

## The Microbiome – Spring 2023

### MCB 4320C and MCB 6670C

#### 3 credit hours

**Brief Background:** This course has introductory microbiology (MCB 3020 or MCB 3023 or equivalent) as a prerequisite with a minimum grade of C and is intended for majors in the Life Sciences. It will be taught at the senior level, and its primary objective is to increase microbiome knowledge and appreciation. Environmental microbiologists began the study of uncultured microbial life in the early 1990s. The idea was to start to understand the breadth of microbial diversity across a wide variety of habitats using methods that do not require culturing of the organisms.

During this period, the technology and data analysis explosion also began in genomics. Environmental microbiologists took full advantage of these new tools and found diverse life in many places. By about 2005, those outside of microbiology began to take notice of these new tools and became interested in discovering microbes associated with their environments of interest. That included biomedical scientists, ecologists, agriculturalists, taxonomists, entomologists, and others. This has led to a sea of papers investigating the collection of microbes associated with eukaryotes.

What is the microbiome? The collection of microorganisms that inhabit a specific environment, their genomes (i.e., genes), and the surrounding environmental conditions are referred to as the microbiome. The microbiome includes all microbial life: bacterial, archaeal, fungal, and viral. Microbiomes exist on and within plants, animals, insects, amphibians, birds, etc. They also live in niches to themselves in a wide variety of terrestrial, marine, and aquatic environments. Many of these environments are extreme, including hot springs, deep ocean thermal vents, and subsurface rock formations.

Given the many environments in which microbiomes thrive, no single course or group of courses can hope to cover them adequately. But this course intends to teach students how microbes are associated with different niches, including humans, animals/insects, plants, soils, water, and polluted environments. Modern tools available to analyze the microbiome will also be taught. Guest speakers may be invited for a Q&A on certain topics. Since there are no proctored exams in this course, the weekly content will be assessed in quizzes and other assignments, with a diversity of assessment-type (e.g., multiple-choice, multiple-answer, short response).

In this course, active learning will be encouraged. The course will include an ongoing microbiome experiment with a specific research question in mind. This question and its importance will be addressed early in the course. In succeeding weeks, students will learn approaches, methods, and technologies to address the question. More questions may arise as the work progresses, as commonly occurs with any research project. Consistent with collaboration in any research project, students will be introduced early in the semester and work in small teams on certain assignments.

The course will be entirely web-based, and all lectures will be delivered online. The reading assignments, course lecture materials, and hands-on individual or team activities will be posted weekly. By the end of the course, all students will have had an original research experience that they can speak to in future endeavors. Interested students may be invited to join us in a scientific publication related to this research after the conclusion of the term.

## **Instructors:**

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The best way to contact us is via E-learning mail, or we can set up a time for individual phone calls and zoom sessions.

## **Course Objectives:**

- 1. Students will be able to understand what the microbiome is and the principles that drive microbial life in different niches.**
- 2. Students will be introduced to how microbial omics data is used to understand the human microbiome and its role in human health.**
- 3. Students will be introduced to the modern technologies used in microbiome research. By understanding the technologies, the students can learn which biological questions can be asked and answered given today's tools.**
- 4. Students will learn how to analyze 16S rRNA and metagenomics data often used in microbiome analysis.**
- 5. Students will participate in the analysis and interpretation of an ongoing microbiome experiment and write a report on their results.**

**e-Learning system:** The course will be managed entirely through the e-Learning in the Canvas system (one of two big orange buttons at <https://elearning.ufl.edu/>). If you are not familiar with this system, you need to become acquainted with it for this course. The LSS homepage contains tips and tutorials for students as well as [computer requirements](#). It is your responsibility to become familiar with e-Learning in Canvas and to ensure that you have the appropriate browsers, settings, internet speed, etc. For any technical questions regarding Canvas, please visit the elearning site ([https://elearning.ufl.edu/help/Student\\_Faq](https://elearning.ufl.edu/help/Student_Faq)) and/or the UF Help desk (<http://helpdesk.ufl.edu/>). They can address technical issues such as being unable to view course materials, not being able to access the quizzes, not being able to send mail, etc. **All technical issues/questions/comments should go to the Help Desk first (352-392-HELP).** They are the experts. The Help Desk suggests that if you encounter any problem (error messages, etc.), you take a screenshot of the problem and save it. This will help the Help Desk in fixing your problem.

If you encounter a problem that the HELP DESK cannot fix, please send a help request to the Technical Support Center of the Microbiology & Cell Science Department. Please fill out your request at <http://microcell.ufl.edu/support/index.php>. The form will ask for your name, number, email, and location. In the location field, please indicate “online course.”

**Office Hours:** Since this is a web-based course, office hours will be online. The office hours will be conducted via zoom. Office hours are difficult to schedule since our students have such varied schedules. We will always be available to answer questions by email or to set up an individual phone or zoom conversation. Just contact us to arrange it.

**Email and Announcements:** All email communication regarding this course will be done through the mail function of E-learning in Canvas. This mail system is private and secure. You are responsible for checking your E-learning Mail and Announcements **frequently** to stay updated on the course. Please check the course a minimum of two times per week to ensure you are not missing any critical communications. As instructors, we will respond to your questions and emails promptly. Maintaining all email communication through Canvas instead of other email domains reduces the chance that discussions will get lost among outside accounts. When sending an email through e-Learning in Canvas, you can also forward the email to the recipient’s ufl account. Please use this option if you have an urgent message. If you receive a course email (from Canvas) to your ufl account, please note that you cannot simply hit “reply” to the email. You must login to Canvas to respond through the mail function.

**Topical outline of weekly modules (all times Eastern):**

Wk.	Dates	Topics for the week:
1	Jan 9-13	Introduction to Course History of the study of the microbiome Introduction to the course's microbiome project
2	Jan 16-20	The great plate anomaly: Why count microbes using high throughput sequencing of marker genes?
3	Jan 23-27	The 16S rRNA data analysis and interpretation
4	Jan 30 – Feb 3	<b>Journal Club</b> – Guided questions and discussion about scientific papers <b>Quiz 1 (Feb 1-8)</b>
5	Feb 6-10	The human microbiome in health and disease
6	Feb 13-17	<b>Journal Club</b> – Guided questions and discussion about scientific papers
7	Feb 20-24	The animal/insect microbiome
8	Feb 27 – Mar 3	<b>Quiz 2 (Mar 1-8)</b>
9	Mar 6-10	The soil microbiome
10	Mar 13-17	<b>Around the world in eight microbiomes</b> - graphical abstract/infographic, and 4-5-minute-video presentation
11	Mar 20-24	The plant microbiome
12	Mar 29-Apr 5	<b>Quiz 3</b>
13	Apr 3-7	The water microbiome
14	Apr 12-19	The microbiome in polluted environments and bioremediation <b>Quiz 4</b>
15	Apr 19-26	<b>Virtual symposium</b> on course's microbiome project

The original research assignments will be distributed across the semester schedule.

## **Grading Scale:**

### **Percentage**

A	90 or above
A-	87-89
B+	84-86
B	80-83
B-	77-79
C+	74-76
C	70-73
C-	67-69
D+	64-66
D	60-63
D-	57-59
E	56 or below

For more information on grade points and UF grading policies, see <https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

## **Assessments**

Students will be introduced to smaller groups early in the semester, after the drop-add period. Any team-structured assignments will be executed by the students collectively within these groups. For the Journal Club, Around the World in Eight Microbiomes, and original research experience assignments, both individual and team assignments will be built in. Quizzes are meant to be completed only by the individual.

## **Journal Club**

At three points in the semester, students will engage in their group in what is called a Journal Club. This is a regular gathering of scientists to discuss a scientific paper or papers. Typically, one student will present a paper more in-depth, and the whole group will discuss it. Such platforms provide a few benefits: 1) staying abreast of new knowledge and research, 2) improvement of scientific reading skills, 3) practice presenting, both orally and visually, 4) networking and improving dialogue and interpersonal relationships with others, 5) practice interpretation of data. Such discussions encourage improvement of outcomes in research.

Here, three journal clubs will be held virtually. Each student will be assigned to pick and present a paper at one of the journal clubs. They will provide the citation for the paper, their take-away, and a short, recorded 10-15-minute presentation for their peers to watch. Because the groups will be smaller, it is expected that only 2-3 students per group will present their papers at each Journal Club. Students will be expected to review the presentations, ask questions and discuss the papers with one another throughout the span of the journal club, with active dialogue assessed on a Discussion Board. Presentations *cannot* be submitted late, as they must be posted in a timely manner to encourage active discussion. Discussion will be open for a full week. Specifics will be provided with the release of the assignment.

- Journal Club Presentation (1 total – 7% of the grade)
- Journal Club Discussions (2 total – 8% of the grade)

### **Quizzes**

All quizzes are open book and unproctored. These quizzes are a *learning tool* so you may take each quiz up to **three times each** and only your last score of quiz will be recorded. A quiz will not be re-opened or reset if it is interrupted by technical difficulties. (NOTE: A slow internet connection may affect timed quizzes, but it is your responsibility to use a connection at the speed suggested in the e-learning homepage.) A 5<sup>th</sup> optional quiz will be open at the end of the semester. If you miss a quiz or if you want to obtain a better grade, you can take this last quiz. We will drop the lowest grade of any of the 4 previews quizzes and substitute by the grade of the 5<sup>th</sup> quiz.

Following the close of each quiz window, you have 10 calendar days to contest your quiz/exam grade in an email to us (i.e., a student cannot request a grade correction on quiz 2 during the last week of the course). Please note that you can ask a question about or discuss any quiz question at any time during the semester for the purposes of understanding and education. Any requests for points must include a clear justification of your response. For example, please do not send an email saying, “tell me why I am wrong”, but rather send an email saying, “this is why I think my response is a better answer or is as complete or appropriate....”

Quizzes will open on Wednesdays and remain open for a full week, closing the following Wednesday, to allow flexibility for taking the quiz according to your schedule.

### **“Around the World in 8 microbiomes” Project**

Students will be asked to read and review recently published papers from the current microbiome literature where connections between the microbiome with different ecological niches have been reported. We'd like you to work in teams to further investigate one such microbial niche. You will answer a few questions about your assigned microbial niche, read several papers of your choice on this microbial niche, and prepare a graphical abstract or infographic about what you learned about the niche along with a short video explanation. We will share the graphics and videos with the class in a separate module.

### **Original Research Project on the saliva microbiome**

To provide all students with some hands-on experience in microbiome research, we have designed a semester-long course project utilizing real microbiome data from one of our research studies (our research team calls this research study “The Great Florida Spitting Contest”). Throughout the course project, you will learn some essential elements of human studies research, including but not limited to research regulation, ethics, scientific literature review, scientific writing, data analysis and interpretation, and science communication. It is not expected for you to have expertise or background in any of these areas. We will use open-source, user-friendly interfaces for you to perform the required analysis, in addition to Microsoft Excel. You will work with a pre-processed data set to simplify the exercise and minimize the time for analysis. This will allow you more time to think *critically* about the findings and collaborate on the final project accordingly.

### **Virtual Symposium**

We will compile the final team presentations generated from the semester-long, original research experience. At the conclusion of the course, we will post these presentations for the class,

as well as invited speakers. This will be structured as the Class Virtual Symposium. The content will be available for several days to engage with at your leisure. To affirm that students interacted with the material, there will be an individual, written assignment connected to the Symposium.

### **Assignment for MCB 6670C – graduate students only**

As requested by UF CALS Curriculum Committee, assignments must account for at least a 15% difference in graded material between the undergraduate and graduate levels. To account for these differences, extra questions will be asked to graduate students during the quizzes and other assessments.

### **Late submissions**

If we accept a late submission on a particular assignment, this will be made known to students in advance when the assignment is released. Under this policy, such an assignment can be submitted up to two days late, with a 10% late deduction each day. We will not accept late submissions on quizzes or assignments structured around teamwork.

### **Assessment Breakdown**

Journal Club (2 total)	15%
Quizzes (4 total)	32%
“Around the World in 8 microbiomes” Project	15%
Original Research Project on the saliva microbiome	35%
Virtual Symposium	3%
<b>Total</b>	<b>100%</b>

**Make up and attendance policy:** This is an online course that gives students enormous scheduling flexibility. Every assignment will be given at least double the adequate time needed to complete the assessment based on past experiences. Hence, accommodation for up to double the time needed to take an exam is already included in the assessment periods. As a result, there will be no makeup exams or quizzes for reasons not accepted by the University. An illness documented by a physician (not a physician's assistant) is grounds for a makeup exam. Otherwise, the deadlines are real and strict. As a student, it is your choice to take all quizzes and exams. If you choose not to take a quiz because of another activity (work, social engagement, etc.), you will get a zero for the grade.

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

**Textbook: There is no required or recommended textbook.**

**Course structure:** The course is structured as 14 lessons or modules – one each week of the semester. Each week will cover a different topic. The topics are built on each other, so in order to understand a topic in week 6, for example, it is necessary that you understand the material from week 1. The first 4 weeks of the course lay the foundation for the remaining weeks.

Each week begins on Monday morning, which is the day by which a new week's worth of material will be posted. Every effort on my part will be made to post material prior to Mondays, but that may not always happen. Start by navigating to the Lessons page. Then, click on the appropriate week. For each week's lesson, there will be several items to complete. Click on the link for each item. The first item will be the **learning objectives** for the week. Keep the learning objectives in mind as you learn the week's material. If you meet the learning objectives, you should do very well on the quiz and the exams. After reading the learning objectives, please go through the week's material in the order presented. The next item in the list will usually be the reading assignment (a handout) followed by the lectures, and links to any online tutorials or modules. After you go through the material in the order presented, you are always free to return and visit any of the content. The introductory lecture will give an example of the types of course content and how it will be presented. The pdf of the lecture slides will also be posted each week for your convenience. This convenience is for students who wish to print out the slides and follow along with the lecture, study the notes later, etc. The lectures slides will only be available in pdf format.

**Academic Honesty:** As a student at the University of Florida, you have committed yourself to uphold the Honor Code, which includes the following pledge: "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity." You are expected to exhibit behavior consistent with this commitment to the UF academic community, and on all work submitted for credit 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."

It is assumed that you will complete all work independently in each course unless the instructor provides explicit permission for you to collaborate on course tasks (e.g. assignments, papers, quizzes, exams). Furthermore, as part of your obligation to uphold the Honor Code, you should report any condition that facilitates academic misconduct to appropriate personnel. It is your individual responsibility to know and comply with all university policies and procedures regarding academic integrity and the Student Honor Code. Violations of the Honor Code at the University of Florida will not be tolerated. Violations will be reported to the Dean of Students Office for consideration of disciplinary action. For more information regarding the Student Honor Code, please see: <http://www.dsoufl.edu/SCCR/honorcodes/honorcode.php>.

**Additional comments regarding academic integrity:**

Students are encouraged to discuss material with each other from the course, help each other understand concepts, study together, and even discuss assessment questions with each other once the quiz window is closed. However, the following is considered academic dishonesty, and I expect that no student will ever do any of the following:

- Have another person complete a quiz in this course
- Copy another student's quiz in this course
- Collaborate with anyone during a quiz in this course
- Discuss the questions and answers of a quiz with other students while the quiz window is still open
- Manipulate and/or distribute any materials provided in this course for any purpose (including course lecture slides).



- Use any materials provided by a previous student in the course

**Software Use:** All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate.

**Campus Helping Resources:** Students experiencing crisis or personal problems that interfere with their general well being are encouraged to utilize the university's counseling resources. The Counseling & Wellness Center provides confidential counseling services at no cost for currently enrolled students. Resources are available on campus for students having personal problems or lacking clear career or academic goals, which interfere with their academic performance.

- *University Counseling & Wellness Center, 3190 Radio Road, 352-392-1575, [www.counseling.ufl.edu/cwc/](http://www.counseling.ufl.edu/cwc/)*
  - Counseling Services
  - Groups and Workshops
  - Outreach and Consultation
  - Self-Help Library
  - Training Programs
  - Community Provider Database
- *U Matter, We Care:* If you or a friend is in distress, please contact [umatter@ufl.edu](mailto:umatter@ufl.edu) or 352-392-1575 so that a team member can reach out to the student.
- *Career Resource Center, First Floor JWRU, 392-1601, [www.crc.ufl.edu/](http://www.crc.ufl.edu/)*

**Students Requiring Accommodations:** Students requesting class accommodation must first register with the Dean of Students Office. The Dean of Students Office will provide documentation to the student who must then provide this documentation to the Instructor when requesting accommodation.

There are no timed quizzes, so exam/quiz length is not a concern in this course.

The Disability Resource Center coordinates the needed accommodations of students with disabilities. This includes registering disabilities, recommending academic accommodations within the classroom, accessing special adaptive computer equipment, providing interpretation services and mediating faculty-student disability related issues. 0001 Reid Hall, 352-392-8565, [www.dso.ufl.edu/drc/](http://www.dso.ufl.edu/drc/)

### **Statement on Distance Education Courses**

Should you have any complaints with your experience in this course, please visit <http://www.distance.ufl.edu/student-complaints>.

### **Course Evaluation**

Students are expected to provide feedback on the quality of instruction in this course by completing online evaluations at <https://evaluations.ufl.edu>. Evaluations are typically open during the last two

or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at <https://evaluations.ufl.edu/results/>.