

NGSS Connections

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Natural Products

High School

Performance Expectations: Students’ ability to complete the following performance expectation(s) will be supported by participation in this activity.

HS-ETC1-1: Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.

HS-ETC1-3: Evaluate a solution to a complex real-world problem based on prioritized criteria and tradeoffs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.

Dimension	NGSS Code or citation	Corresponding student task in activity
Disciplinary Core Idea	ETS1.A Defining and Delimiting Engineering Problems <ul style="list-style-type: none"> • Humanity faces major global challenges today, such as the need for supplies of clean water and food or for energy sources that minimize pollution, which can be addressed through engineering. Those global challenges also may have manifestations in local communities. 	This lab activity focuses on identifying an immediate solution (possibly temporary) in a small, isolated community dealing with a major health concern (persistent and pervasive diarrhea). The activity specifically defines the problem and a possible solution (using natural products to prevent diarrhea).
	ESS1.B Developing Possible Solutions <ul style="list-style-type: none"> • When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts. 	Once students identify certain foods as having natural products that has an antibacterial effect on a model microorganism, students make a recommendation for how to use this information as a solution to the problem of pervasive and persistent diarrhea in the village.
Practice	Planning and Carrying Out Investigations <ul style="list-style-type: none"> • Plan an investigation or test a design individually and collaboratively to produce data to serve as the basis 	Students develop the protocol to test the bacteria’s sensitivity to various food extracts from two “villages”.

	<p>for evidence as part of building and revising models, supporting explanations for phenomena, or testing solutions to problems.</p> <ul style="list-style-type: none"> Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data and refine the data accordingly. 	<p>The purpose of the activity is to determine if natural products in the foods might prevent diarrheal illness.</p> <p>Students design an investigation to test the viability of bacteria to exposure to various foods. They must decide the ratio of bacteria to food extract, how to make an extract, and the protocol for their investigations. They also consider limitations to the data collected and its application to the problem of diarrhea in a village.</p>
	<p>Analyzing and Interpreting Data</p> <ul style="list-style-type: none"> Consider limitations of data analysis (e.g., measurement error, sample selection) when analyzing and interpreting data. 	<p>Students consider the limitations on the data they collected during their investigations. For example, did everyone follow the same protocols? Will all bacteria respond the way the model bacteria responded when exposed to the food extracts?</p>
Crosscutting Concept	<p>Stability and Change</p> <ul style="list-style-type: none"> Much of science deals with constructing explanations of how things change and how they remain stable. 	<p>Ecosystem was stable, but an introduced disturbance (pollution) is changing the environment, the ecosystem populations. Some populations are more sensitive to the pollution than others; changes in these can serve as indicators of ecological health.</p>
	<p>Cause and Effect</p> <ul style="list-style-type: none"> Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. 	<p>The students collect data to show that natural products (cause) can kill microorganisms (effect) and potentially support human health measures. They use this correlation to make recommendations to improve health in a village.</p>

Nature of Science

Scientific Investigations Use a Variety of Method

- Scientific inquiry is characterized by a common set of values that include: logical thinking, precision, open-minded, objectivity, skepticism, replicability of results, and honest and ethical reporting of findings.

Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena

- Scientists often use hypotheses to develop and test theories and explanations.

Scientific Investigations Use a Variety of Methods

- Science investigations use diverse methods and do not always use the same set of procedures to obtain data.

Connections to Common Core State Standards

English Language Arts/Literacy

RST.9-10.3

RST.9-10.8

RST.11-12.2

RST.11-12.8