

MB 590-012

Microbiome Analysis Syllabus

Spring 2022, 3 Credit Hours

Course Description

Microbiome Analysis will address identification of amplicon sequence variants, descriptive and exploratory analyses, and hypothesis testing.

Learning Outcomes

- Basic understanding of microbiome data and bioinformatics
- Proficiency in characterizing microbiome diversity
- Competency in selecting and carrying out appropriate statistical analyses
- Ability to discover and implement new approaches
- Familiarity with R, R studio, various R packages, GitHub, HPC

Course Structure

This course will include a combination of lecture and activities each week. Activities will include analyzing microbiome data, reading and evaluating journal articles, and problem solving. Final student projects are also required.

Instructors

Christine V Hawkes (chawkes) - Instructor

Email: chawkes@ncsu.edu

Office Location: Thomas Hall 2560

Office Hours: Online by appt

Rachel Hammer (rahammer) - TA

Email: rahammer@ncsu.edu

Office Location: Thomas Hall 2552c

Office Hours: Online by appt

Course Meetings

Wednesdays, 1:30pm - 4:15pm

Main Campus, Scott Hall 105

In case of illness, a zoom link can be provided as an alternative to in-person attendance.

Course Materials

All readings, datasets, and scripts will be provided to students via GitHub.

Requisites and Restrictions

This course has no pre-requisites, co-requisites, or restrictions other than permission of the instructor.

General Education Program (GEP) Information

This course does not fulfill a General Education Program category or co-requisite.

Course Schedule (subject to change)

Week	Date	Topic
1	12-Jan	Introduction – R, GitHub, Rmarkdown
2	19-Jan	Sequence prep, 16S ASV pipeline
3	26-Jan	Identification, normalization
4	2-Feb	Practicum – ITS ASV pipeline
5	9-Feb	Exploratory analysis 1 – alpha diversity
6	16-Feb	Exploratory analysis 2 – beta diversity
7	23-Feb	Dada2 on the HPC (Lisa Lowe)
8	2-Mar	Exploratory analysis 3 – core microbiomes
9	9-Mar	Practicum – full exploratory analysis
10	16-Mar	Spring break – no class
11	23-Mar	Hypothesis testing 1 – regression
12	30-Mar	Hypothesis testing 2 – permutation tests
13	6-Apr	Hypothesis testing 3 – TBD
14	13-Apr	Practicum – full hypothesis testing
15	20-Apr	Final project presentations

Additional Learning Opportunities

The NCSU library also has R workshops, ranging from "absolute beginners" to specific tasks:
<https://www.lib.ncsu.edu/workshops/category/data-and-visualization>

In addition, there are other options online where you can work through them on your own. Here are some examples of books and tutorials – there are many options out there that can suit different learning styles:

<https://swirlstats.com/>
<https://r4ds.had.co.nz/index.html>
<http://www.cookbook-r.com/>
<https://bookdown.org/ndphillips/YaRrr/>
<https://www.jaredknowles.com/r-bootcamp/>
<https://www.statmethods.net/>

Classroom Policies

In order for you to get the most out of this class, please expect to do the following:

- Come prepared to class – complete all assignments in advance
- Turn off electronic devices (e.g., cell phones) other than the computer you are using
- Turn off email during class
- Don't hesitate to ask questions
- Be respectful and considerate of your classmates' thoughts and ideas
- This class allows for collaboration via GitHub but you should also feel free to work together outside of class
- Let me know immediately if you have any problem that is preventing you from performing satisfactorily in this class

Grading

	Points	Contribution (%)
Participation	80	20
GitHub contributions	50	12.5
HPC training	30	7.5
Coding exercises	120	30
Final project	120	30

Letter Grades

This Course uses Standard NCSU Letter Grading:

97	≤	A+	≤	100
93	≤	A	<	97
90	≤	A-	<	93
87	≤	B+	<	90
83	≤	B	<	87
80	≤	B-	<	83
77	≤	C+	<	80
73	≤	C	<	77
70	≤	C-	<	73
67	≤	D+	<	70
63	≤	D	<	67
60	≤	D-	<	63
0	≤	F	<	60

Requirements for Credit-Only (S/U) Grading

Performance in research, seminar and independent study types of courses (6xx and 8xx) is evaluated as either "S" (Satisfactory) or "U" (Unsatisfactory), and these grades are not used in computing the grade point average. For credit only courses (S/U) the requirements necessary to obtain the grade of "S" must be clearly outlined.

Requirements for Auditors (AU)

Information about and requirements for auditing a course can be found at <http://policies.ncsu.edu/regulation/reg-02-20-04>.

Policies on Incomplete Grades

If an extended deadline is not authorized by the Graduate School, an unfinished incomplete grade will automatically change to an F after either (a) the end of the next regular semester in which the student is enrolled (not including summer sessions), or (b) by the end of 12 months if the student is not enrolled, whichever is shorter. Incompletes that change to F will count as an attempted course on transcripts. The burden of fulfilling an incomplete is the responsibility of the student. University policy on incomplete grades is <http://policies.ncsu.edu/regulation/reg-02-50-03>. Additional information on incomplete grades for graduate students is in the Graduate Administrative Handbook, Section 3.18.F http://www.fis.ncsu.edu/grad_publicns/handbook/

Late Assignments

Late assignments must be approved in advance with instructor.

Attendance and Absences Policy

Please discuss with the instructor any planned absences or medical leave. For complete attendance and excused absence policies, see <http://policies.ncsu.edu/regulation/reg-02-20-03>

Academic Integrity, Honesty, and Honor Pledge

Students are required to comply with the university policy on academic integrity and honesty found in the Code of Student Conduct found at <http://policies.ncsu.edu/policy/pol-11-35-01>

Honor Pledge - Your signature on any test or assignment indicates "I have neither given nor received unauthorized aid on this test or assignment."

Electronically-Hosted Course Components

Students may be required to disclose personally identifiable information to other students in the course, via electronic tools like email or web-postings, where relevant to the course. Examples include online discussions of class topics, and posting of student coursework. All students are expected to respect the privacy of each other by not sharing or using such information outside the course.

Electronically-hosted Components: <https://github.ncsu.edu/> <https://ncsu.zoom.us>

Accommodations for Disabilities

Reasonable accommodations will be made for students with verifiable disabilities. In order to take advantage of available accommodations, students must register with the Disability Resource Office at Holmes Hall, Suite 304, Campus Box 7509, 919-515-7653. For more information on NC State's policy on working with students with disabilities, please see the Academic Accommodations for Students with Disabilities Regulation (REG02.20.01) (<https://policies.ncsu.edu/regulation/reg-02-20-01/>).

Non-Discrimination Policy

NC State provides equal opportunity and affirmative action efforts, and prohibits all forms of unlawful discrimination, harassment, and retaliation ("Prohibited Conduct") that are based upon a person's race, color, religion, sex (including pregnancy), national origin, age (40 or older), disability, gender identity, genetic information, sexual orientation, or veteran status (individually and collectively, "Protected Status"). Additional information as to each Protected Status is included in NCSU REG 04.25.02 (Discrimination, Harassment and Retaliation Complaint Procedure). NC State's policies and regulations covering discrimination, harassment, and retaliation may be accessed at <http://policies.ncsu.edu/policy/pol-04-25-05> or <https://oied.ncsu.edu/divweb/>. Any person who feels that he or she has been the subject of prohibited discrimination, harassment, or retaliation should contact the Office for Equal Opportunity (OEO) at 919-515-3148.

Transportation

This course will not require students to provide their own transportation. Non-scheduled class time for field trips or out-of-class activities is not required for this class.

Safety & Risk Assumptions

None.

NCSU COVID19 Statement

Due to the Coronavirus pandemic, public health measures have been implemented across campus. Students should stay current with these practices and expectations through the [Protect the Pack](https://www.ncsu.edu/coronavirus/) website (<https://www.ncsu.edu/coronavirus/>). The sections below provide expectations and conduct related to COVID-19 issues.

Health and Participation in Class

We are most concerned about your health and the health of your classmates and instructors/TAs.

- If you test positive for COVID-19, or are told by a healthcare provider that you are presumed positive for the virus, you should not attend any face-to-face (F2F) classes or face-to-face component of a hybrid class. Work with your instructor on any adjustments necessary; also follow other university guidelines, including self-reporting ([Coronavirus Self Reporting](#)): Self-reporting is not only to help provide support to you, but also to assist in contact tracing for containing the spread of the virus.
- If you feel unwell, even if you have not been knowingly exposed to COVID-19, please do not come to a F2F class or activity.
- If you are in quarantine, have been notified that you may have been exposed to COVID-19, or have a personal or family situation related to COVID-19 that prevents you from attending this course in person (or synchronously), please connect with your instructor to make alternative plans, as necessary.
- If you need to make a request for an academic consideration related to COVID-19, such as a discussion about possible options for remote learning, please talk with your instructor.

Health and Well-Being Resources

These are difficult times, and academic and personal stress are natural results. Everyone is encouraged to [take care of themselves](#) and their peers. If you need additional support, there are many resources on campus to help you:

- Counseling Center ([NCSU Counseling Center](#))
- Student Health Services ([Health Services | Student](#))
- If the personal behavior of a classmate concerns or worries you, either for the classmate's well-being or yours, we encourage you to report this behavior to the NC State CARES team: ([Share a Concern](#)).
- If you or someone you know are experiencing food, housing or financial insecurity, please see the Pack Essentials Program ([Pack Essentials](#)).

Community Standards related to COVID-19

We are all responsible for protecting ourselves and our community. Please see the [community standards](#) and Rule 04.21.01 regarding Personal Safety Requirements Related to COVID-19 [RUL 04.21.01 – Personal Safety Requirements Related to COVID-19 – Policies, Regulations & Rules](#)

Course Expectations Related to COVID-19

- **Face Coverings:** All members of the NC State academic community are expected to follow all university policies and guidelines, including the [Personal Safety Rule](#) and [community standards](#), for the use of face coverings. .
- **Course Attendance:** NC State attendance policies can be found at: [REG 02.20.03 – Attendance Regulations – Policies, Regulations & Rules](#). Please refer to the course's attendance, absence, and deadline policies for additional details. If you are quarantined or otherwise need to miss class because you have been advised that you may have been exposed to COVID-19, you should not be penalized regarding attendance or class participation. However, you will be expected to

develop a plan to keep up with your coursework during any such absences. If you become ill with COVID-19, you should follow the steps outlined in the health and participation section above.

- **Technology Requirements:** This course may require particular technologies to complete coursework. Be sure to review the syllabus for these expectations, and see the [syllabus technical requirements](#) for your course. If you need access to additional technological support, please contact the Libraries' Technology Lending Service: ([Technology Lending](#)).

Course Delivery Changes Related to COVID-19

Please be aware that the situation regarding COVID-19 is frequently changing, and the delivery mode of this course may need to change accordingly, including from in-person to online. Regardless of the delivery method, we will strive to provide a high-quality learning experience.

NO LONGER AVAILABLE - Grading/Scheduling Changing Options Related to COVID-19

Two policies, enhanced S/U Grading Option and Late Drop, put in place at the beginning of the COVID-19 pandemic have been discontinued. In some cases, an option may be to request an "incomplete" in the course. If you are experiencing difficult or extenuating circumstances, you should discuss possible options with your instructor and your academic advisor.

Need Help?

If you find yourself in a place where you need help, academically or otherwise, please review this [Step-by-Step Help Topics](#).

Other Important Resources

- **Keep Learning:** [Keep Learning](#)
- **Protect the Pack FAQs:** [Frequently Asked Questions](#) | [Protect the Pack](#)
- **NC State Protect the Pack Resources for Students:** [Resources for Students](#) | [Protect the Pack](#)
- **Academic Success Center** (tutoring, drop in advising, career and wellness advising): [Academic Success Center](#).
- **NC State Keep Learning, tips for students opting to take courses remotely:** [Keep Learning Tips for Remote Learning](#)
- **Introduction to Zoom for students:** <https://youtu.be/5LbPzzPbYEw>
- **NC State Libraries** [Technology Lending Program](#)