

OEB 119: DEEP SEA BIOLOGY, Fall 2024

TUESDAYS AND THURSDAYS, 10:30 to 11:45 AM

in the Museum of Comparative Zoology bldg, room 202

****COURSE DESCRIPTION****

First, here's a fun introductory video if you are so inclined!: [OEB119_Video.mp4](#)

80% of our planet's habitable living space is in the deep sea, the ocean realm that is beyond the reach of sunlight. Every other habitable space that you can think of -including the rainforests, the deserts, cities like Boston- constitute just 20% of our planet's living space. In other words, most of our planet's living space is cold, wet, and dark, so arguably the creatures of the deep are the more typical inhabitants of Earth and we humans are the odd ones.

In this course, we will take a trip through the deep sea, learning about the extraordinary animals and microbes that thrive therein and about their adaptations to this environment. We will also learn about humankind's relationship with the ocean, the birth of deep sea biology and the technological innovations that first took humans into the deep. Finally, we will touch upon humankind's impact on the ocean, and how we still have time to turn the tide if we commit to change here and now.

Most exciting of all is that you and your fellow students will have an opportunity to participate in an honest-to-goodness deep sea expedition from the comfort of our classroom. This spring, we will be connecting you and your teammates via satellite uplink to the Research Vessel *Falkor(too)*, which will be exploring the deep waters of the southern Pacific and Atlantic ocean.

****INSTRUCTORS****

Professor Peter Girguis, PhD (pgirguis@oeb.harvard.edu). He/his.
<https://girguislab.oeb.harvard.edu/people/peter-girguis>

Mr. Ian Hughes. OEB 119 teaching fellow, Ph.D. candidate in Organismic and Evolutionary Biology.
He/his. ihughes@g.harvard.edu

Ms. Breanna Jordan. OEB 119 teaching fellow, Ph.D. candidate in Organismic and Evolutionary Biology.
She/hers. bjordan@g.harvard.edu

****OFFICE HOURS****

Pete's office hours:

"Coffee hour": Early in the course, I will be asking you all to help me pick my coffee hours. These meetings will take place at the Northwest cafe, and when you show up I will buy you the beverage of your choice. Any and all topics are on the table, from questions about the course to questions about your career choices.

To meet with Pete privately, e-mail him (pgirguis@oeb.harvard.edu) & Jenn Thomson (jthomson@oeb.harvard.edu) to set up an appointment.

Teaching fellows office hours:

For clarification on assignments or other such questions, the TFs will hold regular office hours on Tuesday and Thursday mornings in person or via ZOOM (or another time TBD). Please stay tuned for more information from the TFs on their office hours.

****KEY COURSE INFORMATION****

- **Lectures will be in person.** To accommodate those who must isolate due to covid-19 or who are absent due to other illnesses, we can record the lectures **upon request**.
- "Some" instructional videos will be recorded and provided on the Canvas website. Typically these are topics that we simply do not have enough time to cover in class. **You are expected to watch these**

videos as well.

- **Please be prepared to take notes during class.** To complement your notes, PowerPoint slides will be available as PDFs on the Canvas website (under "Files") about 1-2 days after class.
- I encourage you all to genuinely engage with the class. Ask questions of any kind at any time! Try not to get caught up in what's happening on your phone. **Remember that your class participation is 20% of your grade.**

****TEXTBOOK, READINGS, AND SCIENTIFIC PUBLICATIONS****

- We will be using *The Biology of the Deep Ocean (Biology of Habitats)* by Peter Herring. The digital version is available for free on the course Canvas website. Purchasing a hardcopy is completely optional (ISBN # 0198549555).
- All additional course readings will be available on the Canvas website as well.
- That said, you will be required to do your own literature searches for your take-home assignments. You will be expected to find scientific publications through scholarly databases such as Web Of Science or Google Scholar. If you are unfamiliar with doing such searches, please see the teaching fellows.

****PREREQUISITES ****

- The course is designed to be accessible to all concentrators who have had high school Honors biology and chemistry or equivalent. That said, a great many non-science majors have taken this class and earned an "A" in the course, so don't be afraid if you haven't had the above courses! This material really is accessible to all who are committed to learning about the deep sea.

**** COURSE SCHEDULE****

Table of class dates, topics, and assignments

| Date | Topic | â€œCreature Featureâ€ | Readings / Assignments |
|------|--------------------------------------|---------------------------------------|---|
| 9/3 | Welcome and Introduction | | |
| 9/5 | History of Oceanography | Deep sea tools | Herring (1-7) |
| 9/10 | The Physics & Chemistry of the Ocean | Introduction to seafloor mapping | Herring (7-15) |
| 9/12 | Ocean Technologies part I | Fly a remotely operated vehicle (ROV) | Herring (15-26) Watch "ocean technologies II" on Canvas (see "Instructor videos" in the Files section) |
| 9/17 | The Midwater I | midwater invertebrates | Herring (27-49;98-122) |
| 9/19 | The Midwater II | midwater fishes | Herring(161-196) |
| 9/24 | Bioluminescence I | bioluminescent dinoflagellates | Take-home question #1 DUE TODAY |
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|-------|---|----------------------------------|--|
| 9/26 | Bioluminescence II and a movie (Blue Planet II or equivalent) | | Herring (197-216) |
| 10/1 | Benthic habitats | benthic invertebrates and fishes | Herring (50-62; 69-71) |
| 10/3 | Benthic creatures | Meet a deep-sea isopod | |
| 10/8 | Taxonomy (guest lecture by Ms. Breea Jordan, Harvard University) | | OPTIONAL= Herring (239-254) Take-home question #2 DUE TODAY |
| 10/10 | Student presentations group 1 (Martini et. al., 2019) | | Read Martini et. al., 2019 (distribution of bioluminescence in the deep sea) |
| 10/15 | Hydrothermal Vents | | Herring (63-69) |
| 10/17 | Student presentations group 2 | | Read Mitchell <i>et al.</i> , 2019 (Hydrogen & vent symbioses) |
| 10/22 | Hydrocarbon seeps (guest lecture by Dr. Jeff Marlow, Boston University) | | Herring (63-69) Take-home question #3 DUE TODAY |
| 10/24 | Student presentations group 3 (Kraft et al 2022) | | Read Kraft et al 2022 |
| 10/29 | Microbes | | Herring (34; 43-46) |
| 10/31 | Student presentations group 4 (Amon et. al., 2016) | | Read Amon et al 2016 (biodiversity and mining) |
| 11/5 | Human impacts on the ocean I | PRG OUT OF TOWN | Take-home question #4 DUE TODAY |
| 11/7 | Student presentations group 5 (?????) | PRG OUT OF TOWN | ????? |
| 11/12 | Human impacts on the ocean II | | |
| | Student presentations group 6 | | |

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|-------|---|-------------------------|---|
| 11/14 | (?????) | | ?????? |
| 11/19 | VIRTUAL DEEP SEA DIVE with <i>RV Falkor (too)</i> | | |
| 11/21 | VIRTUAL DEEP SEA DIVE with <i>RV Falkor (too)</i> | | |
| 11/26 | Student presentations part I in class | | Student presentations part I in class |
| 11/28 | | THANKSGIVING !!! | |
| 12/3 | Student presentations part II | | Student presentations part II |
| 12/5 | <i>READING PERIOD</i> | | |
| 12/10 | FINAL PRESENTATION FILES DUE | | Your "DIGITAL VERSION" (PowerPoint file, etc) of your final presentation is due today, December 10th |

**** GRADING ****

Your grade is what you earn, not what I "give". I do not believe in grading on a curve or a straight scale. Rather, I am interested in gauging where you are as a scholar, and assessing you by the extent to which you A) show mastery of the material, and B) equally important, the extent to which you improve during this course.

What does this mean in terms of grades? I believe that all students are capable of "earning" an A in this course! How? **In this course, we are grading you against yourself.** We put a lot of time and effort into grading your materials. At the end of the semester, we look to see how much you've progressed and that, accordingly, determines your grade. In other words:

â€¢ *Students who complete all the assignments, responding to our constructive feedback, clearly communicating with the teaching staff, showing improvement over time, and participating fully in the class, you will earn an A.*

â€¢ *Students who complete the assignments but do not demonstrate improvement over the course of the semester, who are modestly engaged with the class during the classroom period, or who miss assignments may earn a B.*

â€¢ *Students who miss assignments, show little engagement in the course, and do not communicate their concerns or challenges with the instructors may earn a C.*

â€¢ *Students who cheat will summarily earn a failing grade.*

â€¢ *NOTE: The "opt-in" extra credit can move a student from a "B" to an "A".*

GRADING BREAKDOWN

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|---|---|
| <p>Take Home essays #1 through 4 (open book, essay-style exams):</p> <p>Each take-home essay will consist of a primary questions and a number of sub-questions. Each essay will total between 3-4 pages of typed, double-spaced text. We expect you to cite your sources and to use the proper citation format. This last point is very important, so please be sure to reach out to us if you need coaching in scientific citations.</p> | <p>Total = 60%</p> <p>(each essay is worth 15%)</p> |
| <p>Participation (SEE BELOW FOR DETAILS)</p> <p>This includes your group presentation grade (15%), and your attendance/participation in the class discussion (5%)</p> | <p>20%</p> |
| <p>Final Presentation:</p> <p>Individual scientific PowerPoint (or equivalent) presentation. <i>See below for details.</i></p> | <p>20%</p> |
| <p>Opt-in assignments.</p> <p>You can earn up to an additional 10% by completing the Weekly Assignments. <i>The credit you earn can ONLY work for you, and not against you.</i> We hope you consider doing these assignments, as they are designed to introduce you to key skills such as referencing scientific citations, etc.</p> | <p>(10%)</p> |
| | <p>100%</p> |

****CLASS PARTICIPATION AND ATTENDANCE****

Participation: A major part of Deep Sea Biology will be peer-led discussions of important primary research (scientific papers) in the field. These papers will reflect and reinforce the material covered in lecture and will illustrate how research is actually conducted in the deep-sea. These discussions, the related assignments, and your attendance in lecture will serve as the class participation portion of your grade for the course.

Attendance: You may miss up to three lectures of your choosing without penalty; additional days will incur penalties to your participation grade. If you know you will miss more than three days for valid reasons, please let the instructor and teaching fellows know in advance and we will do our best to accommodate your absence.

BREAKDOWN OF YOUR 20% PARTICIPATION GRADE

| | |
|---|-------------------|
| <p>Group Presentations:</p> <p>Group presentations will be graded using a rubric, which will be posted on Canvas in the Resources folder.</p> | <p>15%</p> |
| <p>Attendance and engagement:</p> <p>You are expected to attend the class during the allotted course period. We fully understand that all students have obligations beyond this course, and we also understand that unexpected matters can and do arise. <u>You can miss up to three lectures without concern or penalty.</u> Any further absences must be cleared with the instructors, and may be accompanied by additional, make up assignments to ensure that you are atop the material presented in the class.</p> | <p>5%</p> |

We also expect you to remain engaged with your fellow students, teaching fellows, and instructor during the lectures. Please ask questions by raising your hand at any time.

Total percentage of your grade

20%

STUDENT-LED PAPER PRESENTATION AND DISCUSSION

Some weeks, instead of lecture, a team of students will co-present a scientific paper. Each member of the presenting team will have a specific role to play in the presentation (note that these assignments have been made randomly):

- **Presenter #1 = Introduction.** Open the discussion with a brief summary of the paper. How does the study connect to what we have discussed in lecture? Also, present a 2-3 minute overview of any relevant major background information needed to understand this paper. Finally, introduce the other presenters at the appropriate time.
- **Presenter #2 = Methods.** This person presents a 2-3 minute summary of the methods used in the study. What did they do? Explain (in brief) any technologies or methods that are difficult to understand.
- **Presenter #3 = Figures and Tables and Statistics (if appropriate).** What do the figures and tables tell us? Go through these in detail and tell us WHY they might have chosen to represent the data in that manner. As for the statistics, you need to tell us a "bit" about those statistical tests. You do NOT need to become an expert. Rather, tell us why this "KIND" of test is useful for these data (i.e. a small sample set might compel someone to use a "non-parametric" test, which is better at dealing with small numbers that may not have a "normal" distribution).
- **Presenter #4 = Results.** You should be able to clarify or explain techniques or terminology that might not be familiar to everyone.
- **Presenter #5 = Conclusions.** Presents a 2-3 minute summary of the findings of the study. What did they discover? Also, be prepared to ask members of the class to comment on their perception of the paper.

****FINAL EXAM****

The final exam will be a scientific presentation. Later in the course, you will be asked to identify three topics that interest you. You will send us an e-mail with those three topics and your thoughts/idea on the questions you want to ask. Then we will provide you with suggestions on which topic you should focus on. You will do your literature review and compile information on your select topic. Finally, you will synthesize that information into a coherent scientific presentation. Such presentations are a mainstay of scientific communication, and are an efficient means of summarizing one's findings. All students will "represent" their scientific study during the final exam period (or, time permitting and with votes from you all, before reading period)

****MORE IMPORTANT INFORMATION****

ACCESSIBILITY: Harvard University is committed to providing an accessible academic community. The Accessibility Office offers a variety of accommodations and services to students with documented disabilities. Please visit <https://accessibility.harvard.edu> for more information.

INCLUSION: I am dedicated to creating a positive, inclusive work environment that embraces diversity in all forms and rejects any form of hostile work place, discrimination, or bullying. I aim to create a learning environment for my students that supports a diversity of thoughts, perspectives and experiences, and honors your identities (including race, gender, class, sexuality, religion, ability, etc.).

To help accomplish this:

- Please let the class know your chosen name and pronouns (if you feel comfortable doing so). PLEASE, if you so desire, put these on your name placard. Please note that I struggle with remembering names as well as pronouns, so please forgive me if I forget your name or preferred pronoun and correct me as you see fit.

- Your classmates and instructors (like many people) are still in the process of learning about diverse perspectives and identities. If something was said in class (by anyone) that made you feel uncomfortable, please talk to the instructor about it.
- If you feel like your performance in the class is being impacted by your experiences outside of class, please don't hesitate to come and talk with me. I want to be a resource for you.

As a participant in course discussions, you should also strive to honor the diversity of your classmates (e.g., use appropriate pronouns and names, make sure all voices are being heard, etc.).

Harvard University has a clear statement of behavioral expectations (as well as definitions of discrimination, (sexual) harassment, and bullying, which can be found here: <https://college.harvard.edu/life-at-harvard/diversity-inclusion> On this website, you can also find resources and contacts for reporting issues. I am always happy to discuss such matters with you, or any group of you, as you see fit. I am happy to speak in confidence, but please note that **as a faculty member I am a mandatory reporter for Title IX violations (that means if you tell me something that constitutes a title IX violation, I am obliged to tell our Title IX officers, who will reach out to you to determine if and how you want to proceed with formal reporting)**

CHEATING AND PLAGIARISM

You are responsible for understanding Harvard's policies on academic integrity and how to use sources responsibly. Not knowing the rules, misunderstanding the rules, running out of time, submitting the wrong draft, or being overwhelmed with multiple demands are not acceptable excuses. There are no excuses for failure to uphold academic integrity.

Discussion and the exchange of ideas are essential to academic work. For assignments in this course, you are encouraged to consult with your classmates on the choice of paper topics and to share sources. You may find it useful to discuss your chosen topic with your peers or course instructional staff (TF/TAs, course assistants, faculty), particularly if you are working on the same topic as a classmate. However, you should ensure that any written work you submit for evaluation is the result of your own research and writing and that it reflects your own approach to the topic. You must also adhere to standard citation practices in this discipline and properly cite any books, articles, websites, lectures, etc. that have helped you with your work. If you received any help with your writing (feedback on drafts etc. from peers or course instructional staff), you must also acknowledge this assistance.

To support your learning about academic citation rules, please visit these Tips to Avoid Plagiarism (www.extension.harvard.edu/resources-policies/resources/tips-avoid-plagiarism), where you'll find links to the Harvard Guide to Using Sources and two free online 15-minute tutorials to test your knowledge of academic citation policy. The tutorials are anonymous open-learning tools.

SOME PARTING THOUGHTS

I believe that it is my job to help you all become the best scholars you can be. To that end, I will be sharing stories with you about my own education, with the hope that you may learn from my shortcomings and successes. I will strive to help you better recognize and manage your biases, which we all have and which is inherent to all human ventures including science. I aim to empower you with more analytical skills that help you understand how we and all organisms are influenced by our surroundings, and how we in turn influence those same surroundings.

Most of all, I hope to leave you with a deep and profound appreciation for the ocean and organisms that live therein. I will try and make this class one that you will remember for a lifetime, and one that broadens your thinking about the nature of our biosphere, humankind's relationship with the ocean, and our role on this planet.

I look forward to beginning our journey together!