R For Life Sciences
MCB6937
3 credit hours
Academic Term: Fall 2022

Instructor:
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Office hours: Tuesday and Friday 3:00 – 5:00 PM
Office location: Microbiology and Cell Science Department – office #1247
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 the e-Learning in the Canvas system (one of two big orange button 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 and computer requirements. It is your responsibility to become familiar with e-Learning in Canvas and ensure 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 not being able 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 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	Aug 29 – Set 2	Installing R and RStudio; Navigating the RStudio; Creating an R Project and entering data
2	Set 5 - 9	Exploratory data analysis – descriptive statistics and basic graphics
3	Set 12-16	Installing packages; Customizing graphs with ggplo2
4	Set 19-23	Customizing graphs with ggplo2
5	Set 26-30	R Markdown – building reports in pdf and html
6	Oct 3-7	The core tidyverse packages – chaining your code, cleaning, filtering, selecting, arranging and more
7	Oct 10-14	Efficient and quick approach to perform iterations – The apply family
8	Oct 17-21	Executing and interpreting statistical tests using R: t-test, ANOVA, Power analysis, Tukey HSD test and more
9	Oct 24-28	Practicing with real data I
10	Oct 31 – Nov 4	Practicing with real data II
11	Nov 7-11	Practicing with real data III
12	Nov 14-18	Practicing with real data IV
13	Nov 21-25	Practicing with real data V November 23 - 26: Thanksgiving break
14	Nov 28 – Dec 2	Practicing with real data VI
15	Dec 5	Project report due 5 PM for graduate students only

Grading Scale:

	Percentage	**Points**
A	90 or above	90-100
A-	87-89.9	87-89.9
B+	84-86.9	84-86.9
B	80-83.9	80-83.9
B-	77-79.9	77-79.9
C+	74-76.9	74-76.9
C	70-73.9	70-73.9
C-	67-69.9	67-69.9

D+	64-66.9	64-66.9
D	60-63.9	60-63.9
D-	57-59.9	57-59.9
E	56.9 or below	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 (6 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. You will learn how to write your code to generate reproducible reports with customized graphs and tables throughout the course. 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 five 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. Your dropped assignment grade will include any assignment you miss for **any** reason. This includes minor illness, travel, meetings, **technical problems,** etc. 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. For the formatting of the report, we will use the instructions from Trends in Microbiology: http://www.cell.com/trends/microbiology/authors. Each report must follow that format precisely - up to 3500 words and 100 references in length. The abstract must be between 100 and 120 words. Clarity and conciseness of language will be important for each report. 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	September 9
Assignment 2	September 23
Assignment 3	October 7
Assignment 4	November 4
Assignment 5	November 18
Assignment 6	December 2

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 Fridays (see dates below) and need to be completed **Sunday evening 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. Your dropped quiz grade will include any quiz you miss for **any** reason. This includes minor illness, travel, meetings, and **technical problems** etc. Rarely, technical issues may occur while taking the timed quiz, and any quizzes affected by technical issues will count against your drops. 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.)

Plan to take each quiz and save up your dropped quizzes for unexpected events like illness or technical problems. If you do not take a quiz during the open quiz window, then you are shut out of the quiz, and it cannot be reopened for you.

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:	Ends 11:59 PM
Quiz 1	September 16	September 18
Quiz 2	October 14	October 16
Quiz 3	November 11	November 13
Quiz 4	November 25	November 27

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 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, 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 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