




# MATH 115: Quantitative Biology

## Spring 2022

Contact Me	Meet with Me	Class Info
		
<b>Name:</b> Dr. Maggie <b>Pronouns:</b> She/Her/Hers <b>Email:</b> rahmoeller@roanoke.edu	<b>Office:</b> Trexler 270B <b>Office Hours:</b> M/W 9:30-10:30AM F Noon – 1PM Appointments through: <a href="https://drmaggieonline.youcanbook.me/">https://drmaggieonline.youcanbook.me/</a>	<b>Location:</b> Trexler 372 (or Zoom) <b>Days:</b> MWF <b>Time:</b> 10:50 – 11:50AM

### Office Hours Comments:

- The given times above will be consistently available.
- Additional time slots will often be available through <https://drmaggieonline.youcanbook.me/>
- Office hours for the 1<sup>st</sup> two weeks of the semester will be on Zoom only. Hopefully after that we can switch to in-person office hours.

**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.

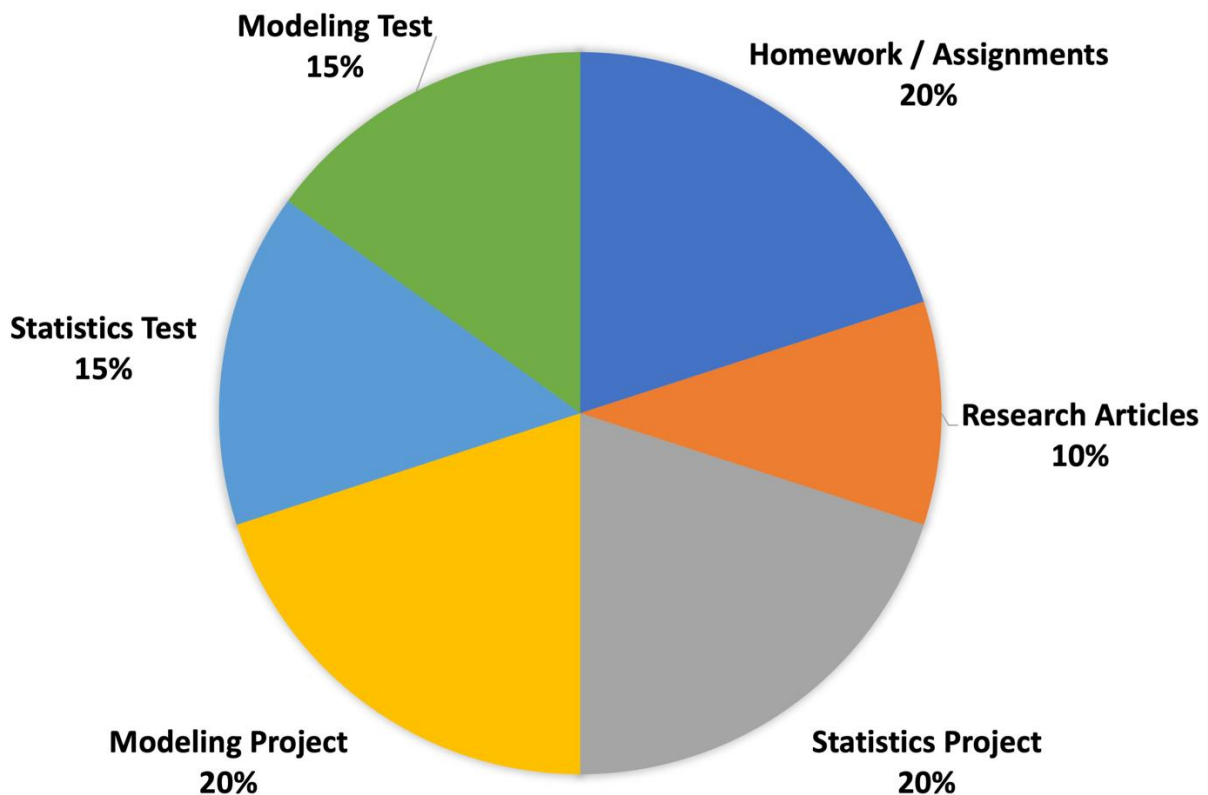
Your success in this class is important to me! We all learn differently and bring a variety of strengths and needs to the class. If there are aspects of the course that prevent you from learning or that make you feel excluded, please let me know as soon as possible. Together we'll develop strategies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

**Required Materials:**

- *Handbook of Biological Statistics*, McDonald (<http://www.biostathandbook.com/>)
- *Modeling Life: The Mathematics of Biological Systems*, Garfinkel, Shevtsov, Guo.

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

**GRADE DISTRIBUTION:**



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

---

## Course Expectations

---

**Class Structure:** We will (sadly) be online for at least the first 2 weeks of the semester (through Jan 31). We'll be meeting via ZOOM (link on Inquire). Then (hopefully!) we'll be back in person starting in February!

Lots of information is given on Inquire. Please always check Inquire for tasks that need to be completed!

**In-Class Policies:** Face masks must be worn over the mouth and nose by all of us anytime we are indoors. By wearing face coverings, we protect our college community and its most vulnerable members.

**Zoom Policies:** To download the Zoom Client for Meetings App, click here: <https://zoom.us/download>. If you scroll down, you will also see Zoom Mobile Apps - you can use the app on your phone. However, Zoom on a computer is better.

In order to participate while online, I ask that:

- your video is on in such a way that I can see your face
- your Zoom name consists of your name (nickname is good) - both first and last
- you mute yourself if there's a lot of background noise around you
- you take notes, ask questions (either verbally or through chat), and are awake
- if I have you work in small groups through Zoom breakout sessions, you join your breakout group and collaborate with your group members

Please contact me if you are having internet connectivity issues!

**Attendance Policy:** If you are sick (especially if you are contagious), please don't come to class! Email me and I will help you stay caught up with the material. If you are able to, feel free to join in on Zoom while class is meeting virtually.

Any absence that is not discussed with me prior to the missed class is considered unexcused. Unexcused absences may result in the lowering of the final grade (for example, a B to a B-), depending on the sheer number of absences. When absent, excused or unexcused, you are responsible for all material covered in class – so email me ASAP so we can work out a plan for you to be successful!

**Late Work:** No late work will be accepted unless you have contacted me prior to the due date and obtained permission to turn in late work. Permission will be granted only for rare circumstances outside your control, such as illness. Do not wait until the last minute to submit work that is due online.

**Academic Integrity:** You are expected to adhere to the Academic Integrity policies of Roanoke College ([https://www.roanoke.edu/inside/a-z\\_index/academic\\_integrity](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 MCSP Conversation Series Reflections, the research article assignments, nor the tests. Unless otherwise stated, you may work together on the homework, but you should write up your solutions separately. If you are looking at another person's work or asking someone what to do next while writing up your homework, then you are in violation of the academic integrity policy of Roanoke College. Using unauthorized sources is a violation of Academic Integrity. This includes solutions posted online (not on Inquire) and "homework help" sites such as Chegg or Course Hero. Uploading our course assignments to these sites is also a violation of Academic Integrity.

### **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.

---

## COURSE ASSIGNMENTS

---

**Homework:** Homework will be assigned regularly in this class (virtually 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. Students will submit their work through Inquire (pdf format only!!)

**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 (most will likely be offered through Zoom this semester) and student research showcases (should they happen this semester) - if you're unsure if a given activity makes sense for this purpose, please email me to ask.

**Within one week of attendance** 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). The first project will culminate in a paper (of the form of a biology research paper). The second project will culminate in a 10-15-minute presentation to be given during the final exam slot. Detailed information will be covered in class and posted on Inquire.

**Tests:** There will be two written tests. The first test will emphasize concepts about statistics. The second test will emphasize both concepts about modeling and computation for modeling. You may need your laptops to complete these tests.

---

## RESOURCES

---

**Accessible Education Services:** 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 Becky Harman, Assistant Director of Academic Services for Accessible Education, at 540-375-2247 or by e-mail at [aes@roanoke.edu](mailto: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 Becky Harman at your earliest convenience to schedule an appointment and/or obtain your accommodation letter for the current semester.

**Subject Tutoring:** 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](http://www.roanoke.edu/tutoring). If you have a question, feel free to stop by, or contact us at [subject\\_tutoring@roanoke.edu](mailto: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	Items Assigned	Items Due
Wed Jan 19		Intro to Course		
Fri Jan 21		Intro to R & Codebook		
Mon Jan 24	McD	Hypothesis Testing & Codebook		
Wed Jan 26	McD	2-Sample t Test		
Fri Jan 28	McD	Paired t Test		
Mon Jan 31	McD	ANOVA	Research Article 1	
Wed Feb 2	McD	ANOVA		
Fri Feb 4	McD	ANOVA		
Mon Feb 7		Project Introduction	Step 1: Choose Chronic Health Condition	Res Article 1 Step 1 Project
Wed Feb 9	McD	Chi Square Test	Step 2: Chi Square - Pose RQ, Choose Var, Clean	
Fri Feb 11	McD	Chi Square Test		Step 2 Project
Mon Feb 14		Project Work Day - Chi Square	Step 3: Chi Square Analysis	
Wed Feb 16	McD	Linear Regression		Step 3 Project
Fri Feb 18	McD	Linear Regression		
Mon Feb 21	McD	Logistic Regression	Step 4: Logistic Reg - Pose RQ, Choose Var, Clean	
Wed Feb 23	McD	Logistic Regression		Step 4 Project
Fri Feb 25		Project Work Day - Logistic Reg	Step 5: Logistic Regression Analysis	
Mon Feb 28		Review		Step 5 Project
Wed Mar 2		Test 1 - Statistics		
Fri Mar 4	McD	Transformations		Project Paper
Spring Break				
Mon Mar 14	GSG	Intro to Modeling	Modeling Project	
Wed Mar 16	1.1	Feedback		
Fri Mar 18	1.2, 1.3	Functions & State Spaces		
Mon Mar 21	1.4	Modeling Change		
Wed Mar 23		Epidemiology		
Fri Mar 25	1.5	Graphical		Step 1 - Intro
Mon Mar 28	1.6	Trajectories		
Wed Mar 30	2.1, 2.2	Derivatives		
Fri April 1	2.5	Derivative Functions		
Mon April 4	2.6	Integration		Step 2 – Expl 1
Wed April 6	3.1, 3.2	Equilibrium		
Fri April 8		NO CLASS - Out of Class Activity		
Mon April 11	3.3, 3.4	3 Dimensions		
Wed April 13	3.5	Basins of Attraction		Step 3 – Expl 2
Fri April 15		NO CLASS - Good Friday		
Mon April 18	6.1, 6.2	Matrix Modeling	Research Article 2	
Wed April 20	6.3	Long-Term Behavior		
Fri April 22	6.4, 6.5	Eigenvalues & Eigenvectors		Step 4 – Expl 3
Mon April 25		Review		Res Article 2
Tues April 26		Test 2 - Modeling		
Fri April 29		Modeling Project Presentations		Modeling Proj