ZOO6927 Measuring Microbial Diversity

Course Description

Sequencing technologies are changing the way that we study species interactions by enabling the identification of multiple taxonomic and evolutionary groups from individual and mixed samples. This graduate-level course will provide the analytical tools and computing resources to quantify microbial diversity and function. The main goal is to familiarize students with current sequencing technologies and analytical pipelines. To accomplish this, we will leverage UF's computing resources (HiPerGator) to perform our analyses. Students will have the opportunity to build an amplicon/metagenomic library, analyze and synthesize published datasets, and communicate their results via tutorials, presentations, and a manuscript. I hope that this class serves as a bridge between students without previous experience in metabarcoding/metagenomics to more advanced students that already have their own datasets to analyze.

Instructor

Ana V. Longo, PhD
Department of Biology
Office Location: 412 Carr Hall
Office Hours: Wednesday 2:00 PM – 3:00 PM by appointment only (see below).
Phone: 352.273.4982
Email: ana.longo@ufl.edu

Preferred Methods for Public and Private Communications

UFL mail should be used for all course-related communications. I will NOT answer emails from external accounts (e.g., GMAIL).
Note: Participation in Canvas and Team Discussions is considered a public conversation within the class.

Course Meeting Times (Periods 3 to 5)

Location: CRR 0611
Wednesday: 9:35 am – 12:35 pm

Office Hour Policies

Office Hours will be on Wednesday 2:00 PM – 3:00 PM by appointment only. I understand that these times might not work for everyone, therefore please contact me to explore other options. Please use this website to schedule your meetings:
https://outlook.office365.com/owa/calendar/UFL2@uflorida.onmicrosoft.com/bookings/

In response to the current disease outbreaks, office hours meetings will be via ZOOM by default, unless the student requests it to be in person. **Students visiting my personal office space will be required to wear a mask.** If a student does not comply to my request, we will move the meeting to an outdoor space (weather permitting).

Use this link for meetings:
https://ufl.zoom.us/j/6566322742

Meeting ID: **656 632 2742**

Course Objectives

After successfully completing this course, students will be able to:

1. Understand the differences between sequencing approaches to study microbial diversity and function.
2. Critically review analytical concepts and understand the technical assumptions behind common tests used to study microbial diversity.
3. Learn to perform reproducible analyses using HiPerGator (QIIME, R, Mothur, etc.).
4. Develop analytical and writing skills by working with a dataset.

Course Textbook (s) and/or Assigned Readings

This course does not have an assigned textbook. Reading material will be available on Canvas and Teams.

Grading

In-class Participation: 20 points
Paper Discussion: 20 points
In-class Tutorial: 20 points
Library preparation: 20 points
Final paper presentation: 20 points
Final manuscript: 100 points
Total: 200 points

Grading Scale

Total points will be rounded (for example: 94.4% = 94% = A-; 94.5 % = 95% = A).

Percent (out of 100)	Grade
≥95-100	A
≥90	A-
≥87	B+
≥85	B
≥80	B-
≥77	C+
≥75	C
≥70	C-
≥67	D+
≥65	D
≥60	D-
<60	E

Information on current UF grading policies for assigning grade points can be found in https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx

Class Attendance and Make-Up Policy

Excused absences are consistent with university policies in the catalog (https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx) and require appropriate documentation.

Course Evaluation

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Click here for guidance on how to give feedback in a professional and respectful manner. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via ufl.bluera.com/ufl/. Summaries of course evaluation results are available to students here.

COVID-19 Best Practices

In response to COVID-19, the following practices are in place to maintain your learning environment, to enhance the safety of our in-classroom interactions, and to further the health and safety of ourselves, our neighbors, and our loved ones.

- If you are not vaccinated, get vaccinated. Vaccines are readily available and have been demonstrated to be safe and effective against the COVID-19 virus. Visit one.uf for screening/testing and vaccination opportunities.
- If you are sick, stay home. Please call your primary care provider if you are ill and need immediate care or the UF Student Health Care Center at 352-392-1161 to be evaluated.
- Course materials will be provided to you with an excused absence, and you will be given a reasonable amount of time to make up work.

Online Privacy

Our class sessions may be audio/visually recorded for students in the class to refer back and for enrolled students who are unable to attend live. Students who participate with their camera engaged or utilize a profile image are agreeing to have their video or image recorded. If you are unwilling to consent to have your profile or video image recorded, be sure to keep your camera off and do not use a profile image. Likewise, students who un-mute during class and participate orally are agreeing to have their voices recorded. If you are not willing to consent to have your voice recorded during class, you will need to keep your mute button activated and communicate exclusively using the "chat" feature, which allows students to type questions and comments live. The chat is automatically recorded, but not shared. As in all courses, **unauthorized sharing of recorded materials without instructor/student knowledge is prohibited.**

Students Requiring Accommodations

Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, www.dso.ufl.edu/drc/) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

Class Demeanor

Students are expected to arrive to class on time and behave in a manner that is respectful to the instructor and to fellow students. Please avoid the use of cell phones. Opinions held by other students should be respected in discussions.

University Honesty Policy

UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." The Honor Code (https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor.

Basic Needs, Counseling and Wellness Center

Any student who has difficulty affording groceries or accessing sufficient food to eat every day, or who lacks a safe and stable place to live, and believes this may affect their performance in the course, is urged to contact UF food pantry: https://pantry.fieldandfork.ufl.edu or the Dean of Students for support. If you or a friend is in distress, please contact umatter@ufl.edu or 352-392-1575 so that a team member can reach out to the student (https://counseling.ufl.edu/). Sexual Assault Recovery Services (SARS) available at Student Health Care Center 352-392-1161;

University Police Department: 392-1111 or 9-1-1 for emergencies.

Class Schedule (Tentative)

Week	Date	Topic	Instructions	Reading Material (Always confirm in Canvas/Teams)
1	Wed Aug 24	Welcome and Class Introduction	1) What are your goals for this class? 2) Come prepared to discuss paper	Koskella, B., Hall, L.J. & Metcalf, C.J.E. The microbiome beyond the horizon of ecological and evolutionary theory. *Nat Ecol Evol* 1, 1606–1615 (2017). https://doi.org/10.1038/s41559-017-0340-2
2	Wed Aug 31	Types of microbiome data, manuscript planning, and brainstorming	Come prepared to discuss and introduce the topic of the paper you want to write about (own data? published data?)	
3	Wed Sep 7	Introduction to Cluster Computing HiperGator (Matt Gitzendanner)	Please make sure that you have an active HiPerGator account	
4	Wed Sep 14	Amplicon Library Prep 1	Read protocol from Earth Microbiome Project	https://earthmicrobiome.org/protocols-and-standards/16s/ Caporaso, J. G., Lauber, C. L., Walters, W. A., Berg-Lyons, D., Huntley, J., Fierer, N., Owens, S. M., Betley, J., Fraser, L., Bauer, M., Gormley, N., Gilbert, J. A., Smith, G., & Knight, R. (2012). Ultra-high-throughput microbial community analysis on the Illumina HiSeq and MiSeq platforms. ISME J 6, 1621–1624. http://doi.org/10.1038/ismej.2012.8
5	Wed Sep 21	Amplicon Library Prep 2		
6	Wed Sep 28	Amplicon Data Analysis I: QIIME, Mothur, DADA	1) Bring computers 2) Introduction of paper (at least 3 paragraphs with reference cited) due by 5pm	
7	Wed Oct 5	Amplicon Data Analysis II: R package phyloseq, microbiome	Bring computers	
8	Wed Oct 12	Temporal analyses	Bring computers	Coenen, A. R., et al. (2020). "A primer for microbiome time-series

Week	Date	Topic	Instructions	Reading Material (Always confirm in Canvas/Teams)
				analysis." Frontiers in genetics 11: 310.
9	Wed Oct 19	Student-led tutorials		
10	Wed Oct 26	Student-led tutorials		
11	Wed Nov 2	Long-read sequencing	1) Bring computers 2) Read paper, be ready to discuss.	Tedersoo, L., et al. (2021). "Perspectives and Benefits of High-Throughput Long-Read Sequencing in Microbial Ecology." Applied and Environmental Microbiology 87(17): e00626-00621.
12	Wed Nov 9	Real-time nanopore sequencing		
13	Wed Nov 16	Long-read sequencing analyses	Draft paper due date by 5pm	
14	Wed Nov 23	**Thanksgiving Break (No Class)**		
15	Wed Nov 30	Writing time (No Class)	1) Submit peer review by 5pm 2) Extended Office Hours starting at 9:35am	
16	Wed Dec 7	Final Project Presentations	1) Deliver 10-15 min presentation; 2) Final paper due by 5pm	