

Introduction

Exaiptasia as a model for studying coral bleaching

Exaiptasia pallida is a small sea anemone which is abundant in Florida Keys. *E. pallida* has a mutualistic symbiotic relationship with photosynthetic nutritional endosymbionts in the *Symbiodinaceae* family. It is critical to recognize that there are other cnidarians (e.g. corals and hydra) that are capable of undergoing similar symbiotic relationship with *Symbiodinaceae*. Unlike corals, *Exaiptasia* are easily maintained as clonal lines in the lab and can also be cultured without *Symbiodinaceae*. *Symbiodinaceae* are microalgae which inhabit gastrodermal cells of *Exaiptasia* and provide the coral host with the majority of their energy budget, largely in the form of glucose produced via photosynthesis. This dinoflagellate is called an endosymbiont, because it lives inside the cells of the sea anemone, its host. The sea anemone receives oxygen and photosynthetic products from the dinoflagellate, whereas the dinoflagellate's photosynthetic ability is enhanced by the carbon dioxide and other molecules produced by the anemone. Most of these molecules are waste products resulting from the sea anemone's metabolic processes. Corals around the world have been dramatically impacted in recent decades by human disturbance; we have lost more than half of the world's living corals. Intensified by anthropogenic climate change, heat stress is one of the causes of coral decline. Heat stress results in a process called coral bleaching—the breakdown of the symbiotic relationship between corals and their nutritional symbionts. The concept for this teaching lab is to begin addressing this problem using a genetics approach.

The sea anemone is used as a model in experiments that analyze the coral bleaching process because it is very easy to maintain in the lab and is capable of undergoing bleaching when it loses its endosymbionts.

Aim 1: Students will investigate the interaction of a phenotype—heat tolerance—and host and symbiont genotypes. Whereas there has been prior work comparing heat tolerance of various host/symbiont genotypes, these have largely been performed on artificial assemblages and relatively limited numbers of hosts. In this lab, we will collect naturally-occurring holobiont assemblages from the South Florida coast, spanning the waters of Miami through the Keys. Students will first assess the upper thermal limit of anemones and then identify the genotype of the host (the anemone) and the symbiont (*Symbiodinaceae*) using molecular markers.

Aim 2: The long-term goal is to identify genes critical for increased thermal tolerance in *Symbiodinaceae*, but a critical step is to create a technique for mutagenesis. Students will employ a forward genetics approach: students will perform a mutant screen on *Symbiodinaceae*, to identify mutants that can survive under chemical selection to determine the conditions for mutagenesis in this organism. This is the first time that such an approach has been implemented in *Symbiodinaceae*. Using *Symbiodinium minutum* strain SSB01, a large clonal population of cells will be mutagenized via UV irradiation. These cells will be plated and subject to a screen, using 5-FOA for selection. Following selection, mutants will be isolated and the mutant gene(s) will be further characterized.

Goal & Objectives

The goal of these laboratories is to:

1. Introduce you to the activities in which research scientists engage when conducting science in genetics.
2. Promote student knowledge and appreciation of the use of model organisms
3. Gaining actual experience doing scientific research
4. Promote confidence and proficiency in scientific skills such as:
 - Formulating questions and hypotheses
 - Caring for a model organism
 - Acquiring molecular biology techniques
 - Using quantitative and statistical analysis
 - Using proper graphical display of data
 - Communicating research results in oral and written venues

Your classroom responsibilities:

As is common in scientific research, this lab requires team interaction, communication, and problem-solving skills. You are expected to engage with your peers and your TA regarding any difficulties you may have as well as ideas that you think might be beneficial to the class discussion. Many of these labs will depend on your maturity and willingness to be successful. To be successful in this course, you need to fulfill the following requirements:

Punctuality is essential

. All experiments will require that the class begins as a group. Please be aware that five minutes late is still LATE! It is important for your professional development that you learn to be consistently punctual for your engagements. Interactive lectures will be given at the beginning of class and a tardy arrival will mean that you cannot get credit for correct responses-NO exceptions! Note: If your TA has not arrived within 15 minutes of the class start time: Please contact the Biology Stockroom by either calling the number on the door or going to the second floor.

Attendance is mandatory.

The structure of lab does NOT reliably allow for make-up labs.

***In certain cases (i.e. religious holidays), it is possible to make-up a lab only if you notify your TA and the head TA a week in advance. You must have approval from the section TA and the head TA in order to make-up a lab.

***An absence may be considered excused in cases including a death in your immediate family or an extreme illness. In all cases, proof is required (i.e. doctor's note with date and time stamp) as is approval from the head TA for an absence to be considered excused and for the lab to be made-up. In addition to showing proof, in order to have an absence excused you must contact your TA no later than 24 hours after your class start time (preferably before).

***In cases where advance notice is known, advance notice must be given to allow for an excused absence (at least a week in advance).

***You may only make-up on the campus (i.e. MMC or BBC) that you are enrolled in.

Proper dress code is mandatory.

Proper attire means that everyone should have a lab coat, close-toed shoes and protective eye wear. If you are in violation of any of these you will not be allowed in to take the lab and you will be considered absent for the class. Ensure you have all of the above items BEFORE the start of the semester so as to avoid any conflicts.

Cellphone use is prohibited

. During the hours of lab, your cell phone is to remain completely off or silent (not vibrate!). Please do not attempt to check email, missed calls, text messages or any of the functions of your cell phone during class time. Regardless of what we're doing during the hours of class, consider your cell phone off limits.

Plagiarism is a serious offense.

Plagiarism is a serious offense and WILL be punished at the very least with a zero for the assignment but can also lead to your dismissal from the university. For a description of plagiarism in all its different forms please go to <http://coeweb.fiu.edu/plagiarism>.

Lab notebook/Presentations.

Lab notebook and presentations are due on the assigned date.

**You cannot pass this laboratory without completing the lab notebook and presentations

** Your TA will go over in detail what your lab notebook should look like. Proper note taking is an essential part of being a scientist, recording data, and keeping track of your project. You may have some experience with keeping a lab notebook, but it is not essential. Your TA will give you instructions on how to keep notes and your project organized with your lab notebook. Your hand-written lab notebook will be graded both for its intellectual content, organization, and clarity. Please see your TA if you need additional assistance with writing.

Grading Policy

Your final grade will be assigned according to the following scale:

Letter	Range (%)	Letter	Range (%)	Letter	Range (%)
A	Above 94	B-	80 - 82		
A-	90 - 93	C+	77 - 79	D	60 - 69
B+	87 - 89	C	70 - 76	F	0 - 59
B	83 - 86				

Note:

F0—failing grade based on non-attendance; IN—incomplete with approval from Instructor of Record

Your grade will depend on your performance on interactive lectures, lab notebook, final group presentation, and final exam.

Course Requirements	Weight
Participation	20%
Attendance	20%
Lab Notebook	20%
Presentation	20%
Final Exam	20%
Total	100%

- It is your responsibility to keep track of your progress in the course.
- **Late assignments** are penalized 10% per day.
- **Participation** in class discussions and group activities will determine this portion of your grade. Your TA may elect to give you quizzes.
- **Attendance** will be taken by the TA at the start of each lab.
- **Lab notebook:** To write effective reports it is important to properly document your laboratory activities. The lab notes should be in chronological order and not shared with any other courses/subjects. Each entry should contain the followings:
 - any procedures/observations you have done or made in lab that week

- the purpose of any procedures in service to the two main experiments we are performing this semester
- any data that you have generated or received in lab that week
- analysis explaining what that data means in terms of the broader experiment, if applicable

Lab notebook (cont.)

-DO print out and include images for observations and data. You can take pictures and put observations of anemones, pictures of gels, and screen shots of your bioinformatic work in your notebook. Paste or tape these neatly into your notebook. Write carefully and legibly.

-DO NOT include loose sheets of paper or paper loosely attached by paperclips to random pages. Do not turn in work that your TA cannot read.

The guideline for writing a proper notebook can be found on the lab website.

Presentations:

In addition to writing, communication of experiment findings is also completed through presentations. Your group will prepare and present the findings of your experiment to the rest of the class. This is due as noted on the schedule. Note the presentation must be completed in order to pass the course.

Extra credit

An additional 1.5% extra credit is offered for any student who completes both the pre- and post-course surveys. The pre-course survey can be found at https://fiu.qualtrics.com/jfe/form/SV_3RhpQbigWnJwhb and will close January 21st at 9AM. The lab has recently undergone a major overhaul so your feedback is especially important to us at this time. Additional extra credit opportunities may be available at your TA's discretion.

Academic Misconduct:

Includes (but is not limited to) giving or receiving assistance on a test, quiz, or homework assignment for which such assistance is not permitted, falsifying a document to obtain an excuse from a test, and using unauthorized notes on a test or quiz. A more complete definition of Academic Misconduct is given in the Student Handbook. Penalties for Academic Misconduct range from an F in the course to expulsion from the University. Academic Misconduct: Full handbook and information can be found at:

<http://www.fiu.edu/~oabp/misconductweb/1acmisconductproc.htm>

DEFINITION OF ACADEMIC MISCONDUCT: Academic Misconduct is defined as the following intentional acts or omissions committed by any FIU student:

1.01 Cheating: The unauthorized use of books, notes, aids, electronic sources; or assistance from another person with respect to examinations, course assignments, field service reports, class recitations; or the unauthorized possession of examination papers or course materials, whether originally authorized or not. Any student helping another cheat may be found guilty of academic misconduct.

1.02 Plagiarism: The deliberate use and appropriation of another's work without any indication of the source and the representation of such work as the student's own. Any student who fails to give credit for ideas, expressions or materials taken from another source, including Internet sources, is guilty of plagiarism. Any student helping another to plagiarize may be found guilty of academic misconduct.

1.08 Academic Dishonesty: In general, by any act or omission not specifically mentioned above and which is outside the customary scope of preparing and completing academic assignments and/or contrary to the above stated policies concerning academic integrity. **If found cheating, YOU WILL RECEIVE AN "F" FOR THE CLASS, NO EXCEPTIONS.**

TURN-IT-IN plagiarism software will be used to check all written reports for plagiarism. If plagiarism is found to exist, YOU WILL RECEIVE AN "F" FOR THE CLASS, NO EXCEPTIONS.

Lab number	Week of	Topic
1	September 9th	Introduction to coral symbiosis
2	September 16th	Molecular Biology Skills, UV mutagenesis of <i>Symbiodinaceae</i>
3	September 23 rd	Anemone observation and stress challenge, plating of <i>Symbiodinaceae</i>

4	September 30 th	DNA extraction
5	October 7 th	PCR amplification
6	October 14 th	Gel electrophoresis
7	October 21 st	Cycle sequencing (Sanger sequencing) &
8	October 28 th	Observation of plates for <i>Symbiodinaceae</i> mutants
9	November 4 th	DNA sequence analysis and bioinformatics
Veteran's day	November 11 th	No classes
10	November 18 th	Communicating research results
Thanksgiving	November 25 th	No Classes
Review	December 2 nd	In-class review for final exam
Final	December 9 th	Final exam in class

Syllabus subject to change

Check your email and stay tuned to the course website for updates!

Please print this page, sign the following and bring it in to class:

By signing the PCB 3063L Syllabus form, I, _____, state that I have read this form and understand the expectations for the course. I will wear closed-toe shoes and my lab coat in the lab. I will be on time to class. I agree to keep my academic integrity intact and I will not cheat or plagiarize.

Printed Name

Signature

Date