BIEB 123
Molecular Methods in Evolution and Ecology
Winter 2023

Dr. Sarah Stockwell
Pronouns: She/her
Office: Muir Biology 1112
sarahs@ucsd.edu

Graduate TAs:
Nolan Graham <ntgraham@ucsd.edu>
Aleksandra Dragozova <adragozo@ucsd.edu>

Combined lecture and lab:
Wednesdays and Fridays 11:00 AM – 4:20 PM, York 4406.

Office hours: Since there is so much contact time in this course, office hours will be by appointment. If you need to talk to Dr. Stockwell or one of the IAs outside of class, please email us to arrange it.

This syllabus is subject to change as dictated by the constraints of the COVID-19 pandemic.

Overview of the course:

Changes to the class for W23:
As you are probably aware, the graduate TAs whose labor is essential to lab classes were on strike through the end of fall quarter, so it was not clear whether we could be able to hold hands-on lab classes in winter 2023. The new contract that ended the strike was ratified in late December. We are happy that UC and the graduate TAs have reached a settlement, but the last-minute timing has meant that we could not prepare the lab, order materials, etc. on the usual schedule. ***As a result, this year's class will only contain about 2/3 of the normal content.*** *We normally do three projects: a wild yeast biodiversity project, a spider biodiversity project, and a metabolic evolution project. This quarter, we will do the wild yeast biodiversity project and 2/3 of the metabolic evolution project, but not the spiders. The class will meet for less time than usual and the schedule will not be consistent; there will be days that run the full time while others days are short. I teach this course every winter quarter and I am hopeful that we will be back to our normal format next year, so if the missing portions of the class are important to you, you may wish to take it in Winter 2024 instead.*

This class will introduce you to molecular techniques used in evolutionary biology and ecology research. We will do two main projects, in addition to some skill-building exercises to teach you basic microbiology and molecular biology skills:

- Wild yeast project: Survey the microbial biodiversity of the Scripps Coastal Reserve, a local natural area. In this project, you will collect biological samples from the Reserve and culture wild yeasts from them. When you have isolated individual yeast species, you will PCR-amplify a ribosomal locus and analyze its sequence to identify the species. You will also work with wild yeast data collected in past years to find patterns in the data and design a follow-up experiment for the future that tests an ecological or evolutionary hypothesis.

- Metabolic evolution project: The budding yeast *Saccharomyces cerevisiae* and the fission yeast *Schizosaccharomyces pombe* diverged hundreds of millions of years ago, but both species still synthesize methionine using many of the same genes. In this project, you will work with plasmids carrying methionine synthesis genes that can be used to introduce the *S. pombe* version of the gene into *S. cerevisiae.* You will also analyze data from selective media plates to figure out which methionine synthesis genes are knocked out in particular strains.

Equipment:

For this lab you will need to purchase the following and bring them to class, including on the first day:

- A lab notebook with a sewn or glued binding. A composition book is fine. A carbon notebook is not necessary, but you can use one if you already have it. Loose-leaf binders, spiral-bound notebooks, and other notebooks where a page can be removed without leaving a trace are not allowed for this purpose. If you have at least 150 blank pages left in a notebook you've already used for another class, it's fine to use it for this class too.
- A 3-ring binder for lab manual printouts and worksheets. Divide your binder into 3 sections for the 3 categories of experiments: Wild Yeast, Metabolic Evolution, and Skill Building. The lab manual for this course will be posted to the class Canvas site as a series of PDFs, which you will need to print out, put in the appropriate section of your binder, and bring to class. There is no separate lab manual to purchase.
- A lab coat that reaches to the knees or longer, not the short hip length version. You will leave your lab coat in the classroom for the entire quarter, so if you are taking more than one lab class you will need another lab coat.
- Eye protection. Safety glasses are much more comfortable than goggles, so I recommend safety glasses. For splash protection, they must wrap around on the sides somewhat and must **not** have vents on the sides. Standard prescription eye glasses are not sufficient. Like the lab coat, these will stay in the classroom for the entire quarter.
- A non-water-soluble pen that you will leave in the lab. An ordinary ballpoint pen is fine. Keep this pen in the pocket of your lab coat and only use it with gloves on. Keep a separate pen/pencil in your backpack for taking lecture notes, taking exams, etc.
- You do not need an iClicker for this course.

Lab attire:

- Wear or bring closed toed shoes. Sandals, flip-flops, or any other open toed footwear are not permitted in the lab.
- Wear or bring pants or longer loose-fitting clothes. Shorts, short skirts, or any other clothing that leaves skin exposed, or is not easily removable, is not permitted in a biology lab that works with live microbes.
- There should not be any skin visible from the waist down. If your shoes expose the top of your foot, you will need to wear socks.
- If you have long hair, you will need to wear it tied back while in lab.
- **UCSD is recommending masks in instructional settings to slow the spread of COVID-19. Since we will be spending hours working closely together each lab day, as a courtesy to your lab partner and others, please wear an N-95 or KN-95 mask while in the classroom.**

Attendance and Absences:

Attendance in lab is mandatory for all class days. The lab is designed for groups of 2 students and your absence would substantially increase the workload on your partner. There are no makeup labs and you cannot attend an alternate section, although you may be asked to make up other work from the day you missed. If there are circumstances **beyond your control** that make it impossible or unsafe for you to attend a class, please do the following **prior to the start of the lab you will miss.** You will then know whether or not the absence can be excused. It is not sufficient to contact your TA alone as your TA does **not** have the authority to excuse your absence.

"I have symptoms/got a positive COVID test/was told to quarantine/must be absent for another reason that is beyond my control. What should I do?"
First, do the following:

- *Send email to Dr. Stockwell, the TAs, and your lab partner as soon as possible. Tell them that you won't be in class. If you know when you'll be able to return, tell them that too. Ask Dr. Stockwell about excusing the absence.*
- *If your lab partner will need to do anything specific with your wild yeast cultures, let them know what that is. Ask your lab partner to post clear photos of their lab notebook on Google Drive by midnight so you can complete any worksheets or other assignments for today. The link to post materials is here: https://tinyurl.com/AbsentLabPartner Note: Most worksheets and in-class assignments are turned in and graded jointly with your lab partner, but if you are absent, you and your partner will complete them separately.*

Second: How are you feeling?

Fine. → The day after class, use the lab notebook/wild yeast culturing information that your lab partner posted on Google Drive to complete today's assignments.

Not so hot. → If you need extra time on any of today's assignments, ask Dr. Stockwell via email.

Please prioritize the health of yourself and others. If you have COVID-19 symptoms, have tested positive, or have been advised to quarantine, please stay home! If you have been exposed to COVID-19, please complete UCSD's Daily Screening tool and follow the instructions you are given.

It is very important that you notify us of your absence in advance so we can plan around it. If there is an emergency that prevents you from emailing us before class, please email as soon as possible. Otherwise the absence will be considered unexcused.

The first unexcused absence will carry a 5% penalty from the total for your grade. If there is a second unexcused absence, you will be asked to drop the class or receive an F in the course. If you anticipate having several absences this quarter, I suggest you withdraw from the course and register for a quarter when you are more available to attend all labs.

Most absences due to scheduling conflicts will not be excused. If you are scheduling interviews for graduate school, please remember that grad school interviews are NOT an automatically acceptable reason for an absence. I would probably excuse ONE absence for this purpose provided it is not on a scheduled midterm day. However, if you were anticipating more than one absence, I would

strongly recommend you register for the lab in a less busy quarter to avoid point penalties or an F in the course.

If it is safe for you to attend in person, it is important that you do so. It places a burden on your lab partner and/or the instructional team if you're not there, because we will need to do some of your work for you. If you are absent for too many classes, you may not be able to complete the course. If you are in doubt about your situation, please email Dr. Stockwell to discuss it.

Tardiness: It is important to come to lab on time. Your IA may give you a verbal warning the first time you are late. If you are more than 15 minutes late, you will automatically lose 2 points from the lab performance and participation score (see below). Further tardiness will result in additional point loss in the class or in more severe penalties.

Grading:

Midterm 1: 75 points
Midterm 2: 75 points
Lab notebook checks: 20 points
Lab manual review questions: 34 points
Worksheets and other in-class assignments: 175 points (estimated; subject to change)
Lab performance and participation (see criteria below): 20 points

399 total points (estimated; subject to change)

Reading ahead of the course:

I will assume that you all have a basic understanding of, and reasonably good memory of, the following from lower division biology or from high school. If you don't remember, I recommend reading to refresh your memory:

- Scientific Method: brush up on this concept – there are several online sites, including Wikipedia, that do a good job of explaining dependent, independent, and controlled variables.
- The essentials of evolutionary biology, including natural selection, phylogenetics and population genetics, at the level taught in a course like BILD 3.
- The essentials of gene transcription and regulation at the level taught in a class like BILD 1.

What to do for each class day:

For each class day, there will be a Canvas page telling you what you need to do for that class. We will use Canvas heavily in this course so please check it often and make sure your notification settings send you email when an announcement is posted on Canvas.

Before class starts:

- **Download, print, and hole-punch the lab manual sections for the day.** We will have a 3-hole punch available in the classroom for you to use. Place each section in the appropriate part of your lab manual binder. **Important: Bring your entire lab manual (not just the**

day's pages) to class each time! You will sometimes need to refer to protocols you did earlier.

- **Read the day's lab manual before coming to class!** It is very important, both for your learning and your safety, that you read the lab manual for the day's activities before you come. Doing so will also let you work much more efficiently in lab so you get to go home sooner!
- **Answer the lab manual review questions** that are posted along with the lab manual. Turn in your answers as a PDF file via Canvas by the start of class time or bring your answers on paper to turn it at the beginning of class. Lab manual review question answers must be in your own words, based on your own understanding. Each lab manual review question is worth 1 point, for a total of 2 points per class day. These will start in class 1B (second class of week 1). I will count the top 17 of these (out of 19 class days), so you can miss 2 days of these without affecting your grade. Late answers will not be accepted.

After class, do the following. Note that for most days, there should be time to do this in the adjoining computer lab before leaving for the day:

- If the lab manual or the day's Canvas page asks you to post results on Google Drive, do so.
- If your lab partner was absent, upload information from today's lab work to https://tinyurl.com/AbsentLabPartner by midnight the day of lab. There is a README file in the folder that tells you what you need to upload.
- **Complete the day's worksheet questions.** You will write the answers to these as you work through the day's activities. You can turn them in via Canvas or on paper at the beginning of the next class. In either case, they are due by the start of the next class. See below for more detail on worksheet questions.
- Go back and quickly re-read the lab manual material in light of the lectures and lab work and you will generally find that it becomes clear. If there are parts you still have questions about, ask the instructor or TA in the next class while the material is still fresh in your mind.

If you have an <u>excused</u> absence for a class, you can still get points for the above activities by doing them remotely, as follows:

- Do the pre-class activities as described above.
- After class: Your lab partner (or, if your partner was absent too, the instructional team) will have posted any necessary results of the day's benchwork in the class Google Drive folder by midnight. Based on this information, complete your lab notebook for the day. Copy the results into your lab notebook as needed. **Important:** make it very clear in your lab notebook which results were collected by someone else, and write that person's name and date next to the data they collected!
- After class: Complete the worksheet questions and any other assignments for the day, and submit them as described above. They are due by the start of the next class day. If one or both lab partners are absent, worksheet questions and in-class assignments should be completed separately and will be graded independently.
- You are responsible for learning the material covered while you are absent, including the contents of the lab manual, the results that were obtained, and any analysis of the results that happened while you were absent. Talk to your lab partner and/or the instructional team (Dr. Stockwell and the TAs) if you have questions.

Worksheets

As often as possible, I will give you questions/problems to think about that should apply the concepts you learned in class. Often, these will be in the form of questions embedded in the lab manual which you will be expected to answer on a worksheet and turn in. Thinking about and attempting to answer these questions and participating in any classroom/lab discussion is excellent practice for exams and for thinking about science in general. If you are not sure how to tackle a worksheet question, ask!

If both lab partners are present and doing the activity together, worksheet questions will be turned in as a joint assignment and both partners will share the grade unless otherwise stated in the lab manual. If one or both partners are absent that day, the worksheet questions will be completed and graded individually.

Lab notebook

See the separate document explaining how to keep your lab notebook.

Grading lab notebooks: We will check your lab notebook entries on 4-5 randomly chosen days during the quarter. Each lab notebook check will be worth 5 points. Make sure your writing is clear: we can only grade what we can read. If there are more than 4 checks, the total points will be normalized to 20 points at the end of the quarter. If you have an excused absence on a day when we do a lab notebook check, we will check your notebook on a different day or pro-rate your other lab notebook checks so they are worth more, at our discretion.

Late assignments policy:

Assignments turned in on paper are due in the first 5 minutes of the lab period of the day on which your report is due, unless otherwise noted. All assignments submitted more than 10 minutes after they are due are automatically late and lose 10% of the points. Any assignment submitted after the due date will lose 10% of the points per day.

Regrade Requests:

Any regrade request should be submitted to the professor in writing within one week of your receiving the graded material.

Lab Performance and Participation

Lab performance and participation will be based on the following criteria:

- Pre-lab preparation
- Arriving to class on time
- Participation in class activities and lectures
- Careful management of lab procedures (e.g., sterile technique, proper waste disposal, experimental procedures, etc.)
- Ability to adapt to unforeseen procedural changes
- Active engagement and thinking about scientific questions

- Caliber of scientific thinking/questioning
- Scientific approach (e.g., proper use of notebooks, controls, experimental design)
- Accuracy (not "did you get the expected answer" but "did you accurately measure and record the data")
- Independence
- Safety consciousness, for yourself and others
- General neatness in lab, careful labeling, etc.

This course is more inquiry-driven and open-ended than you may be used to. We will be collecting genuinely novel data and you will be expected to take the initiative in exploring, analyzing, and interpreting your results.

In addition, good scientific work requires conscientiousness and attention to detail. You will be expected to get into the habit of methodical, well-planned and organized work. It is particularly important that you follow all the protocols and safety procedures while we are working with wild yeast cultures. Failure to do so can endanger yourself and your fellow students, and will significantly affect your grade.

Division of Biology policies and registration policies:

IMPORTANT: As the course catalog description states, you cannot get credit for both BIEB 123 and BIMM 101 (Recombinant DNA Techniques). If you have already taken BIMM 101, you should drop BIEB 123.

LAB SAFETY TRAINING – Enrolled and waitlisted students MUST successfully complete the Biology Lab Safety Training and Assessment before the first lab session:
https://biolabclass-safetyquiz.ucsd.edu
Please note that courses offered by other departments (Chemistry, for example) may have additional safety training requirements.

ATTENDANCE – Enrolled and waitlisted students MUST attend the first lab session whether you are already enrolled or on the waitlist.
Additional details: http://biology.ucsd.edu/go/ug-labs
If you are enrolled and don't attend the first lab session, you cannot stay in the class, and it becomes your responsibility to drop. If you refuse to drop, you should realize that even if you show up for every lab after the first one, you would receive an F for the class. In any event, if you are not present for the first lab day, there will not be a workspace or a partner assigned to you.

If you are on the waitlist, you should come to the first lab, and you will be told whether or not there is a space for you. Automatic roll in of waitlisted students begins the morning after the first lab. If you don't attend the first lab session, then you cannot stay in the class even if the registrar adds you.

Please make sure you are present on time, as attendance should be taken in the first 30 minutes.

ADD/DROP DEADLINES are different for lab courses than lecture courses. Students who drop a Biology lab class after the end of the second class meeting will be assigned a "W".
Additional details: http://biology.ucsd.edu/go/ug-labs.

If you have already decided that you are not going to take the lab this quarter (whether you are enrolled or on the waitlist), please drop as soon as possible to make room for the students who want to add into the class. (Remember that lab courses are different than lecture courses, and you MUST drop by the second lab session to avoid getting a "W".)

I have no control over who gets added to the class beyond keeping track of who shows up the first day. If you want to stay in the class, or be added from the waitlist, be in lab on the first day of class, at the beginning of the lab.

VERY IMPORTANT SAFETY INFORMATION ABOUT THE WILD YEAST PROJECT

One of the projects for this course involves collecting and culturing wild microorganisms. We will take precautions so that the chances of your being exposed to anything that is dangerous to a healthy person are very low. However, if you are immune compromised or pregnant, you should be aware that there is a significant chance that some of the fungi we will cultivate could be harmful to you in particular.

How do you know if you are immune compromised? Here is text from UCSD Occupational Health's website (http://blink.ucsd.edu/safety/research-lab/occ-health/immune-compromise.html):

> *Immune compromise, also referred to as immunocompromise or immunosuppression, is a condition in which the immune system does not work as well as it does in [healthy people]. Immune compromised personnel are at higher risk of illness and/or more serious side effects of illness caused by an infectious disease.*
>
> *There are many medical conditions that cause immune compromise. In general, if you have a medical condition that causes problems with your immune system, your primary physician will have informed you. Some examples include:*

- *Infection with Human Immunodeficiency Virus (HIV)*
- *Prolonged use of corticosteroid (cortisone) medications by mouth or by injection (these drugs are given for a variety of diseases including asthma, allergies, and autoimmune disorders such as lupus and rheumatoid arthritis)*
- *Monoclonal antibody therapy*
- *Medications used by people who have received organ transplants*
- *Long term diabetes mellitus, kidney or liver disease*
- *Blood diseases (diseases that affect the bone marrow or white blood cells, for example leukemia or lymphoma)*
- *Certain forms of cancer, leukemia, and lymphoma.*
- *Cancer chemotherapy and radiation therapy*
- *Chronic under nutrition (malnutrition)*
- *Pregnancy will cause some degree of immune compromise (i.e., Listeria, LCMV)*
- *Spleen removal*

If you are uncertain about whether you are immune compromised, especially if you have had severe or long-term COVID-19 symptoms, please consult your doctor.

If you are a minor (under 18 years of age), please consult with your parents about whether you are immune compromised.

Extremely important: If you are immune compromised or pregnant, there is a possibility that the microorganisms we culture could make you seriously ill. As a result, I strongly urge you to consider dropping the class. If you expect your condition to improve in the future, consider taking it next year (I offer it every winter quarter). If not, I strongly recommend that you take a different class. Recombinant DNA Lab teaches many of the same bench skills. Education is important, but your health and safety are even more important.

If you become immune compromised (including becoming pregnant) during the quarter, I strongly recommend that you let me know as soon as you know of your condition. You don't need to tell me the details, just let me know that you have become immune compromised. We will discuss your course options at that point.

If you have questions or feel uncomfortable about any of this, please come and talk to me (or email me) as soon as possible.

More generally: Anyone who has any special needs associated with health or other issues that affect your ability to take this class or that require any special accommodations, please let me know on or before the first day of lab. Please do not hesitate to bring any questions or issues to my notice. My primary concern is your safety in this lab. If you have any questions or doubts, please feel free to contact me or to ask at Student Informational Services.

Students with special circumstances

UC San Diego (as an institution) and I (as a person and as the instructor of this course) are committed to full inclusion in education for all persons. Services and reasonable accommodations are available to students with temporary and permanent disabilities, to students with DACA or undocumented status, to students facing mental health issues, housing or food insecurity, other personal situations, and to students with specific learning needs. Please feel free to let me know if there are circumstances affecting your ability to participate in class. Some resources that might be of use include:

- Office for Student with Disability, https://students.ucsd.edu/well-being/disability-services/index.html
- UC San Diego CAPS (Counseling & Psychological Services), https://wellness.ucsd.edu/CAPS/Pages/default.aspx
- UC San Diego Undocumented Student Services, https://uss.ucsd.edu/ Note: a list of campus resources can be found here: https://students.ucsd.edu/sponsor/undoc/resources/index.html
- The UCSD Basic Needs HUB is part of a UCSD network to address basic needs insecurity, including housing and food. It contains the Triton food pantry and other organizations. Students can obtain personal care products from the HUB for free, including shampoo, menstrual products, toothpaste, and even diapers for students with young dependents. 39% of UCSD students reported having trouble obtaining food: you are not alone, so I encourage you to take advantage of the support that's available. https://basicneeds.ucsd.edu/
- Learning Strategies Center, https://commons.ucsd.edu/academic-support/learning-strategies/index.html

I would be glad to help you identify other resources if needed.

University Policy on Integrity of Scholarship

Academic Integrity is expected of everyone at UC San Diego. This means that you must be honest, fair, responsible, respectful, and trustworthy in all of your actions. Lying, cheating or any other forms of dishonesty will not be tolerated because they undermine learning and the University's ability to certify students' knowledge and abilities. Thus, any attempt to get, or help another get, a grade by cheating, lying or dishonesty will be reported to the Academic Integrity Office and will result sanctions. Sanctions can include an F in this class and suspension or dismissal from the University. So, think carefully before you act by asking yourself: a) is what I'm about to do or submit for credit an honest, fair, respectful, responsible & trustworthy representation of my knowledge and abilities at this time and, b) would my instructor approve of my action? You are ultimately the only person responsible for your behavior. So, if you are unsure, don't ask a friend -- ask your instructor, instructional assistant, or the Academic Integrity Office. You can learn more about academic integrity at academicintegrity.ucsd.edu. (Source: Academic Integrity Office, 2018)

To uphold academic integrity, students shall:
—Complete and submit academic work that is their own and that is an honest and fair representation of their knowledge and abilities at the time of submission.
—Know and follow the standards of the class and the institution.

Thus, no student shall engage in an activity that undermines academic integrity or facilitates academic integrity violations by others. This includes, but is not limited to, the following behaviors:
- No student shall procure, provide, or accept any material that contains questions or answers to any examination or assignment unless the student's possession of the material has been authorized by the instructor.
- No student shall complete, in part or in total, any academic work (e.g., examination, assignment, paper) or obtain academic credit (e.g., attendance, participation) for another person.
- No student shall allow any academic work or academic credit to be completed or obtained, in part or in whole, for themselves by another person.
- No student shall plagiarize or copy the work of others and submit it as their own work.
- No student shall employ aids in undertaking course work or in completing any exam or assignment that are not authorized by the instructor.
- No student shall alter graded class assignments or examinations and then resubmit them for regrading without the instructor's permission.
- No student shall submit substantially the same material more than once without prior authorization from the instructor, such as a paper that was written and submitted in another class.

(Source: UCSD Policy on Integrity of Scholarship, http://senate.ucsd.edu/Operating-Procedures/Senate-Manual/Appendices/2).

If you do not understand these expectations and authorizations, please speak with the Instructor as soon as possible. Please read the official UCSD policy at https://academicintegrity.ucsd.edu/process/policy.html

Portions of this syllabus adapted from Dr. Lakshmi Chilikuri.

