

R For Life Sciences
MCB6937
3 credit hours
Academic Term: Summer 2023

Instructor:

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The best way to contact me is via E-learning mail or I can set up a time for individual zoom sessions or in-person meetings.

Course Description Introductory course to the basics of the R language and to state-of-the-art methods of analysis, including statistical, applicable to a variety of large biological data sets. Students will learn how to navigate through the RStudio environment, create R projects, learn good practices for data reproducibility, and practice data analysis and interpretation based on existing biological data.

Background: R is a powerful and widely-used programming language for statistical analysis and data science. You can use it to do various tasks like store data, analyze data, and create statistical models and graphs. This course has a minimum grade of C and is intended for majors in Life Sciences. It will be taught at the senior level and its primary objective is to understand, conceptualize and incorporate R language to solve data analysis problems. This course intends to teach students how to operate the R environment, including how to import external data, manipulate data for specific needs, run statistical tests broadly used in Life Sciences, and visualize data using charts, histograms, scatterplots, and other types of graphs. No background in computer science is needed. We will start learning the basics and growing up with practical examples.

The course will be entirely web-based, and all lectures will be delivered online. The only prerequisite is to have a computer where R and RStudio can be installed. The assignments, course lecture materials, and online activities will be posted each week.

Course Pre-Requisites: This course requires MCB3020 or MCB3023 as pre-requisites

Textbook: There is no required or recommended textbook.

Course Objectives:

1. Students will be able to successfully operate and navigate through the RStudio environment and create R projects.

2. Students will be able to select and explain the use of the most popular R packages available for Life Sciences.
3. Students will be able to create and customize graphs for different data types using modern data visualization tools.
4. Students will be able to execute and interpret basic statistics in R and exploratory data analysis.
5. Students will be able to demonstrate good practices for data reproducibility, to document and share their work.
6. In addition to that, students will be able to interpret existing biological data through data analysis.

e-Learning system: The course will be managed entirely through e-Learning in the Canvas system (one of two big orange buttons at <https://elearning.ufl.edu/>). If you are unfamiliar with this system, you must become acquainted with it for this course. The LSS homepage contains tips and tutorials for students and [computer requirements](#). You are responsible for becoming familiar with e-Learning in Canvas and ensuring that you have the appropriate browsers, settings, internet speed, etc. For any technical questions regarding Canvas, please visit the e-learning site (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 sending 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 request help from 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 the Meetings function in e-Learning in Canvas or 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 set up an individual phone or zoom conversation. Just contact us to arrange.

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. It is your responsibility to check 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 that you are not missing any critical communications. As the 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 week
1	May 15	Setting up and installing the tools.
2	May 22	Microbiome data visualization, relative abundance, and data transformation.
3	May 29	Evaluating biosurfactant production. Formatting data, normality test, power, and effect size.
4	June 5	Carbon dioxide emissions. Filtering, grouping, and summarizing information.
5	June 12	Gene expression. Log2 fold change and FRD in volcano plots.
6	June 19	Writing reports to show data characteristics and variability. Testing pairwise differences with the t-test and more
7	June 26-30	Summer break
8	July 3	Visualizing microbial community structure with ordination approaches
9	July 10	Testing microbial community differences with Multivariate Permutational Analysis of Variance
10	July 17	Microbial diversity measurements
11	July 24	Hierarchical clustering
12	August 7	Microbial growth with scatter plots and line plots

Grading Scale:

	<u>Percentage/Points</u>
A	90 or above
A-	87-89.9
B+	84-86.9
B	80-83.9
B-	77-79.9
C+	74-76.9
C	70-73.9
C-	67-69.9
D+	64-66.9
D	60-63.9
D-	57-59.9

E 56.9 or below

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

Assessments

Assignments (5 total, drop the 1 with the lowest score): This is a practical class. To provide all students with some hands-on experience, I designed assignments using real biological data from our lab and the literature. Throughout the course, you will learn how to write your code to generate reproducible reports with customized graphs and tables. Through assignments, the students will have the opportunity to use the R packages presented in class and get used to the main capabilities of each package.

The four highest-scoring assignments will each be worth 12% of your course grade for **60%** of your course grade. The lowest score of the six project assignments will be dropped. The assignments are due roughly every other week and are staggered with the assigned quizzes. **The tentative assignment due dates are listed below and are subject to change.** You will be notified in Canvas when each assignment is open.

Final project assignment for graduate-level students

Graduate students will be required to write a final report (case study writing assignment) using their own data or any other data available on public databases. This assignment will be worth **18%** of the course grade. Each graduate student writes his or her own report. There will be no working in groups on this. All assignments for the report **MUST** be entered into Canvas. The objective of this report is not just to show how a set of data was analyzed using R, but also to present the results following the standards of a scientific paper.

Project assignment times and dates (dropping lowest score of one assignment):

These assignments will be open at 2 PM on Fridays (see dates below) and must be completed **next Friday**. Due at 11:59 PM:

Assignment 1	June 5
Assignment 2	June 19
Assignment 3	July 3
Assignment 4	July 17
Assignment 5	August 7

Quizzes: Brief quizzes will ensure timely participation and progress in the course. All quizzes are open-book and unproctored. These short quizzes will be available at 2 PM on

Wednesdays (see dates below) and must be completed by next **Tuesday BY midnight**. These quizzes are a *learning tool* so you may take each quiz up to **three times each** and only your **last score** of each week's quiz attempt will be recorded. Your quiz average will count for **22%** of your final grade. There will be a total of 4 quizzes. You can drop one lowest quiz score. 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.)

Following the close of each quiz and assignment window, you have 10 calendar days to contest your quiz grade in an email to me (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/assignment question at any time during the semester for 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 instead send an email saying, "this is why I think my response is a better answer or is as complete or appropriate...."

Quiz times and dates (dropping 1 lowest score):

	Begins 2 PM:
Quiz 1	June 12
Quiz 2	June 25
Quiz 3	July 10
Quiz 4	July 24

Course structure: The course is structured as 12 lessons or modules – one each week of the semester. Each week will cover a different topic. The topics build on each other, so to understand a topic in week 2, you must understand the material from week 1.

Each week begins on Monday morning when a new week's material will be posted. Every effort on my part will be made to post material before 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. After reading the learning objectives, please go through the week's material in the order presented. After you go through the material in the order presented, you are always free to return and visit any content. The introductory lecture will give an example of the types of course content and how it will be presented.

Grades and Grade Points

For information on current UF policies for assigning grade points, see <https://catalog.ufl.edu/UGRD/academic-regulations/grades-grading-policies/>.

Attendance and Make-Up Work

Requirements for class attendance and make-up exams, assignments and other work are consistent with university policies that can be found at:
<https://catalog.ufl.edu/UGRD/academic-regulations/attendance-policies/>.

Online Course Evaluation Process

Student assessment of instruction is an important part of efforts to improve teaching and learning. At the end of the semester, students are expected to provide feedback on the quality of instruction in this course using a standard set of university and college criteria. Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at: <https://gatorevals.aa.ufl.edu/students/>. 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 <https://ufl.bluera.com/ufl/>. Summaries of course evaluation results are available to students at: <https://gatorevals.aa.ufl.edu/public-results/>.

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.dso.ufl.edu/sccr/process/student-conduct-honor-code>.

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. 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 or assignment in this course
- Copy another student's quiz or assignment 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.

Services for Students with Disabilities

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. Students requesting classroom 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.

0001 Reid Hall, 352-392-8565, <https://disability.ufl.edu/>

Campus Helping Resources

Students experiencing crises or personal problems that interfere with their general

wellbeing 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
Counseling Services
Groups and Workshops
Outreach and Consultation
Self-Help Library
Wellness Coaching

- U Matter We Care, www.umatter.ufl.edu/
 - Career Connections Center, First Floor JWRU, 392-1601, <https://career.ufl.edu/>.
 - Student Success Initiative, <http://studentsuccess.ufl.edu>.
- Student Complaints:
- Residential Course: <https://sccr.dso.ufl.edu/policies/student-honor-code-studentconduct-code/>.
 - Online Course: <http://www.distance.ufl.edu/student-complaint-process>