ENVS 21B Oceanography (Summer 2021)

Contact Details (professor)

Professor: Dr. Sally Warner

I prefer to be called Professor Warner by my students. I use she/her pronouns.

Email: sallywarner@brandeis.edu

Email is *by far the best way to contact me*. I make a point to respond to all student emails within 24 hours on weekdays. Feel free to email me to ask questions, to give feedback about this course, to get help deciding on a major, to ask for a recommendation letter, to get advice about your future after Brandeis, or to schedule a meeting outside of my virtual one-on-one student hours (see below).

Office location: Rabb Graduate Center Room 373

This is completely useless information as I will be working entirely from home this summer.

Virtual office hours: Mon/Wed from 11:10 AM – 12:10 PM

Use this Google Calendar to schedule a meeting with me. *If possible, please choose the earliest available timeslot in the block.* You will receive a Zoom link for the meeting automatically from Google Calendar. Note that these times may change throughout the semester. If you cannot meet when slots are available, email me to set up another appointment.

Contact Details (TA)

Teaching Assistant: Miranda (Andie) Sheinbaum

Andie was an enthusiastic student in this course in Spring 2021. She will be a great resource and I encourage you to talk with her outside of class during her office hours. She uses she/her pronouns.

Email: msheinbaum@brandeis.edu

Drop-in office hours: **TBD**

The Zoom link will be posted on Latte.

Meeting Details

Class times

Mondays, Tuesdays, Wednesdays, and Thursdays from 9-11 AM (Eastern Daylight Time)

Zoom link
See Latte for course Zoom link.

Instruction mode
This class will be taught in a **remote, synchronous** mode. Students should attend class while it is happening because much of class time will be devoted to group problem solving and both small and large group discussions.

Course Description

The Earth is an ocean planet. Covering 71 percent of the Earth's surface and holding 97 percent of the Earth's water, the oceans are perhaps our planet's most distinctive feature. This course will address fundamental questions about the oceans, such as, how does the ocean influence Earth's climate and how is the ocean being affected by climate change? Why are there ocean currents, and how do they influence the patterns of life in the ocean? How are human actions changing the ocean today, and how does this impact people's lives?

To answer these questions, this course will introduce the complex interactions among geological, physical, chemical, and biological processes in the ocean. In-class group activities, discussions, debates, and a creative science communication project will emphasize quantitative problem solving, critical thinking, and science communication skills.

Learning Goals:
By the end of this course, you should be able to:

- Describe the factors that control the distributions of salinity, temperature, nutrients, carbon, and oxygen in the ocean, and how marine organisms and people can alter these patterns.
- Analyze and interpret real oceanographic data presented in numerical and graphical formats.
- Understand what drives the physical and chemical effects of climate change on the ocean, including sea level rise, ocean acidification, warming temperatures, and deoxygenation; and predict and evaluate the consequences of these changes for marine organisms and for people.
- Evaluate the scientific and societal merit of proposed human interventions to address and adapt to current ocean issues and changes.
- Create new media to accurately and effectively communicate ocean science and its relevance to people's lives to public audiences, and critically evaluate science media created by others.

Transferable Skills:
Transferrable skills are abilities that you will develop in this course that will be useful in future jobs in a wide variety of fields.

- **Science is a team activity:** Scientific research is not conducted by individuals working alone, but by collaborative teams composed of scientists, students, educators, and the public. In this class, you will collaborate with your peers to learn new material and tackle challenging tasks. I will emphasize and practice group problem solving during the online lectures. Research on learning shows that this will both improve how much you learn as an individual as well as help you develop transferable skills for working as a member of a team.

- **No fear of math or graphs!** Quantitative analysis of information is important both for scientists and scientifically-literate global citizens. In this class, you will develop your ability to quantitatively interpret and explain scientific data from graphical, numerical, and algebraic sources. Specifically, by the end of the semester you will have the ability to make back of the envelope estimates and determine if your answers "makes sense," you will be able to make simple calculations involving unit conversions and dimensional analysis, and you will gain experience with the construction of graphs to evaluate the relationships between variables.

- **Career paths to oceanography:** Throughout this class, you will learn about the careers, experiences, and scientific accomplishments of oceanographers who have made and are currently making important contributions to our knowledge about the oceans. We will specifically highlight the contributions of oceanographers from backgrounds currently underrepresented in the field. The goal of highlighting these oceanographers and their work is to expose you to the excitement of scientific discovery across a wide range of sub-disciplines within the field, and encourage you to identify with the range of backgrounds and paths that lead to careers in oceanography, science, and environmental policy.

Teaching/learning strategies

This course will consist of 8 hours of in-class time per week that will be devoted to lectures, group problem solving, and discussions. **If you prefer in-class time to be devoted 100% to lectures, this is not likely the course for you.** You will be expected to complete assigned readings prior to class. In-class activities will help you hone your quantitative reasoning skills.

Prerequisites

There are no formal prerequisites for this course. This course will involve quantitative calculations on assignments, therefore you will need to be able to perform basic mathematical calculations at a high school algebra level.

Credit Hours:

During the regular semester, success in this four-credit course is based on the expectation that students will spend a minimum of nine hours of study time per week in preparation for class. In this 5-week condensed version of the course, this equates to ~20 hours per week outside of class.

Course Requirements

PRIOR TO EACH CLASS: Thoughts and questions (TQs) about the assigned readings

There will be assigned readings for every class. I will use the term "readings," but the medium will vary and will include textbook sections, newspaper articles, scientific papers, videos, podcasts, etc.

You will respond briefly — in writing — to questions about the reading before class. This process will help you focus your thinking about the reading. Over the course of the semester you will write **at least 10** such Thoughts & Questions (TQs) based on the reading for that class, but you are encouraged to write more. At the start of the semester, there will typically be one prompt (*What did you find most*

challenging, confusing, or noteworthy about the reading?) to which you will respond with a few sentences of your thoughts and your questions. Later in the semester, specific prompts that pertain to each reading may be used.

TQs will be **due by 8 AM** so that I have time to incorporate them into my lecture for that day. TQs will not be accepted late. TQs will be graded on a credit/no credit basis.

DURING CLASS: Participation and Quantitative Assignments

In-class participation on Zoom. This includes positing to the chat, taking part in discussions, answering live polls, and asking questions. The TA will record everyone's participation throughout each class. (Activities such as the debates will not count toward in-class participation as they will be included in the debate grades.)

There will be numerous **quantitative assignments** in this course. The assignments will ask you to solve problems about the geology, physics, chemistry, and biology of the ocean. Some problems will involve the use of ocean measurements from buoys, satellites, autonomous ocean-sensing robots, sediment cores, and/or computer models. You will need a calculator to do most of these assignments. We will typically start each assignment in class where you will have time to work on the assigned problems individually or in small groups. If the assignments aren't finished by the end of class, they will be due by the start of the next day's class.

DURING CLASS: Ocean Issues Debate

We will hold two in-class debates organized around current societally-relevant ocean issues: (1) responding to coastal hazards and (2) ocean-based climate solutions. You will be part of a team that will orally argue the role of specific stakeholders. Each debate will have an associated set of readings and a writing assignment that you will complete in preparation for the debate.

The goal of these debates is to provide you with a chance to apply the knowledge you have gained in class to evaluate the scientific and societal merit of ocean-related policy decisions, and to practice communicating that knowledge in both written and oral formats.

The written preparation materials will be due at the start of class on the day of the debate and will not be accepted late. If you miss the oral portion of the debate, you will receive no credit unless you experienced a severe hardship that is out of your control. If that occurs, you will be able to meet with me over Zoom to discuss and debate the topic one-on-one.

Exams

There will be two **open-book, take-home** exams in this course: a midterm exam at the middle of the course and a final exam at the end of the semester. You will have 3 hours to complete the exam once you begin. If you have an academic accommodation, the time limit will be adjusted accordingly. Exams will ask you about content of the readings and lectures and will ask you to solve problems similar to those in the assignments.

Science communication project

A key goal of this course is that you be able to synthesize scientific knowledge about the ocean, re-frame it, and effectively communicate it to the public. Over the course of the semester, you will produce a concise translation of a concept from this course into the artistic or journalistic medium of your choice. Examples could include — but aren't limited to — an animated video, a comic strip, a podcast, a newspaper article or op-ed, a game that will teach players about an aspect of the ocean, an ArcGIS storymap, a skit, a song, or a video about a topic related to the ocean. As part of your project, you will articulate the target audience, your communication goals, and you will determine the best way to share your project publicly.

There will be 4 components of the Science Communication Project, which will be due throughout the semester:

(1) Proposal for what you plan to do.
(2) Progress report on your project.
(3) The final version of your project, which you will share with your peers during the last day of class.
(4) Reflection essay that will discuss the choices you made in order to effectively communicate your chosen messages and content.

Late submission policy

I have two categories for submitting work after the due date:

(1) "No excuse needed" category: I will accept assigned work **up to 3 days late** for all items above except TQs, exams, and debate preparation. You will lose 10% of the maximum value of each assignment for each day that it's late (i.e. 0-24 hours late loses 10%, 25-48 hours late loses 20%, and 49-72 hours late loses 30%; submission times rounded to the nearest hour). You do not need to give me an excuse to submit late work in this category. It's up to you to decide if it's worth it to lose the points for submitting a late assignment — sometimes the extra time will allow you to learn more and receive a better grade. I cannot accept late assignments after 3 days because answer keys need to be made available to the rest of the class in a timely manner.

(2) "Severe hardship" category: If you cannot submit your assignment on time because you have experienced a severe hardship that's out of your control, please email me ***before the due date*** to discuss options for extensions.

Academic Integrity

Every member of the University community is expected to maintain the highest standards of academic integrity. A student shall not submit work that is falsified or is not the result of the student's own effort. Infringement of academic honesty by a student subjects that student to serious penalties, which may include failure on the assignment, failure in the course, suspension from the University or other sanctions (see section 20 of R&R). Please consult Brandeis University Rights and Responsibilities for all policies and procedures related to academic integrity. Students may be required to submit work to TurnItIn.com software to verify originality. A student who is in doubt regarding standards of academic honesty as they apply to a specific course or assignment should consult the faculty member responsible for that course or assignment before submitting the work. Allegations of alleged academic dishonesty will be forwarded to the Department of Student Rights and Community Standards. Citation and research

assistance can be found at Brandeis Library Guides - Citing Sources (https://guides.library.brandeis.edu/c.php?g=301723).

Evaluation

Class Element	Grade %	Percentage breakdown
Thoughts and Questions (TQs) about the assigned readings	10%	You will receive full credit by submitting 10 TQs throughout the semester. Graded as credit/no credit.
In-class participation & quantitative assignments	16%	
Ocean Issues Debate	14%	For each of the 2 debates, written preparation will be worth 4% and oral performance as a group will be worth 3%
Midterm Exam	15%	
Final Exam	15%	
Science Communication Project	30%	(1) Proposal (5%) (2) Progress report (5%) (3) Final project and reflection essay (20%)

Your letter grade in the course will be based on the following cumulative percentages:
A: 93-100%, A-: 90-92%, B+: 87-89%, B:83-86%, B-: 80-82%, C+: 77-79%, C:73-76%,
C-: 70-72%, D+: 67-69%, D:63-66%, D-: 60-62%, E: <60%.

Essential Resources

Course Materials

Our primary textbook will be:

> **Segar, Douglas A. and Elaine Stamman Segar, 2018.** ***Introduction to Ocean Sciences*****.** Second digital edition, Version 4.3.

Download the textbook from: www.reefimages.com/oceansci.php. (I encourage you to use the link on the author's website to donate a few dollars to offset the graphics/photos/software expenses he incurs to keep the book updated, relevant, and *free for students*.)

Additional reading assignments will come from chapters in other reference books, scientific journal articles, newspaper articles, and videos. You may also wish to consult additional references for your science communication project. The following three textbooks are available for free by direct download or through the Brandeis Library

1. Webb, Paul. *Introduction to Oceanography.* Download the textbook from: https://rwu.pressbooks.pub/webboceanography/.

2. Pinet, Paul R., 2019. *Invitation to Oceanography*, Eighth Edition. Burlington: Jones & Bartlett Learning.

3. Garrison, Tom and Robert Ellis, 2013. *Oceanography: An Invitation to Marine Science*, Ninth Edition. Boston: Cengage Learning.

Accommodations

Brandeis seeks to welcome and include all students. If you are a student who needs accommodations as outlined in an accommodations letter, I want to support you.

In order to provide test accommodations, I need the letter more than 48 hours in advance. I want to provide your accommodations, but cannot do so retroactively. If you have questions about documenting a disability of requesting accommodations, please contact Student Accessibility Support (SAS https://www.brandeis.edu/accessibility/) at 781.736.3470 or access@brandeis.edu.

LATTE

LATTE is the Brandeis learning management system: http://latte.brandeis.edu. Login using your UNET ID and password.

Library

The Brandeis Library collections and staff offer resources and services to support Brandeis students, faculty and staff. These include workshops, consultations, collaboration, materials and instruction on emerging trends in technologies such as machine learning, emerging trends in research such as data visualization, and emerging trends in scholarship such as open access. Librarians at the Circulation Desk, Research Help Desk, Archives & Special Collections, Sound & Image Media Studios, MakerLab, AutomationLab, and Digital Scholarship Lab are available to help you.
https://www.brandeis.edu/library/about/index.html

Student Support

Brandeis University is committed to supporting all our students so they can thrive. The following resources are available to help with the many academic and non-academic factors that contribute to student success (finances, health, food supply, housing, mental health counseling, academic advising, physical and social activities, etc.). Please explore the many links on this Support at Brandeis page

(https://www.brandeis.edu/support/undergraduate-students/browse.html) to find out more about the resources that Brandeis provides to help you and your classmates to achieve success.

Teaching Continuity

In general, all communication from me will be through Latte. I will regularly post to the "Course Announcements" in Latte, which should automatically be forwarded to your email.

Since this course will be held in an online format on Zoom, there are numerous events that can interrupt your learning, some of which are unique to an online environment. My policies for all of these are explained below:

- **Illness:** Luckily, since lectures will be held remotely, you will not infect others if you attend class while sick (if you are able). If you are ill and cannot attend lecture, please communicate this to me and the TA as soon as possible via email. ("As soon as possible" means before class or within a day of class.) If you become infected with a long-term illness, we can discuss on a case-by-case basis. Please email me if this occurs.

- **Covid-19 quarantine (for non-sick students):** Since this course will be held online via Zoom, if you have to quarantine due to exposure to Covid-19, I expect that you will still be able to attend class.

- **Time-zone incompatibility:** It is important for you to engage in discussions with your classmates during class, therefore, I want everyone to attend this class when it is held.

- **Athletic or religious events:** You must communicate this to me *before* the class that you will miss, so we can discuss ways that you can make up the missed class.

- **Internet glitches:** One of the biggest difficulties of a remote course is poor internet connection.
    - If you miss a portion of class because you are having internet issues, please communicate this to me and the TA, and watch the recording of the portions of class that you missed.
    - If your internet is always really slow, try turning off your video and limiting the number of video feeds that you see in Zoom. If that doesn't work, try connecting to the audio by calling in with a telephone. If this is a regular problem for you, please contact me by email so we can discuss possible solutions.

- **Campus closure due to inclement weather:** Since all lectures will be held online via Zoom, I will plan to hold lectures even if campus is physically closed due to inclement weather. Extenuating circumstances, such as a severe storm that causes a power outage will be dealt with on a case-by-case basis and will be communicated to students through email and Latte.

Course Plan

Please note that this course plan is subject to change. **The course Latte page will contain finalized information about each day's topics, assigned readings, and other due dates.**

Class #	Date	Topics	Submissions
1	Tuesday, June 1	Introduction and motivation for the course; Oceanographers and ocean data	
2	Wednesday, June 2	Plate tectonics and the seafloor	
3	Thursday, June 3	Hazards: sea level rise	
4	Monday, June 7	Hazards: ocean warming and hurricanes	
5	Tuesday, June 8	Debate #1: Responding to Coastal Hazards	Debate #1 written preparation
6	Wednesday, June 9	Density and Stratification: salinity, temperature, and CTDs and stratification experiment/demo	
7	Thursday, June 10	Density and stratification: Deep water formation and thermohaline circulation	
8	Monday, June 14	Ocean Currents: Coriolis Force, Ekman transport with rotating tank demo	Science communication project proposal
9	Tuesday, June 15	Ocean Currents: Upwelling & Eddies; Determining currents from sea surface height group activity	
10	Wednesday, June 16	El Niño–Southern Oscillation (ENSO) and equatorial dynamics	
11	Thursday, June 17	Ocean productivity: photosynthesis, phytoplankton, zooplankton; Midterm review	
12	Monday, June 21	Ocean productivity: Seasonal blooms and food webs; New England Fisheries	Midterm due by start of today's class
13	Tuesday, June 22	Ocean carbon cycle	
14	Wednesday, June 23	Ocean acidification and coral bleaching	Science communication project progress report
15	Thursday, June 24	Open ocean deoxygenation an coastal hypoxia	
16	Monday, June 28	Debate #2: Ocean-based climate solutions	Debate #2 written preparation
17	Tuesday, June 29	Waves and wave take demo	
18	Wednesday, June 30	Share science communication projects; Final exam review	Science communication projects & reflective essays due
19	Thursday, July 1	Take-home final exam done on your own time	Take-home final exam