BIEB 123
Molecular Methods in Evolution and Ecology
Winter 2022

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Class meeting times:
Wednesdays and Fridays 11:30 AM – 3:50 PM, York 4406. The officially scheduled class time is 10:30-3:50 but we will start at 11:30 so you have time to watch the recorded lecture before coming to class. NOTE: The first 3 weeks of class will be remote.

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:

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

- Wild yeast project: Survey the microbial biodiversity of the natural areas in San Diego. In this project, you will collect biological samples from natural areas and culture wild yeasts from them. When you have isolated individual yeast species, you will amplify a ribosomal locus and analyze its sequence to identify the species. Based on your research about the species you find, you will work with the class to design a follow-up experiment for the future that tests an ecological or evolutionary hypothesis.
- Spider biodiversity project: In a parallel project, you will work with spiders that have been collected in San Diego. You will extract DNA and amplify a mitochondrial barcoding locus to identify their species, and contribute your data to the Barcode of Life Database for other researchers to use.
- 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 test how strongly conserved one of the genes in the methionine synthesis pathway is by introducing the *S. pombe* version of the gene into a strain of *S. cerevisiae.* You will test whether the substitution allows the methionine synthesis pathway to function.

Equipment:

For this lab you will need to purchase:

- 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 4 sections for the 4 categories of experiments: Wild Yeast, Spider Barcoding, 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 (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 **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.
- An N95 or KN95 face mask, or a disposable mask underneath a cloth mask. A cloth mask alone is not sufficient. You will need to wear your mask(s) at all times while in the classroom.
- 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.
- Because lectures will be remote this quarter, you do NOT need an iClicker.

Lab attire for in-person days

- 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.

Attendance and Absences:

Because of the ongoing pandemic, we do not want you to feel pressured to attend every in-person lab session in order to earn a good grade. So we have a way for you to remotely make up the points for missed in-person labs if you are unable to attend (see "How the course will work this quarter" for more details). Please prioritize the health of yourself and others: if you have any symptoms, tested positive, have been exposed, or have been advised to quarantine, please stay home!

However, 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 will be absent, please see the "Lab absence flow chart" below. 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 and will result in a loss of 40 points. Absences due to scheduling conflicts will not be excused. If you are likely to have interviews for graduate school, etc., please schedule them on non-lab days.

If you are absent for too many in-person 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.

Repeated tardiness will result in point loss in the class or in more severe penalties.

Note: Because we are offering in-person lab activities and must plan them in advance, everyone enrolled in the class will be charged a lab fee, which is unfortunately non-refundable.

Lab absence flow chart (adapted from Dr. Katie Petrie)

I have symptoms/got a positive COVID test/was told to quarantine. What should I do?
1) What is today's course format?
    Remote → go to 2.
    In-person → go to 3.
2) How are you feeling?
    Fine. → Great! Join us via Zoom.
    Not so hot. → Let Dr. Stockwell and the IAs know you can't make it to the remote class and if you need extra time on any assignments for today, ask.
3) How are you feeling?
    Fine. → Send email to Dr. Stockwell, the IAs, and your lab partner. Tell them that you won't be in class. If you know when you'll be able to return, tell them that too. If they will need to do anything specific with your wild yeast cultures, let them know what that is. 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. → Send email to Dr. Stockwell, the IAs, and your lab partner. Tell them that you won't be in class. If they will need to do anything specific with your wild yeast cultures, let them know what that is. If you need extra time on any assignments for today, ask.

Grading:

Midterm 1: 75 points
Midterm 2: 75 points
Lecture quizzes: 34 points
Lab manual review questions: 34 points
Lab notebook checks: 20 points
Worksheet questions and other participation assignments: 200 points (estimated)
Lab performance and participation (see criteria below): 10 points

Mini-writeups: 25 points each (there are two of these)

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498 total points
These point totals are estimates; exact numbers may change during the quarter.

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.

How the course will work this quarter:

The first three weeks of the course will be remote because of the recent conditions of the pandemic. The current plan is for the rest of the course to be almost entirely in-person.

For each class day, there will be a Canvas page telling you what you need to do for that class. You will need to allow time to complete the following **before class starts:**

- **Download, print, and hole-punch the lab manual sections for the day.** (Note: when we are in person, 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. For in-person days: 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 (remote or in-person). 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.
- **Answer the lab manual review questions** that are posted along with the lab manual. Turn in your answers as a PDF file via Canvas before the start of class. If it is an in-person day, you also have the option of bringing your answers on paper to turn it at the beginning of each class. 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.
- **Watch the recorded lecture.**
- **Answer the questions on the Lecture Review Quiz.** You can answer these as many times as needed until you get them correct, so you should always get full credit on this. However, if you find that you are often getting questions wrong on the first try, that's an important signal that you need to pay more attention the lectures and perhaps do some independent background reading. If you have questions about the lecture material, ask Dr. Stockwell during class. Each lecture 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 Lecture Review Quizzes will not be accepted.

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

- **Add the day's lab notebook entries to the class Google Drive folder.** For wild yeast culturing, do this by updating your Yeast Portfolio spreadsheet with the day's information. For other projects, upload clear photos of the pages of your lab notebook that you wrote in today. These are due by midnight.
    - Grading lab notebooks: We will check the lab notebook entries on 4-5 randomly chosen days during the quarter. Each lab notebook check will be worth 5 points. Make sure your photos are 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.
    - There may also be photos or other data to post on a particular day; if so, the Canvas page for today's class will tell you how to do that.
- **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 (if the next class is in person) 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 IA in the next class while the material is still fresh in your mind.

If you have an <u>excused</u> absence for an in-person class day, 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! Submit the photos of your completed lab notebook via the same methods described above. They are due by the start of the next class day.
- 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.
- 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 IAs) if you have questions.

<u>Worksheets</u>

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 the best

practice you can have for exams and for practicing 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. If one partner is 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.

Late policy:

Assignments turned in on paper are due in the first 5 minutes of the lab period of the day on which they are due, unless otherwise noted. 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 20% of the points per day. Lab notebook pages, lecture quizzes, and lab manual review questions will not be accepted late.

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 (whether remote or in person)
- Participation in class activities
- 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:

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/introduction
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 (yes, even though it is remote this quarter).
Additional details: http://biology.ucsd.edu/education/undergrad/course/ug-labs.html

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/education/undergrad/course/ug-labs.html

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 Laboratory (BIMM 101) 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, or 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.

University of California, San Diego
Consent to Act as a Research Subject

Investigating the Impact of Pedagogical Choices on University Student Learning and Engagement

Who is conducting the study, why you have been asked to participate, how you were selected, and what is the approximate number of participants in the study?
Gabriele Wienhausen, Director of the Teaching and Learning Commons, together with her education research colleagues is conducting a research study to find out more about how pedagogical choices affect student learning and experience in the classroom. You have been asked to participate in this study because you are a student in a class that is being studied or used as a control. There will be approximately 500,000 participants in this study.

Why is this study being done?
The purpose of this study is to create knowledge that has the potential to improve the learning and educational experience of students at UC San Diego and beyond.

What will happen to you in this study and which procedures are standard of care and which are experimental?
If you agree to be in this study, the following will happen:

- Your data from this class including grades, homework and exam submissions, and survey responses will be included in the analysis to determine the effectiveness of the pedagogical techniques used in this course compared to other similar courses.

How much time will each study procedure take, what is your total time commitment, and how long will the study last?
Your participation involves only agreeing to let us use your data in our analysis. It will require no time on your part above the time you put into this course without agreeing to the study.

What risks are associated with this study?
Participation in this study may involve some added risks or discomforts. These include the following:
1. A potential for the loss of confidentiality. We will not share your personally identifying data with people outside our research team. Data will only be kept in anonymized form for research purposes. Course data will not be used for this research study until after final grades have been posted and will be rendered confidential by removing any identifiers before analysis. Your instructor will not know whether or not you are participating in this study until after final grades have been posted. Data from students who opt out of the study will be removed prior to data analysis. Research records will be kept confidential to the extent allowed by law. Research records may be reviewed by the UCSD Institutional Review Board.
Since this is an investigational study, there may be some unknown risks that are currently unforeseeable. You will be informed of any significant new findings.

What are the alternatives to participating in this study?
The alternatives to participation in this study are not to participate. If you choose to opt-out of participating in this research study, we will exclude your data from analysis. Whether you

participate will have no impact on your experience or grade in the associated class as the professor will not know who is or is not participating in the study until after final grades are assigned.

What benefits can be reasonably expected?
There is no direct benefit to you for participating in the study. The investigator, however, may learn more about how to improve student learning, and society may benefit from this knowledge.

Can you choose to not participate or withdraw from the study without penalty or loss of benefits?
Participation in research is entirely voluntary. You may refuse to participate or withdraw or refuse to answer specific questions in an interview or on a questionnaire at any time without penalty or loss of benefits to which you are entitled. If you decide that you no longer wish to continue in this study before the end of the quarter, simply respond to the online opt-out form here: https://goo.gl/forms/JSBRjEmkES6W6xYc2. If you decide to opt out after the quarter has ended, you must contact Laurel Nelson (laureln@ucsd.edu) and give the quarter and the course from which you would like your data withdrawn.

You will be told if any important new information is found during the course of this study that may affect your wanting to continue.

Can you be withdrawn from the study without your consent?
The PI may remove you from the study without your consent if the PI feels it is in your best interest or the best interest of the study. You may also be withdrawn from the study if you do not follow the instructions given you by the study personnel.

Will you be compensated for participating in this study?
You will not be compensated for participating in this study.

Are there any costs associated with participating in this study?
There will be no cost to you for participating in this study.

Who can you call if you have questions?
Gabriele Wienhausen and/or her colleague has explained this study to you and answered your questions. If you have other questions or research-related problems, you may reach Gabriele Wienhausen at gwienhausen@ucsd.edu or (858) 534-3958.

You may call the Human Research Protections Program Office at 858-246-HRPP (858-246-4777) to inquire about your rights as a research subject or to report research-related problems.

Your Consent
If you consent to participate in this study, no action is needed. If you DO NOT consent to participate in this study, or you choose to opt-out at any time during the quarter, please submit this form online at https://docs.google.com/forms/d/e/1FAIpQLScs0Cznypp4SxQJOsFMgP9nFDjJ0zzYPlSBWsiP3_wiWkdjaA/viewform. Your instructor will not have access to the list of students who opted out until after grades are posted. Note that you must separately opt-out of the study for each course involved in this study.

[ ] I am not 18 years or older or I do not consent to anonymized research use of my data from the course specified below.

Course name: _____

Course section number: _____

Term: _____

Name: _____

PID: _____

