

RISING RESEARCHERS

MICROBIOLOGY RESEARCH INTENSIVE SUMMER CAMP

**2 College Credits - partnered with University of
Massachusetts Amherst**



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MICROBIOLOGY RESEARCH INTENSIVE

2 College Credits

Summer 2021

Dates: July 26 – August 20

Schedule: Mon, Tues, Wed, Thurs 6p-8p ET (live lessons), office hours Wed 5p ET

Academic Credit: 2 U.S. College Credits + Certification of Completion Issued by University of Massachusetts Amherst (UMass)

Student Profile: Rising 9th - Rising 12th grade (no age restrictions). International applicants are welcome.

Course Prerequisites: This course has no course prerequisites, but requires students to be committed to attend classes, learn, fully participate in the class experiments and discussions, and be respectful to each other.

Format: Online with live (synchronous) sessions + offline (asynchronous) assignments.

Cost: \$4900 (includes lab kit).

Payment Details: A 50% deposit is required to secure a student's spot, with the remaining balance due 30 days prior to the program start date. The deposit is non-refundable but is transferable to a future session.

Lab Kit

All students are mailed a lab kit prior to the start of the course.

The Lab Kit includes:

- Handheld digital microscope plus slides and stain solution
- Petri dishes
- Microcentrifuge tubes
- Soil sample, legume seeds, and pots
- Digging tools
- Safety goggles and gloves

Class materials: E-Textbook, online video library, and research papers

Course Overview

This is a 4-week online summer research class with four learning units organized by themes. The course is designed to provide you with an introduction to the principles of scientific and microbiology research. Through lectures, hands-on experiments at home, class, and small group discussions, we will delve into the microbial world with an emphasis on the interactions of microorganisms with humans, plants and their impact on disease and agriculture. The hands-on experiments will emphasize the proper use of the scientific method to answer a research question, make observations and interpret results.

Learning Units

1. Scientific method and introduction to general microbiology
2. Host-microbe interactions including Soil Microbiology and examples
3. Rhizobia bacteria-legume symbiosis
4. Microbial genetics and identification of bacteria from host tissue

Course Goals

- Exploration of microbiology research and opportunities in the field.
- Construction of a unique research question.
- Development of a research strategy including the identification of appropriate research methodologies.
- Presentation of initial research design as "mini-poster session" (PowerPoint and/or VoiceThread presentation).
- Investigation of existing literature to build a reference and resource list.
- Creation of initial research draft template for article submission to high school research journals.

Upon successful completion of this course, students should have mastered the following:

- Describe and demonstrate the ability to use the scientific method
- Develop fundamental knowledge of the microbiology field
- Define the basic morphology and functions of microorganisms (microbes) using examples of prokaryotes, eukaryotes, and viruses, with emphasis on their associations to humans, plants, the air, soil, and food
- Describe the classification of microorganisms, particularly bacteria, fungi, and viruses
- Define and compare beneficial versus pathogenic host-microbial interactions
- Describe the beneficial/symbiotic relationship between rhizobial bacteria and legume plants
- Perform hands-on experiments safely at home
- Demonstrate the ability to observe, record, obtain and interpret data from experiments
- Demonstrate the ability to communicate results

Course Credit and Grading

- Each student receives a grade and feedback throughout the course; however, the transcript will contain a pass/fail grade
- Students will receive 2 U.S. College Credits and an official transcript from UMass

**UMass and Rising Researchers cannot guarantee the credits will transfer to every college. It is at the discrepancy of the attending college to accept the college credits. The attending college will determine how the credits will be applied and will have their own requirements. Contact your attending college to see if the credits will transfer.

Grading

- Attendance: 30%
- Experiment photo uploads per week: 30%
- Shared electronic (Google Docs) lab notes completion every week: 20%
- Weekly progress on poster template sections (10%)
- Group discussion participation: 5%
- Final group project: 10%

COURSE SCHEDULE

Week	Dates	Lecture/ Reading Topic	Experiment/Research Activity
Pre-class	W, Th, M	<ul style="list-style-type: none"> • Watch video on <ul style="list-style-type: none"> ◦ The scientific method ◦ Safety in the laboratory ◦ Microbiology and study/career opportunities ◦ Soil microbiology 	<ul style="list-style-type: none"> • Wed: Receive the 'Home-Lab Kit' from the instructor • Thur: Collect soil from two different locations of choice • Mon: Plant seeds in soil and water them for a week
Pre-class	M, W, T	<ul style="list-style-type: none"> • Explore hypothesis/prediction of what type of microbes might be present in the selected soil samples 	<ul style="list-style-type: none"> • Keep watering the plants every other day
Week 1	M, T, W, T	<ul style="list-style-type: none"> • Mon: Introduction to the scientific method and components of a laboratory report; discuss hypotheses and possible reasons of what type of microbes might be present in the soil samples • Tue: Introduction to microbiology and opportunities in the field • Wed: Microbe-host interactions • Thur: Discuss methodology; Q&A 	<ul style="list-style-type: none"> • Mon: Together observe (phenotype) plant roots at 2 week post-planting; Take photos and record results in shared google doc lab notebook • Tue: Group discussion and quiz on career opportunities • Wed: Journal Club - Class studying and discussion of a research article - then Zoom breakouts • Thur: Class and small group work: start working on methods write-up
Week 2	M, T, W, T	<ul style="list-style-type: none"> • Mon: Bacteria-plant interactions; Types of microscopy used in microbiology labs • Tue: Symbiosis between rhizobial-bacteria and legume plants (Early stage and Late stage) • Wed: Bacterial culturing, safety and aseptic techniques • Thur: Discuss literature search and Q&A 	<ul style="list-style-type: none"> • Mon: Together observe (phenotype) plant roots at 3 weeks post-planting; Take photos and record results in shared Google Docs lab notebook • Tue: Examine 2 root nodules under the microscope • Wed: Isolate rhizobia from 2 root nodules; examine colony morphology • Thur: Continue working on methods write-up

Week 3	M, T, W, T	<ul style="list-style-type: none"> • Mon: Bacteria-plant interactions; types of microscopy used in microbiology labs • Tue: Symbiosis between rhizobial-bacteria and legume plants • Wed: Bacterial culturing, safety and aseptic techniques • Thur: Discuss literature search and Q&A 	<ul style="list-style-type: none"> • Mon: Together observe (phenotype) plant roots at 4 weeks post-planting • Tue: Make overnight cultures of bacteria from colonies; working on poster template sections • Wed: Extract DNA from rhizobia • Thur: Running of DNA products on agarose gel electrophoresis; send DNA for sequencing; continue working on methods write-up
Week 4	M, T, W, T	<ul style="list-style-type: none"> • Mon: DNA Sequencing methods; Journal Club - class studying a research article on 16S DNA Sequencing • Tue: Discuss poster presentation • Wed: Working on poster template sections • Thur: Q&A 	<ul style="list-style-type: none"> • Mon: Discuss DNA sequencing results • Tue: Working on poster template sections • Wed: Group practice of poster presentation • Thur: Poster presentation

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