **pre-lecture reading assignments**, **pre-laboratory assignments**, **in-lecture discussions and activities**, and **laboratory notebooks**. Participation will be graded for thoughtful completion, and 80% participation items (rounded up to whole items) will be counted.

Pre-class reading assignments:

Before most classes there will be a reading assignment and associated quiz on TritonEd to be completed before class. Check the weekly content folders on the TritonEd site for reading and quiz details and due dates. Pre-class reading assignments and quizzes are designed to 1) introduce some relevant background material, so you are prepared for class and can have productive discussions; 2) introduce some relevant primary literature, which could be useful later when you are writing reports; 3) your quiz responses help the instructor know what material students are struggling with.

In-class discussions: these will happen on a regular basis, and include clicker questions.

Pre-lab assignments:

You will be asked to do a pre-lab outline to indicate the goals for the day. This should include the goals for the day, predictions about results (when possible). This is to be done in your carbon books, and submitted at the start of lab.

Lab notebooks: lab notebook entries will be collected after most labs and randomly graded for documenting results, reflecting on results (evaluating/comparing to predictions) and drawing relevant conclusions based on evidence and reasoning.

Professionalism: This portion of the course grade is intended to motivate students to consider the impact of their actions on their own learning and the learning of others in the course. Unprofessional interactions consume time yet have no meaningful benefits to you, your fellow students, and/or the teaching team. Analogously in the workplace, being unprofessional to your colleagues or supervisors will only discount you. When you are discounted, you will not be invited for new opportunities that you may or may not be aware of.

Professionalism can be demonstrated through individual and community efforts (1% each). The individual component is to account for demonstrating maturity and professionalism. By default, every student is assumed to be professionally mature. Hence, this component is awarded to every student at the beginning of the quarter. During the quarter, based on observations by the teaching team, which includes

but is not limited to one-on-one interactions, electronic communication, and follow-up conversations on grades, your professionalism credit may be deducted in steps of 0.5%.

For the community professionalism component, the 1% can be earned by completing course evaluations and related surveys that can aimed to improve the course and the educational experiences of your future peers. If 90% or more of all students complete CAPEs, instructional assistant evaluations, and other course-based evaluation surveys in a mature and professional fashion (i.e. taking them seriously and providing timely and constructive feedback), 1% will be awarded to everyone in the course.

Quizzes: Quizzes will be open resources (e.g. notes and calculators but not electronic equipment that can be used to communicate with others). Quizzes will be cumulative but will focus on the most recent material. There will be 4 short quizzes (20%) and 1 longer, final quiz (15%).

To facilitate reflection and learning from quizzes, the short quizzes will be in two phases: The first phase will be done individually, and the second phase will be the same quiz done again in groups. The group score will be compared to the average of the group's individual quiz scores. If the group score is higher than that average, the difference between the group score and the average will be added to each person's individual score (to a max of 100%)

Example: Group consists of student A, B, C, and D.

Student A: 90% on individual Student B: 80% on individual

Student C: 70% on individual Student D: 60% on individual

Average of individual scores: 75%.

That same group gets 80% on the group quiz. Difference between avg individual and group = 5%.

Therefore, each individual gets an additional 5% on their scores, so the final quiz scores look like:

Student A: 95% Student B: 85%

Student C: 75% Student D: 65%

Why use this collaborative testing method? People tend to learn more from collaborative work compared to doing work alone^{2, 3}. These collaborative testing opportunities allow us to deepen our understanding because we are receiving feedback on our thinking in a very timely fashion (and feedback is critical for learning). Also, it is an opportunity to practice communicating effectively and collaborating to solve problems.

2 Heller et al., 1992. http://www.physics.emory.edu/faculty/weeks/journal/Heller_AJP_91a.pdf

3 Gilley and Clarkston, 2014. http://www.cwsei.ubc.ca/SEI_research/files/Gilley-Clarkston_2-Stage_Exam_Learning_JCST2014.pdf

Laboratory Mini Reports & Assignments:

Guidelines and rubrics for each of the mini reports and assignments will be posted on TritonEd and due dates announced on TritonEd and in class. Reports will be submitted to Turn-it-in and hard-copies must be submitted in person within 5 minutes of the due date time.

There are 6 writing assignments:

Writing in your own voice assignment – 4%

PCR variations mini report – 6%

Promoter mutants mini report – 8%

Gel electrophoresis mini report– 5%

Ligation efficiency mini report – 7%

RNAi assignment – 5%

The mini reports will be written in in the format of research papers from peer-reviewed journals. We will use the Division of Biological Sciences undergraduate research journal Saltman Quarterly (<http://sq.ucsd.edu/>) as a guide. They are concise reports, ranging from 1 to 2 pages max. Reports not submitted to turn-it-in will be docked points.

ACADEMIC INTEGRITY

<https://students.ucsd.edu/academics/academic-integrity/index.html>

Integrity of scholarship is essential for an academic community. The University expects that both students and faculty will honor this principle and in so doing protect the validity of University intellectual work. For students, this means that all academic work will be done by the individual(s) to whom it is assigned, without unauthorized aid of any kind.

In this course, we need to establish a set of shared values. Following are values adopted from the International Center for Academic Integrity (<http://www.academicintegrity.org/ica/home.php>), which serve as the foundation for academic integrity. These values include:

| | As students we will..... | As the teaching team we will..... |
|------------------------|--|---|
| Honest | <ul style="list-style-type: none">• Honestly demonstrate your knowledge and abilities according to expectations listed in the syllabus or in relation to specific assignments and exams• Communicate openly without using deception, including citing appropriate sources | <ul style="list-style-type: none">• Give you honest feedback on your demonstration of knowledge and abilities on assignments and exams• Communicate openly and honestly about the expectations and standards of the course through the syllabus and in relation to assignments and exams |
| Responsibility | <ul style="list-style-type: none">• Complete assignments on time and in full preparation for class• Show up to class on time and be mentally and physically present• Participate fully and contribute to team learning and activities | <ul style="list-style-type: none">• Give you timely feedback on your assignments and exams• Show up to class on time and be mentally and physically present• Create relevant assessments and class activities |
| Respect | <ul style="list-style-type: none">• Speak openly with one another while respecting diverse viewpoints and perspectives• Provide sufficient space for others to voice their ideas | <ul style="list-style-type: none">• Respect your perspectives even while we challenge you to think more deeply and critically• Help facilitate respectful exchange of ideas |
| Fairness | <ul style="list-style-type: none">• Contribute fully and equally to collaborative work, so that we are not freeloading off of others on our teams• Not seek unfair advantage over fellow students in the course | <ul style="list-style-type: none">• Create fair assignments and exams and grade them in a fair and timely manner• Treat all students and collaborative teams equally |
| Trustworthiness | <ul style="list-style-type: none">• Not engage in personal affairs while on class time• Be open and transparent about what we are doing in class• Not distribute course materials to others in an unauthorized fashion | <ul style="list-style-type: none">• Be available to all students when we say we will be• Follow through on our promises• Not modify the expectations or standards without communicating with everyone in the course |
| Courage | <ul style="list-style-type: none">• Say or do something when we see actions that undermine any of the above values• Accept the consequences of upholding and protecting the above values | <ul style="list-style-type: none">• Say or do something when we see actions that undermine any of the above values• Accept the consequences of upholding and protecting the above values |

All course materials are the property of the instructor, the course, and the University of California, San Diego and may not be posted online, submitted to private or public repositories, or distributed to unauthorized people outside of the course.

Any suspected instances of a breach of academic integrity will be reported to the Academic Integrity Office for review.

* This class statement of values is adapted from Tricia Bertram Gallant Ph.D.

LABORATORY SAFETY

Safety precautions are crucial in the laboratory setting. Biology lab safety training and assessment (<https://biology.ucsd.edu/education/undergrad/course/ug-labs.html>) must be completed by the **beginning of the first lab** in week 1.

From the beginning of the first lab, appropriate laboratory attire and personal protective equipment (PPE) are required, including laboratory coats that cover to the knees, UV-blocking safety glasses or goggles, long pants or equivalent, long socks or equivalent, and closed-toe and closed-heel shoes. No skin should be exposed from the waist down at all times.

LABORATORY ATTENDANCE

Attendance in laboratory is required. Missing one laboratory session without a documented excuse (documented illness or serious family emergency), will automatically result in a 5% deduction in your final course grade. If you miss two labs for undocumented reasons, you will be asked to drop the course.

Please [be on time for laboratory sessions](#). Two late attendances will be counted as one absence. Additional policies are available online (<https://biology.ucsd.edu/education/undergrad/course/waitlist.html>).

LATE ASSIGNMENTS AND QUIZZES

Late assignments will be subject to a 10% deduction per day (note that assignments handed in after the first 5 minutes of lab are considered late) up to a maximum of 2 days late (after which you will receive a 0). There are no make-up quizzes offered except in the case of a documented medical or family emergency (in which case the instructor will decide how to go about the make-up testing).

No late participation items will be accepted, and no make-up quizzes will be offered, as only up to 80% of these grades are counted.

LECTURE PODCAST

<http://podcast.ucsd.edu/>

Whenever possible, lectures will be recorded and available online as videos as a resource for review. However, attendance and participation are highly encouraged, as [substantial portions of lectures will be interactive](#). Please see participation in the grading section for more details.

WRITING CENTER

<https://writingcenter.ucsd.edu/>

The Writing Center provides support for undergraduates working on course papers (i.e. laboratory reports and the research proposal) and independent writing projects. Writing mentors can help at any stage of the writing process, from brainstorming to final polishing.

The Writing Center offers: one-on-one appointments for undergraduates with peer writing mentors; group workshops addressing a variety of writing projects, genres, and issues; and Drop-In Zone for quick questions, targeted assistance, and a comfortable writing space.

REGRADES

If a grading error has been made, you should submit a re-grade request to Dr. McDonnell at the end of a lecture within two days of return of the exam. The time and date of closing down the appeal process will be announced in class. Simply write “please re-grade Q #” or “arithmetic error on p. #” on the cover of your paper. If you think your answer deserves more points (e.g. it is not an arithmetic error), please write a concise description of how your answer compares to the key, and why you think it should have received more points, on a separate but attached piece of paper. Regrades will not be done if these instructions are not followed.

No re-grades are possible for exams written in pencil or non-permanent ink. Students who submit exams for re-grading understand that we may (1) re-grade the entire exam, and (2) compare the submitted paper to a scanned copy of the original exam.

TECHNOLOGY POLICY:

Laptop computer policy: Students are welcome to bring laptops to lecture for note-taking purposes. Please see this research study that shows “multi-tasking” on computers is likely to decrease your grade, but it also decreases the grades of people around you who can see your screen⁴! For this reason, we ask that you do not flip between lectures notes and the internet. The use of cell phones, computers, or any other electronic devices is not permitted during exams. Use of a cell phone or other similar electronic devices during an exam or quiz is grounds for receiving a failing grade.

4 Sana et al. 2013. <http://www.sciencedirect.com/science/article/pii/S0360131512002254>

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CALENDAR

More specific details for each week, including reading and assignments, will be provided on TritonEd and in class. We may also adjust the schedule as necessary, while still focusing on the foundational concepts and laboratory skills.

| Week | Date | Lab | Lecture | Readings & Assignments due |
|------|----------------|---|--|--|
| 0 | Friday Sept 23 | LAB 1 A. Pipetting B. Dilutions C. Calibration of a pipetmen D. Mol. Bio. Review | Intro | |
| | Mon Sept 26 | | Mol. Bio Review | Syllabus quiz & survey due on TED. Due **Sunday Sept 25 at 11:59pm** |
| 1 | Wed Sept 28 | LAB 2 A. Agarose gel electrophoresis on two DNA samples of unknown size and concentration (estimating using standard curve) | Agarose gel electrophoresis | pre-class/lab quiz due on TED |
| | Friday Sept 30 | LAB 3 *Computer Lab* A. Image analysis of gel electrophoresis results & graphing | More AGE, graph/data interpretation, perhaps start PCR | Writing in your own voice assignment due 10am on TritonEd |
| | Mon Oct 3 | | Peer-review of AGE | AGE Draft due in class |
| 2 | Wed Oct 5 | Lab 4 A. Part 1 & 2: Isolation & purification of chromosomal DNA from <i>Vibrio fischeri</i> | Introduction to luxAB operon & bioluminescence | pre-class/lab quiz due on TED |
| | | B. Spectrophotometric analysis of <i>Vibrio</i> DNA | DNA extraction, start PCR | |
| | Friday Oct 7 | LAB 5 | | Pre-class quiz |

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|---|---------------|---|--|---|
| | | A. Computer Lab - Bioinformatics Part I: exploring the Lux operon on NCBI + primer design | PCR and experimental design (controls) | Agarose Gel electrophoresis mini report due at start of lab |
| | | B. Plan PCR experiment | | |
| | Mon Oct 10 | | Quiz 1: Week 1-2 | |
| | Wed Oct 12 | LAB 6 A. Set up PCRs (amplifying <i>V. fischeri luxAB</i> genes) | More on PCR | |
| 3 | Friday Oct 14 | Lab 7 *Computers A. Checking the success of the PCR reaction by gel electrophoresis B. Computer Lab: Using Image J to analyze PCR results + make graph C. Time to repeat PCRs | Paper discussion | pre-class assignment, due at start of class |
| | Mon Oct 17 | | Paper discussion continued | |
| | Wed Oct 19 | Lab 8 *Computers (please bring lap top if you have one) A. Run gel of repeats (if necessary) B. Clean up best <i>luxAB</i> PCR product from lab 6 C. Restriction digest of <i>luxAB</i> PCR products and pGEM with <i>XbaI</i> and <i>EcoRI</i> | Cloning and restriction digestion | pre-class/lab quiz due on TED |
| 4 | | | | |

D. **Computer Lab:** Bioinformatics Part II and III
(restriction digestion) & Part IV Primer Design

Friday Oct 21

LAB 9

A. Clean up *Xba*I and *Eco*RI digest of pGEM

PCR papers - peer review

pre-class/lab quiz due on TED

Draft of PCR paper due

B. Quantification of digests from gel

C. Ligation of pGEM and *lux*AB inserts

Mon Oct 24

Quiz 2: Week 3-4

Wed Oct 26

Lab 10

Transformation, intro to promoter
mutants project

pre-class/lab quiz due on TED

A. Transformation of competent cells with
ligation products

B. Plan promoter mutants project (synthetic
biology)

PCR reports due start of lab

C. Start overnights of cultures containing plasmids
with different promoters

5 Friday Oct 28

Lab 11

pre-class/lab quiz due on TED

A. Counting blue/white colonies & screening for
clones containing *lux*AB by adding exogenous
aldehyde

Ligation project & synbio project

B. Pool data from whole class to do statistical
analysis of results (ligation efficiency).

C. Alkaline lysis miniprep: purification of plasmid
DNA from overnight cultures (promoter mutants
project)

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|---|---|--|--|---|
| | Mon Oct 31 | | Paper discussion | pre-class assignment due at the start of class |
| | Wed Nov 2 | Lab 12 *Computers | | |
| 6 | | A. Setting up digests of Biobrick plasmids | Data analysis (ANOVA) | pre-class/lab quiz due on TED |
| | | B. Statistical analysis of ligation data plus working on report | Review ligation efficiency report expectations | |
| | Friday Nov 4 | Lab 13 | | |
| | | A. Removing the stuffer fragment from the plasmids containing the promoter sequences | Review of what's happening in lab + Gibson assembly | pre-class/lab quiz due on TED |
| | | B. Gel purification of the DNA fragment containing the RFP sequence | | |
| | | C. Ligating plasmids with promoter sequences and RFP sequence | | |
| | Mon Nov 7 | | Quiz 3: week 5-6 | |
| | Wed Nov 9 | Lab 14 | | |
| | | A. Transformation of competent cells with RFP ligation products | RFP analysis and paper discussion (promoter mutants) | Ligation efficiency mini report due at start of lab |
| 7 | Friday Nov 11 - Veterans Day Holiday. Thurs and Friday labs cancelled. | | | |
| | Mon Nov 14 | | | Online assignment due re: promoter mutants |
| 8 | Wed Nov 16 | Lab 15 *Computers | | |

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|----|------------|---|--------------------------------|---|
| 8 | Fri Nov 18 | A. Analyze effect of promoters on RFP expression (fluorometer measurements). Pool class data for analysis. B. Statistical analysis of results C. Optional: choose RFP colony to grow up and send for sequencing D. Begin RNAi project Lab 16 | Brief on analysis + RNAi | pre-class/lab quiz due on TED |
| | | A. Observe worm phenotypes and isolate RNA B. Quantitate RNA and set up quantitative RTqPCR C. Optional: purify plasmid, run gel to check concentration and send for sequencing | RT & qPCR | pre-class/lab quiz due on TED |
| | Mon Nov 21 | Quiz 4: Week 7-8 | | |
| | Wed Nov 23 | Lab 17 *Computers (please bring laptop if you can) A. Computer Lab: Analyze results of RT-qPCR measurement of <i>unc-22</i> mRNA B. Optional: analyze sequencing results *Lab clean-up | Developing data analysis plan | pre-class/lab quiz due on TED promoter-RFP at the start of lab |
| | Fri Nov 25 | Thanksgiving no labs or class | | |
| 10 | Mon Nov 28 | RNAi assignment due online | | |
| | Wed Nov 30 | Paper Discussion & Review | Paper discussion/guest speaker | pre-class quiz due on TED |
| | Fri Dec 2 | Quiz 5: Final Quiz (cumulative) during lab time | Office Hours in lieu of class | |