

Community-Engaged Environmental Engineering–Environmental Antimicrobial Resistance

Program Dates: July 22- August 02, 2024

Community-Engaged Environmental Engineering Program Overview:

In this program, pre-college students can enroll in two-unit research-based courses addressing community needs, in collaboration with a partner. Through readings and discussion, students will explore case studies of environmental injustice. In the laboratory, students will be trained in basic research skills and will participate in an authentic research experience, depending on the track they choose. The Environmental Antimicrobial Resistance Track will collect and analyze coastal water samples for multidrug resistance, while the Lead in Soils Track will collect and analyze community garden soils for a suite of metals, including lead.

All tracks will share a common curriculum in environmental justice. Through readings, guest speakers, and discussions, we will explore how race, poverty, and exposure to environmental contamination are related.

Environmental Justice Texts:

Washington, Harriet, A. A Terrible Thing to Waste. Environmental Racism and its Assault on the American Mind. Little Brown Spark. ISBN:978-0-316-50943-5

Thomas, Leah. The Intersectional Environmentalist: How to Dismantle Systems of Oppression to Protect People + Planet.

Work to be done before the course begins

Reading: Approximately one hour of reading will be assigned before each day's class time. So, if students would like to read ahead before the course begins, they are welcome to do so.

Lab safety training: The lead in soils track will need to take Lab Safety Fundamental Concepts (LSFC), while the antibiotic resistance track will have to take LSFC and Biosafety Level 2.

Community-Engaged Environmental Engineering–Environmental Antimicrobial Resistance Program Description:

Students will learn the fundamental concepts driving the global rise in environmental antibiotic resistance and the need for increased surveillance of the environment. In collaboration with our community partner Wildcoast, we analyze samples from Imperial Beach, San Diego. In the laboratory, students will selectively culture *Escherichia coli*, an organism that the World Health Organization has identified as an ideal model for assessing antimicrobial resistance. They will learn to purify different strains of the bacteria from the environment and assess those individual strains for resistance to a suite of antibiotics. Students will be able to compare the prevalence

of multidrug-resistant bacteria from different coastal sites in California. In a culminating activity, students will visualize the data they have acquired and share it with the community partner.

The course will run from 9 AM - 4 PM daily.

Tentative schedule:

Environmental Antimicrobial Resistance Week 1		
Day	Topic	Goals
1	-Course Introduction -Indigenous rights -Lab skills: Pipetting and Dilutions	-Meet lab leaders (30 min) -Case study discussion and activity (1.5 hrs) -Lab walk-through and safety review (1 hr) -Lunch Break (1 hr) -Pipetting and dilutions overview (30 mins) -Pipetting and dilutions experiment (2 hrs)
2	--A Terrible Thing to Waste Preface and Introduction: Covid and Environmental Racism, Importance of IQ -Lab skills: IDEXX	-Case study discussion and activity (1 hr) -Overview of lab work for the day (30 mins) -Lab demonstration (30 minutes) -Lunch Break (1hr) -IDEXX overview (30 min) -IDEXX experiment (2 hrs)
3	--A Terrible Thing to Waste: Ch 1. The Prism of Race -Lab skills: Sample processing	-Field Day. Field collection of water samples at local beaches and beaches in San Diego County. -Lunch Break (1hr) -Lab processing. Set up tests for <i>Escherichia coli</i> (2.5 hrs)
4	-A Terrible Thing to Waste: Ch 2. The Lead Age: Heavy Metals, Low IQs -Lab skills: Colony isolation	-Case study discussion and activity (1 hr) Antimicrobial resistance background (1 hr) -Overview of lab work for the day (30 minutes) -Lunch Break (1 hr) -Colony isolation overview (30 min) -Colony isolation, first purification (2 hrs)
5	--A Terrible Thing to Waste: Ch 3. Poisoned World: Racial Gradients of Environmental Neurotoxins -Lab skills: Colony isolation	-Case study discussion and activity (1 hr) -Antimicrobial resistance background (1 hr) -Overview of lab work for the day (30 minus) -Lunch Break (1 hr) -Colony isolation, second purification (2.5 hrs)

Environmental Antimicrobial Resistance Week 2		
Day	Topic	Goals
1	<ul style="list-style-type: none"> --A Terrible Thing to Waste: Ch. 4 Prenatal Policies: Protecting the Developing Brain -Lab skills: Culturing 	<ul style="list-style-type: none"> -Case study discussion and activity (1 hr) -Antimicrobial resistance background (1 hr) -Overview of lab work for the day (30 minutes) -Lunch (1 hr) -Grow pure cultures from various environmental samples in broth to prepare for antimicrobial testing (2.5 hrs)
2	<ul style="list-style-type: none"> -A Terrible Thing to Waste: Ch 5. Bugs in the System: How Microbes Sap U.S. Intelligence -Lab skills: Disk diffusion 	<ul style="list-style-type: none"> -Case study discussion and activity (1 hr) -Antimicrobial resistance background (1 hr) -Lunch -Disk diffusion overview (30 mins) -Disk diffusion experiment. Spreading plates with liquid purified cultures, placing disks on plates (2 hrs)
3	<ul style="list-style-type: none"> -A Terrible Thing to Waste: Ch 6. Taking the Cure: What Can You Do, Now? -Lab skills: Disk diffusion 	<ul style="list-style-type: none"> -Workshop 1: Characterizing study sites -Reading results from the previous day's round of antimicrobial testing.
4	<ul style="list-style-type: none"> -A Terrible Thing to Waste: Ch 7. A Wonderful Thing to Save: How Communities Can Unite to Preserve -Data analysis 	<ul style="list-style-type: none"> -Workshop 2: Presenting Results -Calculate and Visualize Results
5	<ul style="list-style-type: none"> -Presentation to Client -Final Reception 	<ul style="list-style-type: none"> -Presentation of results to the client