MATH 115: Quantitative Biology
Spring 2024

Contact Me	Meet with Me	Class Info
Name: Dr. Maggie **Pronouns:** She/Her/Hers **Email:** rahmoeller@roanoke.edu	**Office:** Trexler 270B **Student Hours (Drop In!):** Tues 3:00-4:00PM Wed 3:30-4:30PM Fri 9:30-10:30AM	**Location:** Miller 213 **Days:** MWF **Time:** 10:50 – 11:50AM

Student Hours Comments:

- The given times above will be consistently available unless emergencies arise.
- These are opportunities for you to ask me questions about material and/or class, including celebrations and concerns.
- Please come prepared to ask your questions – examples of more useful questions include, "I really don't understand what an exponential function is. Can you explain it again?" or "What does a test statistic measure again?". Examples of questions that are less useful include, "I'm completely lost. I don't know where to begin. Can you help?" or "I haven't looked at the homework…can you help me?"
- It's always ok to pop by and say, "HI!" – I love getting to know you and chatting with you! But, these have to be short, fun visits ☺ Sadly, none of us have time to sit back and chill anymore. But – please pop by any time for a short 5-10 minute hello. And – never be afraid to come by if you need help ☺

Course Description: This course is focused for students intending to pursue a degree in the biological sciences. The course builds upon statistics knowledge gained in INQ 240 and offers an introduction to mathematical modeling - both continuous and discrete. Students will learn how to apply appropriate models and statistical tests to a variety of situations.

Intended Learning Outcomes: By the end of this course, you will be able to:
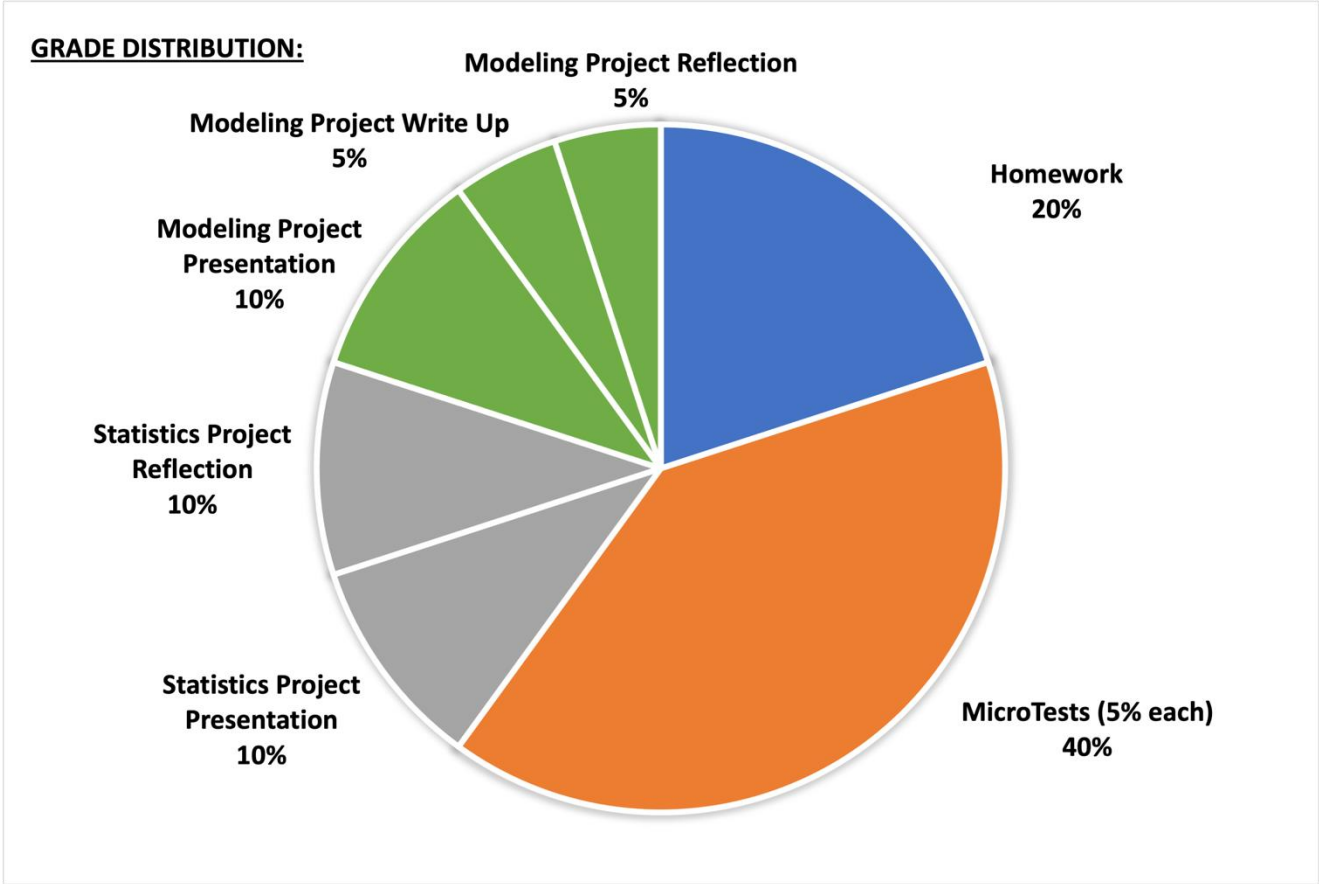
- Given a research question or data set, choose an appropriate statistical test to use.

- Research, find, and utilize additional statistical tests outside of those found in INQ 240 or this course.

- Understand the concepts of a derivative and its importance in mathematical modeling.

- Understand the terms that appear in mathematical models relevant to biology and apply those models in appropriate ways.

- Understand the mathematics and statistics present in selected biology research papers.

> Your success in this class is important to me! We all learn differently and bring a variety of strengths and needs to the class. If there are aspects of the course that prevent you from learning or that make you feel excluded, please let me know as soon as possible. Together we'll develop strategies to meet both your needs and the requirements of the course.

Required Materials:

- *Handbook of Biological Statistics*, McDonald (http://www.biostathandbook.com/)

- *Calculus for the Life Sciences*, Cornette and Ackerman, 2010 (on Inquire)

- **STRONGLY RECOMMENDED:** Laptop Computer (not an iPad or tablet, etc.)

Commitment Hours: This course expects you to spend at least 12 hours of work a week inside and outside of class.

GRADE DISTRIBUTION:

Modeling Project Reflection
5%

Modeling Project Write Up
5%

Modeling Project
Presentation
10%

Statistics Project
Reflection
10%

Statistics Project
Presentation
10%

Homework
20%

MicroTests (5% each)
40%

A:	94-100	B:	83-86	C:	73-76	D:	63-66
A-:	90-93	B-:	80-82	C-:	70-72	D-:	60-62
B+:	87-89	C+:	77-79	D+:	67-69	F:	Below 60

Classroom Environment: You are expected to treat all students in the class and me with courtesy and respect. Your comments to others should be factual, constructive, and free from harassing statements. You are encouraged to disagree with other students, but such disagreements need to be based upon facts and documentation (rather than prejudices and personalities). My goal is to promote an atmosphere of mutual respect in the classroom. Please let me know if you have suggestions for improving the classroom environment. (Source: Iowa State University)

Diversity and Inclusivity

I consider this classroom to be a place where you will be treated with respect, and I welcome individuals of all ages, backgrounds, beliefs, ethnicities, genders, gender identities, gender expressions, national origins, religious affiliations, sexual orientations, ability – and other visible and nonvisible differences. All members of this class are expected to contribute to a respectful, welcoming and inclusive environment for every other member of the class.

Attendance Policy: Our course's success depends on you attending class! If you miss class, you will miss community building, engaging conversations, and information that I deem worthy of your time! Plus, we will miss you!

However, life happens! You may get sick, have a game scheduled, or have something else come up. It will not be the end of the world if you miss a class *very occasionally*. At some point, though, missing class can be detrimental to success. So, do your best to be in class! Strive for perfect attendance!

What should you do if you have to miss class? Let me know ASAP! Communication is key! I don't need details (please, spare me the details!) but do let me know ahead of time, so we can make plans, if

needed. If you cannot let me know ahead of time (emergencies do happen!), just let me know as soon as you can. Email is typically the best form of communication for me.

If you are sick (and contagious), please either stay home OR come to class wearing a mask (unless you have COVID symptoms – then follow both Roanoke College & CDC guidelines). And be sure to use Health Services on campus!

Late Work: Whether or not to accept late work is always a tough decision. Life happens – and occasionally we need more time to complete tasks! But, sometimes turning in an assignment late causes more complications than benefits.

In this course, we will have daily HW, Project presentations & reflections, and MicroTests:

- I need to be able to return homework and post solutions QUICKLY in this class. **Once the homework solutions have been posted to Inquire, I will not accept your homework.**
    - Note that you have 36 homework assignments this semester…I know, it seems like a lot. I will keep them as reasonably short as possible – some may take a little more time due being part of a project or requiring finicky software. Please let me know if you feel overwhelmed with HW work in this class – it may result in changes in HW structure.

    - Since there are 36 assignments and HW is worth 20% of your grade, it's equivalent to each assignment being worth ½ a percentage point for your final grade. What does this mean? Say you miss 2 HW assignments and ACE everything else in the class, you'd get a 99%. Say you did no HW and ACED everything else (highly unlikely…), you'd get an 80% in the class. Missing an assignment here or there is not the end of the world – but strive to do them all!

- Project presentations are set for specific days – it's really hard to make up a presentation. I have worked with students in the past in emergency situations, but let's aim for no emergencies ;) These are group projects, too, which means it's really hard to find a solution if one member isn't there. It can be done…but it's not fun. **Should you miss a presentation, you will be given a make-up assignment to complete on your own…and have to present**

by yourself on that assignment.

- MicroTests are also scheduled for specific days, but these are individual and, dare I say it, easier to make up if missed. **But, except for emergencies, I will only allow a make-up MicroTest if you reach out to me ahead of time with your legitimate excuse and I give an ok.**

> ****In summary, the best thing you can do is *communicate* with me.** Let me know if you have concerns about turning in an assignment on time – I will do my best to work with you.**

Academic Integrity: Students are expected to adhere to the Academic Integrity policies of Roanoke College (https://www.roanoke.edu/inside/a-z_index/academic_integrity). All work submitted for a grade is to be your own work! No collaboration is allowed on MicroTests.

Please – work with each other on homework! This doesn't mean you copy another person's work or sit idly while they do the work – rather, chat with each other, brainstorm with each other, and/or look over notes together and ask each other clarifying questions. Why participate in active collaboration rather than passive collaboration?
1) You will learn WAY better!
2) It's more fair to your study buddy – why should they do your work for you?
3) It's sounds pretty boring to have to sit there while your study buddy does all the work.

You may use software from class (e.g., RStudio, Mathematica) for help with any homework and project work. You may also look at solutions to problems we have done in class, problems that are worked through in the textbook for the course, and class notes. But using unauthorized sources is a violation of Academic Integrity. This includes solutions posted online (not on Inquire), "homework help" sites, and Artificial Intelligence Tools. Uploading our course assignments to these sites is also a violation of Academic Integrity.

WHY? You spend a lot of money attending Roanoke College working toward a (or several) degree(s). Don't you want that degree to mean something? If RC students are only getting degrees by cheating,

---

COURSE ASSIGNMENTS

Homework: Homework will be assigned regularly in this class (pretty much every class period) and may take several forms. Typically, it will be due at the start of the class period immediately following the assigning of the homework. Homework will be graded partly on effort and partly on correctness. **Work will be submitted through Inquire – pdf only!**

- **Effort**: Minimal response? One-line answers? Leaving problems blank? Too messy? All of these show lack of effort. Complete sentences? More than just the minimal response? Providing explanation or reflection, not just a basic answer? All of these show positive effort. Aim for positive effort. You don't have to write pages…unless necessary for a specific type of problem.

- **Correctness**: I don't expect you to be right 100% of the time. Part of doing homework is giving you the opportunity to try working problems on your own – this is when you discover what material you are comfortable with and what material you aren't comfortable with. However, correctness is a part of effort. Having problems incorrect shows more than just lack of understanding – it also shows lack of effort. I encourage you to ask me questions, to work with peers in class, and to read the text and class notes – all of these show effort and help you learn the material more efficiently and better!

MCSP Conversation Series: The MCSP+ department and Roanoke College offer many opportunities to engage with mathematical ideas outside of classes. Members of this class are encouraged to attend many of these activities, however attending at least one is mandatory. Examples include MCSP Conversation Series talks, math bio talks from local institutions, and student research showcases - if you're unsure if a given activity makes sense for this purpose, please email me to ask.

Within one week of attendance (to help you remember the event), you must submit a brief response to the activity. This should not simply be a regurgitation of the content, but rather a personal contemplation of the experience.

Additional participation (and submission of reflection papers) will earn you extra credit, with .5% added to your course average for each attended, up to 2% total. In addition, individually, you may request that other appropriate events count.

Research Articles: You will examine 2 biology research papers. One paper will be based on statistical analysis of data and the other will focus on mathematical modeling. Articles will be provided along with guided reading questions.

Projects: There will be two projects for this course. The first project will assess your understanding of statistical analysis. The second project will assess your understanding of modeling a scenario based on assumptions about scientific principles that underlie the phenomena being modeled. For each project, you will work with a partner (different partner for each project). Both projects culminate in presentations, write-ups, and reflections. Detailed information will be covered in class and posted on Inquire.

MicroTests: There will be eight MicroTests this semester. The first 4 emphasize concepts about statistics, and the last 4 emphasize both concepts about modeling and computation for modeling. You may need your laptops to complete these MicroTests. What is a MicroTest? It's more than what we typically mean by *quiz* but less than what we typically mean by *test* – shorter than a test but should be treated more importantly than many of us treat quizzes. I expect them to last about half a class period – the rest of class will go toward material.

> **I know that testing can evoke stress for many students. Testing is very different from most other assignments in typical classes – you have no idea what is going to be on the tests, you know you only have a certain amount of time to work on the problems, and commonly, they are a one-and-done situation. It makes sense that these are stressful! MicroTests are shorter and hence cover less material – this helps with the first issue mentioned. Since there are 8 of them, each is worth 5% of your final grade…not enough to make or break your grade. And I'm always open to ideas to make them less stressful for you – so talk to me!!**

<div style="border: 2px solid navy;">

MCSP Tea Time

Thursdays, 2:20 – 3:20PM
Trexler 271

A chance to chill with peeps while munching on cookies and sipping tea! Often cards make an appearance – or other games! Take an opportunity to relax, have fun, and hang with other students and professors!

</div>

RESOURCES

Accessible Education Services (AES) is located in the Goode-Pasfield Center for Learning and Teaching in **Fintel Library**. AES provides reasonable accommodations to students with documented disabilities. To register for services, students must self-identify to AES, complete the registration process, and provide current documentation of a disability along with recommendations from the qualified specialist. Please contact Dustin Persinger, Assistant Director of Academic Services for Accessible Education, at 540-375-2247 or by e-mail at aes@roanoke.edu to schedule an appointment. If you have registered with AES in the past and would like to receive academic accommodations for this semester, please contact Dustin Persinger at your earliest convenience to schedule an appointment and/or obtain your accommodation letter for the current semester.

Subject Tutoring, located on the lower level of Fintel Library (Room 5), is open 4-9 PM, Sunday-Thursday. Subject Tutors are highly trained, current students who offer free, one-on-one (and small group) tutorials in over 80 courses taught at Roanoke College, including: Business, Economics, Mathematics, INQ 240, Modern Languages, Lab Sciences, and Social Sciences. Check out all available subjects and schedule 30- or 60-minute appointments at www.roanoke.edu/tutoring. If you have a question, feel free to stop by, or contact us at subject_tutoring@roanoke.edu or 540-375-2590. See you soon!

Student Health & Counseling Services supports students through in-person health appointments, in-person counseling, 24/7 telehealth (TimelyCare), Therapy Assistance Online, as well as resources related to general wellness, LGBTQ+, sexual assault, substance abuse, and suicide prevention. Unmet

health needs can negatively impact your performance in this course. Student Health & Counseling Services can help. Please see https://www.roanoke.edu/shcs for more information and to access services.

TENTATIVE COURSE SCHEDULE

Date	Section	Topic	HW
Wed Jan 17	McD	Data	1 – Find Dataset
Fri Jan 19	Supp.	Datasets	2 – Explore Dataset
Mon Jan 22	Supp.	Posing Questions	3 – Asking Stat Qs Part 1 Study!
Wed Jan 24		Project Intro	4 – Choose Variables (Project) Study!
Fri Jan 26	Supp.	MicroTest 1 / Statistical Q's	5 – Asking Stat Qs Part 2 (Project)
Mon Jan 29	McD	2 Sample T Test (means)	6 – 2 Sample T Test (DIY)
Wed Jan 31	McD	ANOVA intro	7 – ANOVA
Fri Feb 2	McD	ANOVA w/ R	8 – ANOVA (DIY) Study!
Mon Feb 5	McD	Chi Square Test (qualitative)	9 – Chi Square Variables (Project) Study!
Wed Feb 7	McD	MicroTest 2 / Chi Square w/ R	10 – Chi Square (DIY)
Fri Feb 9		Project Work Day – Chi Square	11 – Chi Square Write-Up (Project)
Mon Feb 12	McD	Linear Regression	11 – Linear Regression
Wed Feb 14	McD	Linear Regression	12 – Linear Regression (DIY) Study!
Fri Feb 16	McD	Logistic Regression	13 – Logistic Regression Study!
Mon Feb 19	McD	MicroTest 3 / Logistic	14 – Logistic Regression Variables (Project)
Wed Feb 21	McD	Logistic Regression	15 – Logistic Regression (DIY) Study!
Fri Feb 23	McD	Project Work Day - Logistic Reg	16 – Logistic Regression Write-Up (Project) Study!
Mon Feb 26		MicroTest 4 / Project Work Day	17 – Finalize Project / Reflection
Wed Feb 28		Presentation Day 1	
Fri Mar 1		Presentation Day 2	
SPRING BREAK!!			

Mon Mar 11	BioCalc	Intro to Modeling	18 – Choose NetLogo Model (Project)
Wed Mar 13	1.1-1.3	Dynamic Equations	19 – Dynamic Equations
Fri Mar 15	1.4-1.6	Doubling Time / Half Life	20 – Doubling Time / Half Life Study!
Mon Mar 18	1.7-1.9	Equilibrium	21 – Equilibrium Study! Read 1.10 & 1.11
Wed Mar 20		MicroTest 5	22 – Explore NetLogo Model 1 (Project)
Fri Mar 22	2.1-2.4	Functions	23 – Functions
Mon Mar 25	2.5-2.8	Periodic Functions	24 – Periodic Functions
Wed Mar 27	11.1-11.3	Graphing Solutions	25 – Graphing Solutions Study!
Fri Mar 29		NO CLASS – Good Friday	
Mon April 1	11.6-11.7	Population Modeling	26 – Population Modeling Study!
Wed April 3		MicroTest 6	27 – Explore NetLogo Model 2 (Project)
Fri April 5	3.1-3.2	Tangents / Limits	28 – Tangents / Limits
Mon April 8	3.3 / 7.2	Derivatives	29 – Derivatives Study!
Wed April 10	5.1-5.5	Exponential Functions	30 – Exponential Functions Study!
Fri April 12		MicroTest 7	31 – Explore NetLogo Model 3 (Project)
Mon April 15	3.4	Modeling with Derivatives	32 – Modeling with Derivatives
Wed April 17	7.4-7.5	Oscillation Systems	33 – Oscillation Systems
Fri April 19		MicroTest 8	34 – NetLogo Presentation (Project)
Mon April 22	Ch 13	Integration Part I	35 – NetLogo Write Up (Project)
Tues April 23	Ch 13	Integration Part II	36 - NetLogo Reflection (Project)
Fri April 26	8:30-11:30 AM	Modeling Project Presentations	