

# Microbiomes of Animals and Ecosystems

PCB4917/ZOO6927

## **Class Periods:**

- Monday, Period 3 – 4 (9:35 AM – 11:30 AM)
- Tuesday, Period 3 – 5 (9:35 AM – 12:35 PM)
- Wednesday, Period 3 – 5 (9:35 AM – 12:35 PM)
- Thursday, Period 3 – 4 (9:35 AM – 11:30 AM)

**Location:** TBD

**Academic Term:** Spring 2024, First Immersion Session

**Instructor:** Christopher Dutton

**Research Areas:** Microbiomes, low-cost open source technologies, environmental monitoring, aquatic ecosystem ecology, biogeochemistry, microbial community dynamics, conservation

**Email:** [duttonc@ufl.edu](mailto:duttonc@ufl.edu) (please contact me through Canvas for course related emails)

**Office Hours:** Anytime, by appointment (typically within a few hours of notice)

**Office:** Carr Hall, 510

**Course Website:** Canvas (<https://elearning.uf.edu/>)

## **Course Description**

We will learn about how to conduct a basic microbiome study using captive Zoo animals of conservation concern. As part of this, we will work with Zoo Keepers to identify interesting questions related to captive animal microbiomes, collect samples, extract DNA, prepare sequencing libraries, then sequence the samples to reconstruct the microbiomes of the animals and their immediate environment. This course will involve the use of HiPerGator and the R statistical programming language. The final project of the course will be a full workflow documented in R markdown and a brief presentation to the Zoo staff. This course will involve several trips to a Zoo and developing a working relationship with the Zoo keepers. **The overarching goal of this course is to inspire you and to have fun exploring microbial ecology.** 4 Credit Hours.

## **Course Objectives**

These are my top 7 course objectives. We'll approach each of these objectives through readings, lectures, discussions, and hands-on practice.

1. **Understanding Microbiomes:** Gain a foundational understanding of what microbiomes are, including their composition, diversity, and functions in different animal species.
2. **Animal-Microbiome Interactions:** Explore the intricate relationships between animals and their microbiomes, focusing on how these interactions affect animal health, behavior, and evolution.
3. **Microbiome Diversity Across Species:** Study the variation of microbiomes across different animal species, including terrestrial and aquatic animals, and understand how these differences are shaped by environmental factors.

4. **Impact on Health and Disease:** Investigate how microbiomes influence animal health, including their role in disease resistance, digestion, and nutrient absorption, and how disruptions in microbiomes can lead to health issues.
5. **Methodologies in Microbiome Research:** Learn about the techniques and methodologies used in microbiome research, such as DNA sequencing and computational biology.
6. **Conservation and Microbiomes:** Understand the role of microbiomes in wildlife conservation efforts, including how microbiomes can be used as biomarkers for ecosystem health and species conservation.
7. **Hands-On Experience:** Provide practical experience through laboratory work, field trips, or research projects to apply theoretical knowledge to real-world situations.

#### **Format**

- This course is not your typical course. I have structured it as an investigative choose-your-own-adventure. We will learn about microbiomes, by actually working with Zoo keepers to investigate several current mysteries involving their animals.
- I anticipate that we will have three or four groups, with each group focusing on a separate mystery at a different facility (Disney's Animal Kingdom, Santa Fe Zoo, and Carlson Springs Wildlife Conservancy).
- There will be a final project and class presentation for each group. This will involve:
  1. Developing a hypothesis in related to a captive animal of conservation concern,
  2. Collect samples, extract DNA and do quality control,
  3. Sequence DNA on a Nanopore Minion,
  4. Analyze data using R,
  5. Give a short presentation to the class and Zoo staff on your project.

#### **Course Pre-Requisites / Co-Requisites**

None. No prior knowledge necessary.

#### **Materials and Supply Fees**

None! I've worked hard to make this course cheap and accessible.

#### **Required Textbooks and Software**

There are no required textbooks for this course. It is recommended that each person in this course brings a laptop computer with them during each class. At a minimum, each group will need a laptop computer during class. We will be using the following FREE software packages during this class:

- R Programming Language
  - <https://cran.r-project.org/>
- R Studio
  - <https://rstudio.com/>

#### **Recommended Materials**

Recommended readings, videos and material will be posted on the Canvas site.

#### **How to do well in this course?**

Show up and actively participate in your group. Ask questions when you don't understand something. There are no dumb questions! Reach out to me early for any problems, issues, or questions.

### ***Course Schedule***

This is a **preliminary outline** of the course schedule. The course will evolve throughout the five weeks depending on how the investigation proceeds.

#### **Week 1: Introduction to Microbiomes**

- Day 1 – Introduction to the course and material, Microbiomes of Animals and Ecosystems
- Day 2 – Trip to Carson Springs Wildlife Conservancy.
- Day 3 – Trip to Santa Fe Zoo.
- Day 4 – Trip to Disney's Animal Kingdom (ALL DAY TRIP)

#### **Week 2: Extractions**

- Day 5 – **Holiday. No Class.**
- Day 6 – Laboratory Work Overview of Equipment and Techniques
- Day 7 – Laboratory Work. Extractions of fecal and environmental samples.
- Day 8 – Laboratory Work and Sequencing Overview

#### **Week 3: Sequencing**

- Day 9 – Laboratory Work
- Day 10 – Laboratory Work
- Day 11 – Laboratory Work
- Day 12 – Laboratory Work and Bioinformatic Overview

#### **Week 4: Bioinformatics**

- Day 13 – Bioinformatics
- Day 14 – Bioinformatics
- Day 15 – Bioinformatics
- Day 16 – Bioinformatics

#### **Week 5: Presentations and Wrap-up**

- Day 17 – Project Group Work.
- Day 18 – Trip to Carson Springs for Presentations
- Day 19 – Trip to Santa Fe Zoo for Presentations
- Day 20 – Trip to Disney for Presentations, class wrap-up. (ALL DAY TRIP)

### ***Attendance Policy, Class Expectations, and Make-Up Policy***

Attendance and participation are mandatory and will be a large part of your final grade. Due to the fast-paced nature of this course, it is very important to attend all classes. Of course, I understand that things come up and that's OK too. You will need to meet with me as soon as possible after a missed class so that I can bring you up to speed with what you missed. If you know that you will miss a class, please notify me ahead of time so that we can plan to make it up. Excused absences must be consistent with university policies and require appropriate documentation. Additional information can be found here: <https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>

### ***Evaluation of Grades***

<b>Assignment</b>	<b>Total Points</b>	<b>Percentage of Final Grade</b>
Attendance	60	60%
Final Project	30	30%
Presentation	10	10%
<b>TOTAL:</b>		<b>100%</b>

***Grading Policy***

Percent	Grade	Grade Points
90.0 - 100.0	A	4.00
87.0 - 89.9	A-	3.67
84.0 - 86.9	B+	3.33
81.0 – 83.9	B	3.00
78.0 - 80.9	B-	2.67
75.0 - 79.9	C+	2.33
72.0 – 74.9	C	2.00
69.0 - 71.9	C-	1.67
66.0 - 68.9	D+	1.33
63.0 - 65.9	D	1.00
60.0 - 62.9	D-	0.67
0 - 59.9	E	0.00

More information on UF grading policy may be found at:

<http://gradcatalog.ufl.edu/content.php?catoid=10&navoid=2020#grades>

<https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

***Students Requiring Accommodations***

Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center by visiting <https://disability.ufl.edu/students/get-started/>. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

***Course Evaluation***

Students are expected to provide feedback on the quality of instruction in this course by completing online evaluations at <https://gatorevals.aa.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://gatorevals.aa.ufl.edu/>.

***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://www.dso.ufl.edu/sccr/process/student-conduct-honor-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 or TAs in this class.

***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. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

#### ***Student Privacy***

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see:

<http://registrar.ufl.edu/catalog0910/policies/regulationferpa.html>

#### ***Campus Resources:***

##### ***Health and Wellness***

###### **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.

**Counseling and Wellness Center:** <http://www.counseling.ufl.edu/cwc>, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

###### **Sexual Assault Recovery Services (SARS)**

Student Health Care Center, 392-1161.

**University Police Department** at 392-1111 (or 9-1-1 for emergencies), or <http://www.police.ufl.edu/>.

#### ***Academic Resources***

**E-learning technical support**, 352-392-4357 (select option 2) or e-mail to [Learning-support@ufl.edu](mailto:Learning-support@ufl.edu).  
<https://lss.at.ufl.edu/help.shtml>.

**Career Resource Center**, Reitz Union, 392-1601. Career assistance and counseling.  
<https://www.crc.ufl.edu/>.

**Library Support**, <http://cms.uflib.ufl.edu/ask>. Various ways to receive assistance with respect to using the libraries or finding resources.

**Teaching Center**, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring.  
<https://teachingcenter.ufl.edu/>.

**Writing Studio, 302 Tigert Hall**, 846-1138. Help brainstorming, formatting, and writing papers.  
<https://writing.ufl.edu/writing-studio/>.

**Student Complaints Campus**: [https://www.dso.ufl.edu/documents/UF\\_Complaints\\_policy.pdf](https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf).

**On-Line Students Complaints**: <http://www.distance.ufl.edu/student-complaint-process>.

