Marine Molecular Biology
BI457 Fall 2021

Syllabus

This course introduces students whose primary interests are in Marine Biology to molecular methods. The course offers hands-on experience with basic universally applicable molecular techniques in the context of small-scale research projects focused on marine organisms. Students conduct DNA extraction, gel electrophoresis, PCR, and DNA sequence analysis, generate novel sequence data, and learn to analyze it using public databases and sequence analysis software. Students write a group project paper, and present results of research projects to the class.

Learning goals:

1. Become familiar with how molecular techniques are applied in marine biology by participating in individual and group research projects.

2. Acquire molecular laboratory experience.

3. Be able analyze DNA sequence data using specialized software and databases.

4. Gain or improve skills writing a research report paper and presenting results.

Instructor: Christina Ellison (cellison@uoregon.edu)

Teaching Assistant: Nicole Nakata (nnakata@uoregon.edu)

Class meets Wednesdays from 8:30 to 3:30 in the McConnaughey Teaching Lab.

Communication: Communication will take place through Canvas, in the form of announcements. Please check these regularly. You can also reach out to us by email for individual questions or concerns.

Office hours: Office hours with the instructor are available by request. Please contact me directly and we can set up a time to meet that works for you.

Nicole will host office hours in the classroom on Fridays from 3-4pm.

Course material: All course material is organized by “Module” on Canvas, with modules for each week and each assignment. Read the material within each Week module *before* coming to class that week. (e.g. readings posted in Week 2 should be read before class on Week 2). Instructions for assignments are located in their respective assignment module. All assignments will be submitted through Canvas. All quizzes will be conducted on Canvas outside of class.

Course outline:

Week 1 (Sept 29) Lecture 1: Molecular methods in the study of marine life. Lab: Sort plankton from the Charleston marina, select specimens of interest to you to DNA-barcode, photograph and preserve them. Complete pipetting practice. Lecture 2: DNA barcoding of planktonic larvae. Lab: Extract DNA from individual larvae using InstaGene protocol.
Week 2 (Oct 6) Lecture 3: Polymerase Chain Reaction. Lab: Use PCR to amplify two DNA-barcoding gene markers from DNA extracted during Week 1. Lab: Use gel electrophoresis to visualize PCR products. Learn to interpret PCR results, and troubleshoot samples that did not amplify well.
Week 3 (Oct 13) **Quiz 1 due (interpreting PCR results)** **Assignment 1 due (interpreting *your* PCR results),** Lab: PCR purification. Quantify DNA in purified PCR products. Lecture 4: DNA Sequencing. Presentation of group project options (preferences due by Friday of Week 3)
Week 4 (Oct 20) **Reading write up 1 due** Demo: How to process sequences, BLAST them, interpret results Lecture 5: Sequence alignment, measuring change Lab: Extract DNA from tissue samples with DNEasy. Run gels to verify DNA was extracted successfully.
Week 5 (Oct 27) **Quiz 2 due (PCR & Sequencing)** **Assignment 2 due (Individual project write up & 5 min presentation).** Individual project presentations. Begin work on group projects (finish extracting DNA, or begin sample collection) Demo: How to make alignments, trees.
Week 6 (Nov 3) **Assignment 3 due (building and interpreting trees with top 10 BLAST results of your samples)** **Reading write up 2 due** Lecture 6: Species delimitation. Continue work on group projects (PCR)
Week 7 (Nov 10) **Reading write up 3 due.** Lecture 7: Phylogenetic analysis, consensus trees, clade support. Continue work on group projects (all purified samples must be ready to ship)
Week 8 (Nov 17) **Quiz 3 due (interpreting trees)** **Reading write up 4 due.** Lab: Analyze sequences from group project. Discuss results of group projects, work on writing paper.
Week 9 (Nov 24) Thanksgiving week **Reading write up 5 due.** **Rough draft of papers due for review by Friday.** TBD
Week 10 (Dec 1) **Assignment 4 due (Group presentations of projects)** Group project presentations. Clean up, preserve tissues, etc.
Week 11 (Dec 8) **Assignment 5 due (Group papers)** No class: Final papers and laboratory notebooks due.

Participation in class

All lectures and labs will take place in person. Students are expected to participate in all of these meetings. Though all of us are required to be vaccinated (unless you filed for an exemption), given the contagiousness of the delta variant, the high infection rates in our area, and the real possibility of breakthrough infections, it will be extremely important for each of us to exercise caution and limit our exposure as much as possible. Because the course is laboratory based, it will be very difficult to meet the course objectives in the event of an outbreak. *However*, if you are feeling sick, **please don't come to class** (see the COVID section below for more guidance). Contact the instructor (cellison@uoregon.edu) and we will work something out.

Research projects

The main purpose of this course is to provide a significant hands-on experience with standard molecular laboratory techniques in a context of research projects. We will dive right into Individual research projects on day 1: DNA-identification of planktonic larvae of marine invertebrates. Each student will extract DNA from plankton samples of their choice, and attempt to identify these samples using DNA sequence data they obtain and analyze during Weeks 2-4. Each student will report results in a short (5 min) presentation during Week 5. Group research project: During Weeks 5-9 the class will be split into groups. Each group will carry out a different research project, while continuing to learn methods of DNA sequence analysis. Because it is usually difficult for students to come up with an interesting and feasible research project on their own in a short amount of time, the instructor will offer a choice of projects and provide samples for research.

Laboratory notebook

All students are expected to maintain a detailed laboratory notebook. The notebook should allow you to be able to 1) reproduce each procedure, and 2) reconstruct exactly how the data was obtained (e.g. which DNA extraction corresponds to which original sample, where that sample came from, which PCR tube corresponds to which DNA extraction, which sequence corresponds to which PCR etc.). It is important to note any deviations from standard protocols and operator errors (mislabeled tubes, uncertainties about labels and so on). The notebook should contain notes on how DNA was extracted (which protocol used), parameters of PCR reactions (primers, annealing temperatures), results of gel electrophoresis (annotated pictures of gels), and so on. Check with the instructor if you want feedback on your notebook. Notebooks will not be graded, but maintaining a detailed lab notebook is essential for success in the course.

Assessment and grading:

Assignments 60%

1. Interpreting PCR results, troubleshooting (10%)
2. Individual project sequence analysis, write-up, presentation (20%)
3. Sequence alignment, building and interpreting trees (10%)
4. Group project presentation (10%, group graded)
5. Group project paper (10%, group graded)

Quizzes (3) 15%

Reading write ups (5) (25%)

97-100 A+
93-96.9 A
90-92.9 A-
87-89.9 B+
83-86.9 B
80-82.9 B-
77-79.9 C+
73-76.9 C
70-72.9 C-
67-69.9 D+
63-66.9 D
60-62.9 D-
<59.9 = F

COVID-19

Academic Disruption

In the event of a campus emergency that disrupts academic activities, course requirements, deadlines, and grading percentages are subject to change. Information about changes in this course will be communicated as soon as possible by email, and on Canvas. If we are not able to meet face-to-face, students should immediately log onto Canvas and read any announcements and/or access alternative assignments. Students are also expected to continue coursework as outlined in this syllabus or other instructions on Canvas. In the event that the instructor of this course has to quarantine, this course may be taught online during that time.

COVID Containment Plan for Classes

As the University of Oregon returns to in-person instruction, the key to keeping our community healthy and safe involves ***prevention, containment***, and ***support***. Here is information critical to how the UO is responding to COVID-19.

Prevention: To prevent or reduce the spread of COVID-19 in classrooms and on campus, all students and employees must:

- Comply with vaccination policy
- Wear face coverings in all indoor spaces on UO campus
- Complete weekly testing if not fully vaccinated or exempted
- Wash hands frequently and practice social distancing when possible
- Complete daily self-checks
- Stay home/do not come to campus if feeling symptomatic
- Complete the UO COVID-19 case and contact reporting form if you test positive or have been in close contact with a confirmed or presumptive case (https://oregon.qualtrics.com/jfe/form/SV_6lfKVJkE0jAGPvn)

Containment: If a student in class tests positive for COVID-19, all relevant classes will be notified via an email by the Corona Corps Care Team with instructions for students and staff based on their vaccination status. Specifically:
Vaccinated and Asymptomatic students: Quarantine not required, but daily self-monitoring before coming on campus is advised; sign up for testing through MAP 3-5 days after exposure if advised you are a contact.
Unvaccinated or partially vaccinated students: 14-day quarantine advised – do not come to class – and sign up for testing 3-5 days after notification through MAP, if asymptomatic, or through University Health Services (541-346-2770) or your primary care provider, if symptomatic.
Symptomatic students: stay home (do not come to class/campus), complete the online case and contact form, and contact University Health Services (541-346-2770) or your primary care provide to arrange for immediate COVID-19 testing.

Students identified as a close contacts of a positive case will be contacted by the Corona Corps Care Team (541-346-2292).

Support: The following resources are available to you as a student.

- University Health Services (541) 346-2770
- University Counseling Center (541) 346-3277 or (541) 346-3227 (after hrs.)
- MAP Covid-19 Testing
- Corona Corps (541) 346-2292
- Academic Advising (541) 346-3211
- Dean of Students (541)-346-3216

Good Classroom Citizenship

- Wear your mask and make sure it fits you well
- Stay home if you're sick
- Get to know your neighbors in class, and let them know if you test positive
- Get tested regularly
- Watch for signs and symptoms with the daily symptom self-check
- Wash your hands frequently or use hand sanitizer
- Complete the UO COVID-19 case and contact reporting form if you test positive or are a close contact of someone who tests positive (https://oregon.qualtrics.com/jfe/form/SV_6lfKVJkE0jAGPvn)

You can also visit the following webpages for more information:

https://coronavirus.uoregon.edu/regulations

https://coronavirus.uoregon.edu/covid-exposure