FLEX

Microbiome

Unit storyline

There is evidence to suggest that the approximately 100 trillion bacteria living on and in the human body may correlate to many different health conditions. Further, altering one's microbiome can result in altering one's health for better or worse. Most notably, a treatment known as a fecal transplant — a transplant that involves using microorganisms from one person's healthy gut microbiome to cure another person who is suffering from a potentially deadly infection — has been under review. Students take on the role of student researchers as they work to figure out why a fecal transplant cured a patient suffering from a C. difficile infection.

Featured activity:
Microscope

Students first engage in a discussion about how they would know whether something is living or nonliving and what the expected differences might be between living and nonliving things at the microscopic scale. They then think about specific objects and whether they are living or not. Students observe a variety of objects under a microscope on slides that they have prepared, and that experience helps them identify characteristics of living things. Later, students bring objects from home so they can determine if there is microscopic evidence that shows whether these objects are living or nonliving.

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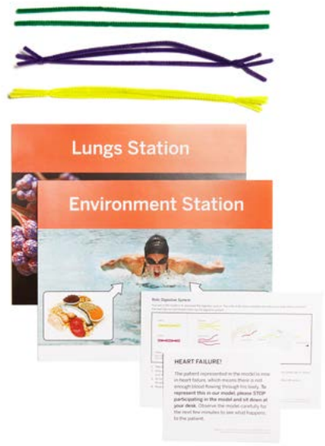
Metabolism

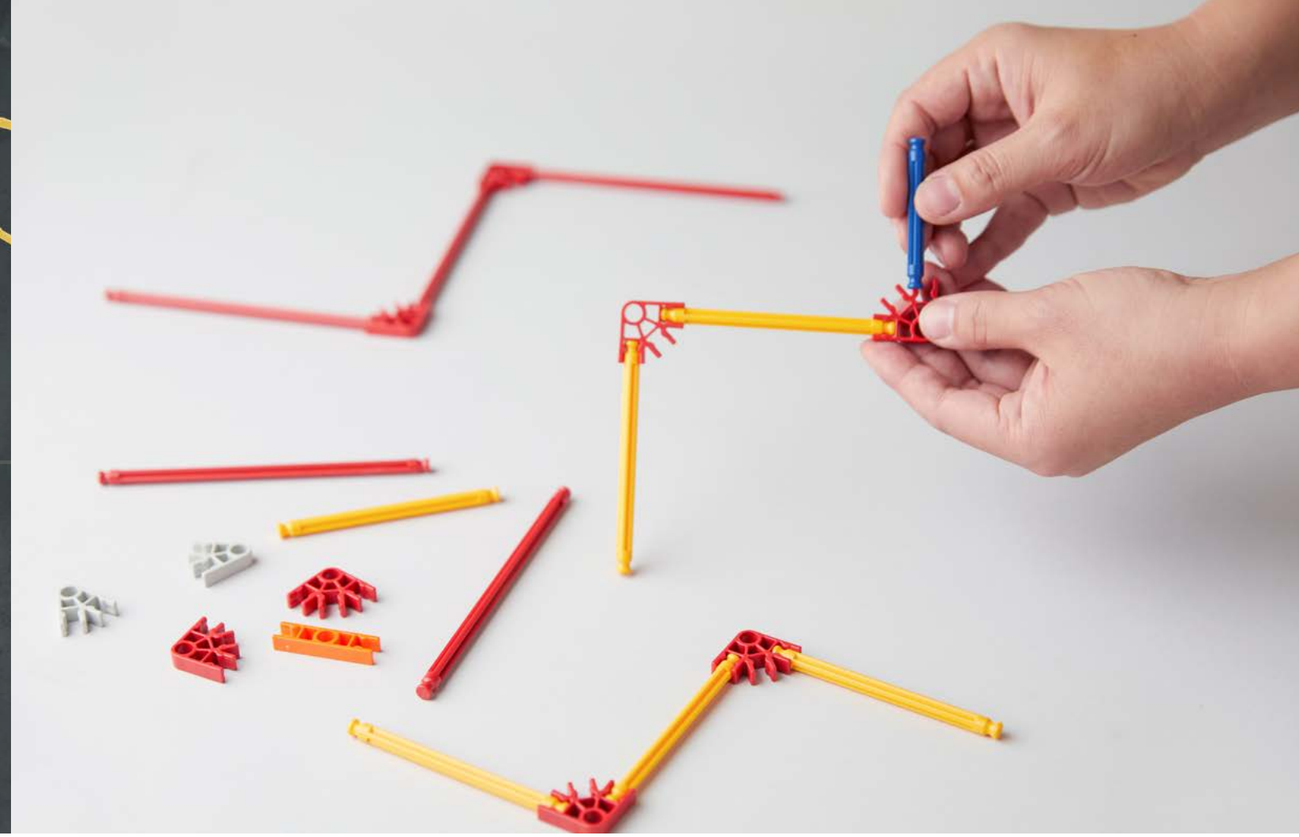
Unit storyline

Through inhabiting the role of medical students in a hospital, students are able to draw the connections between the large-scale, macro-level experiences of the body and the micro-level processes that make the body function as they first diagnose a patient and then analyze the metabolism of world-class athletes. They uncover how body systems work together to bring molecules from food and air to the trillions of cells in the human body.

Featured activity:
Body System Model (Lesson 2.1)

In Lesson 2.1 of the *Metabolism* unit, students participate in a classroom-sized model of the human body in which students play the roles of body systems delivering molecules (represented by pipe cleaners) to cells. Students who play the digestive system take starch and protein molecules from the environment and break them down into glucose and amino acid molecules; they then transport them to the circulatory system through the villi in the small intestine. Students who play the respiratory system take oxygen molecules from the environment and transport them to the circulatory system through the alveoli in the lungs. Students who play the circulatory system take the oxygen, glucose, and amino acid molecules to the cells. This kinesthetic experience demonstrates the important role that each body system plays in bringing necessary molecules to the body's cells.





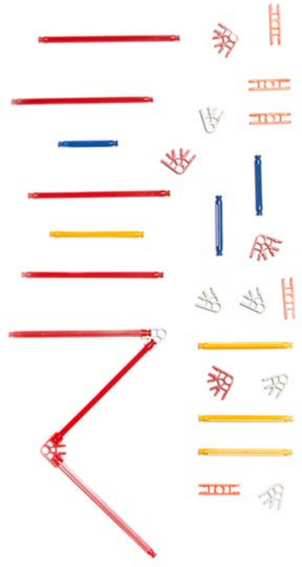
Traits and Reproduction

Unit storyline

Scientists and engineers are investigating possible ways spider silk can be used for medical purposes, such as for artificial tendons. Students act as student geneticists to investigate what causes variation in spider silk traits. Specifically, they explain why parent spiders have offspring with widely varied silk flexibility traits. They uncover the roles of proteins and genes and the way that genes are inherited.

Featured activity:
Gathering Evidence About Genes (Lesson 2.2)

In Lesson 2.2 of the *Traits and Reproduction* unit, students gather evidence that will help them figure out how organisms make different protein molecules for a particular feature. Students participate in a model in which printed instructions represent genes and connected K'NEX pieces are models of protein molecules. Students, playing the roles of ribosomes, follow the instructions in order to construct the protein molecules. By participating in this model, students conclude that each gene version provides a unique instruction to make a specific protein molecule. This hands-on activity also reinforces the idea that the genes themselves do not build the protein molecules. Students then receive changes to the instructions and rebuild their molecule models. These new instructions represent mutations, which allows students to see how mutations can result in changes to proteins.



Thermal Energy

Unit storyline

In their roles as student thermal scientists, students work with the principal of a fictional school, Riverdale School, in order to help the school choose a new heating system. They compare a system that heats a small amount of water with one that uses a larger amount of cooler groundwater. Students discover that observed temperature changes can be explained by the movement of molecules, which facilitates the transfer of kinetic energy from one place to another. As they analyze the two heating system options, students learn to distinguish between temperature and energy, and to explain how energy will transfer from a warmer object to a colder object until the temperature of the two objects reaches equilibrium.

Featured activity:
Investigating Hot and Cold (Lesson 1.2)

In Lesson 1.2 of the *Thermal Energy* unit, students begin thinking about which heating system is better by investigating how something is different when it is warmer or cooler. They add food coloring to cup of hot water and a cup of cold water to observe how the coloring spreads in each cup. They see that the food coloring spreads faster in warmer water than it does in colder water, which helps them see the connection between temperature and movement and begin to understand temperature in terms of molecular motion.

Ocean, Atmosphere, and Climate

Unit storyline

Students act as student climatologists helping a group of farmers near Christchurch, New Zealand, figure out the cause of significantly colder air temperatures in New Zealand during the El Niño climate event. To solve the puzzle, students investigate what causes regional climates. They learn about energy from the sun and energy transfer between Earth's surface and atmosphere, ocean currents, and prevailing winds.

Featured activity:
What Determines the Direction of Ocean Currents? (Lesson 3.2)

In Lesson 3.2 of *Ocean, Atmosphere, and Climate*, students continue to gather evidence about the Investigation Question: What determines the direction of ocean currents? Working in groups, students use a tank of water and straws to make water move in different directions and at different speeds. Students visualize the direction and speed of the water using pepper which floats on top of the water. Students observe and gather first-hand evidence for how wind (air blown through straws) and continents (sides of the tank) affect currents. The hands-on investigation helps students conclude that prevailing winds and the position of continents determine the direction of ocean currents and prepares them to think about how a change to prevailing winds can affect how much energy is brought toward or away from a location.

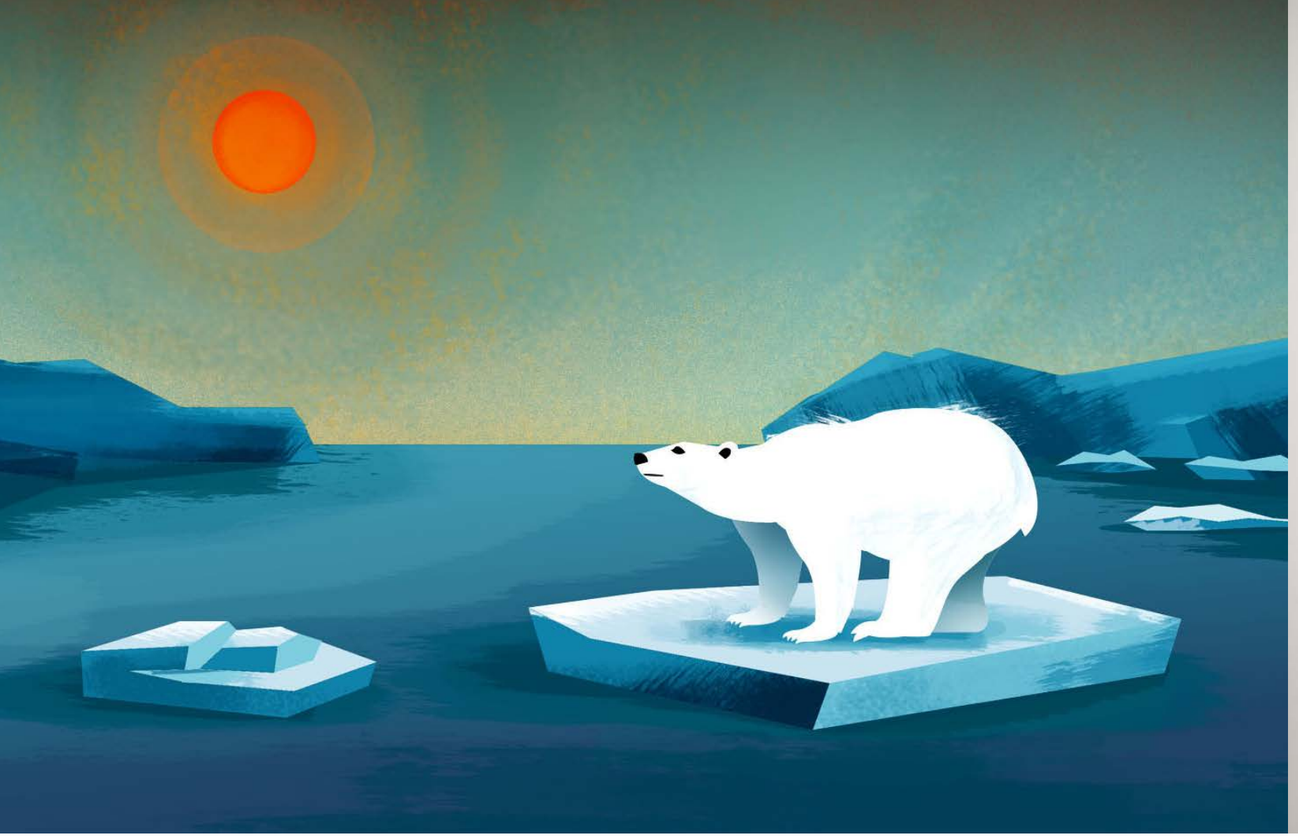
Weather Patterns

Unit storyline

Weather is a complex system that affects our daily lives. Understanding how weather events, such as severe rainstorms, take place is important for students to conceptualize weather events in their own community. Students play the roles of student forensic meteorologists as they discover how water vapor, temperature, energy transfer, and wind influence local weather patterns in a fictional town called Galetown. They use what they have learned to explain what may have caused rainstorms in Galetown to be unusually severe in recent years.

Featured activity:
Investigating Condensation (Lesson 1.3)

In Lesson 1.3, students investigate why and when condensation happens by making a model air parcel in a plastic baggie. After blowing air into two baggies, students leave one baggie at room temperature and put the other baggie in a cooler of ice. Students observe that more condensation happens when the air outside of the baggie is colder. This first-hand investigation is one way that students gather evidence to conclude that when water vapor in an air parcel cools, it can condense into liquid water which can form a cloud and fall as rain.

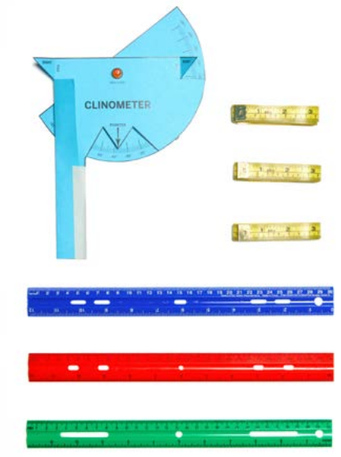


FLEX

Earth's Changing Climate

Unit storyline

In the role of student climatologists, students investigate what is causing ice on Earth's surface to melt in order to help the fictional World Climate Institute educate the public about the processes involved. Students consider claims about changes to energy from the sun, to the atmosphere, to Earth's surface, or in human activities as contributing to climate change.



Featured activity:
Tree Measurements

In the role of student climatologists, students investigate what is causing ice on Earth's surface to melt in order to help the fictional World Climate Institute educate the public about the processes involved. Students consider claims about changes to energy from the sun, to the atmosphere, to Earth's surface, or in human activities as contributing to climate change. Students measure the height of trees (by triangulation) and the circumference of trees and use these measurements to calculate estimates of the amount of carbon stored in the trees. They then relate these amounts to the amount of carbon dioxide produced by the human activities of an average American in a year.

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Earth's Changing Climate: Engineering Internship

Unit storyline

Students act as civil engineering interns to design a plan to modify a city's roofs in order to reduce the city's impact on climate change. These plans must meet three design criteria: One, reducing impact on the climate; two, preserving the city's historic character; and three, minimizing costs. Students focus on the practice of isolating variables in planning and conducting tests to deepen their understanding of climate change; students also learn about the cause-and-effect mechanisms involved as changes to albedo and changes to combustion of fossil fuels affect climate.

Featured activity:
Exploring Albedo (Day 1)

In this lesson, students take on the roles of climate change interns and predict, then test the relative albedo (the amount of light reflected) of a variety of surfaces. As part of this activity, students use light meters to measure the albedo percentages of various surfaces, such as black felt, aluminum foil, and cardboard. Students will later apply their findings to what they learned about roof modifications and how they can help reduce the impact on the climate.