

BIEB 123
Molecular Methods in Evolution and Ecology
Winter 2020

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Combined lecture and lab:
Tuesdays and Thursdays 11:30 AM – 4:50 PM, York 4406.

Office hours:
Sarah Stockwell: Mondays 1:30-2:30 PM, Muir Biology 1112.
Jessica Bloom: Tuesdays 10-11 AM at the Art of Espresso coffee cart (next to Mandeville).
Michael Overton: Mondays 12:30-1:30 PM in Muir Biology 2230.

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 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 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 collect spiders from the Reserve, identify, and photograph them. 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.
- 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.
- An iClicker (available for purchase at the UCSD bookstore). A secondhand one is fine. Once you have purchased your Clicker, you can register it on the class Canvas site.

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.

Attendance and Absences:

1. Your attendance is required at EVERY lab and through the entire lab period, until all the experimental work for the day is completed.
2. Absences will NOT be treated lightly. The labs are set up for groups of two and your absence will place an unnecessary burden on your partner. There are no make up labs, although you may be asked to make up other work from the day you missed.
3. Documentation and permission will be required for all unavoidable absences. The only unavoidable absences that are accepted or excused are those related to documented health/legal issues or family emergencies. If there is such an emergency or health issue, you should contact me by email before the start of the lab you will miss. You will then know whether or not the absence can be excused. If you are ill enough to miss lab you must go to

the student health center and provide documentation of your illness. Absences due to scheduling conflicts will not be excused.

4. If you are likely to have interviews for graduate school, etc., please schedule them on non-lab days.
5. All absences without prior notification/permission and the appropriate documentation will be considered unauthorized.
6. **30-point penalty** for the first unauthorized, unexplained absence from the lab. If there is a second such absence, you will be asked to drop the course or will be given an F.
7. Tardiness: Your IA will give you a verbal warning the first time you are late. Further tardiness will result in point loss in the class or in more severe penalties.

Grading:

Clicker participation: 10 points

Midterm 1: 75 points

Midterm 2: 75 points

Lab notebook checks: 15 points

Lab manual review questions: 10 points

Lab performance and participation (see criteria below): 20 points

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

Worksheets and other assignments: 150 points (overall score on these assignments will be normalized to 150 points)

430 total points

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.

Reading during the course:

- Before coming to each class, check the class Canvas site for the new sections of the lab manual and any other assignments (e.g., other items to read). These will be posted at least 24 hours before the start of class.
- Download, print, and hole-punch the lab manual section. Place it in the appropriate part of your lab manual binder. Bring your **entire lab manual 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.

- **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, or bring your answers on paper to turn it at the beginning of each class. Late answers will not be accepted.
- After attending the lab, 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.

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 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!

Clickers

This lab will introduce you to new material and concepts. To increase the depth of your understanding and to give you practice in applying these concepts, I will provide opportunities for you to reflect on and discuss the ideas in class via clicker questions.

Your grade for clicker questions will be based on participation, not on correctness. If you answer the participation questions at least 80% of the time during the quarter, you will get full credit. If you answer the questions less than 80% of the time, your participation grade will be based on the proportion of questions you answered. For example, if you answer questions 70% of the time, you will get $(70\%)(10 \text{ points}) = 7 \text{ points}$.

i>Clickers are available for purchase at the UCSD bookstore, and used clickers are available for purchase online. You will need to register your iClicker on our class's Canvas site and bring it to each class.

You cannot share a clicker with another student enrolled in this class. Clicking in for another student is an academic integrity violation and both students involved will get 0 clicker points for the quarter.

It is your responsibility to have your clicker with you at lecture and to make sure it is working properly. There will be no make-up opportunities for clicker questions, for any reason, nor can you get clicker credit for handing in questions on paper, etc. If your clicker is not working, I will **not** award points retroactively, so you **must** figure out why it's not working immediately. Like all technologies, clickers sometimes malfunction. This is why I give full clicker credit if you answer 80% of the questions or more. I do not adjust scores in other ways.

If you lose your clicker mid-quarter and use a different clicker, you need to change your registration on the class Canvas site and you need to email me with this information before the next lecture): a) your student ID number b) your new clicker ID.

In order to give you time to get your clicker registered and iron out any technical problems, clicker points will not start counting toward your grade until the second week of class.

Lab notebook

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

Class website

This course will be using an online learning management system (LMS) to manage content and/or grades. Currently, there are two LMSs, TritonEd and Canvas. This particular course will be managed using Canvas, our newest LMS, while some of your other courses may appear in TritonEd. The Course Finder page (coursefinder.ucsd.edu) will display all of your TritonEd and Canvas courses. Therefore, it is recommended that you use the Course Finder page to access your classes. Select the login button and enter your Active Directory credentials.

If you have not used Canvas before, refer to the student help guides and videos, which are located on the left-side menu's help section (the question mark icon). Should you need any technical assistance with Canvas, please alert your instructor and send an email to servicedesk@ucsd.edu. In the header of the email, please write "Canvas". Make sure to include your name, course title and section, as well as your contact information in the email body. A representative will get back to you within 48 hours (Monday through Friday). Thank you for helping UC San Diego migrate from TritonEd to Canvas!

Late policy:

A printed (paper) copy of the assignment is due in the first 5 minutes of the lab period of the day on which your report is due, unless otherwise noted. All homework assignments submitted more than 10 minutes after they are due are automatically late and lose 10% of the points. Any homework submitted after the due date will lose 20% 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 discussions 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:

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.

Additional details: <http://biology.ucsd.edu/go/ug-labs>

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>.

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 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.

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, other personal situations, and to students with other kinds of 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>
- 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.

Consent to Participate in Educational Research

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 and are at least 18 years old, 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://goo.gl/forms/JSBRjEmkES6W6xYc2>. 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.