

Curriculum Summary

Dartmouth Rural STEM Educator Partnership

An educational outreach project funded by SEPA-NIGMS

Humans and Disease	
Lesson	Description
Lesson 1: mystery disease	In this lesson, students will learn about how the human body responds to invasion by germs. The main focus is on the immune system and its role in defending us from infections.
Lesson 2: bacterial growth	In this lesson, students will grow bacteria from their hands on agar plates. They will compare differences in bacterial growth using hand sanitizer and antibiotics.
Lesson 3: Disease vectors	A discussion of various vectors through which diseases can move from host to host.
Lesson 4: Vector identification	Students will review fictional case studies of people suffering from Lyme disease in an attempt to identify the vector for Lyme disease.
Lesson 5: Agar plate analysis	Microbes (bacteria) are found almost everywhere, but are nearly always too small to be seen by the unaided eye. Given ideal environmental conditions (incubation) and an abundance of nutrients (agar plates), bacteria can grow quickly, and form colonies that are easily seen by the naked eye.

Ticks	
Lesson	Description
Lesson 1: Ticks 101	In this lesson, students will learn how to use a microscope in order to make observations about tick samples.
Lesson 2: Tick life cycles	In this lesson, students will learn about the tick life cycle and tick questing behavior. Students will also learn how tick activity changes seasonally through a graphing activity.
Lesson 3: Food Webs	In this lesson, students will learn about food webs, and how ticks are connected to other species in a food web.
Lesson 4: Transmission of Lyme disease	This lesson will help to teach students about bacterial and viral infection. Specifically, it will teach students how Lyme disease is transmitted from one host to another via a vector (tick). This lesson includes a brief presentation and a game for students to play to learn more about disease transmission.

Lesson 5: Reflections	In this lesson students will reflect on what they have learned so far. They will compile all of the information into a form of their choice.
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Climate	
Lesson	Description
Lesson 1: Weather vs. Climate	Students will collect data and interpret graphs to gain an understanding that climate is the long-term behavior of temperature and precipitation in a region whereas weather involves short term fluctuations that are essentially random.
Lesson 2: Greenhouse gas experiment	Students will develop hypotheses about the role of gasses in the atmosphere and how they do or do not impact climate. Students will test these hypotheses by developing an experiment that quantifies how much CO ₂ affects air's ability to absorb heat from light.
Lesson 3: Carbon footprint	In this lesson students will first learn about how and why gasses are contributing to climate change. Then they will calculate their carbon footprint and brainstorm ideas to cut it down.
Lesson 4: Historical climate data	Students will be able to describe the difference between weather and climate by observing and analyzing weather and climate changes over time in two cities, Hanover, NH and Phoenix, AZ.
Lesson 5: Climate and Tick-borne illness link	Students will investigate the impact of increasing temperatures on tick questing behavior in a card game format. A subsequent collective group discussion will link global warming -> increased questing behavior -> increased tick-borne illnesses.
Lesson 6: The future?	Students will create a report, poster, podcast, or video to describe what the future looks like for ticks, Lyme disease, and climate.

Terraria – Arduino Board and Coding

Lesson	Description
Lesson 1: Arduino Board Introduction	What is a microcontroller and how can we use it to learn about the world? Students will be introduced to the Arduino microcontroller with a light sensor and get them excited about using it.
Lesson 2: Building Your First Sensor	How can you use a microcontroller to make measurements? This lesson guides students to build a simple circuit that uses an Arduino to control a sensor. They will form and test hypotheses that guide their learning about how experimental conditions affect plant growth.
Lesson 3: Recording Data Over Time	How should sensor measurements be saved for later analysis? Group exploration of ideal frequency of measurement. Introduction to storing Arduino outputs to a memory card and bringing stored outputs into Excel.
Lesson 4: Integrating Multiple Sensor with a Real-Time Clock	How can multiple sensors be integrated into one experiment? Expanding your simple circuit to include multiple integrated sensors controlled by the Arduino.
Lesson 5: Collecting and Interpreting Time-Lapse Imagery	How can a camera be a measurement device? “Images are more than pictures, they are data” (Gillies <i>et al.</i> 2016). Introduction to a camera as a set/bundle/matrix of light detectors. Introduction to imaging as a scientific tool.

Terraria – Plant Growth Variables

Lesson	Description
Lesson 1: Experimental Variable	In this lesson students will explore different experimental variables that could be used to answer questions about plant growth and health such as light, humidity, seeding density, soil composition, water, and fertilizer. Students will design experiments to help them answer hypothesis-driven questions.
Lesson 2: Measuring Outcomes	In this lesson students will develop skills and knowledge while measuring and recording changes in plant health characteristics. They will form and test hypotheses that guide their learning about how experimental conditions affect plant growth.

Forensic Science

Lesson	Description
Lesson 1: Blood spatter	In this lesson students will make fake blood and use it to simulate blood spatter. They will then use scientific tools to record observations between height the blood was dropped and the diameter of the blood droplets.
Lesson 2: Fingerprinting	In this lesson students will observe that fingerprints are unique and can be used to identify individuals.
Lesson 3: Gel electrophoresis	In this lesson students identify a suspect using DNA electrophoresis, which separates DNA fragments based on size.
Lesson 4: Chromatography - Ink Analysis	A ransom note is left in the classroom. Students are tasked with collecting pens from suspects and using chromatography/component analysis to determine who wrote the note.
Lesson 5: Fiber analysis	Students use microscopes to analyze different fibers and match unknown fibers to those in a database.