

**BIOL 290 S01 (3 credits) University of North Carolina at Chapel Hill
ENVIRONMENTAL MICROBIOLOGY**

Instructor: Dr. Sophie McCoy

Office hours: Tuesdays 11am – 12pm

Office: Wilson Hall 334A (walk through the lab to get to my office, back right)

e-mail: sophie.mccoy@unc.edu

Lectures: Wilson Hall 213

Tuesdays and Thursdays 9:30 – 10:45 am

Zoom link (for use as needed or if specified in the course schedule):

<https://unc.zoom.us/j/93732664631?pwd=YnMvSWJLWDdPQXRkWCs1aU01dzdlZz09>

Passcode: EnvMicro

This class will not regularly be simulcast online or recorded.

Prerequisites: Suggested Biol 101, 103, 104, 150, or AP Biology.

This syllabus is a living document and is subject to change. Teaching and learning are dynamic processes. So that the course can adjust to the real-time needs of our class, *changes may be made during the semester in the assignments and content of the course.* If this need arises, I will notify you of the changes with a Canvas announcement and class email as soon as possible and update the version date at the top of the document accordingly.

Course description: This course surveys multiple dimensions of environmental microbiology, including methods and techniques for microbial genomics, transcriptomics, and metabolomics, ecological and evolutionary microbiology, the roles of microbes in ecological systems, and current applications of and issues in environmental microbiology.

Learning objectives: By engaging in this course, you will be empowered to:

- understand the primary ecological and evolutionary processes that structure microbial communities;
- describe genomics methods for the study of microbial communities and functions;
- identify mechanistic links between biological and physico-chemical processes in microbial systems and their relationships to ecosystem function and services; and
- develop written and oral skills in presenting scientific arguments in the style of scientific and media reports, using primary sources from the scientific literature.

Required readings: There is no textbook for this course. This course will draw on the primary scientific research literature to help forge links between seminal ecological theories as they were originally proposed and as they are still used today, and to incorporate new and recent research findings into a synthetic understanding of the field. All required readings are available on the course Canvas site and are listed in the course schedule, below.

Schedule:

| Week | Date | Topic | Format | Readings | In Class | Assignments Due |
|------|-------|--------------------------------------------------------|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|-------------------------------------------------------------------|
| 1 | 8/16 | Microbial Diversity | In person | <ul style="list-style-type: none"> How to read a scientific paper Scientific Article Review Hug et al. 2016 | Lecture | |
| 1 | 8/18 | Introduction to Ecological Concepts | In person | <ul style="list-style-type: none"> Prosser 2020 Ecological Concepts lectures | Writing an abstract | Writing an abstract |
| 2 | 8/23 | Methods to Study Microbes | In person | <ul style="list-style-type: none"> Caporaso et al. 2010 Caporaso et al. 2013 Haegeman et al. 2013 | Lecture | |
| 2 | 8/25 | Methods to Study Microbes | In person | <ul style="list-style-type: none"> Thomas et al. 2012 Grabherr et al. 2011 | Methods worksheet | Methods worksheet |
| 3 | 8/30 | Evolutionary Processes | In person | <ul style="list-style-type: none"> Doolittle et al. 2000 Sriswadi et al. 2017 | Lecture Evolutionary processes worksheet | Evolutionary processes worksheet |
| 3 | 9/1 | Viruses | In person | <ul style="list-style-type: none"> Andersson and Banfield 2008 Owen et al. 2021 | Lecture Virus worksheet | Virus worksheet |
| 4 | 9/6 | Wellbeing Day | No class | | | |
| 4 | 9/8 | Growth, Reproduction, and Metabolism | In person | <ul style="list-style-type: none"> Karl et al. 1999 Somera et al. 2016 | Lecture | Science in the News 1 |
| 5 | 9/13 | Growth, Reproduction, and Metabolism | In person | <ul style="list-style-type: none"> Dorrestein et al. 2014 Aldridge and Rhee 2014 Williams et al. 2012 | Metabolism worksheet | Sara Jackrel Seminar – Watch and Response Metabolism worksheet |
| 5 | 9/15 | Interactions | In person | <ul style="list-style-type: none"> Kastman et al. 2017 Pernthaler et al. 2005 | Lecture | |
| 6 | 9/20 | Interactions | In person | <ul style="list-style-type: none"> Cavaliere et al. 2017 Review media summary examples (Resources module) | Media summary | Media summary |
| 6 | 9/22 | Community Structure (trophic processes) | In person | <ul style="list-style-type: none"> Weitz et al. 2015 Wilhelm et al. 2016 Knowles et al. 2016 Emerson et al. 2018 | Lecture | |
| 7 | 9/27 | Marine Diseases and Viruses | In person | <ul style="list-style-type: none"> Bourne 2009 Danovaro et al. 2011 Moniruzzaman et al. 2017 | Lecture 2 case study presentations | Peer grading forms |
| 7 | 9/29 | Midterm | In person | | Midterm | Midterm |
| 8 | 10/4 | Microbes as Ecosystems | Asynchronous | <ul style="list-style-type: none"> Graham 2016 Hug 2018 | 4 case study presentations | Peer grading forms |
| 8 | 10/6 | Community Structure (niche, competition, biogeography) | In person | <ul style="list-style-type: none"> Martigny et al. 2006 Hanson et al. 2012 Davidson 2017 | Lecture | Science in the News 2 |
| 9 | 10/11 | Intermediate Disturbance Hypothesis | In person | <ul style="list-style-type: none"> Connell 1978 Santillan 2022 | Lecture IDH worksheet | IDH worksheet |
| 9 | 10/13 | The Holobiome | In person | <ul style="list-style-type: none"> Vanderkoornhyse et al. 2015 Gilbert et al. 2018 | Lecture 2 case study presentations | Peer grading forms |
| 10 | 10/18 | Symbioses | In person | <ul style="list-style-type: none"> Hoffmeister and Martin 2003 | Lecture | Peer review test |
| 10 | 10/20 | Fall Break | No class | | | |
| 11 | 10/25 | Symbioses | In person | <ul style="list-style-type: none"> McCutcheon and Moran 2011 | 4 case study presentations | Science in the News 3 Peer grading forms |

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| 11 | 10/27 | Microbial Mats | In person | <ul style="list-style-type: none"> Ghoul and Mitri 2016 Palmer and Foster 2022 | Debate | Debate prep and Response |
| 12 | 11/1 | Community Assembly | In person | <ul style="list-style-type: none"> Nemergut et al. 2013 | Lecture | |
| 12 | 11/3 | Community Assembly | In person | <ul style="list-style-type: none"> Shade et al. 2012 Lax et al. 2014 | Community assembly worksheet | Community assembly worksheet |
| 13 | 11/8 | Microbes as Ecosystems | In person | <ul style="list-style-type: none"> Sylveira et al. 2017 | Lecture | Assignment Design Draft |
| 13 | 11/10 | Community Structure: Top-Down vs. Bottom-Up | In person | <ul style="list-style-type: none"> Paerl and Otten 2013 Cissell and McCoy 2022 | Debate | Debate prep and Response |
| 14 | 11/15 | Ecosystem and Health Services | In person | <ul style="list-style-type: none"> Porter and Sachs 2020 | Lecture 2 case study presentations | Assignment Design Peer Review Peer grading forms |
| 14 | 11/17 | Ecosystem and Health Services | In person | <ul style="list-style-type: none"> Larsson and Flach 2022 o Probiotics lecture | 2 case study presentations Antibiotic resistance worksheet | Peer grading forms Antibiotic resistance worksheet |
| 15 | 11/22 | Ecosystem and Health Services | <i>Asynchronous</i> | | 8 case study presentations | Peer grading forms |
| 15 | 11/24 | Thanksgiving | No class | | | |
| 16 | 11/29 | Flex Day – Catching Up or Topic of Choice | In person | <ul style="list-style-type: none"> TBD | Lecture | Assignment Design Final |
| 16 | 12/1 | Reading Period | No class | | | |
| 17 | 12/6 | Final Exam | In person | Tuesday 12/6 8:00 am | Final Exam | Final Exam |

Grading: I expect you to have a thorough understanding of basic concepts covered in class and empirical studies and management examples that apply those concepts. Your mastery of the material will be evaluated in exams, presentations, and various types of smaller assignments.

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|-------------------------|-----|
| In Class Assignments | 35% |
| Assignment Design | 15% |
| Case Study Presentation | 10% |
| Science in the News | 5% |
| Midterm exam | 15% |
| Final exam | 20% |

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|---------------------|----|------|
| Grade scale: | A | 93% |
| | A- | 90% |
| | B+ | 86% |
| | B | 83% |
| | B- | 80% |
| | C+ | 76% |
| | C | 73% |
| | C- | 70% |
| | D | 60% |
| | F | <60% |

Please note that grades will not round up (i.e. 92.8% is an A-).

Late assignment policy: 10% will be deducted for each calendar day late. This policy applies only to assignments turned in online – other late assignments will not be accepted. The Canvas

folder will remain open for late assignments for 10 days (until they are not worth any points). Note that for some assignments, late assignments may affect your ability to receive feedback for your next draft and may disqualify you from participating in peer reviews, which may further affect your grade. I will not send reminders for assignment due dates or for late assignments.

Assignments:**In Class Assignments**

35% overall grade

Some days, in class assignments will be graded on participation only and used as a learning tool. Most days, the activity will also be used as a graded assessment method. Your attendance in class will be worth 1 of 10 possible points on the worksheet. Activities will vary from short-answer worksheets to collaborative small projects. You will upload the day's activity to Canvas at the end of class (assignment folders open until midnight).

We will occasionally use a flipped classroom design. This means that you should come to class having viewed the appropriate lecture recordings and having done the required readings (listed in the schedule) beforehand.

If you require an accommodation for in class assignments, please see me as soon as possible with appropriate documentation to discuss your needs.

Assignment Design

15% overall grade

Design an in-class activity to help develop familiarity with and assess the understanding of hypothetical future students to a topic that has been covered in this course. You can be inspired by activities we have done in class so far, or you can be as creative as you wish! Maybe yours will be used in a future year! (Attributed to you and only with your permission.)

Your assignment design project will include both the assignment and a grading rubric, and you will be graded on both components. *This requires you to think critically about why you might ask students to complete an activity or answer a specific question.* At the top of the grading rubric, please state two learning goals (examples provided on Canvas).

This is a solo project that involves two drafts. The first draft will be reviewed by two of your peers for comments on how to improve your assignment. The **multiple drafts** laid out are designed to assist you with the idea development and writing process. **Peer reviews** will be most useful to you if you submit the draft assignment with the same attention to detail you would for a final version. You will be graded on your submission of a first complete draft and completion of two thoughtful peer reviews as part of the total assignment grade. Your project will be graded by the instructor.

Components:

- Assignment (as distributed to the class)
- Grading rubric for each component of the assignment.
- Two learning goals stated at the top of the grading rubric.

Case Study Presentation

10% overall grade

This is a solo project and presentation. Presentations will be given in class and be spread over several topics (weeks 7-15). Sign-ups will open on Canvas in Week 3.

Please start reading your chosen article early so that you have time to meet with me about any questions you have about the methodology, analysis, and conclusions prior to your presentation.

Within your chosen topic, you will select one of the papers I have chosen to present to the class. Your presentation will follow the format of a standard scientific conference talk: a 12 minute presentation with slides and 3 minutes for questions. Your presentation will include an introduction and motivation for the case study, with a description of the applied problem at hand. You will then introduce the methods, results, and generalizable conclusions of the case study. You may need to reference additional material within your talk – a good starting place are the references cited in the article you will present. Your classmates' assessments will be weighted at 50% and your instructor's assessment will be weighted at 50% to calculate your total score.

Science in the News

5% overall grade

Find a news article - not an academic article, but something written for the public. Ideally, this is something you come across naturally in a newspaper. If you get desperate, try the science section of the New York Times or National Geographic. The article should be related to class content in some way. You must include a link to the article. These articles can be from any credible news source. These should be 'popular press' news articles and not scientific articles – the point is to translate what you are learning about in class to newsworthy events in the public arena. A rough length guideline is 500-1000 words. Your write up should include:

- an introduction to the topic
- a summary of the news article
- a description of links between what you read and course content

The writing style should be somewhat formal and accessible to readers not in our class. For example, don't say "This related to class material from last week because...".

General Policies

Canvas and email policy: This course will operate on the Canvas platform, where your assignments will be posted and should be turned in electronically. I will communicate with the class as a whole through the Canvas site announcements and course emails. You may set your own notification preferences through Canvas, so please keep in mind how that will affect your notification of any course announcements. Both class emails and Canvas notifications will go to your @unc email address, which you are required to monitor. I receive my own notifications as a daily email digest.

You may also communicate with me directly through email. I do my best to respond to all emails within 36 hours of receiving them. Please be courteous and professional in your emails with me and other class members, for example by using a relevant subject line, beginning with a greeting, and closing with your name. Emails should be sent from your UNC account.

Participating in the class learning environment: The in-class components of this course depend on your participation and collaboration with classmates – just like in a professional research setting. Some guidelines for expectations are below:

- We can only have interesting and productive class discussions if you share your thoughts and ideas. Please speak up! This requires some self-awareness. If you struggle with speaking in class, set goals for yourself. If you tend to talk a lot, look around at your classmates before raising your hand to make sure you give them space to speak up.
- Pay attention during class with your mind and your body language.
- Engage in creating the learning environment you need. Make an effort to get to know your classmates and to conduct group work with different people during the semester. Introduce yourself and gently correct the pronunciation of your name or pronouns. Listen respectfully to other ideas and learn from those with different approaches.

Zoom etiquette: Zoom will be used for synchronous online classes. While no classes are planned to occur this way, it is likely that illness or weather will move an in person class to this format. Please treat Zoom class the way you would treat an in person class.

If you do not know how to do the following, please seek assistance from a classmate or instructor in the first week of class.

- Know how to turn the camera on/off, mute/unmute yourself.
- Enable a virtual background if you wish.
- Upload a profile picture so we have a visual to associate with you if you are not able to turn on your camera.
- Accept a breakout room assignment.
- Share your screen.
- Know how to turn out subtitles and download a transcript of the meeting:
<https://digitalaccessibility.unc.edu/resources/video/zoom-live-transcripts/>

I expect you to:

- Turn the camera on during class discussions so that you can engage as you would during an in person class. This helps us build a sense of community and engage collaboratively together.
- Edit your name as it appears in Zoom to how you would like to be addressed. This should be professional (aka, “Richard,” “Ringo,” or “Starr,” and not “BeatleMania”).
- Refrain from sharing Zoom meeting links and passwords with anyone who is not in our class.
- Participate professionally and appropriately in the Zoom chat.
- Refrain from other activities (including computer and phone based distractions) during class time.

Missed class: Students are expected to borrow notes from a classmate to catch up on missed classes. I will not hold a repeat class session for those who have missed class. Make-up missed in-class assignments, including presentations, will be issued only for University-approved absences.

Re-grade policy: If you feel that you have not been graded fairly on an assignment, please detail your objections *in writing* and hand in this explanation, together with your corrected assignment, to your instructor *within five days* after your assignment has been returned. Please

be specific: I expect a discussion of the scientific point(s) at issue and not merely a request for an answer to be re-evaluated. Only work written in pen or provided as an original printout with our grade and comments on it will be considered for re-grading. I will re-grade the entire assignment upon receiving it, so be aware of the possibility that some scores could be lowered. Mistakes in adding points may be brought to the attention of the instructors for immediate correction.

Academic integrity and plagiarism: I take academic integrity very seriously. All activities and homework in the class are expected to conform to the standards summarized by the UNC Honor System and explained by the UNC Office of Student Conduct:
<https://studentconduct.unc.edu/>

I expect each student's work to be his/her own unless the assignment is explicitly a group assignment. Absolutely all group work must be acknowledged; if an assignment was completed by a group, you must write the names of your collaborators on your assignment. Please do not copy other people's words or use material from another source without attribution. If you are confused about anything regarding academic integrity and plagiarism, I am here to be a resource. Please ask for help. <https://writingcenter.unc.edu/tips-and-tools/plagiarism/> I am required to file a formal report to the University Honor Court if your work is suspected to have violated Honor System standards or if you are suspected to have assisted another student in violation of those standards. Your doing so will result in a grade of 0 for the assignment(s) in question and may result in a disciplinary action by the University.
<https://studentconduct.unc.edu/report-incident/>

Appointments and questions: I make myself available to answer any questions you have about the course or about ecology and evolution in general. I encourage questions during or after class but am also available for longer discussions during my office hours or by appointment.

I am also here as a resource if you are struggling with class material and study skills. You and you alone stand to benefit from holding yourself to high standards in this class, and you alone are responsible for your success. However, please reach out to me if you feel that you are having trouble keeping on track so that I may help you plan for success and find the on campus resources to help you.

If you are affected by illness, emergency, or other circumstances that affect your ability to complete your coursework on time, reach out to me immediately so we can discuss your options. I cannot support you if you do not clearly and promptly communicate with me.

Please note that I have been designated as a **mandatory reporter**. This may differ from some of your other instructors. I am here to help and advise you, but I may be required to report certain situations to UNC's Title IX office.

Letters of recommendation: A good reference writer is someone who can comment on concrete strengths and examples and who knows you well from a professional or academic context. Before asking me for a letter, please ask yourself if you can identify several specific aspects of your development as a scholar that I have uniquely been able to observe and can comment on your relevant strengths. If the answer is yes, then please ask.

I require at least one month's notice and weekly reminders until you have confirmation that my letter has been submitted. You must furnish me with details of the position you are applying for, the deadline, to whom the letter should be addressed, your updated resume or CV, and details for how to submit the letter. I will not provide a non-specific letter directly to a student.

University Policies

Absence, grading, and examination:

UNC policies can be found here.

<https://catalog.unc.edu/policies-procedures/attendance-grading-examination/#text>

Support for anxiety and stress: UNC provides a wealth of student wellness offerings and resources that you can find here: <https://studentwellness.unc.edu/about-us/dimensions-wellness> Counseling and Psychological Services (CAPS) is strongly committed to addressing the mental health needs of a diverse student body through timely access to consultation and connection to clinically appropriate services. Go to their website: <https://caps.unc.edu/> to learn more or call 919-966- 3658 (available 24/7). Resources are also available through the National Suicide Prevention Lifeline (1-800-273-8255) and the Crisis Text Line (Text START to 741-741).

Supporting Fellow Students in Distress: As members of the UNC community, we each share a personal responsibility to express concern for one another and to ensure that our course meetings and the campus as a whole remain a healthy environment for learning. Occasionally, you may become worried or concerned about a fellow classmate's well-being. When this is the case, I would encourage you to share these concerns with the professionals at either the Office of the Dean of Students (<https://odos.unc.edu/carereferral>) or CAPS.

As always, if you think there is immediate danger call 9-1-1.

Policy on Non-Discrimination: The University is committed to providing an inclusive and welcoming environment for all members of our community and to ensuring that educational and employment decisions are based on individuals' abilities and qualifications. Consistent with this principle and applicable laws, the University's Policy Statement on Non-Discrimination offers access to its educational programs and activities as well as employment terms and conditions without respect to race, color, gender, national origin, age, religion, creed, genetic information, disability, veteran's status, sexual orientation, gender identity or gender expression. Such a policy ensures that only relevant factors are considered and that equitable and consistent standards of conduct and performance are applied.

If you are experiencing harassment or discrimination, you can seek assistance and file a report through the Report and Response Coordinators (see contact info at safe.unc.edu) or the Equal Opportunity and Compliance Office, or online to the EOC at <https://eoc.unc.edu/report-an-incident/>.

Title IX Resources: Any student who is impacted by discrimination, harassment, interpersonal (relationship) violence, sexual violence, sexual exploitation, or stalking is encouraged to seek resources on campus or in the community. Reports can be made online to the EOC at <https://eoc.unc.edu/report-an-incident/>. Please contact the University's Title IX Coordinator (Elizabeth Hall, interim-titleixcoordinator@unc.edu), Report and Response Coordinators in the Equal Opportunity and Compliance Office (reportandresponse@unc.edu), Counseling and Psychological Services (confidential), or the Gender Violence Services Coordinators (gvsoc@unc.edu; confidential) to discuss your specific needs. Additional resources are available at safe.unc.edu.

Accessibility Resources: The University of North Carolina at Chapel Hill facilitates the implementation of reasonable accommodations, including resources and services, for students with disabilities, chronic medical conditions, a temporary disability or pregnancy complications resulting in difficulties with accessing learning opportunities. It is your own responsibility to get the appropriate documentation filed and to approach me about your needs. All accommodations are coordinated through the Accessibility Resources and Service Office. See the ARS Website for contact information: <https://ars.unc.edu> or email ars@unc.edu. Relevant policy documents as they relate to registration and accommodations determinations, as well as the student registration form, are available on the ARS website under the About ARS tab.

Thanks to Drs. Marchetti and Zwemer for developing some of the policies in this syllabus.