

BIEB 123
Molecular Methods in Evolution and Ecology
Winter 2017

Dr. Sarah Stockwell
1212 Muir Biology Building
sarahs@ucsd.edu

Graduate IA: Brian Tsu <bvtstu@ucsd.edu>

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

Office hours:

Sarah Stockwell: Tuesdays 1:30-2:30 PM, Muir Biology Building 1208 or 1212.

Brian Tsu (IA): Fridays 9-10AM, Natural Sciences Building (NSB) 5314.

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 (bound notebook, regular or spiral bound). A carbon notebook is not necessary, but you can use one if you already have it. Loose-leaf binders are not allowed for this purpose.
- 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 TritonEd 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 coat.
- Eye protection (safety glasses preferred over goggles; 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.
- 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 TritonEd: go to the Tools section and look for the iClicker registration link.

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 and you will not be allowed to do benchwork on non-lab days, although you may be asked to make up the work from the day you missed.
3. Documentation and permission will be required for all unavoidable absences.
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. If you are ill on a lab day or have an emergency, e-mail or call (instructor or lab partner) before the start of the lab. If you are ill enough to miss lab you must go to the student health center and provide documentation of your illness.
8. You need to inform both the IA and the instructor of any proposed absence. Only the instructor can decide whether or not the reason for an absence is sufficient to call it an authorized absence.

Grading:

Clicker participation: 10 points

Midterm 1: 20 points

Midterm 2: 20 points

Lab notebook checks: 5 points

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

Worksheets and writeups of your results and analysis: 125 points

200 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, you may wish to read ahead:

- 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.

Reading during the course:

- Before coming to each class, check TritonEd for the new sections of the lab manual and any other assignments (e.g., a paper 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 and READ IT 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.
- 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 find that it becomes very 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.

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 at least 80% of the participation questions during the quarter, you will get full credit. If you answer less than 80% of the questions, your participation grade will be based on the proportion of questions you answered. For example, if you answer 70% of the questions, you will get $(70\%)(10 \text{ points}) = 7 \text{ points}$. This

i>Clickers are available for purchase at the UCSD bookstore. You will need to register your iClicker on TritonEd (under the Tools link) and bring it to each class.

You cannot share an iclicker remote 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 in TritonEd 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.

Late policy:

A hard copy of the assignment is due in the first 5 minutes of the lab period of the day on which your report is due. All homework assignments submitted more than 10 minutes after start of lab are automatically late and lose 10% of the points. Any homework submitted the next calendar day will lose 50% of the points. No homework will be accepted after the second calendar day. Additional points may be taken for late electronic submissions.

Regrade Requests:

All regrade requests should be submitted 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
- 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

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://dbportal3.ucsd.edu:3443/safety-training/>

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 recommend** that you do one of the following in the **FIRST WEEK** of class so I can accommodate your needs. If you become immune compromised or pregnant during the quarter, I **strongly recommend** that you do one of the following as soon as you know of your condition:

- Inform me in writing (email is fine) and get a written acknowledgement from me. You don't need to tell me the details, just let me know that you need to be accommodated.
- If you would prefer not to talk to me about it directly, you can email Joanna Boval (jboval@ucsd.edu) at the Office for Students with Disabilities. She is aware of our class and its special requirements. She will let me know that you need to be accommodated while protecting your privacy. Additional accommodations for your other courses may also be warranted based on the limitations of your condition, and Joanna will discuss this with you as well.

Once I know that you need this accommodation, I will arrange alternate activities for you during the times when we are working with live wild microbial cultures.

If you have questions or feel uncomfortable about any of this, please come and talk to me.

University Policy on Integrity of Scholarship

The principle of honesty must be upheld if the integrity of scholarship is to be maintained by an academic community. The University expects that both faculty and students will honor his principle and in so doing protect the validity of University grading. This means that all academic work will be done by the student to whom it is assigned, without unauthorized aid of any kind. Instructors, for their part, will exercise care in planning and supervising academic work, so that honest effort will be encouraged.

Student Responsibility:

Students are expected to complete the course in compliance with the instructor's standards. No student shall engage in any activity that involves attempting to receive a grade by means other than honest effort; for example:

- No student shall knowingly procure, provide, or accept any unauthorized material that contains questions or answers to any examination or assignment to be given at a subsequent time.
- No student shall complete, in part or in total, any examination, or assignment for another person.
- No student shall knowingly allow any examination or assignment to be completed, in part or in total, for himself or herself by another person.
- No student shall plagiarize or copy the work of another person and submit it as his or her own work.
- If any work is plagiarized from that of another student, both students will be reported to the Office of Academic Integrity, even if one of the students has graduated already. Remember that most graduate schools check the undergraduate records for any indications of dishonesty before awarding a degree.
- No student shall alter graded class assignments or examinations and then resubmit them for regrading.
- No student shall submit substantially the same material in more than one course without prior authorization.

*Portions of this syllabus adapted from Dr. Lakshmi Chilikuri.
The remainder is copyrighted 2017 Sarah Stockwell. Do not distribute without permission.*