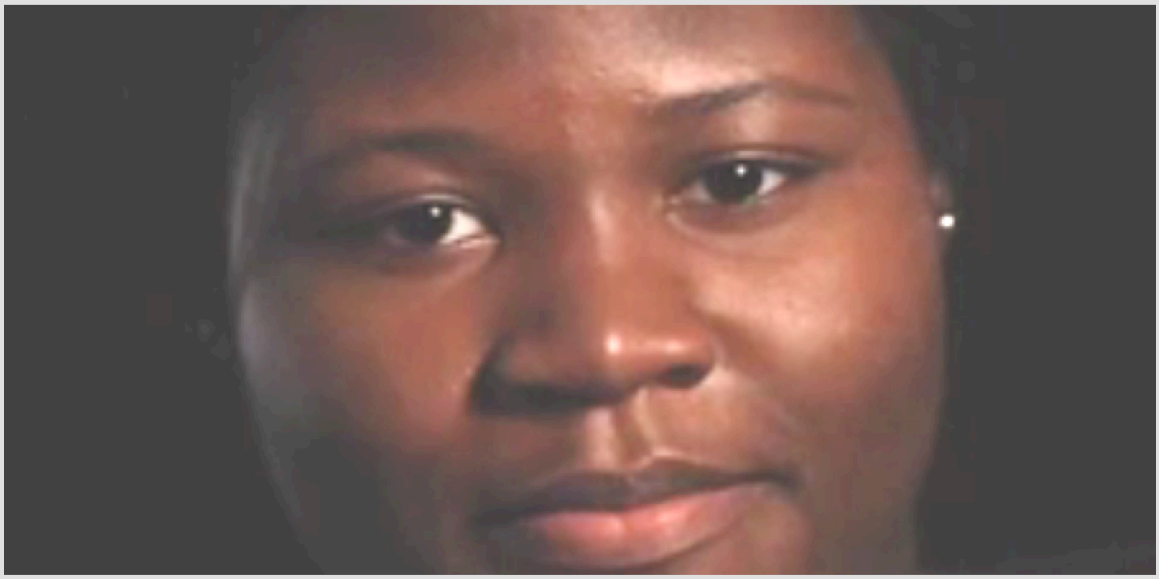
What Controls My Health?



Health in Our Hands

October 2017

This project was supported by a Science Education Partnership Award (SEPA) from the National Institutes of Health, Office of the Director, under Award Number R25OD16534-1. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

This curriculum is under development but can be used with appropriate citations and recognizing that revised versions will be distributed in the future. To realize the full potential of the curriculum, professional development and support for teachers in the classroom is highly recommended.

Project Description: CREATE for STEM Institute at Michigan State University is collaborating on the project, ***Health in Our Hands (HIOH),*** in partnership with University of Michigan School of Public Health, Flint Community Schools, Community-based Organization Partners of Flint, Sloan Museum, Flint Public Library, University Preparatory Science and Math Middle School, Detroit Public Schools Community District, Detroit Public Library, Michigan Science Center, Charles Wright Museum of African American History, and Friends of Parkside in Detroit, and the Concord Consortium in Massachusetts. The goal of HIOH is to produce a coordinated set of classroom and community activities intended to give youth and adults an understanding of modern concepts in genetics they can use to appreciate the importance of both genetic and environmental factors in their risk for disease. The project is funded by the National Institutes of Health Science Education Partnership Awards (SEPA).

"What controls my health?" is designed to meet the Next Generations Science Standards. Students investigate Type-2 diabetes, which connects them to real-world experiences and provides relevance for their learning. Diabetes, like many common diseases, is caused by a combination of both genetic and environmental factors. During the project-based unit, students meet Monique, a girl their age diagnosed with diabetes, and investigate how lifestyle options for healthy foods and exercise help prevent or reduce diabetes. For their final project, students conduct a community action project to improve their school or neighborhood to help prevent or reduce diabetes. After completing their investigations, students share their findings with their peers and broader community, draw conclusions regarding their inquiry question while addressing ethical issues, and suggest solutions and potential actions based on their findings.

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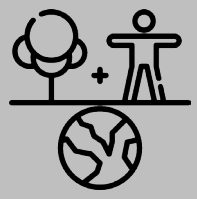
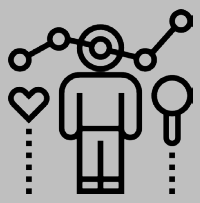




Sixth grade students are starting a **new science unit** that studies diabetes to explore how the environment and genetics affect health. Over the next several weeks, the unit will focus on answering the driving question: ***What controls my health?***

You can follow along!

With each lesson, you will receive a **newsletter** with ways for you to be involved and to learn with your child outside of class with activities and questions.

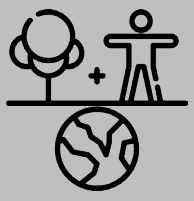
Follow us on Instagram at ***health_in_our_hands***

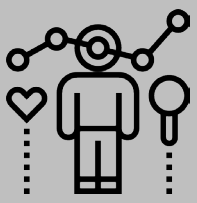
(Please sign and return the media release form so we can post pictures of your student.)

Thank you for your participation with the children as they explore science and how to control their health!

Health in Our Hands

What controls my health?





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Health in Our Hands: What controls my health?
Curriculum storyline

Question(s)	Phenomena	Scientific Practice(s)	(DCI) - (CCC)	Learning Goals
Lesson 1 ***Why does Monique have diabetes?***	The story of Monique, a teenager experiencing Type 2 diabetes *Monique's first video*	Asking questions Developing and using models	DCI: LS1.B. Growth and Development of Organisms CCC: Cause and effect	• The students generate questions about the causes and effects of Monique's diabetes. • The students construct models in order to explain a phenomenon of their choice.
Lesson description: 1. The students watch a video of a young girl, Monique, who has Type 2 diabetes. 2. Students generate their own questions about Monique's health and are introduced to the driving question of the unit, "What controls my health?". 3. Students develop an initial model that explains a phenomenon of their choice.				
Question(s)	**Phenomena**	**Scientific Practice(s)**	**(DCI) - (CCC)**	**Learning Goals**
Lesson 2 ***How can we describe Monique's diabetes?***	Experience of being diabetic from video Monique *Monique's second video*	Obtain, communicate, and evaluate information Developing and Using Models	DCI: LS1.B. Growth and Development of Organisms CCC: Cause and effect	• The students obtain and evaluate information about the causes and effects of diabetes • The students obtain and evaluate information about how groups of body cells work together in subsystems that are affected by genetic components, and have a negative or positive impact on the growth and health/development of organisms. • The students revise their model of the gene-environment interactions that lead to diabetes.
Lesson description: 1. The students read the article, '*What's Diabetes?*'. They share information about the cause, symptoms and treatment of both Type 1 and Type 2 diabetes by completing the **KWL chart**. 2. The students perform a glucose tolerance test by analyzing simulated blood plasma samples to determine if the person has Type 1 or Type 2 diabetes. 3. The students learn about the heart, as an example of an organ which may be affected by diabetes. They watch a short video which introduces the heart and its various functions, and dissect a real sheep's heart to reinforce their experience.				

4. The students revisit the ***Driving Question Board (DQB)*** and reflect upon their learning.
5. The students revise their models and add the biological aspect of diabetes to their model.

Question(s)	Phenomena	Scientific Practice(s)	(DCI) - (CCC)	Learning Goals
Lesson 3 ***How does Monique's family affect her diabetes?***	Patterns of inheritance of traits	Developing models	DCI: LS3.A. Inheritance of Traits CCC: Patterns Cause and effect	• The students use models to predict how patterns of inheritance can affect variation in the inheritance of diabetes. • The students revise their model by adding how genetic factors affect diabetes.

Lesson description:

1. The students examine pictures of a family to identify some genetic factors of characteristics that might be inherited.
2. The students collect data on tongue rolling and arm span. They use this data to explore the population variation of the inheritance patterns of single and multi-factorial genes.
3. The students use beads to simulate the inheritance of risk factors for diabetes. Students identify the risk of diabetes of offspring based on number and type of risk factors inherited during the simulation.
4. The students revisit the ***Driving Question Board (DQB)*** and reflect upon their learning.
5. The students revise their models and add the effect of genetic factors on Monique's diabetes.

Question(s)	Phenomena	Scientific Practice(s)	(DCI) - (CCC)	Learning Goals
Lesson 4 ***How does where Monique lives and what she does affect her diabetes?***	The effect of the environment on plants' growth (simulation)	Planning and carrying out investigations Analyzing and interpreting data Constructing explanations Developing and Using Models	DCI: LS3.A. Growth and Development of Organisms CCC: Patterns Cause and effect	• The students plan and carry out an investigation to identify environmental factors that affect the growth and health of organism. • The students revise their model by adding cause and effect of environmental factors on diabetes.

Lesson description:

1. The students investigate the effect of environmental factors on the growth of plants using an online simulation. Students plan a class experiment, collect data in pairs, share and discuss their results, and draw evidence-based conclusions.
2. The students link the plant simulation to diabetes and discuss the environmental factors that affect health.
3. The students revisit the *Driving Question Board (DQB)* and reflect upon their learning.
4. The students revise their models and add the effect of environmental factors on Monique's diabetes.

Question(s)	Phenomena	Scientific Practice(s)	(DCI) - (CCC)	Learning Goals
Lesson 5 ***How do Monique's characteristics and environment affect her diabetes?***	The effect of genetics and environment on sand-rats' health (simulation)	Planning and carrying out investigations Analyzing and interpreting data Constructing explanations Developing and Using Models	DCI: LS1.B. Growth and Development of Organisms Inheritance of Traits CCC: Patterns Cause & effect	• The students plan and carry out investigations to identify that the both genetic factors and environmental factors affect the growth and health of organism. • The students revise their model to include the interaction of both environment and genetic factors on organisms' traits.

Lesson description:

1. The students investigate the effect of both genetic information and environmental factors on the health of sand-rats using an online simulation. They plan and carry out an experiment using the simulation, collect and analyze data, and draw evidence-based conclusions. Then they share and discuss their results with their peers.
2. The students revisit the *Driving Question Board (DQB)* and reflect upon their learning.
3. The students revise their models and add the interaction of environment and genetic factors on Monique's diabetes.

Question(s)	Phenomena	Scientific Practice(s)	(DCI) - (CCC)	Learning Goals
Lesson 6 ***What can Monique do to make her environment healthier?***	The story of Tim, a teenager with Type 2 diabetes, that shops and looks at labels for nutrition information Tim's video	Obtaining, communicating, and evaluating information Developing and using model	DCI: LS1.B Growth and Development of Organisms CCC: Patterns Cause and effect Scale, proportion, and quantity	• The students obtain, evaluate and communicate information about their eating habits based on the data of hidden sugars in their food. • The students use their models they have developed for Monique to explain what affects their own health.

Lesson description:

1. The students interpret the *nutrition fact table* on food labels, and calculate the amount of sugar in their food and usual diet. They discuss the effects of excessive sugar consumption on one's health, and consider ways to reduce sugar consumption, especially *added* sugar, in their diet.
2. The students revisit their model and discuss whether their models apply only to Monique. Then, they create a consensus model and generalize their models to their own health. The students use the model to explain and predict the effect of genes and environment on their health.

Question(s)	Phenomena	Scientific Practice(s)	(DCI) - (CCC)	Learning Goals

Lesson 7 **Community action projects** ***How can we work together to make our environment healthier?***	Obstacles to healthy lifestyle in the neighborhood	Asking questions Planning and carrying out investigations Analyzing and interpret data Developing and using models	DCI: LS1.B Growth and Development of Organisms CCC: Patterns Cause and effect	• Students plan and carry out an investigation about obstacles to a healthy lifestyle in their environment. • Students analyze data and communicate findings with peers and their broader community to explain environmental factors in their neighborhoods that can be changed to make their environment healthier. • Students revise their models by adding the action component to their health.

Lesson description:

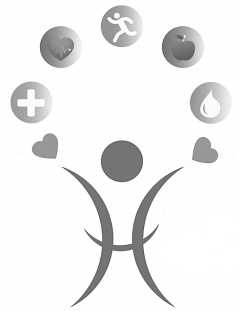
1. The class will transform into a research group whose goal is to answer an inquiry question regarding a public health issue in students' environment. First, the students develop and choose their inquiry question, design and develop their research tools, and plan and carry out their investigations.
2. After completing their investigations, the students analyze the data and draw conclusions, share their findings with their peers and broader community, draw conclusions regarding their inquiry question while addressing ethical issues, and suggest solutions and potential actions based on their findings.
3. The students revise their models and add an action component and its effect on their health.

Question(s)	Phenomena	Scientific Practice(s)	(DCI) - (CCC)	Learning Goals
Lesson 8 (optional multi literacy lesson) ***How can we work together to make our community healthier?***	Vending machine in schools	Obtaining, evaluating, and communicating information Engaging in argument from evidence	DCI: LS3.A. Growth and Development of Organisms CCC: Patterns Cause and effect	• Students obtain and evaluate information about obstacles to healthy food choices in their environment. • Students develop, communicate and critique arguments based on evidence using ethical considerations about the connections between student health and risk for diabetes and their environment.

Lesson description:

1. The students make claims and develop arguments for needed changes to their environment that can lead to a positive impact on their growth and development.
2. Then, they engage in a role-play exercise that emphasizes the need for access to healthy food in the school environment.

Health in Our Hands



What controls my health?

Lesson 1:

Why does Monique have diabetes?

Meet Monique, a young girl living with Type 2 diabetes. Monique will be with us through each lesson. Monique is the only person in her family with Type 2 diabetes and is working on making choices to improve her health such as walking and eating healthy. Monique is taking control of her health. The first step to taking control of your health is asking questions. In Lesson 1, students brainstorm a list of traits and characteristics affecting Monique's health. Then they will begin to develop a *scientific model* to describe diabetes.

For discussion at home:
Who is Monique?

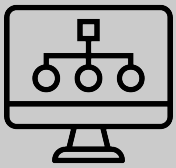
Key Point #1

Traits are characteristics people have that can affect their health in different ways, some good and some not so good. Examples of traits that can affect health include being good at sports or being overweight.

Key Point #2

Asking questions about why Monique has diabetes is the first step to understanding how someone gets diabetes and what can be done to prevent it.

Key Point #3



Models are like maps that help us describe relationships between traits and characteristics and health. For example, a model can explain how Monique's diet and exercise affect her diabetes. A model can also predict how changes Monique makes can improve her health

Explore more: Interview someone at home

Share:

What did you find out?

Question 1: Do you or anyone else in your family have Type 2 diabetes?
Question 2: What do you know about diabetes and why some people get it while others do not?
Question 3: What do you do to stay healthy?
Question 4: Do you have a favorite healthy food?
Question 5: What do you do to relax if you are stressed out?

Goal: Asking questions is a good way to learn more about someone.

How can I control my health?

Eat right.
How often do you eat breakfast? Try and eat breakfast everyday this week. Breakfast jump starts your day.

Get fit.
Get active with your friends and family! Find a physical activity you all enjoy and do it together. Dance, walk or swim.

Be mindful.
Think about how the choices you make affect your health. Are there any habits of choices you might want to work on?

What's coming next?

Lesson #2: How can we describe Monique's diabetes? Next lesson, students will focus understanding the science behind diabetes – what happens in the body and cells of people who have or do not have the disease:

1. What is diabetes?
2. How is diabetes diagnosed? How many kinds are there?
3. Which body organs may be affected by diabetes?

Get involved

Tell YOUR story: StoryCorps at the Flint public library lets people to record and listen to stories from members of the Flint community.

- http://fpl.info/learn-create/create/storycorps/

About us

We are the CREATE for STEM Institute at MSU. Funded by Science Education Partnership Award (SEPA) granted by the National Institutes of Health (NIH), the project is developing a new generation of learning materials that blends school and community learning experiences to teach genomics (the study of all the genes of an organism and gene-environment relationships) and evolution.

Instagram
Follow HIOH on Instagram at ***health_in_our_hands***

Partners: UMichigan, Flint Public Schools, Concord Consortium, Community-Based Organization Partners, Sloan Museum, Flint Public Library

Lesson 1: Why does Monique have diabetes?

Unit Driving Question:	Materials	Suggested lesson time
What controls my health? **Sub-Driving Question:** Why does Monique have diabetes?	• Computer - one per pair of students • Projector - one for the class • Large "whiteboard" - to be used as Driving Question Board • Sub-driving question cards • Sticky notes • Markers	4 days

Framing the Lesson

Purpose
The first lesson introduces the Driving Question of this unit: "What controls my health?" This Driving Question will be examined through the case of Monique, a teenager who is experiencing Type 2 diabetes. The sub-driving questions of this unit will specifically address Monique and her diabetes, and will be be generalized to "***our health***" in later lessons. The purpose of this lesson is to engage students in the the Driving Question of the unit by by generating questions about diabetes.

Learning Goals
- The students generate questions about the causes and effects of Monique's diabetes.
- The students construct models in order to explain a phenomenon of their choice.

Building Coherence
In this lesson, students generate questions and models regarding Monique's health. They will revisit their generated questions and models throughout the unit and refine them as they explore how gene-environment interaction affects people's health.

Overview of the Lesson

Activity 1 - Introducing Monique - Generating the Driving Question Board
The students will watch a video of a young girl, Monique, who has Type 2 diabetes. Based on the information from the video, students will generate their own questions about Monique's health and share them with the class. These questions will be organized and posted on a classroom Driving Question Board (DQB), a visual reference for the entire unit.

Activity 2 - Introducing RoadMap
The teacher will introduce RoadMap, the software students use to engage in the learning activities. The students will understand its rationale and how to use it for learning.

Activity 3 - Modeling - How can we explain a phenomenon?
The students will generate models of a phenomenon of their choice using the *SageModeler* software. The goal of this activity is to expose the students to the practice of scientific modeling and the software, while allowing them to model a phenomenon that is authentic and interesting to them.

Connection to NGSS

Target Performance Expectations

MS-LS1-5. Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.

Disciplinary core idea	Science and engineering practices	Crosscutting concepts
LS1.B: Growth and Development of Organisms	**Asking questions:** Ask questions that arise from careful observation of phenomena, models, or unexpected results, to clarify and/or seek additional information. **Developing and using models:** Develop and/or use a model to predict and/or describe phenomena.	**Cause and effect** • Cause and effect relationships may be used to predict phenomena in natural systems.

How these elements are integrated and embedded in this lesson

This lesson starts with watching a video of Monique who has Type 2 diabetes. Students generate questions about the cause and effect of Monique's diabetes. Students develop a model to explain a phenomenon.

Connection to Students' Lives

Link to out-of-school activity and everyday life

- Some students may have family members who experience diabetes. Explain to students that what they learn in this unit can help them understand their everyday life.
- Encourage students to include their family in their learning when at home. For example, students can ask their parents if any of their family members have diabetes, what their parents understand about diabetes, and what choices family members make related to their own health.

Link to career-awareness

- The Driving Question Board is similar to a diagnosis chart used in health-related careers. Make the connection that doctors, for example, ask questions, collect data, and discuss ideas about diagnoses and plan the care of their patients.
- Other careers related to diabetes may include nurses, nutritionist, fitness coaches, health educators.

Instructional Sequence

Introducing the Lesson

Drawing from prior knowledge - Start the lesson with an introductory conversation; ask questions that encourage students to think about diabetes and share their related experience.

- What do you know about diabetes?
- Do you know anyone who has diabetes?
- What's your experience with diabetes?

Activity 1 - Introducing Monique - Generating the Driving Question Board

1. **Introducing Monique:** Show the students a video about Monique (URL: https://drive.google.com/file/d/0B0MDMHTsE_4ublU4NEFWY25sOFE/view 2:44 minutes), a girl who is experiencing Type 2 diabetes.
2. **Scaffold asking questions:** Together with the class, scaffold the students as they ask questions related to Monique and her health.

	The purpose of the unit is to engage the students in the **Driving Question "What controls my health?"** and to start thinking about aspects of an individual and his or her lifestyle that are related to one's health. This Driving Question will be answered through the case of Monique, a young girl with diabetes. At this point, since students are not expected to come up with correct answers, encourage them to share their knowledge, accept all answers, and tell them they will return to this information later in the curriculum.

Use the *Brainstorming* strategy to demonstrate to students some ways to generate questions, and provide several examples.

Scaffolding students using *learning strategies*

1. **What are learning strategies -** Explain what learning strategies are, and emphasize the importance of learning strategies for effective learning (see teacher's guide).

2. **Explain what *Brainstorming* is and how it can be used** - Brainstorming is a strategy for generating ideas. It includes generating a list of spontaneous ideas which are associated with a specific topic. For effective brainstorming: (a) focus on quantity; (b) withhold criticism; (c) welcome unusual and wild ideas; and (d) combine and improve ideas.

3. **Scaffold *Brainstorming*** - Together with the entire class, use the *brainstorming* strategy to generate as many questions as possible regarding Monique's diabetes:
    a. **Generating "anchors:"** Tell students to imagine Monique in their minds in as many aspects of her life as they can: her home, her family, her friends, her looks, her characteristics, her emotions, her favorite food, her hobbies, etc. After generating these *aspects of Monique's life*, write them on the board. In the next step you will guide the students to use these as "*anchors*" to generate questions (such as those below) that connect them to Monique's health.
    b. **Generating questions***:
        - ***Family* (as an anchor):** Does Monique's mother/father have diabetes? Does Monique's brother/sister have diabetes? Does Monique's grandmother/grandfather have diabetes? Did she get diabetes from someone in her family? How did her family react when they heard she had diabetes? Who has helped Monique with her diabetes? How did they help her?
        - ***Friends* (as an anchor):** Do Monique's friends know that she has diabetes? Did Monique talk to her friends about her health? What did her friends do when they heard about her health? Do any of Monique's friends have diabetes?
        - ***Hobbies* (as an anchor*):*** What does Monique like to do? Does Monique engage in team sports? Does Monique exercise on her own (e.g., walk to school, ride her bike, etc.)? Can sports or exercise reduce the risk of getting diabetes? Does Monique like engaging in sports? Does Monique like to exercise?
        - ***Feelings* (as an anchor):** How did Monique feel about having diabetes? Has she wanted to make a change to her health?
        - ***Diabetes* (as an anchor):** Can you infect another person with diabetes? Is what Monique eats related to her diabetes? What causes diabetes? How many kinds of diabetes are there? Can Monique get rid of her diabetes?

* ***This is not an exhaustive list***

3. **Asking questions:** In pairs, have the students continue to write as many questions as they can about Monique's diabetes. Then, each pair should:
    - Choose two questions, one for each partner, that interest them the most and to which they would like to know the answers;
    - Write the questions on the front side of the sticky notes, and indicate the reason for choosing each question on the back.

Making connections to medical careers and health-related issues
Point out to students that people who work in the medical field ask patients many questions as they collect information for diagnosis and treatment. This will give students a purpose/motivation for generating questions.

4. **Grouping questions**: In pairs and with their questions, have the students walk around in the class and examine their peers' questions. Ask the students to form groups according to similar questions, and sit in different areas of the class.

5. **Exposing the Driving Question Board**: Expose the class to the Driving Question Board, which at this point includes the Sub-Driving Question for this lesson: "***Why does Monique have diabetes?***"

Scaffolding students using *learning strategies*

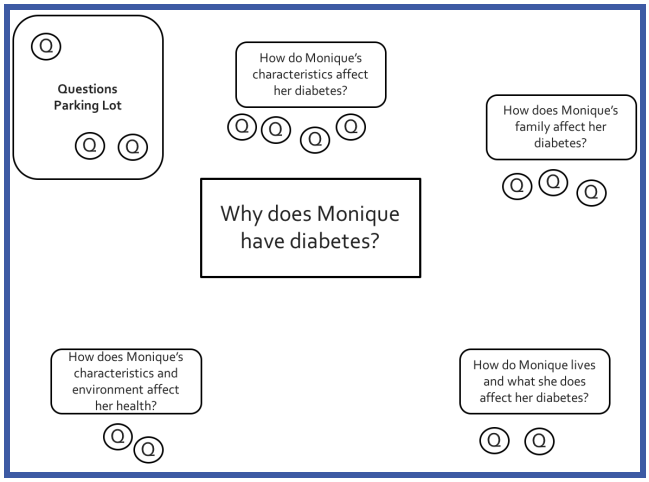
1. **What are learning strategies:** Explain what learning strategies are, and emphasize the importance of learning strategies for effective learning (see teacher's guide).
2. **Explain what *a Driving Question Board (DQB) is and how it can be used:*** A Driving Question Board (DQB) is a visual reference used to develop students' understanding of the overarching driving question. It is a dynamic tool, which will change over time as the students progress through the lessons (for further description, please refer to the teacher's guide).

The initial DQB:

Why does Monique have diabetes?

6. **Discussing:** With the entire class, discuss the questions that were generated by the pairs and the grouping of pairs together under similar topics. For example, why did they choose these questions? Why are you grouped together? What is similar/different about your questions? Then, put the Sub-Driving Questions (SDQs) up on the DQB and, together with the students, make connections between their questions and groups and the SDQs:
    - If the questions fit under a SDQ, put them in the relevant place
    - If the questions do not fit a SDQ, put the questions in the "Parking Lot" and tell the students that we might come back to these questions later
    - If additional questions are asked during the process, write them on sticky notes and put them up under the relevant SDQs or the Parking Lot.

The DQB with Sub-Driving Questions and students' questions:
(Go to page 13 to print out each question)



7. **Working with the DQB:** Tell the students that the questions that they asked will be revisited throughout the unit, as each lesson will address a different SDQ.

8. **Generalizing**: Tell the students that Monique and her diabetes will be the focus of many lessons in this unit, but that everything discussed can be applied to a person's health in general. By the end of the unit, we will come back to a more general Driving Question: **"What controls MY HEALTH?"**

Activity 2 - Introducing RoadMap

Introducing RoadMap - Using the RoadMap presentation, introduce RoadMap to the students. Make sure to emphasize the following aspects of roadMap (See Teacher Guide for more information):

- What are maps and how we use them
- The purpose of the map's key
- What is the students' RoadMap
- Indicate and explain the different types of nodes
- The purpose of using RoadMap:
  - i. Setting goals for learning
  - ii. Monitoring one's learning
  - iii. Freedom to re-examine past activities

Important *- students should not open the nodes that are labeled "SageModeler" before they actually use them. By doing so they will not be able to use them again. If a student opens a SageModeler node accidently contact the technical assistance.*

Activity 3 - Modeling - How can we explain a phenomenon?

Students at this point in their education are just learning to develop and use models. They may not have encountered the *SageModeler* software previously (See Teacher Guide for more information). Therefore, the first modeling activity in this curriculum has two goals:

1. Experience the *SageModeler* - a modeling supporting software, and
2. Engage in the practice of modeling within an authentic context for the students

Models and Modeling

1. **Drawing from prior knowledge - For this part, use slides 1-17.** Start the activity with an introductory conversation about models. Use the following prompts:
   - What are phenomena?
   - What are models?
   - Do you have previous experience with modeling?
   - What phenomena can we model?

	In science, models are used to help ***explain and understand*** phenomena (phenomena are reoccurring events we can experience in everyday life). Models can also be used ***to make predictions*** of phenomena. By observing how the model represents the phenomenon and then comparing it to the actual behavior of the phenomenon, the model can be ***revised*** to more accurately reflect the phenomenon.

Be sure to point out the difference between 1) how we use the word "models" in everyday language as opposed to "models" in science, and 2) how we may build representations (like a representation of a cell or solar system) as opposed to models whose roles are to explain and predict phenomena.

2. **Developing a model together - *structured modeling*** – through a class discussion, develop a model together with the class. The phenomenon for this exercise will be: *How can I change my grades in school?* Through this exercise, the teacher will introduce:
    - The modeling cycle and its constituent steps
    - The scaffolding prompts at each step of the modeling cycle
    - *SageModeler*, the software used to scaffold the students' modeling practices

For this part, use slides 18-29. Be sure to:
    - Break the task into the smaller steps and engage in "peer-review" processes often
    - Use the prompts to scaffold students' thinking in class discussions and for individual support
    - Have the students fill out the online reflections at the end of the process. Review students' reflection in a class discussion.

3. **Developing a model of your own – *guided modeling*** - Ask the students to choose a phenomenon that they would like to model. This could be **any** phenomenon that is authentic and has meaning to them (for example, improving your grades or being a better athlete).

For this part, use slides 30-38. Make sure to:
    - Break the task into the smaller steps and engage in "peer-review" processes often.
    - Let the students work individually or in pairs on their devices to develop their models. Circle among them and discuss their models with them as they work using the prompts.
    - Have the students fill out the online-worksheet as they develop their models, and the online reflection at the end of the process. Review students' reflections in a class discussion.

Follow-up activity

Instruct the students to complete the reading assignment: ***What are scientific models?*** Discuss their answers to the worksheet.

Name_____Date_____Class_____

What are scientific models?

Scientists explain ***why*** and ***how*** something happens. For example, when there are fewer plants in an ecosystem, the number of animals also gets smaller. Scientists investigate to understand why. They use ***scientific models*** to explain why this happens, and most importantly to **predict** *why* and *how* these incidents may happen again.

Figure 1 below is a model of a food chain. This model can explain who eats what. You can also use this model to predict what will happen. For example, what do you think will happen to the number of eagles if many of the snakes were suddenly killed?

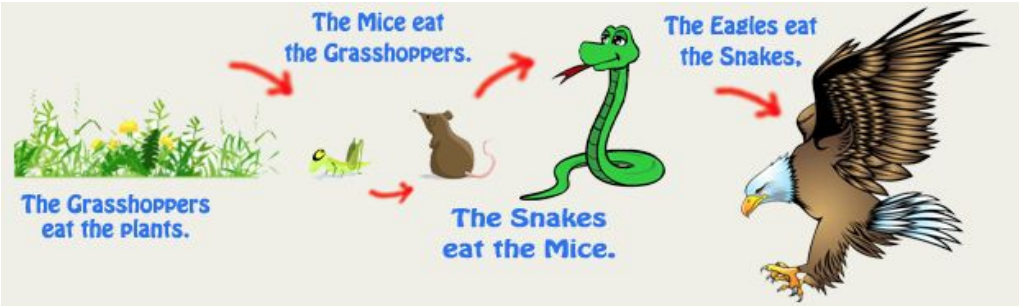


Figure 1. Food chain

Another example of using scientific models is weather forecasting. Weather changes all the time, and it affects our lives. Throughout time, people have tried to predict the weather. Now, scientists predict weather by collecting and analyzing weather data from many different places by using technology and using computerized models (Figure 2).

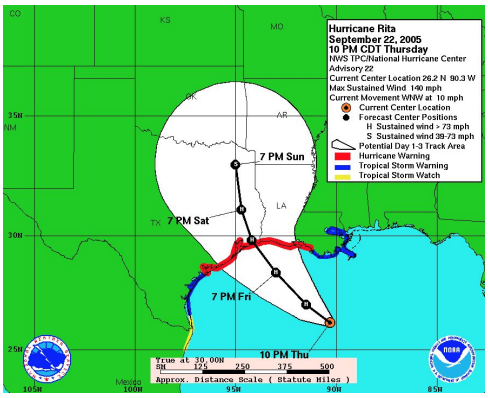


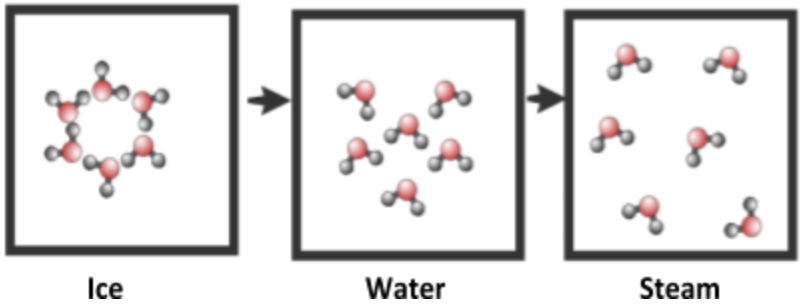
Figure 2. Use of computer-model to forecast weather

Which do you think is a scientific model? Explain in the space provided below each picture.

1. Is this a model?

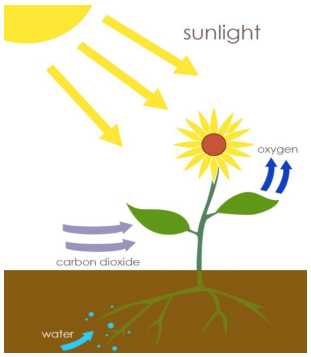
Your answer:

2. Is this a model?



Your answer:

3. Is this a model?



Your answer:

4. Is this a model?

Your answer:

Why does Monique have diabetes?

How can we describe Monique's diabetes?

How does Monique's family affect her diabetes?

How does where Monique lives and what she does affect her diabetes?

How do Monique's characteristics and environment affect her health?

What can Monique do to make her environment healthier?

Parking lot

Scaffolding the student's modeling - Lesson 1

Modeling can be difficult to teach and learn, especially for teachers and students who are new to modeling as a scientific practice. Students' modeling can be improved if their thinking is scaffolded (supported) by a series of prompts at each step of the modeling cycle. For "What Controls My Health, challenges to students' thinking were identified and specific prompts designed to help support students throughout the process. There are quite a few prompts to use to scaffold modeling in the instructional sequence of every lesson, so in this section, we provide a background and rationale for their use.

Below is a table that shows the cognitive and metacognitive challenges that were identified and the prompts that were designed *for teachers to use in discussion* to scaffold students' thinking at each stage of the modeling cycle. Some of the generic challenges are about science content (domain-general challenges) and some are specific to learning about diabetes and gene-environment interaction (domain-specific challenges). Some prompts were designed as generic for domain-general challenges, and some were designed as context-specific for domain-specific challenges. Here are some definitions to clarify terms:

- Cognitive scaffolds – scaffolds aimed at supporting skills necessary to encode, memorize, and recall information
- Metacognitive scaffolds – scaffolds aimed at supporting skills that enable learners to understand and monitor their cognitive processes.
- Generic scaffolds – scaffolds aimed at supporting a general understanding of the framework for modeling regardless of the science content area
- Context-specific scaffolds – scaffolds aimed at supporting an understanding of the context-specific modeling task, and the content knowledge to be used

Students' challenges (*cognitive* or *metacognitive*)	**Generic prompts**	**Context-specific prompts**
Planning		
Identifying what they know about the phenomenon that needs to be integrated into the models (*metacognitive*)		What is the question you are trying to answer about your phenomenon? What are the components of your model? Make a list!
Identifying measurable components to be included in the model (*cognitive*)	Why is it necessary to have quantitative components? How can you find out if the components are quantitative?	Are the components quantitative? Can they answer the question HOW MUCH of this component has an effect?

Categorizing the components that needed to be included in the model (*cognitive*)	Why is it important to categorize the components? How can you categorize them?	Do the components have something in common? Can they be organized into categories?
Building		
Organize the components and the relationships between them on their actual models (*cognitive*)		How are the components related? Describe the relationships between the components.
Identifying the direction of cause and effect relationships between the components (cognitive)	How are cause and effect relationships between components represented in models? What does the direction of the arrow represent?	What are the cause and effect relationships between the components in your model? Do the arrows in your model represent these relationships correctly?
Testing		
Identifying errors in their models (*metacognitive & cognitive*)		Does your model make sense? Does your model explain the causes and effects of your phenomenon? Are any components missing? Are the relationships correct?
Revising		
Identifying their new knowledge and how it relates to the phenomenon (*metacognitive*)		Not applicable for this lesson
Identifying the components and relationships to be added to the models (*cognitive*)		
Using the feedback (provided by teacher or peers) to revise their models to better capture the mechanism underlying the process of diabetes (*metacognitive*)		What feedback did you receive about your model? How can you use the feedback to improve your model? What needs to be changed?
Using insights from other students' models to revise and improve their own (*metacognitive*)		Not applicable for this lesson

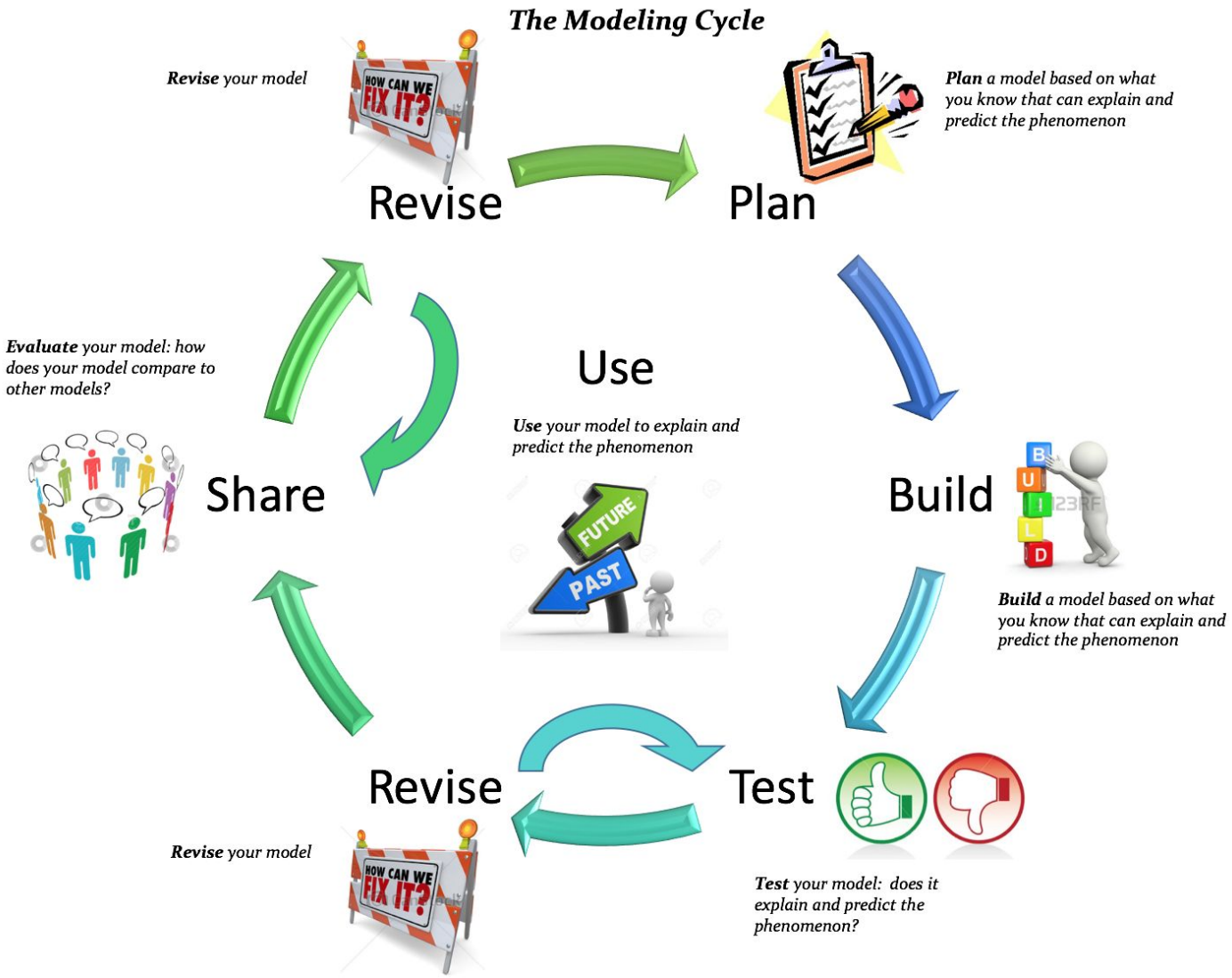
Sharing		
Communicating their models not only by describing the components and the relationships between them, but also by providing an overview of the gene-environment interactions that lead to diabetes (*cognitive*)		What question is your model trying to answer? What is the answer to the question according to your model?
Providing feedback to their peers on the core aspects of modeling to help them improve their models (*cognitive*)	Why do we create models?	Does the model explain and predict the phenomenon?

Developing your model

Definitions:

- A **phenomenon** is a fact or situation that we can observe, explain and predict.
- A **model** is a visual representation of a phenomenon. A model explains and predicts a phenomenon.

The modeling cycle:



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What's your phenomenon: _____

Step 1: Planning

1. What is the question you are trying to answer about your ***phenomenon***?

_____

_____

2. What are the components of your model? Make a list!

_____

_____

_____

3. Be sure to use components that can answer the question HOW MUCH.
4. Can the components be organized into categories? Categorize them!

Categories:					
Components:	_____ _____ _____ _____ _____ _____ _____	_____ _____ _____ _____ _____ _____ _____	_____ _____ _____ _____ _____ _____ _____	_____ _____ _____ _____ _____ _____ _____	_____ _____ _____ _____ _____ _____ _____

Step 2: Building

Open SageModeler and start developing your model
https://concord.org/projects/building-models

1. Use components from your list - you can add/omit components
2. Choose pictures to express each component
3. How are the components related? Use the arrows to describe the relationships (cause to effect).

Step 3 & 4: Testing and Revising

Make sure that:

- ❑ Does your model make sense? Does your model explain your phenomenon?
- ❑ Are any components missing? Are the relationships correct?

Revise your model if necessary!

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Step 5: Sharing

1. Explain your model - what question is your model trying to answer?

_____

2. What is the answer to the question according to your model?

_____
_____
_____

Step 6: Revising

1. What feedback did you receive about your model? How can you improve your model? What needs to be changed?

_____
_____
_____

2. Look at other models in your class: How are they similar or different than yours? Are there ways they explain phenomena better? How can you use them to improve your own model?

_____
_____
_____

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Thinking About My Model

1. Score your model - How well does your model explain the phenomenon?

Circle score (1=not well, 6=very well)
1 2 3 4 5 6

Explain your score: _____

_____

_____

2. Was it easy to think of the **components** and the **relationships** that you should add to your model?

Circle score (1=not at all, 6=very much)
1 2 3 4 5 6

How did you think of them? _____

_____

_____

3. Did the class discussion about the models help you improve your own model?

Circle score (1=not at all, 6=very much)
1 2 3 4 5 6

Why? What changes did you make to your model following the class discussion?_____

_____

_____

4. When you are asked to model a phenomenon, what should you do? (*hint - look at the modeling cycle*)

_____

_____

_____

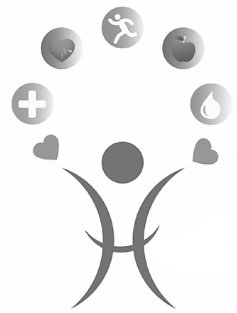
_____

_____

_____

_____

Health in Our Hands



What controls my health?

Lesson 2:

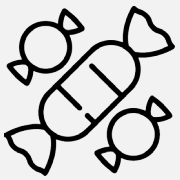
How can we describe Monique's diabetes?

Diabetes is caused by a both genetic factors passed down from relatives and environmental factors like diet and exercise. When we eat food, our body breaks sugars down into glucose. Our body produces insulin that acts like a key to move glucose into cells, so it can be used for energy. When people have diabetes, insulin does not act like a key, so glucose does not make it into cells. This causes high blood sugar. Diabetes is diagnosed with a blood test that shows if you have high blood sugar. If diabetes is not well controlled, it can cause problems with your eyes, brain, heart, kidneys, feet, and nerves.

For discussion at home:
What is the difference between Type 1 and Type 2 diabetes?

Key Point #1

Diabetes affects how the body processes sugar or glucose from the foods we eat. Cells in our bodies need glucose for energy.

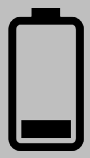


Key Point #2

Our bodies produce insulin, which acts like a key and allows glucose to get into our cells, so they have the energy they need.

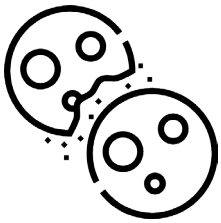
Key Point #3

When someone has Type 2 diabetes, insulin does not work well so glucose cannot get into our cells. Then the body to not have the energy it needs to function properly.



Explore more: Sugar Cookies

Ask an adult at home to help with this activity



Step 1: Pick a cookie recipe. Follow the recipe but do not add any sugar.
Step 2: Divide the mix equally into three separate bowls.
Step 3: Add the recipe amount of sugar to the first bowl. Add ½ of the recommended sugar to the second bowl and ¼ of the recommended sugar to the third bowl.
Step 4: Bake each set of cookies, keeping the three groups of cookies separate.
Step 5: After the cookies have cooled have other people in your house sample one cookie from each group. Don't tell them how much sugar is in each cookie until after they taste. See which cookie people like the most!
Step 6: Share your results with your class!

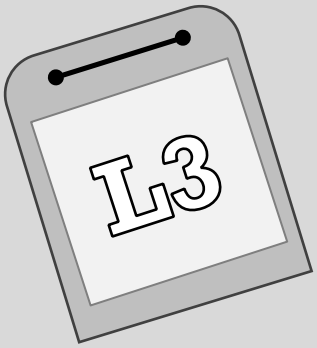
HIOH **Health Tips**

Eat right.
If you do have diabetes, make sure to monitor your blood sugar regularly to know if your insulin is working properly. Even if you don't have diabetes, this is an important health tip.

Get fit.
It is a good idea to talk with your doctor about what exercise routine is best for you and how best to live an active lifestyle.

Be mindful.
Keep in mind what activities make you feel better or worse. Keep a list of activities that make you feel good and focus on those.

What's coming next?



Lesson #3: How does Monique's family affect her diabetes?

Next lesson, students will learn about how genetic traits inherited from parents affect diabetes. Students will address the following questions:

1. What does it mean to inherit genetic factors?
2. How can traits be inherited?
3. How do genetic factors influence the inheritance of diabetes?

Get involved…

Enjoy science as a family! Join the Sloan Longway Museum the first Friday of each month at 6:00 pm for a fun event or an interesting lecture by a local science expert. For details on each month's event, visit: http://sloanlongway.org/first-friday/

SLOAN LONGWAY
Museum, Planetarium & Automotive Gallery

first fridays
Special Events Every Month

About us

We are CREATE for STEM Institute at MSU. Funded by Science Education Partnership Award (SEPA) granted by the National Institutes of Health (NIH), the project is developing a new generation of learning materials that blends school and community learning experiences to teach genomics (the study of all the genes of an organism and gene-environment relationships) and evolution.

Instagram

Follow HIOH on Instagram at ***health_in_our_hands***

Partners: UMichigan, Flint Public Schools, Concord Consortium, Community-Based Organization Partners, Sloan Museum, Flint Public Library

Lesson 2: How can we describe Monique's diabetes?

Unit Driving Question:	Materials	Suggested lesson time
What controls my health? **Sub-Driving Question:** How can we describe Monique's diabetes?	• Computer - one per pair of students • Projector - one for the class • Sticky notes • Markers • Cow/sheep/pig heart (Organs should be kept in individual baggies during student observations to cut down on spreading bacteria) • The ***Diagnosing Diabetes*** by ***Science Take Out***.	4 days

Framing the Lesson

Purpose
The purpose of this lesson is to expose students to strategies that can be used to obtain information from text and to use these strategies to learn how environmental and genetic factors can lead to diabetes. Then, students will begin to develop models regarding Monique's diabetes and further investigate the **Driving Question: What controls my health?**

Learning Goals
- The students obtain and evaluate information about the causes and effects of diabetes.
- The students obtain and evaluate information about how groups of body cells work together in subsystems that are affected by genetic components, and how these genetic components can have a negative or positive impact on the growth and health/development of organisms.
- The students develop models of the gene-environment interactions that lead to diabetes.

Building Coherence
In this lesson, students continue to investigate Monique's characteristics, health, and diabetes. They obtain and evaluate information from text in order to answer some of the questions they generated in Lesson 1. Students also review their models and add components related to diabetes and the human body.

Overview of the Lesson

Activity 1 - What is diabetes?
The students will read the article, "***What's Diabetes?***" They will share information about the cause, symptoms, and treatment of both Type 1 and Type 2 diabetes by completing the **KWL chart** (detailed later in the lesson).

Activity 2 - How is diabetes diagnosed?
The students will perform a glucose tolerance test by analyzing simulated blood plasma samples to determine if the person has Type 1 or Type 2 diabetes.

Activity 3 - Which body organs may be affected by diabetes?
The students will learn about the heart as an example of an organ which may be affected by diabetes. They will see a short video which introduces the heart and its various functions, and will dissect a real heart to reinforce their experience.

Wrapping-up the activities - revisiting the Driving Question Board
The students will revisit the ***Driving Question Board (DQB)*** and reflect upon their learning.

Activity 4- Modeling: Why does Monique have diabetes?
Each pair of students will collaboratively use the ***SageModeler*** program to develop models that explain the causes and effects of Monique's diabetes. Then, they will share their models with the whole class, discuss similarities and differences among the components of their models, and evaluate the relationships presented.

Connection to NGSS

Target Performance Expectations

MS-LS1-5. Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.
MS-LS1-3. Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.

Disciplinary core idea	Science and engineering practices	Crosscutting concepts
LS1.B: Growth and Development of Organisms	**Obtain, communicate, and evaluate information:** Critically read scientific texts adapted for classroom use to determine the central ideas and/or obtain scientific and/or technical information to describe patterns in and/or evidence about the natural and designed world(s). **Developing and Using Models:** Develop and use a model to describe phenomena.	**Cause and effect** • Cause and effect relationships may be used to predict phenomena in natural systems.

How these elements are integrated and embedded in this lesson

Students will obtain information about diabetes from the article to identify the multiple **causes** of diabetes. Students will also figure out genetic and environmental factors that can positively or negatively affect the growth and development of Monique and others and add these factors to their original models.

Connection to Students' Lives

Link to out-of-school activity and everyday life

- Create a classroom as a safe environment for students to bring their personal experience.
- Encourage students to share what they learn from their family at home. For example, students may ask friends and family members about medical issues related to diabetes.

Link to career-awareness

- This lesson provides an opportunity to discuss medical careers related to diabetes. One suggestion could be to contact local universities, hospitals, etc. to obtain possible speakers with careers related to diabetes. The American Society of Human Genetics have resources in this area.

Instructional Sequence

Introducing the Lesson

1. **Keeping coherence using the DQB** - Remind students of their questions related to Monique and diabetes on the Driving Question Board (DQB). Tell students that in this lesson they will further investigate the case study of Monique to determine how her characteristics are affecting her health and that they should pay particular attention to the questions that they had clustered around that Sub-Driving Question.

2. **Introducing the lesson** - Play the Lesson 2 video clip of Monique (1:41 minutes).

Activity 1 - What is diabetes?

1. **Introducing the KWL chart -** Introduce the KWL chart, its purpose, how to use it, and its importance.

	**Scaffolding students using *learning strategies*** 1. **Remind students about learning strategies:** Remind students of what learning strategies are, and emphasize the importance of learning strategies for effective learning (see teacher's guide) 2. **Explain what a *KWL chart* is and how it can be used** - KWL charts are graphic organizers that help students organize information before, during, and after a unit, a lesson, a project, or a reading. They can be used to engage students in a new topic, activate prior knowledge, share unit objectives, and monitor learning. • **"K" - What do I KNOW -** Before reading the text, identify **prior knowledge** about the topic of the reading, and connect between your own experiences and the text. • **"W" - What do I WANT to know** - Before reading the text, identify **what you want to learn** about the topic of the reading. • **"W" - What do I think the article WILL tell me** - Use the text features such as pictures, captions, and diagrams to **predict what you think you will learn** from the text. • **"L" - What did I LEARN** - After reading the text, indicate what you have learned about diabetes and cite evidence from the article.

2. **Completing the "K" and "W" of the KWL chart** - together with the class, complete the K and W parts of the KWL chart:
    - **"K" - What do I KNOW:** Ask the students to write their ideas about diabetes and record them under the "What do I **K**NOW about diabetes?" in their KWL chart, and then share with class.

    - **"W" - What do I WANT to know:** Ask the students to think about what they still need/want to know about diabetes in order to understand how it affects Monique. Instruct each student to write at least 2 questions under the "What do I **W**ANT to know about diabetes?" in their KWL chart and then share their questions with another student. Ask each group to pick two questions to share with the class, and then share with the class.

    - **"W" - What do I think the article WILL tell me:** Introduce the reading guide, and point out its source (from the Diabetes Research Institute). Ask students if they think they can trust this information and why. Then, ask them to predict what they think they will learn from the text about diabetes. Instruct them to scan the text for features such as titles, captions, pictures, and diagrams by using the following questions as prompts:
        - Why is there a picture of a lock and key?
        - What do the subtitles tell us about diabetes?

      Have the students predict and describe what the article might tell them about diabetes under the "What do I think the article WILL tell me about diabetes?" in their KWL chart. Discuss the students' ideas and which text feature they used as evidence for their idea.

3. **Obtaining information from text:** Introduce the reading guide and discuss the meaning of each of the text codes. Ask the student to read the article and code it in the margin of the text as they read.

	The purpose of ***text coding*** is to support students' engagement in the text and thinking as independent readers. Make sure to model text coding before asking students to use it. Stress the importance of identifying things that the students do not understand when they read, and encourage them to use the question mark.

4. **Completing the "L" of the KWL chart:** After the students complete the reading, use the codes to discuss what they have learned about diabetes. Ask the students to complete the "L" part of the KWL chart:

    "L" - What did I LEARN: Ask the students to write what they have learned about diabetes under the "What did I **L**EARN about diabetes?" in their KWL chart, and share with class.

5. **Discussing:** Together with the class, discuss the students' answers to the KWL chart:
    - Identify the ***explanation*** of what diabetes is, ***causes*** of diabetes, ***effects*** of diabetes, and ***symptoms***.
    - Discuss which causes are related to genetic factors and which are related to environmental factors (to connect to the next lessons).
    - Show the JDRF video that summarizes facts about diabetes and specifically Type II diabetes.
    - Show video of pancreas (3:20 minutes) to summarize what they learned about how the pancreas is related to diabetes.

Activity 2 - How is diabetes diagnosed?

Students will perform a glucose tolerance test by analyzing simulated blood plasma samples to determine if the person has Type 1 or Type 2 diabetes. For this activity, follow the instructions of the ***Diagnosing Diabetes*** by ***Science Take Out***.

Activity 3 - Which body organs may be affected by diabetes?

1. **Linking diabetes and heart disease -** Project the three awareness advertisements to the class and discuss their content (see ***Images 1-3***). Then, introduce the term ***Diabetic Heart Disease***, which refers to heart disease that develops in people who have diabetes. Write on the board these facts about people with diabetes:
    a. Are at higher risk for heart disease
    b. Have additional causes of heart disease
    c. May develop heart disease at a younger age
    d. May have more severe heart disease.

    Divide the students into groups of four and give each group 1 or 2 of the images. Ask them to find evidence in their images to support one or more of these facts. Have each group present their findings to the class.

2. **Introducing the anatomy of the human heart** - Show the students a short video about the anatomy of the heart: https://www.youtube.com/watch?v=oHMmtqKgs50 (2:56 minutes). First, let the students try to understand the information by themselves. Then, repeat the video while stopping it every few seconds to repeat and emphasize the heart's anatomy and its various functions.

INFO ABOUT THE HEART'S PARTS AND FUNCTIONS

The heart is a muscular organ about the size of a closed fist that functions as the body's circulatory pump. It is located between the lungs and behind the **sternum** (breast bone) in an area called the **thoracic cavity**. The lower tip of the heart rests just above the **diaphragm.** The base of the heart is located along the body's midline with the **apex** pointing toward the left side of the body. Because the heart points to the left, about 2/3 of the heart's mass is found on the left side of the body and the other 1/3 is on the right.

The heart's goal:
The heart moves the blood around the body. It takes in deoxygenated blood (blood without oxygen) from the veins and delivers it to the lungs for oxygenation (to get oxygen). Then, it pumps it into the various arteries, which provide oxygen and nutrients to body tissues by transporting the blood throughout the body.

Chambers of the heart:
The heart contains 4 chambers: the **right atrium**, **left atrium**, **right ventricle**, and **left ventricle**.

- The **atria** are the smaller chambers. They act as receiving chambers for blood, so they are connected to the **veins** that carry blood to the heart.
- The **ventricles** are the larger, stronger pumping chambers that send blood out of the heart. They are connected to the **arteries** that carry blood away from the heart.

The blood's circulation:
The right side of the heart maintains circulation to the nearby lungs; this is called **pulmonary circulation**. The left side of the heart pumps blood all the way to the extremities of the body; this is called the **systemic circulatory loop**.

Diabetes and heart disease:
Over time, high blood glucose levels damage nerves and blood vessels, and may therefore lead to heart disease and stroke. Heart problems are the leading causes of death among people with diabetes.

3. **Introducing the hearts' parts using a dissection** - Using a real organ, show the kids the various parts of the heart and emphasize their various functions. During the dissection, project to the class the picture of the heart, its parts, and its functions (see below ***Image 4***). After introducing the parts of the heart, follow the instructions at the following link to demonstrate the pumping activity of the heart: https://www.youtube.com/watch?v=ruM4Xxhx32U (4:27 minutes)

Wrapping-up the activities - revisiting the Driving Question Board

With the class, revisit the ***Driving Question Board (DQB)***. Prompt the students to reflect upon their learning using the following prompts:

1. Which questions on the DQB have we answered, and which remain open?
    - Students should attach their answers/artifacts of investigation onto the DQB next to the questions they relate to.

2. After completing the activities in the lesson, do you have any additional questions?
    - Any new questions should be added to the board near the SDQ they relate to.

Activity 4 - Modeling: Why does Monique have diabetes?

In the previous lesson, the students developed models of phenomena of their choice together and individually. From this lesson onwards, the students will develop models of Monique's diabetes and gene-environment interactions. The modeling activity in this lesson has two goals:

1. Support the students' understanding of models and modeling.
2. Begin generating a model of Monique's diabetes.

NOTE: From this lesson onwards, the students will **revise these models and add more components to them.**

Developing models of Monique's diabetes

1. **Developing a model Monique's diabetes - *guided modeling*** – Start with a class discussion about Monique's diabetes. **For this part, use the presentation for lesson 2.** Make sure to:
    - Break the task into the smaller steps and engage in "peer-review" processes often
    - Let the students work individually or in pairs on their devices to develop their models of Monique's diabetes. Circle among them, and discuss their models with them as they work using the prompts. Emphasize the various phases of the modeling cycle and use the scaffolding prompts.
    - Have the students fill out the online-worksheet as they develop their models, and the online reflection at the end of the process. Review students' reflections in a class discussion.

While the students experience using the ***SageModeler***, circle in the class, support the students, and encourage them to share their thinking and consult with their peers about their models. Students' models can vary. However, since the models need to explain the relationships among the components, make sure the models include:

Components

- Type 2 diabetes
- Macro level: body organs, such as the pancreas, liver, and heart
- Micro level: body cells, receptors, insulin, blood stream
- Sugar, glucose, glucose tolerance test, glucose levels in the blood
- Environmental factors: Healthy food, unhealthy food, exercise, etc.
- Genetic factors: genetic material

Relationships and labels

- The relationships among the components
- The relationship between the components and Monique's diabetes

Discuss with the students:

- The similarities and differences between the models
- The models' strengths and weaknesses
- Ways to improve the various models

A discussion which shares insights from the various models and compares among them is extremely important as it will scaffold the students' second revision of their models in the following step. Use questions to prompt the students to critically examine their peers' models.

Components:

- ***Components identity*** - What components are included in each model? Are key components included?
- ***Number of components*** - How many components are indicated in the model? Are MORE components necessarily better?
- ***Grouping of components*** - How can we group the various components? Why should we group components—does it improve our models? Is the grouping meaningful?

Relationships among components:

- ***Explicit relationships among the components*** - Are the relationships amo the components indicated? Do these relationships make sense? Are the indicated relationships important?

General features:

- ***Complexity of the model*** - How complex is the model?
- ***Organization*** - How well is the model organized? Is the organization meaningful?

What is diabetes?

Do you know someone who can't eat sweets? What about someone who gets a shot before meals? It might be because they have diabetes. Thousands of kids all over the world have diabetes. They can still have a healthy life if they understand what diabetes is and make healthy choices.

What is diabetes?

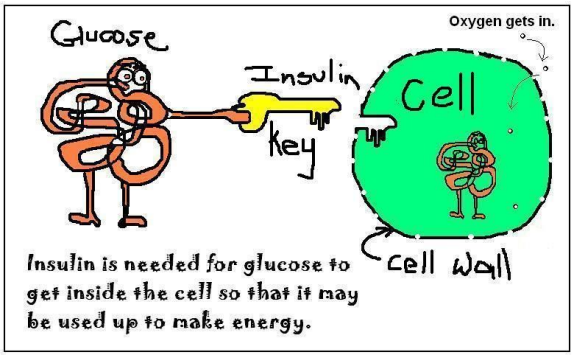
Diabetes is a disease that affects how the body uses sugar. The type of sugar that the body uses is called **glucose (GLOO-kose)**. The body uses glucose for energy. Most glucose comes from the food that we eat. Your body needs energy to keep going just like a cell phone needs to be charged. We get glucose from foods like bread, cereal, pasta, fruit, and starchy vegetables. If you have diabetes, your body has problems using glucose (sugar) properly for energy.

What happens in your body?

When you eat food, your body turns some of the food into glucose. The glucose goes into your blood, which carries it all over your body. Your body is made of tiny building blocks called cells. Your cells take some of the glucose that is in the blood and use it for energy to help you breathe and move and live.

The pancreas is an organ that helps the cells use glucose. Organs are parts of your body, like your lungs or brain, that have special jobs that keep you alive. The pancreas is a long, flat organ near your stomach. It helps to digest your food. The pancreas makes a chemical called insulin and adds it to the blood. The blood carries insulin and glucose to the cells.

Insulin acts like a key to a lock. The insulin unlocks the door to the cells. When the cell is unlocked, the glucose can leave the blood and get into the cell. The cells can get the energy that they need when glucose is inside the cell.



Type 1 Diabetes

There are two types of diabetes. Usually children have Type 1 diabetes. If you have Type 1 diabetes, you do not get diabetes from eating too much sugar. Your pancreas is not making enough insulin to unlock the cells. A person with Type 1 diabetes has to take insulin shots so that their cells can take in glucose.

Causes

Scientists are still trying to figure out what causes diabetes. They are studying patterns of diabetes in families. They are also studying the environment of people with diabetes, including where and how they live. Scientists think that Type 1 diabetes might be caused by:

- Genetics—inherited from your parents
- Our environment—coming into contact with a very specific virus or specific chemicals.

Type 2 Diabetes

Type 2 diabetes usually occurs in adults. More and more children are also getting Type 2 diabetes. The pancreas still makes insulin if you have Type 2 diabetes, but the insulin cannot properly unlock the cell. It is like having the wrong key for the door. The glucose is slower getting into the cell because the insulin does not work correctly.

Causes

Scientists believe that Type 2 diabetes might be caused by:

- Genetics—inherited from your parents
- Our environment—unhealthy diet and not enough exercising.

Being hungry, thirsty, sleepy, and having blurred vision are just some of the symptoms of diabetes.

How does it feel to have diabetes?

In Type 1 and Type 2 diabetes, too much glucose ends up in the blood. This is called high blood sugar. The body cells are not getting enough glucose for energy. This can cause you to feel thirsty, hungry, or tired. You might frequently pass urine or have blurry vision. Diabetes can cause problems with your eyes, brain, heart, kidneys, feet, and nerves.

How can you stay well with diabetes?

Regular exercise and a healthy diet are the most important things you can do to stay well with diabetes. People with Type 1 or Type 2 diabetes may have to take insulin and other medicines from a pill or a shot. They also have to check the sugar level in their blood using a small machine that looks like a cell phone. People who have diabetes must work as a team with their doctor and their family to stay healthy. They also have to work with a dietician to learn about healthy eating. A diabetes educator can help people to learn about how to keep from getting sick and live a healthy life.

Name_____Date_____Class_____

What is diabetes?

1. Think about these questions as you watch the Lesson 2 video.
   - What characteristics does Monique talk about that affect her?
   - What does she describe as her biggest problem?
2. Monique says that most people don't really know much about diabetes. Think about:
   - What do you know about diabetes?
   - Do you or does anyone you know have diabetes? What is it like?

Completing a KWL Chart

"K" - What do I KNOW about diabetes?

Write down your ideas about diabetes and any experiences you have had with diabetes:

"W" - What do I WANT to know about diabetes?

To understand what is affecting Monique, we have to understand more about diabetes. What do we need to know about diabetes? Write down at least 2 questions that you think would be important to ask about diabetes:

Share your questions with your partner. Pick 2 questions that you and your partner agree are the most important and share them with the class.

"W" - What do I think the article WILL tell me about diabetes? Think about:
Look at the pictures, captions, and titles in the article ***What's Diabetes*?**

- What do you think this article is about?
- Do you think it will help to answer any of the questions that you wrote above?

Make a prediction. Write at least 3 sentences that say what you think this article will be about.

Read the article ***What's Diabetes?***
Put text codes in the margin of the article to describe what you think as you read.

Text codes

✓	When you read something that makes you say, "Yeah, I knew that" or "I predicted that" or "I saw that coming."
X	When you run across something that contradicts what you know or expect.
?	When you have a question, need clarification, or are unsure.
!	When you discover something new, surprising, exciting, or fun that makes you say cool, whoa, yuck, no way, awesome.
★	When you read something that seems important, vital, key, memorable, or powerful.

Look at all of the things that you coded in the article. Think about:

- Why did you think that they were important?
- Do you still feel that they are important?
- How will they help us understand Monique's health?

"L" - What did I LEARN about diabetes?

Write down what you have learned from this article about diabetes. Use the ***star*** and ***exclamation mark*** codes to help you decide what to write.

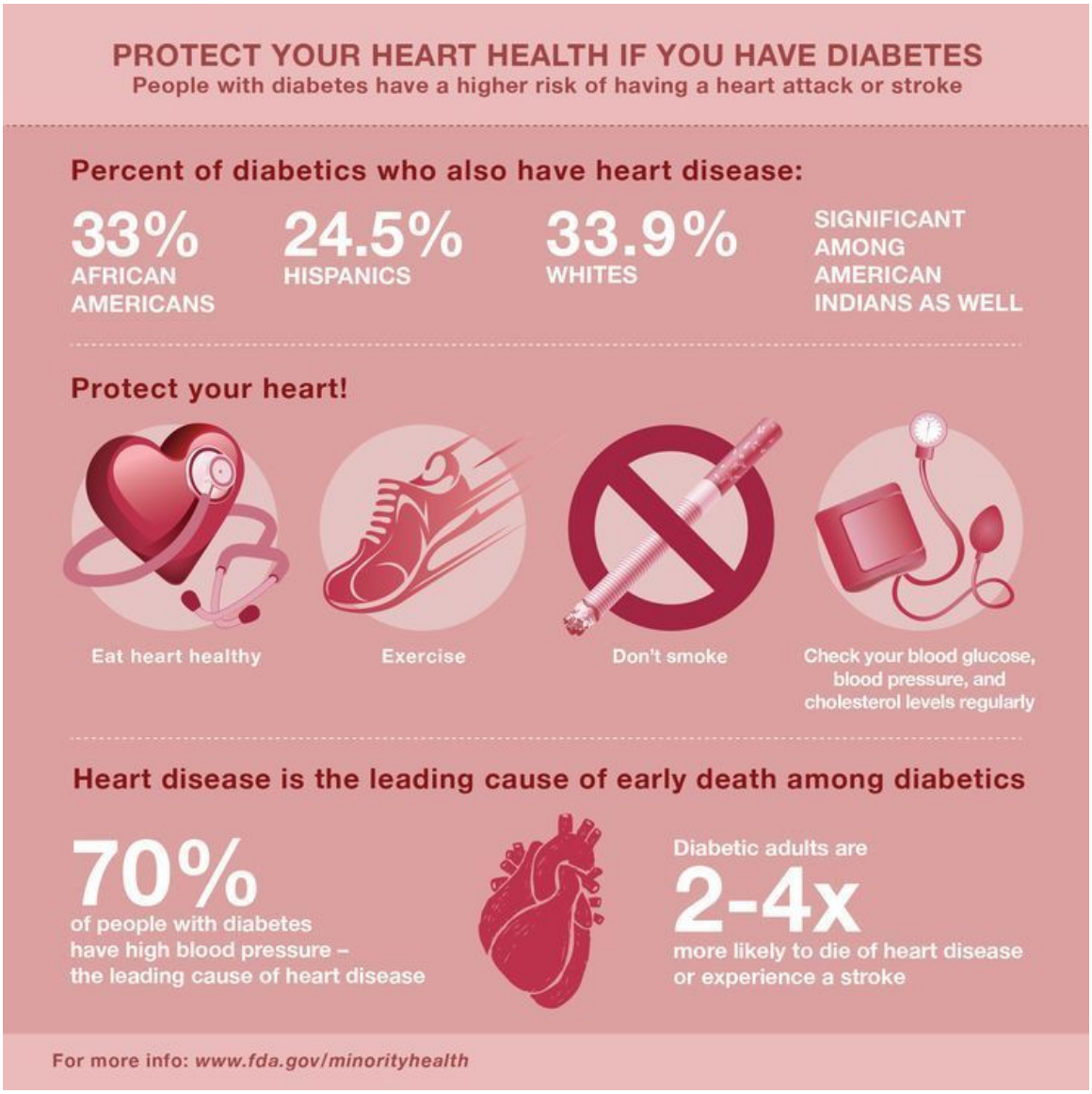
Identify which of your ideas are:

1. **Descriptions/explanations:** What is diabetes? What happens in the bodies of people who have diabetes?
2. **Causes:** What are some of the causes of Type 1 and Type 2 diabetes?
3. **Effects:** What are the effects of diabetes? What can it do to the body?
4. **Symptoms**: What are the symptoms of people with diabetes?

You can highlight each type of information (descriptions/explanations, causes, effects, or symptoms) in a different color, and make a key of their meaning.

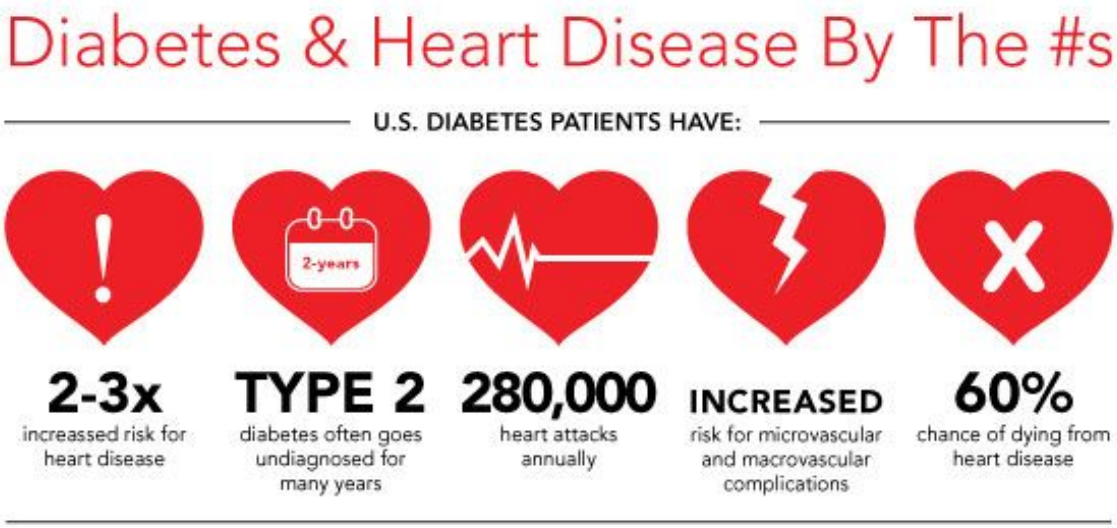
Which body organs may be affected by diabetes?

Diabetes and Heart Disease - *Image 1*



Which body organs may be affected by diabetes?

Diabetes and Heart Disease - *Image 2*

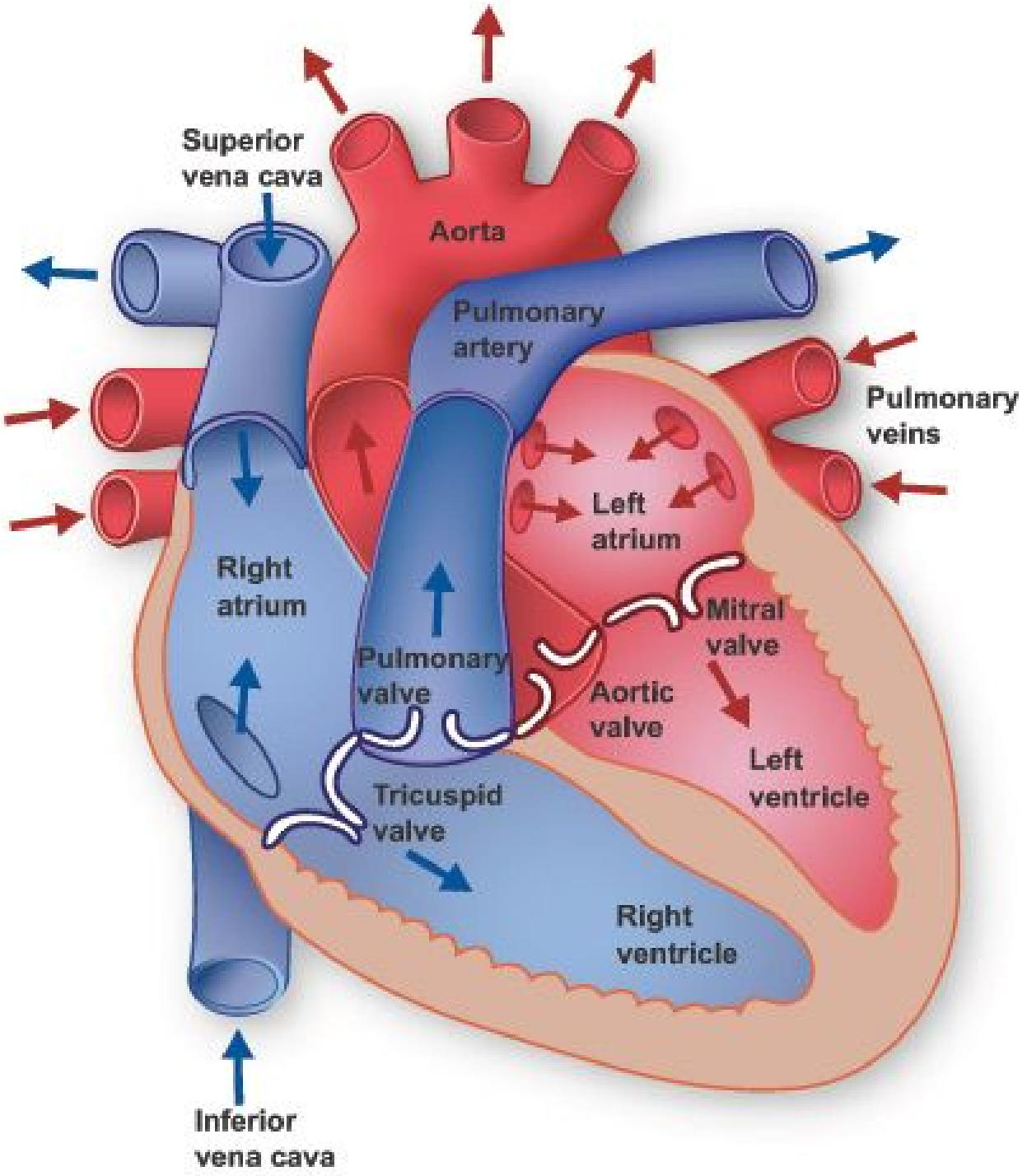


Which body organs may be affected by diabetes?

Diabetes and Heart Disease - *Image 3*

Which body organs may be affected by diabetes?

Diabetes and Heart Disease - *Image 4*



Scaffolding the student's modeling

Modeling can be difficult to teach and learn, especially for teachers and students who are new to modeling as a scientific practice. Students' modeling can be improved if their thinking is scaffolded (supported) by a series of prompts at each step of the modeling cycle. For "What Controls My Health, challenges to students' thinking were identified and specific prompts designed to help support students throughout the process. There are quite a few prompts to use to scaffold modeling in the instructional sequence of every lesson, so in this section, we provide a background and rationale for their use.

Below is a table that shows the cognitive and metacognitive challenges that were identified and the prompts that were designed *for teachers to use in discussion* to scaffold students' thinking at each stage of the modeling cycle. Some of the generic challenges are about science content (domain-general challenges) and some are specific to learning about diabetes and gene-environment interaction (domain-specific challenges). Some prompts were designed as generic for domain-general challenges, and some were designed as context-specific for domain-specific challenges. Here are some definitions to clarify terms:

- Cognitive scaffolds – scaffolds aimed at supporting skills necessary to encode, memorize, and recall information
- Metacognitive scaffolds – scaffolds aimed at supporting skills that enable learners to understand and monitor their cognitive processes.
- Generic scaffolds – scaffolds aimed at supporting a general understanding of the framework for modeling regardless of the science content area
- Context-specific scaffolds – scaffolds aimed at supporting an understanding of the context-specific modeling task, and the content knowledge to be used

Students' challenges (*cognitive* or *metacognitive*)	Generic prompts	Context-specific prompts
Planning		
Identifying what they know about the phenomenon that needs to be integrated into the models (*metacognitive*)		What is the question you are trying to answer about Monique's diabetes? What are the components of your model about Monique's Type II diabetes? Make a list!
Identifying measurable components to be included in the model (*cognitive*)	Why is it necessary to have quantitative components? How can you find out if the components are quantitative?	Are the components quantitative? Can they answer the question HOW MUCH of this component affects Monique's diabetes?

Categorizing the components that needed to be included in the model (*cognitive*)	Why is it important to categorize the components? How can you categorize them?	Do the components have something in common? Can they be organized into categories, such as genetic or environmental factors?
Building		
Organize the components and the relationships between them on their actual models (*cognitive*)		How are the components related? How do they affect Monique's diabetes? Describe the relationships between the components.
Identifying the direction of cause and effect relationships between the components (cognitive)	How are cause and effect relationships between components represented in models? What does the direction of the arrow represent?	What are the cause and effect relationships between the components in your model? Do the arrows in your model represent correctly the causes and effects of Monique's diabetes?
Testing		
Identifying errors in their models (*metacognitive & cognitive*)		Does your model make sense? Does your model explain the causes and effects of Monique's diabetes? Are there any components missing? Are the relationships correct?
Revising		
Identifying their new knowledge and how it relates to the phenomenon (*metacognitive*)		Not applicable for this lesson
Identifying the components and relationships to be added to the models (*cognitive*)		
Using the feedback (provided by teacher or peers) to revise their models to better capture the mechanism underlying the process of diabetes (*metacognitive*)		What feedback did you receive about your model? How can you use the feedback to improve your model to better explain Monique's diabetes? What needs to be changed?

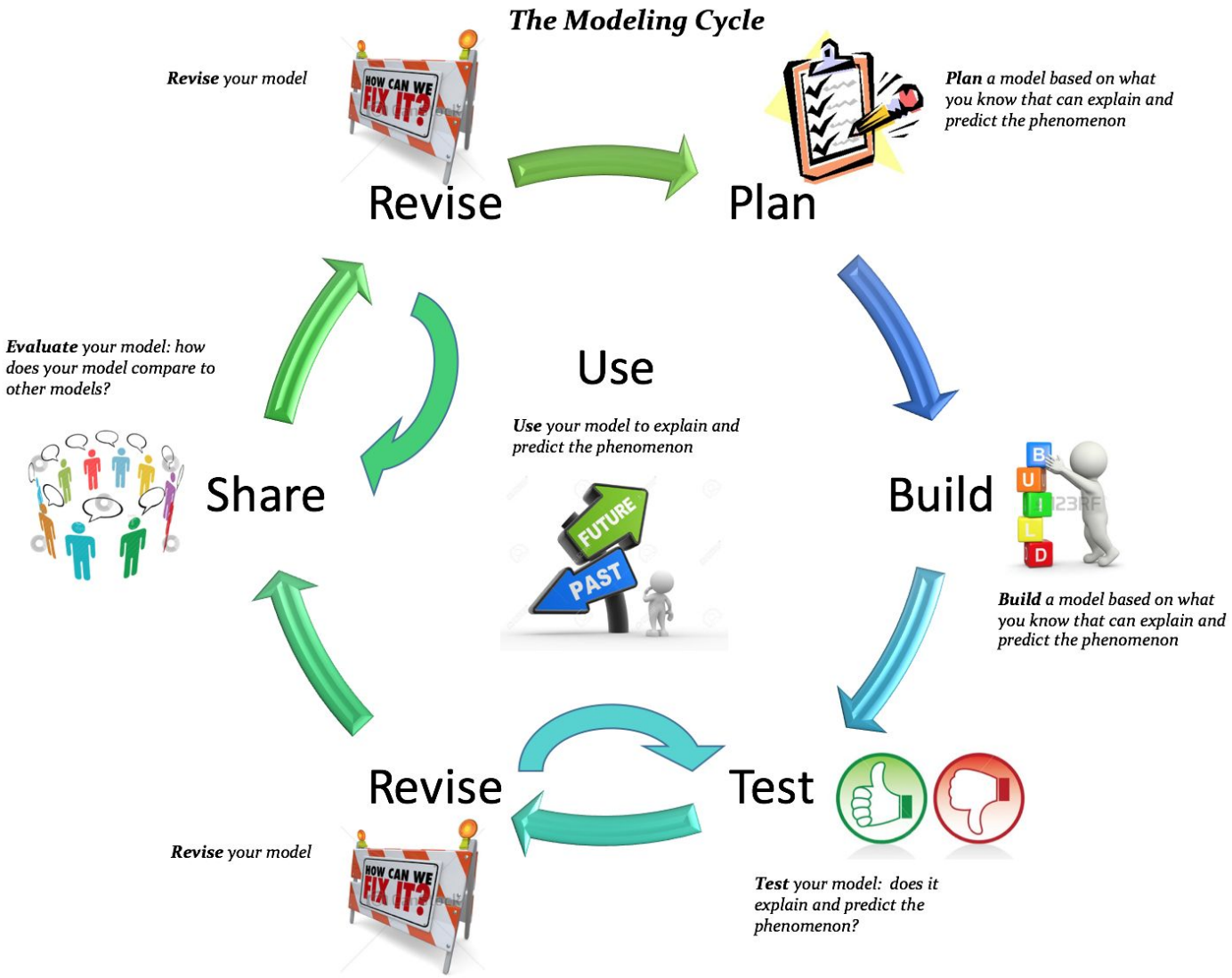
Using insights from other students' models to revise and improve their own (*metacognitive*)		Look at other models of Monique's diabetes: How are they similar or different than yours? Are the ways they explain Monique's diabetes better? How can you use them to improve your own model?
Sharing		
Communicating their models not only by describing the components and the relationships between them, but also by providing an overview of the gene-environment interactions that lead to diabetes (*cognitive*)		What question about Monique's diabetes is your model trying to answer? Why does Monique have diabetes according to your model?
Providing feedback to their peers on the core aspects of modeling to help them improve their models (*cognitive*)	Why do we create models?	Does the model explain and predict Monique's diabetes?

Developing your model

Definitions:

- A **phenomenon** is a fact or situation that we can observe, explain and predict.
- A **model** is a visual representation of a phenomenon. A model explains and predicts a phenomenon.

The modeling cycle:



CREATE for STEM Institute

HealthInOurHands

Why does Monique have diabetes?

Step 1: Planning

1. What is the question you are trying to answer about your ***Monique's diabetes***?

_____

_____

2. What are the components of your model that will explain Monique's diabetes? Make a list!

_____

_____

_____

3. Be sure to use components that can answer the question HOW MUCH - do they increase or decrease Monique's diabetes?.
4. Can the components be organized into categories? Categorize them!

Categories:					
Components:	_____ _____ _____ _____ _____ _____ _____	_____ _____ _____ _____ _____ _____ _____	_____ _____ _____ _____ _____ _____ _____	_____ _____ _____ _____ _____ _____ _____	_____ _____ _____ _____ _____ _____ _____

Step 2: Building

Open SageModeler and start developing your model
https://concord.org/projects/building-models

1. Use components from your list - you can add/omit components
2. Choose pictures to express each component
3. How are the components related? Use the arrows to describe the relationships (cause to effect).

Step 3 & 4: Testing and Revising

Make sure that:

- ❏ Does your model make sense? Does your model explain why Monique has diabetes? Does your model explain the causes and effects of Type 2 diabetes?
- ❏ Are any components missing? Are the relationships correct?

Revise your model if necessary!

MICHIGAN STATE UNIVERSITY

Step 5: Sharing

1. Explain your model - what question about diabetes is your model trying to answer?

_____

2. Why does Monique have diabetes according to your model?

_____

_____

_____

Step 6: Revising

1. What feedback did you receive about your model? How can you improve your model to better explain diabetes? What needs to be changed?

_____

_____

_____

2. Look at other models of Monique's diabetes: How are they similar or different than yours? Are the ways they explain Monique's diabetes better? How can you use them to improve your own model?

_____

_____

_____

Thinking About My Model

1. Score your model - How well does your model explain why Monique has Type 2 diabetes?

Circle score (1=not well, 6=very well)
1 2 3 4 5 6

Explain your score: _____
_____
_____

2. Was it easy to think of the **components** and the **relationships** that you should add to your model to explain and predict Monique's diabetes?

Circle score (1=not at all, 6=very much)
1 2 3 4 5 6

How did you think of them? _____
_____
_____

3. Did the class discussion about the models help you improve your own model about Monique's diabetes?

Circle score (1=not at all, 6=very much)
1 2 3 4 5 6

Why? What changes did you make to your model following the class discussion?_____
_____
_____

4. When you are asked to model a phenomenon, what should you do? (*hint - look at the modeling cycle*)
_____
_____
_____
_____
_____
_____
_____

Diagnosing Diabetes

Teacher Information

science take·out®
just add students™

Summary

Students analyze simulated blood plasma samples collected during a glucose tolerance test for diabetes. They test glucose and insulin levels to determine if the patient has Type 1 or Type 2 diabetes.

Core Concepts

- To maintain homeostasis the internal environment must be kept stable – within normal limits that are favorable for cell activities.
- Homeostasis in an organism is constantly threatened. Failure to respond effectively can result in disease or death.
- Organisms detect and respond to change in a variety of ways both at the cellular and at the organismal level.
- Blood sugar levels are maintained by insulin from the pancreas.
- Receptor molecules and hormones play an important role in the interactions between cells.
- If hormone signals are blocked, cell communication is disrupted and the organism's stability is affected.

Time Required

Two 40-minute class periods + homework. Part 1 may be done as pre-lab homework.

Kit contains

- 5 tubes of simulated "Blood Plasma" (0, 30, 60, 90 and 120 minutes)
- 1 tube of simulated "Insulin Indicator"
- 6 labeled droppers
- Simulated "Glucose Test Paper"
- Glucose/Insulin Test Color Charts
- Glucose Tolerance Testing Sheet
- Colored sheet of graphics for *What You Should Know About Diabetes and the Glucose Tolerance Test*

Teacher Provides

- Safety goggles
- Paper towels for clean up
- Scissors
- Tape or glue

Warning: Choking Hazard

This Science Take-Out kit contains small parts. Do not allow children under the age of seven to have access to any kit components.

Reusing *Diagnosing Diabetes* kits

Teachers will need to instruct students on how to handle clean-up and return of the re-usable kit materials. For example, teachers might provide the following information for students:

Discard	Rinse with water and dry with paper towel	Return to kit bag
• Used glucose test papers	• Glucose Tolerance Testing Sheet • All droppers	• All labeled droppers (rinsed) • All labeled microtubes • Glucose Test Paper bag • Glucose/Insulin Color Chart* • Glucose Tolerance Testing Sheet (rinsed)

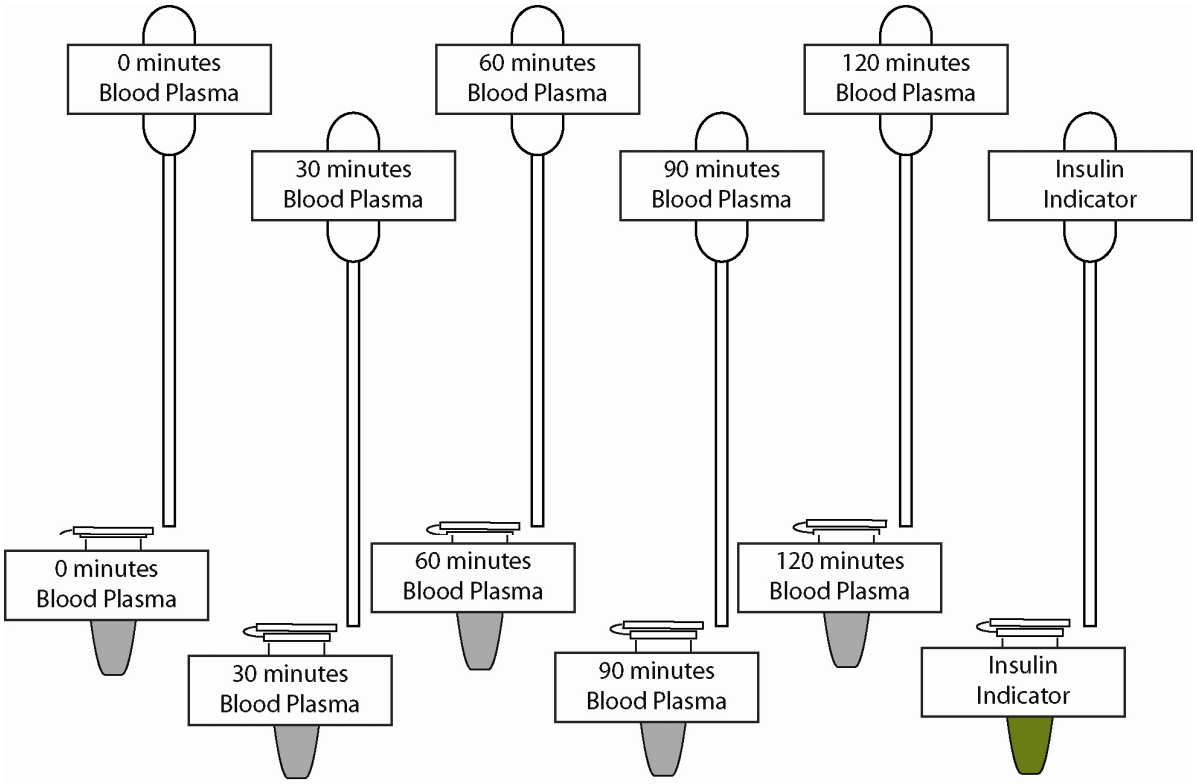
Do not immerse droppers in water. To rinse, simply squirt the contents out of the dropper and then draw water up into the dropper several times. Empty water out of dropper. Dry outside of dropper.

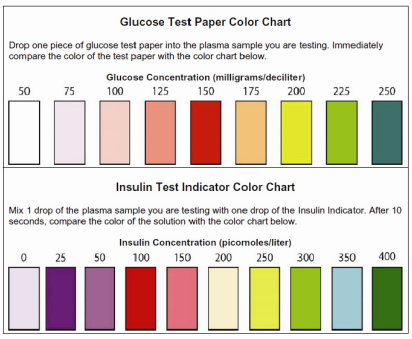
*Note: Consider laminating printed parts of the kits (such as colored graphics or instruction cards) that will be reused.

Refills for *Diagnosing Diabetes* kits are available at www.sciencetakeout.com. The **10 Kit Refill Pack** includes the following materials:

- Instructions and Quick Guide for refilling kit
- 6 graduated transfer pipets (for teacher use)
- 5 ml of each simulated "Blood Plasma" sample (0, 30, 60, 90, 120 minutes)
- 5 ml of "Insulin Indicator"
- 60 pieces of "Glucose Test Paper"
- 10 sheets of colored graphic cards. *Note: if each kit is being used by more than one student, you may make additional copies (in grayscale or color).*

Kit Contents Quick Guide

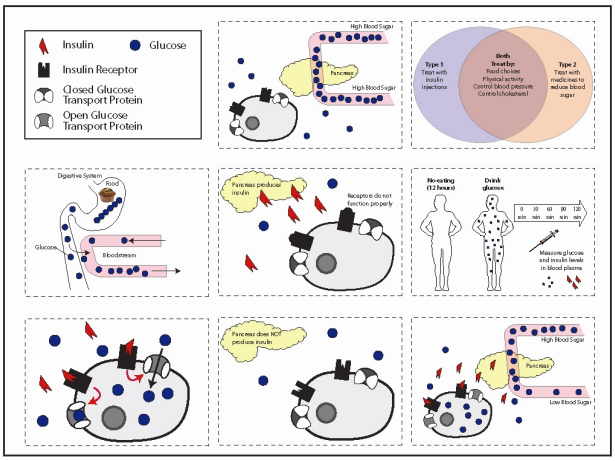




Glucose Test Paper

Glucose Tolerance Testing Sheet

Time of Blood Collection Minutes After Drinking Glucose Solution	Column 1 Drop of Blood Plasma for Glucose Test	Column 2 Drop of Blood Plasma for Insulin Test
0 (fasting)		
30		
60		
90		
120		



Read these instructions before using Science Take-Out kits

Parental or Adult Supervision Required

This kit should be used only under the supervision of an adult who is committed to ensuring that the safety precautions below, and in the specific laboratory activity, are followed.

Safety Goggles and Gloves Strongly Recommended

We encourage students to adopt safe lab practices, and wear safety goggles and gloves when performing laboratory activities involving chemicals. Safety goggles and gloves are not provided in Science Take-Out kits. They may be purchased from a local hardware store or pharmacy.

Warning: Choking and Chemical Hazard

Science Take-Out kits contain small parts that could pose a choking hazard and chemicals that could be hazardous if ingested. Do not allow children under the age of seven to have access to any kit components. Material Safety Data Sheets (MSDS) provide specific safety information regarding the chemical contents of the kits. MSDS information for each kit is provided in the accompanying teacher instructions.

Chemicals Used in Science Take-Out Kits

Every effort has been made to reduce the use of hazardous chemicals in Science Take-Out kits. Most kits contain common household chemicals or chemicals that pose little or no risk.

General Safety Precautions

1. Work in a clean, uncluttered area. Cover the work area to protect the work surface.
2. Read and follow all instructions carefully.
3. Pay particular attention to following the specific safety precautions included in the kit activity instructions.
4. Goggles and gloves should be worn while performing experiments using chemicals.
5. Do not use the contents of this kit for any other purpose beyond those described in the kit instructions.
6. Do not leave experiment parts or kits where they could be used inappropriately by others.
7. Never taste or ingest any chemicals provided in the kit - they may be toxic.
8. Do not eat, drink, apply make-up or contact lenses while performing experiments.
9. Wash your hands before and after performing experiments.
10. Chemicals used in Science Take-Out experiments may stain or damage skin, clothing or work surfaces. If spills occur, wash the area immediately and thoroughly.
11. At the end of the experiment, return ALL kit components to the kit plastic bag. Dispose of the plastic bag and contents in your regular household trash.

No blood or body fluids from humans or animals are used in Science Take-Out kits. Chemical mixtures are substituted as simulations of these substances.

Diagnosing Diabetes: *Teacher Answer Key*

The Case:

Your patient reports problems with fatigue and increased urination. You suspect that she might have diabetes. The results of her blood tests indicate that her blood glucose level is slightly above the normal range. You schedule the patient for a glucose tolerance test which is a medical test to check how the body metabolizes blood sugar.

Your Tasks:

- Organize pictures to illustrate a patient information sheet
- Test and graph the glucose levels in blood plasma samples collected during the patient's glucose tolerance test.
- Test and graph the insulin levels in blood plasma samples collected during the patient's glucose tolerance test.
- Analyze the test results to determine if the patient has Type 1 or Type 2 diabetes.

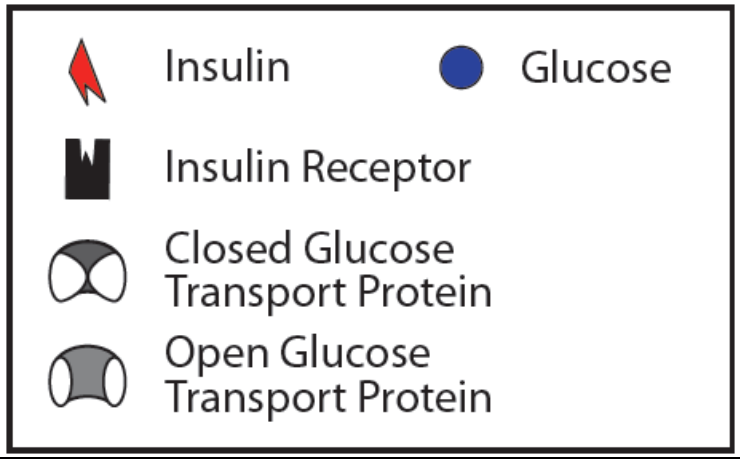
PART 1:
What you should know about diabetes and the glucose tolerance test

You have a patient information sheet called *What You Should Know About Diabetes and the Glucose Tolerance Test,* that explains diabetes and the glucose tolerance test. However, many of your patients have difficulty reading this information sheet. You would like to add some pictures that you have collected to illustrate the information in the brochure.

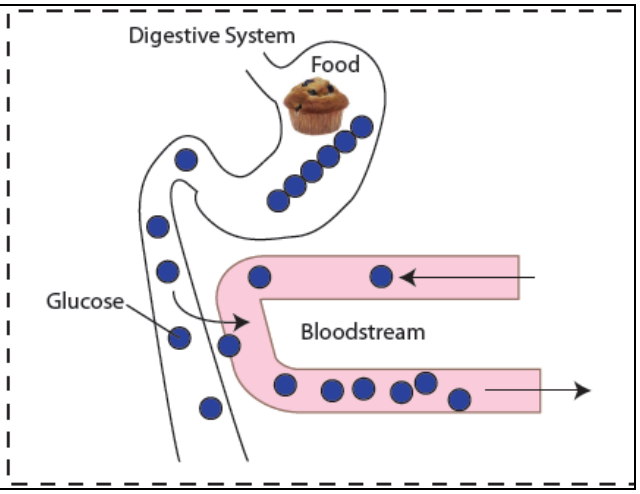
1. Read the patient information sheet on the next three pages—*What You Should Know About Diabetes and the Glucose Tolerance Test*. For each paragraph, select the color graphic on the separate handout that illustrates the information. Cut and paste the graphics in the appropriate boxes on the information sheet.

What You Should Know About Diabetes and the Glucose Tolerance Test

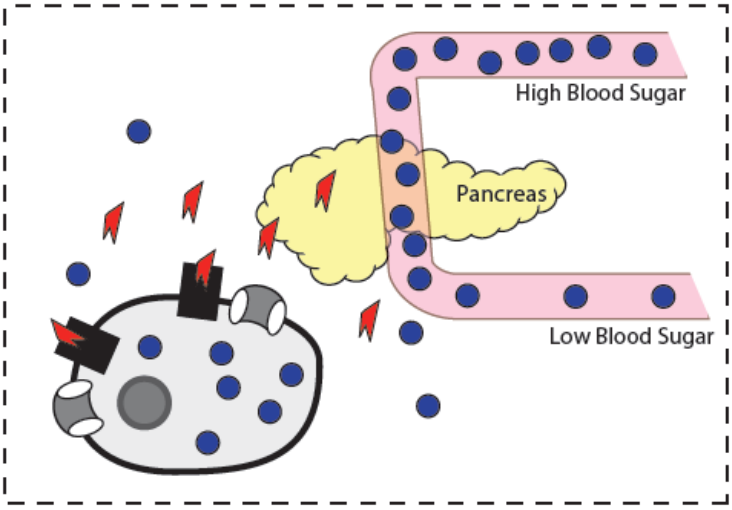
1. Key to the Diagrams



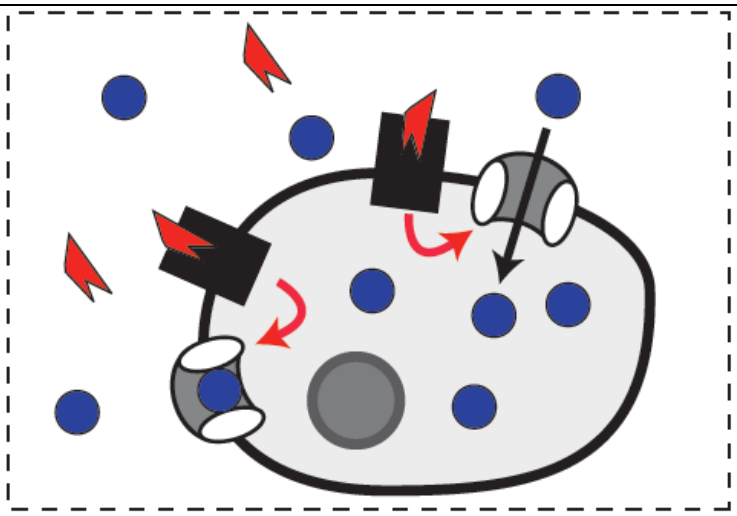
2. Most of the food you eat is turned into glucose, or sugar, for your body to use for energy. Your blood carries the glucose to all the cells in your body. Your blood always has some glucose in it because your body needs glucose for energy to keep you going. But too much glucose in the blood isn't good for your health. To maintain homeostasis, you need to keep a normal level of glucose in your blood.



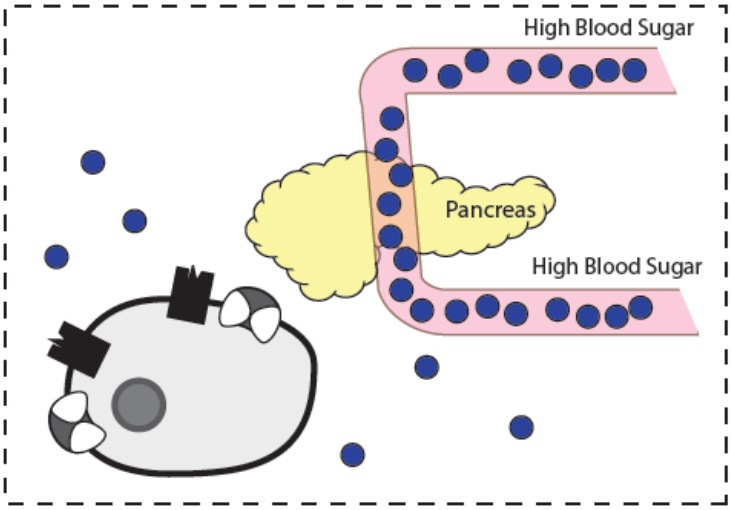
3. Healthy people have a **feedback (control) mechanism** that maintains homeostasis by keeping blood glucose levels relatively constant and within a normal range. A high blood glucose level acts as a stimulus for the pancreas. The pancreas responds to this stimulus by secreting **insulin,** a chemical messenger (hormone). Insulin helps the glucose from food diffuse out of the blood and into your cells. This lowers blood sugar levels.



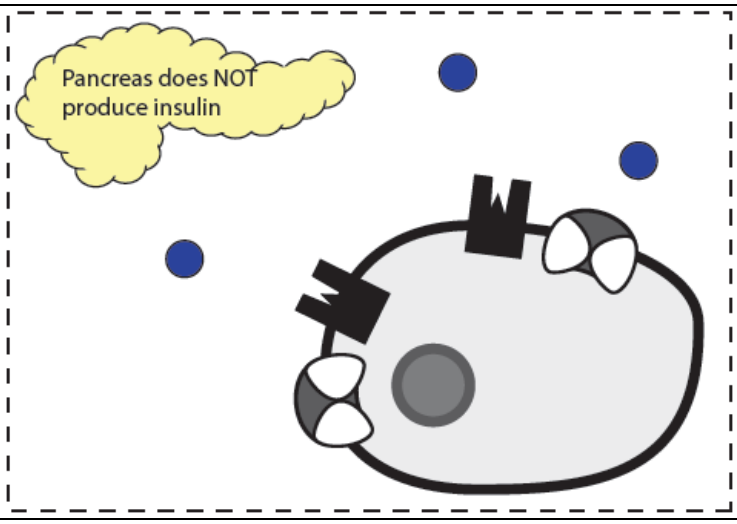
4. Most of the cells in the body carry **receptors** for the insulin hormone on their cell membranes. Once the insulin binds to one of these receptors, the receptor gives a signal to the cell's interior. This signal causes glucose transport proteins in the cell membrane to open and allow glucose to diffuse out of the blood and into body cells.



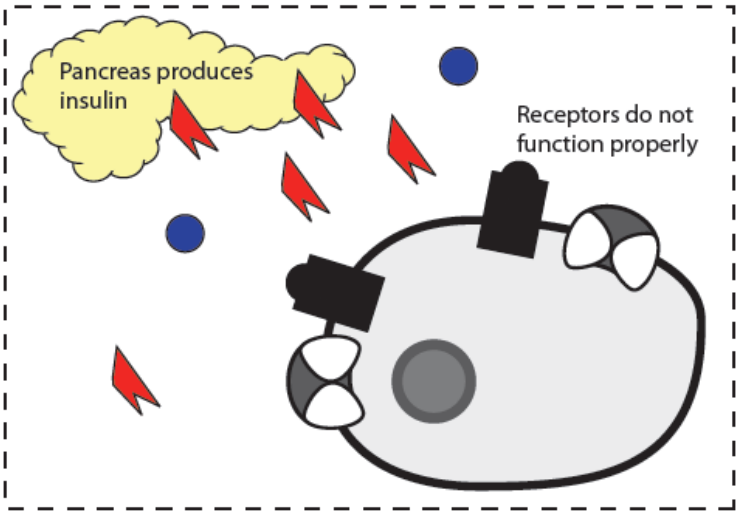
5. **Diabetes** means that your blood glucose (often called blood sugar) is too high because glucose can't get into your cells. When glucose can't get into your cells, it stays in your blood.



6. **Type 1 diabetes** accounts for 5% to 10% of all diagnosed cases of diabetes. Type 1 diabetes is called an autoimmune disease, because the immune system attacks the person's own pancreas cells. The cells in the pancreas that produce insulin are destroyed. Most people with Type 1 diabetes produce no insulin at all. Without insulin, glucose cannot get into the cells and accumulates in the blood.

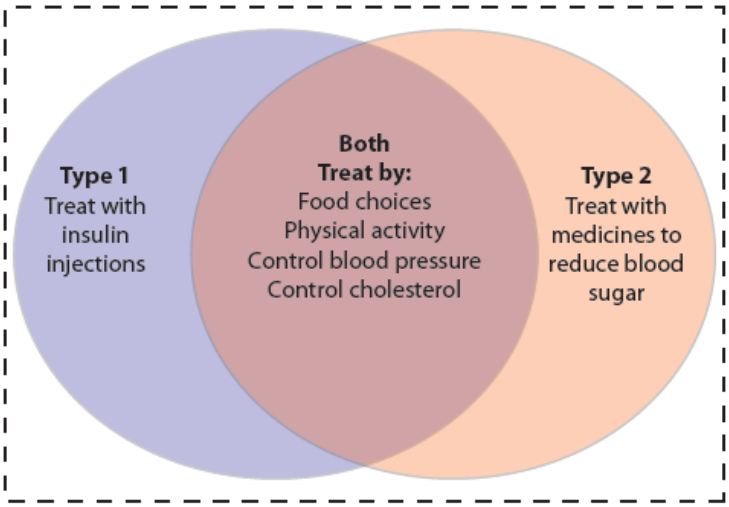


7. **Type 2 diabetes** accounts for about 90% to 95% of all diagnosed cases of diabetes. People can develop Type 2 diabetes at any age - even during childhood, although most people with Type 2 diabetes are adults. People with Type 2 diabetes produce insulin but the insulin receptors on their cells do not respond properly to the insulin message. Being overweight and inactive increases the chances of developing type 2 diabetes.



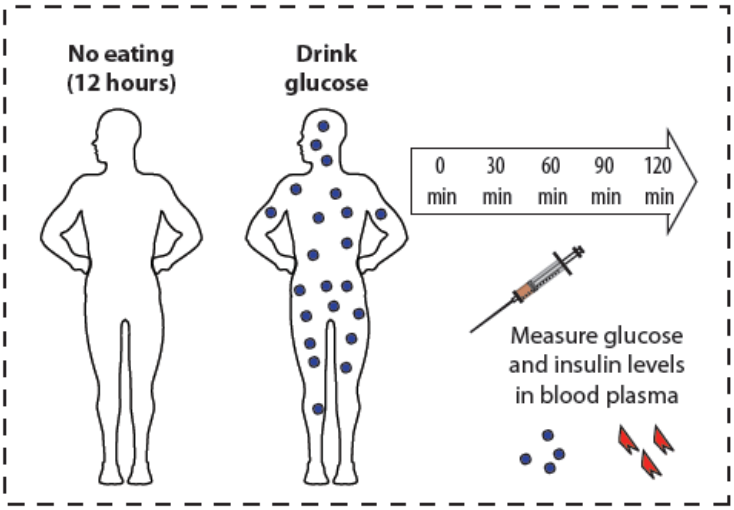
8. Treatments for both types of diabetes include making wise food choices, being physically active, and controlling blood pressure and cholesterol levels. People with Type 1 diabetes must take insulin injections. People with Type 2 diabetes use oral medicines to lower blood glucose levels.

   If diabetes is not properly treated, the high blood glucose levels can cause serious health complications including heart disease, blindness, kidney failure and leg amputation. Diabetes is the sixth leading cause of death in the United States.



9. A **Glucose Tolerance Test** is a diagnostic blood test for diabetes. After fasting (not eating) overnight, you are given a concentrated sugar solution (50 to 100 grams of glucose) to drink. Your blood is sampled periodically over the next several hours to test its glucose levels.

   Normally, blood glucose does not rise very much and returns to normal within two to three hours. If you have diabetes, the blood glucose level is usually higher after fasting, rises more after drinking the glucose solution and takes from four to six hours to come down to normal levels.



Answer the following questions. Refer to the information and diagrams in *What You Should Know About Diabetes and the Glucose Tolerance Test*:

2. What is insulin? What does it do in your body?

   Insulin is a hormone that is secreted by the pancreas. It sends a message to cells that causes them to take up glucose from the bloodstream.

3. What do the insulin receptor molecules on the cells in your body do?

   Insulin receptors on cells receive the insulin message and then give a signal to the cell's interior. This signal causes glucose transport proteins in cell membranes to open so that glucose can diffuse into cells.

4. List two similarities between Type 1 and Type 2 diabetes.

   Both involve higher than normal blood sugar levels.
   Both involve failure of cells to transport glucose from the blood into the cells.
   Both result in serious complications if they are left untreated.
   Both can lead to death.
   A healthy diet and exercise are part of the treatment for both types.

5. List two differences between Type 1 and Type 2 diabetes.

   Type 2 diabetics produce insulin. Type 1 diabetics do not.
   Insulin receptors in Type 2 diabetics do not work properly. The insulin receptors in Type 1 diabetics work properly.
   The pancreas of a Type 1 diabetic is defective. The pancreas of a Type 2 diabetic is not.

6. What health problems may result if a patient's diabetes is not properly treated to maintain normal blood glucose levels?

   Diabetes can cause serious health complications including heart disease, blindness, kidney failure and leg amputation. Diabetes is the sixth leading cause of death in the United States.

PART 2:
Analyzing Blood Glucose Levels

To prepare for the glucose tolerance test, your patient fasted for 12 hours. To begin the test she drank a solution that contained a measured amount of glucose. Blood samples were collected immediately before she drank the glucose solution and every half hour after she drank the glucose solution. The blood sample was centrifuged to separate it into blood cells and blood plasma. You will test the concentration of glucose in the patient's blood plasma to determine if she has diabetes.

1. Your lab kit has 5 samples of the patient's blood plasma that were collected at various time intervals during the patient's glucose tolerance test.

2. Use Column 1 on the "Glucose Tolerance Testing Sheet." Place 1 drop of the appropriate plasma samples to be tested in the appropriate circles in Column 1. Save the samples of patient blood plasma for use in Part 3.

3. Place a strip of glucose test paper into each of the circles in Column 1 of the "Glucose Tolerance Testing Sheet" that contain the plasma samples that you are testing. Immediately compare the color of the test paper with the color on the Glucose Test Paper Color Chart. Record the results of the glucose tests in Table 1 below.

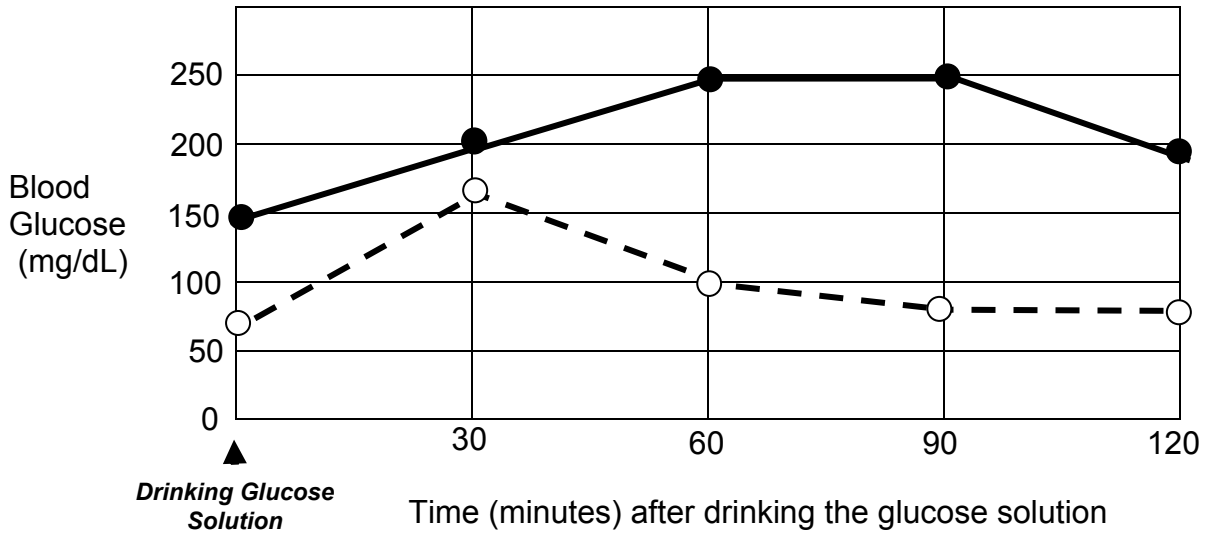
TABLE 1

Time of Blood Collection **Minutes After Drinking Glucose Solution**	**Glucose Level in Blood** **(milligrams/deciliter)**
0 (after fasting)	***150***
30	***200***
60	***250***
90	***250***
120	***200***

4. The graph below shows the blood plasma glucose levels for a healthy person who does <u>not</u> have diabetes. Plot the data from the patient's glucose test results (from Table 1) on the graph.

Key: = Healthy person who does not have diabetes
= The patient

Glucose Concentration During Glucose Tolerance Test



Use the information in the *What You Should Know About Diabetes and the Glucose Tolerance Test* fact sheet to help you interpret the results of the patient's glucose tolerance test.

5. Explain why the blood glucose level for the healthy person was low (70 mg/dL) at the beginning of the glucose tolerance test.

   The patient fasted (did not eat). The glucose in their blood has been used for their life activities (it has been metabolized).

6. Explain why the blood glucose level for the healthy person rises after drinking the glucose solution.

   The glucose from the solution was absorbed into the bloodstream.

7. Explain what causes the healthy person's blood glucose levels to decrease after 30 minutes.

   The pancreas detected the high glucose levels and began secreting insulin. The insulin caused the glucose to move out of the blood and into the body cells.

8. Explain what might cause the patient's blood glucose levels to remain high after 30 minutes.

   The glucose could not move out of the blood into the cells. Note: this could be due to an inability to produce insulin or an inability of the cells to respond to the insulin message.

9. Based on the information in this graph, do you think the patient has diabetes? Support your answer with evidence from the graph.

   Yes, the patient has diabetes because their blood sugar level rose higher and remained higher than the level shown for a healthy patient.

10. Do you have enough information to determine if the patient has Type 1 or Type 2 diabetes? If not, how would you figure this out?

    No, I would need to know if the patient was making insulin. If they do not make insulin, then they have Type 1 diabetes. If they do make insulin, they have Type 2 diabetes.

PART 3:
Analyzing Blood Insulin Levels

There are two types of diabetes that result in higher than normal blood glucose levels – called Type 1 and Type 2 diabetes. A person with Type 1 diabetes does not produce insulin. A person with Type 2 diabetes does produce insulin but their cells are unable to respond to the insulin message.

To determine whether the patient has Type 1 or Type 2 diabetes, you need to test the concentration of insulin in the patient's blood plasma.

1. Use Column 2 on the "Glucose Tolerance Testing Sheet." Place 1 drop of the appropriate plasma samples to be tested in the appropriate circles in Column 2.

2. Add 1 drop of the Insulin Indicator to the plasma in each of the circles in Column 2. After 10 seconds, compare the color of the fluid in each circle with the Insulin Test Indicator Color Chart.

3. Record the results of the insulin tests in Table 2 on the next page.

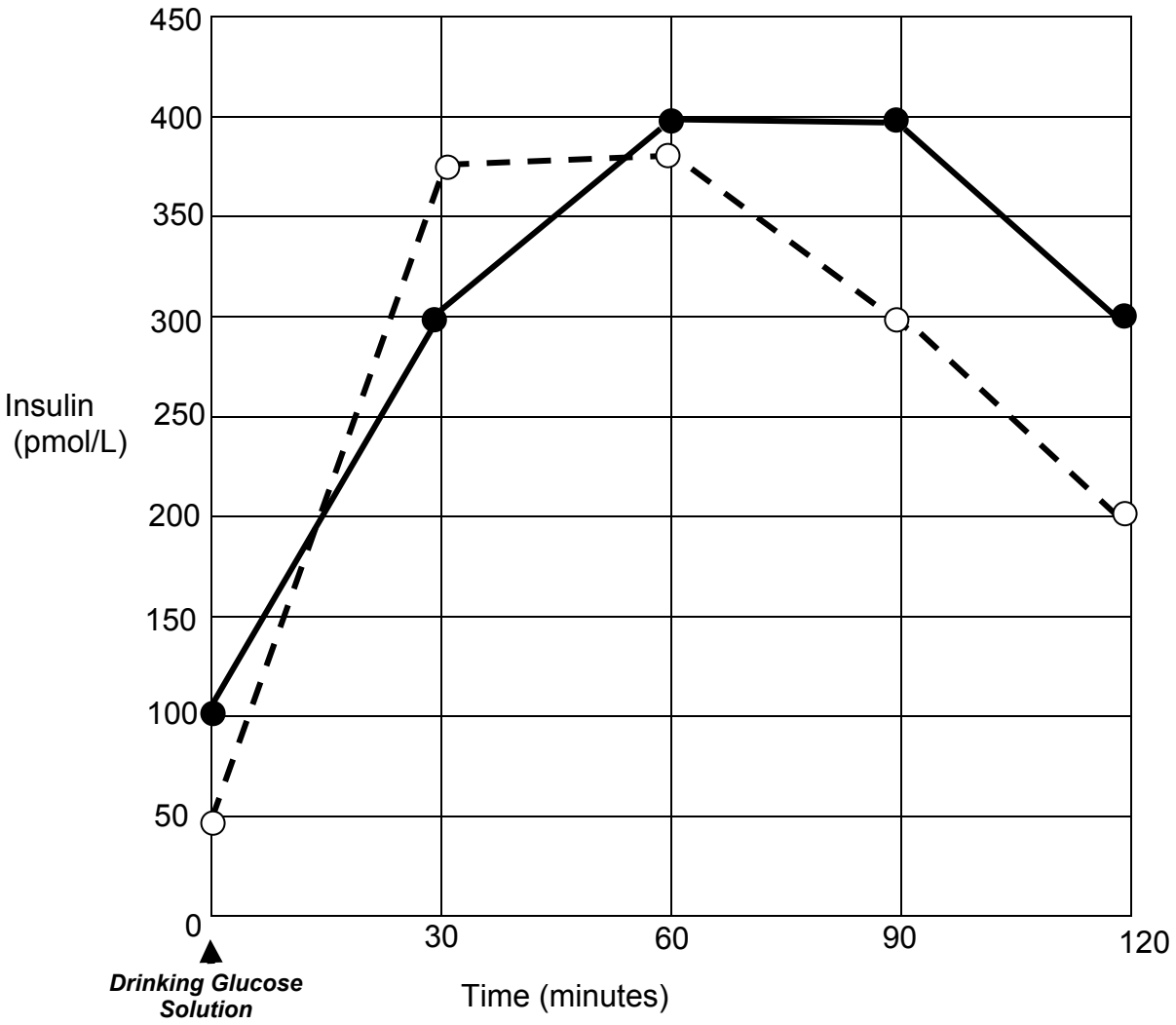
4. The graph on the next page shows the blood plasma insulin levels for healthy person who does not have diabetes. Plot the data from the patient's insulin test results on the graph.

TABLE 2

Time for Blood Collection Minutes After Drinking Glucose Solution	Insulin Level in Blood (picomole/liter)
0 (after fasting)	***100***
30	***300***
60	***400***
90	***400***
120	***300***

Key: = Healthy person who does not have diabetes
= The patient

Insulin Concentration During Glucose Tolerance Test



Use the information in the *What You Should Know About Diabetes and the Glucose Tolerance Test* fact sheet to help you interpret the results of the patient's glucose tolerance test.

5. Compare the insulin levels in a healthy person with the insulin levels in the patient.

   The patient secreted slightly more insulin than the healthy person.

6. Based on the information in the graph, do you think the patient has Type 1 or Type 2 diabetes? Support your answer with information from the graph.

   Type 2 diabetes because the patient produces insulin.

7. Why would insulin injections typically not be used to treat the patient's diabetes?

   She is producing insulin. Her cells are not responding to the insulin signal.

8. What treatment plan would you suggest to keep the patient's glucose levels within normal range?

   Treatment for type 2 diabetes includes using oral diabetes medicines, making wise food choices, being physically active, and controlling blood pressure and cholesterol.

9. What health problems may result if the patient does not follow the treatment plan suggested to keep her blood glucose levels within normal range?

   Diabetes can cause serious health complications including heart disease, blindness, kidney failure and leg amputation. Diabetes is the sixth leading cause of death in the United States.

SAFETY DATA SHEET

GENERAL STORAGE CODE GREEN

Section 1 Chemical Product and Company Information

Science Take-Out
80 Office Park Way
Pittsford, NY 14534
(585)764-5400

CHEMTREC 24 Hour Emergency
Phone Number (800) 424-9300
For laboratory use only. Not for drug, food or household use

Product	Buffer Solution pH3
Synonyms	"0 Minutes Blood Plasma" (simulated)

Section 2 Hazards Identification

This substance or mixture has not been classified at this time according to the Globally Harmonized System (GHS) of Classification and Labeling of Chemicals.

Signal word: WARNING
Pictograms: None required
Target organs: None known

GHS Classification:
Skin Irritation (Category 3)
Eye irritation (Category 2B)

GHS Label information: **Hazard statement(s):**
H316: Causes minor skin irritation.
H320: Causes eye irritation.

Precautionary statement(s):

P264: Wash hands thoroughly after handling.

P305+P351+P338: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

P332+P313: If skin irritation occurs: Get medical attention.

P337+P313: If eye irritation persists: Get medical attention.

Ca Prop 65 - This product does not contain any chemicals known to the State of California to cause cancer, birth defects, or any other reproductive harm.

Section 3 Composition / Information on Ingredients

Chemical Name	CAS #	%	EINECS
Water	7732-18-5	99.74%	231-791-2
Potassium bipthalate	877-24-7	1.08%	212-889-4
Hydrochloric acid	7647-01-0	0.18%	231-595-7

Section 4 First Aid Measures

INGESTION: Call physician or Poison Control Center immediately. Induce vomiting only if advised by appropriate medical personnel. Never give anything by mouth to an unconscious person.

INHALATION: Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

EYE CONTACT: Check for and remove contact lenses. Flush thoroughly with water for at least 15 minutes, lifting upper and lower eyelids occasionally. Get immediate medical attention.

SKIN ABSORPTION: Remove contaminated clothing. Flush thoroughly with mild soap and water. If irritation occurs, get medical attention.

Section 5 Fire Fighting Measures

Suitable Extinguishing Media: Use any media suitable for extinguishing supporting fire.

Protective Actions for Fire-fighters: In fire conditions, wear a NIOSH/MSHA-approved self-contained breathing apparatus and full protective gear. Use water spray to keep fire-exposed containers cool.

Specific Hazards: During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion.

Section 6 Accidental Release Measures

Personal Precautions: Evacuate personnel to safe area. Use proper personal protective equipment as indicated in Section 8. Provide adequate ventilation.

Environmental Precautions: Avoid runoff into storm sewers and ditches which lead to waterways.

Containment and Cleanup: Absorb with inert dry material, sweep or vacuum up and place in a suitable container for proper disposal. Wash spill area with soap and water.

Section 7 Handling and Storage

Precautions for Safe Handling: Read label on container before using. Do not wear contact lenses when working with chemicals. Keep out of reach of children. Avoid contact with eyes, skin and clothing. Do not inhale vapors, spray or mist. Use with adequate ventilation. Avoid ingestion. Wash thoroughly after handling. Remove and wash clothing before reuse.

Conditions for Safe Storage: Store in a cool, well-ventilated area away from incompatible substances.

Section 8 Exposure controls / Personal Protection

Exposure Limits:

Chemical Name	ACGIH (TLV)	OSHA (PEL)	NIOSH (REL)
None	None established	None established	None established

Engineering controls: Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower and fire extinguishing material. Personnel should wear safety glasses, goggles, or faceshield, lab coat or apron, appropriate protective gloves. Use adequate ventilation to keep airborne concentrations low.

Respiratory protection: None should be needed in normal laboratory handling at room temperatures. If misty conditions prevail, work in fume hood or wear a NIOSH/MSHA approved respirator.

Section 9 Physical and Chemical Properties

Appearance: Clear, colorless liquid.
Odor: No odor.
Odor threshold: Data not available.
pH: 3.0
Melting/Freezing point: Approx. 0°C (32°F) (water)
Boiling point: Approx. 100°C (212°F) (water)
Flash point: Data not available

Evaporation rate (Water = 1): <1
Flammability (solid/gas): Data not available.
Explosion limits: Lower/Upper: Data not available
Vapor pressure (mm Hg): 14 (water)
Vapor density (Air = 1): 0.7 (water)
Relative density (Specific gravity): Approx. 1.0 (water)
Solubility(ies): Complete in water.

Partition coefficient: Data not available
Auto-ignition temp.: Data not available
Decomposition temp.: Data not available
Viscosity: Data not available.
Molecular formula: Mixture
Molecular weight: Mixture

Section 10 Stability and Reactivity

Chemical stability: Stable
Hazardous polymerization: Will not occur.
Conditions to avoid: Excessive temperatures which cause evaporation.
Incompatibilities with other materials: Acids, alkalies, and air will change the buffer's ability.
Hazardous decomposition products: Carbon oxides and chlorine gas.

Section 11 Toxicological Information

Acute toxicity: Data not available
Serious eye damage/irritation: Data not available
Germ cell mutagenicity: Data not available
Skin corrosion/irritation: Data not available
Respiratory or skin sensitization: Data not available
Carcinogenity: Data not available

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity: Data not available
Aspiration hazard: Data not available
STOT-single exposure: Data not available
STOT-repeated exposure: Data not available

Potential health effects:
Inhalation: May be harmful if inhaled.
Ingestion: May be harmful if swallowed.
Skin: May cause mild irritation.
Eyes: May cause mild irritation.

Signs and symptoms of exposure: To the best of our knowledge the chemical, physical and toxicological properties have not been thoroughly investigated. Specific data is not available. Exercise appropriate procedures to minimize potential hazards.
Additional information: RTECS #: Data not available

Section 12 Ecological Information

Toxicity to fish: No data available
Toxicity to daphnia and other aquatic invertebrates: No data available
Toxicity to algae: No data available
Persistence and degradability: No data available
Bioaccumulative potential: No data available
Mobility in soil: No data available
PBT and vPvB assessment: No data available
Other adverse effects: An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.

Section 13 Disposal Considerations

These disposal guidelines are intended for the disposal of catalog-size quantities only. Federal regulations may apply to empty container. State and/or local regulations may be different. Dispose of in accordance with all local, state and federal regulations or contract with a licensed chemical disposal agency.

Section 14 Transport Information

UN/NA number: Not applicable
Shipping name: Not Regulated
Hazard class: Not applicable
Packing group: Not applicable
Reportable Quantity: No
Marine pollutant: No
Exceptions: Not applicable
2012 ERG Guide # Not applicable

Section 15 Regulatory Information

A chemical is considered to be listed if the CAS number for the anhydrous form is on the Inventory list.

Component	TSCA	CERLCA (RQ)	RCRA code	DSL	NDSL	WHMIS Classification
Potassium bipthalate	Listed	Not Listed	Not Listed	Listed	Not Listed	Not listed
Hydrochloric acid	Listed	5,000 lbs (2270 kg)	Not Listed	Listed	Not Listed	E

Section 16 Additional Information

The information contained herein is furnished without warranty of any kind. Employers should use this information only as a supplement to other information gathered by them and must make independent determinations of suitability and completeness of information from all sources to assure proper use of these materials and the safety and health of employees.
NTP: National Toxicology Program, IARC: International Agency for Research on Cancer, OSHA: Occupational Safety and Health Administration, STOT: Specific Target Organ Toxicity, SE: Single Exposure, RE: Repeated Exposure, ERG: Emergency Response Guidebook.

SAFETY DATA SHEET

GENERAL STORAGE CODE GREEN

Section 1 Chemical Product and Company Information

Science Take-Out
80 Office Park Way
Pittsford, NY 14534
(585)764-5400

CHEMTREC 24 Hour Emergency
Phone Number (800) 424-9300
For laboratory use only. Not for drug, food or household use

Product	Buffer Solution pH7
Synonyms	"30 Minutes Blood Plasma" (simulated), "120 Minutes Blood Plasma" (simulated)

Section 2 Hazards Identification

This substance or mixture has not been classified at this time according to the Globally Harmonized System (GHS) of Classification and Labeling of Chemicals.

Signal word: WARNING
Pictograms: None required
Target organs: None known

GHS Classification:
Skin Irritation (Category 3)
Eye irritation (Category 2B)

GHS Label information: **Hazard statement(s):**
H316: Causes minor skin irritation.
H320: Causes eye irritation.

Precautionary statement(s):

P264: Wash hands thoroughly after handling.

P305+P351+P338: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

P332+P313: If skin irritation occurs: Get medical attention.

P337+P313: If eye irritation persists: Get medical attention.

Ca Prop 65 - This product does not contain any chemicals known to the State of California to cause cancer, birth defects, or any other reproductive harm.

Section 3 Composition / Information on Ingredients

Chemical Name	CAS #	%	EINECS
Water	7732-18-5	99.15%	231-791-2
Potassium phosphate, monobasic	7778-77-0	0.72%	231-913-4
Sodium hydroxide	1310-73-2	0.13%	215-185-5

Section 4 First Aid Measures

INGESTION: Call physician or Poison Control Center immediately. Induce vomiting only if advised by appropriate medical personnel. Never give anything by mouth to an unconscious person.

INHALATION: Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

EYE CONTACT: Check for and remove contact lenses. Flush thoroughly with water for at least 15 minutes, lifting upper and lower eyelids occasionally. Get immediate medical attention.

SKIN ABSORPTION: Remove contaminated clothing. Flush thoroughly with mild soap and water. If irritation occurs, get medical attention.

Section 5 Fire Fighting Measures

Suitable Extinguishing Media: Use any media suitable for extinguishing supporting fire.

Protective Actions for Fire-fighters: In fire conditions, wear a NIOSH/MSHA-approved self-contained breathing apparatus and full protective gear. Use water spray to keep fire-exposed containers cool.

Specific Hazards: During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion.

Section 6 Accidental Release Measures

Personal Precautions: Evacuate personnel to safe area. Use proper personal protective equipment as indicated in Section 8. Provide adequate ventilation.

Environmental Precautions: Avoid runoff into storm sewers and ditches which lead to waterways.

Containment and Cleanup: Absorb with inert dry material, sweep or vacuum up and place in a suitable container for proper disposal. Wash spill area with soap and water.

Section 7 Handling and Storage

Precautions for Safe Handling: Read label on container before using. Do not wear contact lenses when working with chemicals. Keep out of reach of children. Avoid contact with eyes, skin and clothing. Do not inhale vapors, spray or mist. Use with adequate ventilation. Avoid ingestion. Wash thoroughly after handling. Remove and wash clothing before reuse.

Conditions for Safe Storage: Store in a cool, well-ventilated area away from incompatible substances.

Section 8 Exposure controls / Personal Protection

Exposure Limits:

Chemical Name	ACGIH (TLV)	OSHA (PEL)	NIOSH (REL)
Potassium phosphate	None established	None established	None established

Engineering controls: Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower and fire extinguishing material. Personnel should wear safety glasses, goggles, or faceshield, lab coat or apron, appropriate protective gloves. Use adequate ventilation to keep airborne concentrations low.

Respiratory protection: None should be needed in normal laboratory handling at room temperatures. If misty conditions prevail, work in fume hood or wear a NIOSH/MSHA approved respirator.

Section 9 Physical and Chemical Properties

Appearance: Clear, colorless liquid.
Odor: No odor.
Odor threshold: Data not available.
pH: 7.0
Melting/Freezing point: Approx. 0°C (32°F) (water)
Boiling point: Approx. 100°C (212°F) (water)
Flash point: Data not available

Evaporation rate (Water = 1): <1
Flammability (solid/gas): Data not available.
Explosion limits: Lower/Upper: Data not available
Vapor pressure (mm Hg): 14 (water)
Vapor density (Air = 1): 0.7 (water)
Relative density (Specific gravity): Approx. 1.0 (water)
Solubility(ies): Complete in water.

Partition coefficient: Data not available
Auto-ignition temp.: Data not available
Decomposition temp.: Data not available
Viscosity: Data not available.
Molecular formula: Mixture
Molecular weight: Mixture

Section 10 Stability and Reactivity

Chemical stability: Stable
Hazardous polymerization: Will not occur.

Conditions to avoid: Excessive temperatures which cause evaporation.
Incompatibilities with other materials: Acids, alkalies, and air will change the buffer's ability.
Hazardous decomposition products: Thermal decomposition will yield phosphates and sodium oxide and/or hydroxides.

Section 11 Toxicological Information

Acute toxicity: Oral-rat LD50: 3,200 mg/kg [Potassium phosphate]
Serious eye damage/irritation: Data not available
Germ cell mutagenicity: Data not available

Skin corrosion/irritation: Data not available
Respiratory or skin sensitization: Data not available
Carcinogenity: Data not available

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity: Data not available
Aspiration hazard: Data not available

STOT-single exposure: Data not available
STOT-repeated exposure: Data not available

Potential health effects:
Inhalation: May be harmful if inhaled.
Ingestion: May be harmful if swallowed.
Skin: May cause mild irritation.
Eyes: May cause mild irritation.

Signs and symptoms of exposure: To the best of our knowledge the chemical, physical and toxicological properties have not been thoroughly investigated. Specific data is not available. Exercise appropriate procedures to minimize potential hazards.
Additional information: RTECS #: TC661500 [Potassium phosphate]

Section 12 Ecological Information

Toxicity to fish: No data available
Toxicity to daphnia and other aquatic invertebrates: No data available
Toxicity to algae: No data available
Persistence and degradability: No data available
Mobility in soil: No data available
Bioaccumulative potential: No data available
PBT and vPvB assessment: No data available
Other adverse effects: An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.

Section 13 Disposal Considerations

These disposal guidelines are intended for the disposal of catalog-size quantities only. Federal regulations may apply to empty container. State and/or local regulations may be different. Dispose of in accordance with all local, state and federal regulations or contract with a licensed chemical disposal agency.

Section 14 Transport Information

UN/NA number: Not applicable
Hazard class: Not applicable
Exceptions: Not applicable
Shipping name: Not Regulated
Packing group: Not applicable
2012 ERG Guide # Not applicable
Reportable Quantity: No
Marine pollutant: No

Section 15 Regulatory Information

A chemical is considered to be listed if the CAS number for the anhydrous form is on the Inventory list.

Component	TSCA	CERLCA (RQ)	RCRA code	DSL	NDSL	WHMIS Classification
Potassium phosphate	Listed	Not Listed	Not Listed	Listed	Not Listed	Uncontrolled Product
Sodium hydroxide	Listed	1,000 lbs (454 kg)	D002	Listed	Not Listed	E

Section 16 Additional Information

The information contained herein is furnished without warranty of any kind. Employers should use this information only as a supplement to other information gathered by them and must make independent determinations of suitability and completeness of information from all sources to assure proper use of these materials and the safety and health of employees.
NTP: National Toxicology Program, IARC: International Agency for Research on Cancer, OSHA: Occupational Safety and Health Administration, STOT: Specific Target Organ Toxicity, SE: Single Exposure, RE: Repeated Exposure, ERG: Emergency Response Guidebook.

SAFETY DATA SHEET

GENERAL STORAGE CODE GREEN

Section 1 Chemical Product and Company Information

Science Take-Out
80 Office Park Way
Pittsford, NY 14534
(585)764-5400

CHEMTREC 24 Hour Emergency
Phone Number (800) 424-9300
For laboratory use only. Not for drug, food or household use

Product	Buffer Solution pH9
Synonyms	“60 Minutes Blood Plasma” (simulated), “90 Minutes Blood Plasma” (simulated)

Section 2 Hazards Identification

This substance or mixture has not been classified at this time according to the Globally Harmonized System (GHS) of Classification and Labeling of Chemicals.

Signal word: WARNING
Pictograms: None required
Target organs: None known

GHS Classification:
Skin Irritation (Category 3)
Eye irritation (Category 2B)

GHS Label information: **Hazard statement(s):**
H316: Causes minor skin irritation.
H320: Causes eye irritation.

Precautionary statement(s):

P264: Wash hands thoroughly after handling.

P305+P351+P338: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

P332+P313: If skin irritation occurs: Get medical attention.

P337+P313: If eye irritation persists: Get medical attention.

Ca Prop 65 - This product does not contain any chemicals known to the State of California to cause cancer, birth defects, or any other reproductive harm.

Section 3 Composition / Information on Ingredients

Chemical Name	CAS #	%	EINECS
Water	7732-18-5	99.18%	231-791-2
Potassium chloride	7447-40-7	0.40%	231-211-8
Boric acid	10043-35-3	0.33%	233-139-2
Sodium hydroxide	1310-73-2	0.09%	215-185-5

Section 4 First Aid Measures

INGESTION: Call physician or Poison Control Center immediately. Induce vomiting only if advised by appropriate medical personnel. Never give anything by mouth to an unconscious person.

INHALATION: Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

EYE CONTACT: Check for and remove contact lenses. Flush thoroughly with water for at least 15 minutes, lifting upper and lower eyelids occasionally. Get immediate medical attention.

SKIN ABSORPTION: Remove contaminated clothing. Flush thoroughly with mild soap and water. If irritation occurs, get medical attention.

Section 5 Fire Fighting Measures

Suitable Extinguishing Media: Use any media suitable for extinguishing supporting fire.

Protective Actions for Fire-fighters: In fire conditions, wear a NIOSH/MSHA-approved self-contained breathing apparatus and full protective gear. Use water spray to keep fire-exposed containers cool.

Specific Hazards: During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion.

Section 6 Accidental Release Measures

Personal Precautions: Evacuate personnel to safe area. Use proper personal protective equipment as indicated in Section 8. Provide adequate ventilation.

Environmental Precautions: Avoid runoff into storm sewers and ditches which lead to waterways.

Containment and Cleanup: Absorb with inert dry material, sweep or vacuum up and place in a suitable container for proper disposal. Wash spill area with soap and water.

Section 7 Handling and Storage

Precautions for Safe Handling: Read label on container before using. Do not wear contact lenses when working with chemicals. Keep out of reach of children. Avoid contact with eyes, skin and clothing. Do not inhale vapors, spray or mist. Use with adequate ventilation. Avoid ingestion. Wash thoroughly after handling. Remove and wash clothing before reuse.

Conditions for Safe Storage: Store in a cool, well-ventilated area away from incompatible substances.

Section 8 Exposure controls / Personal Protection

Exposure Limits:

Chemical Name	ACGIH (TLV)	OSHA (PEL)	NIOSH (REL)
Potassium chloride	None established	None established	None established

Engineering controls: Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower and fire extinguishing material. Personnel should wear safety glasses, goggles, or faceshield, lab coat or apron, appropriate protective gloves. Use adequate ventilation to keep airborne concentrations low.

Respiratory protection: None should be needed in normal laboratory handling at room temperatures. If misty conditions prevail, work in fume hood or wear a NIOSH/MSHA approved respirator.

Section 9 Physical and Chemical Properties

Appearance: Clear, colorless liquid.
Odor: No odor.
Odor threshold: Data not available.
pH: 9.0
Melting/Freezing point: Approx. 0°C (32°F) (water)
Boiling point: Approx. 100°C (212°F) (water)
Flash point: Data not available

Evaporation rate (Water = 1): <1
Flammability (solid/gas): Data not available.
Explosion limits: Lower/Upper: Data not available
Vapor pressure (mm Hg): 14 (water)
Vapor density (Air = 1): 0.7 (water)
Relative density (Specific gravity): Approx. 1.0 (water)
Solubility(ies): Complete in water.

Partition coefficient: Data not available
Auto-ignition temp.: Data not available
Decomposition temp.: Data not available
Viscosity: Data not available.
Molecular formula: Mixture
Molecular weight: Mixture

Section 10 Stability and Reactivity

Chemical stability: Stable
Hazardous polymerization: Will not occur.

Conditions to avoid: Excessive temperatures which cause evaporation.
Incompatibilities with other materials: Acids, alkalies, and air will change the buffer's ability.
Hazardous decomposition products: Boron oxide and chlorine gas.

Section 11 Toxicological Information

Acute toxicity: Data not available
Serious eye damage/irritation: Data not available
Germ cell mutagenicity: Data not available
Skin corrosion/irritation: Data not available
Respiratory or skin sensitization: Data not available
Carcinogenity: Data not available

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity: Data not available
Aspiration hazard: Data not available
STOT-single exposure: Data not available
STOT-repeated exposure: Data not available

Potential health effects:
Inhalation: May be harmful if inhaled.
Ingestion: May be harmful if swallowed.
Skin: May cause mild irritation.
Eyes: May cause mild irritation.

Signs and symptoms of exposure: To the best of our knowledge the chemical, physical and toxicological properties have not been thoroughly investigated. Specific data is not available. Exercise appropriate procedures to minimize potential hazards.
Additional information: RTECS #: Data not available

Section 12 Ecological Information

Toxicity to fish: No data available
Toxicity to daphnia and other aquatic invertebrates: No data available
Toxicity to algae: No data available
Persistence and degradability: No data available
Mobility in soil: No data available
Bioaccumulative potential: No data available
PBT and vPvB assessment: No data available
Other adverse effects: An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.

Section 13 Disposal Considerations

These disposal guidelines are intended for the disposal of catalog-size quantities only. Federal regulations may apply to empty container. State and/or local regulations may be different. Dispose of in accordance with all local, state and federal regulations or contract with a licensed chemical disposal agency.

Section 14 Transport Information

UN/NA number: Not applicable
Hazard class: Not applicable
Exceptions: Not applicable
Shipping name: Not Regulated
Packing group: Not applicable
2012 ERG Guide # Not applicable
Reportable Quantity: No
Marine pollutant: No

Section 15 Regulatory Information

A chemical is considered to be listed if the CAS number for the anhydrous form is on the Inventory list.

Component	TSCA	CERLCA (RQ)	RCRA code	DSL	NDSL	WHMIS Classification
Potassium Chloride	Listed	Not Listed	Not Listed	Listed	Not Listed	Uncontrolled Product
Sodium hydroxide	Listed	1,000 lbs (454 kg)	D002	Listed	Not Listed	E

Section 16 Additional Information

The information contained herein is furnished without warranty of any kind. Employers should use this information only as a supplement to other information gathered by them and must make independent determinations of suitability and completeness of information from all sources to assure proper use of these materials and the safety and health of employees.
NTP: National Toxicology Program, IARC: International Agency for Research on Cancer, OSHA: Occupational Safety and Health Administration, STOT: Specific Target Organ Toxicity, SE: Single Exposure, RE: Repeated Exposure, ERG: Emergency Response Guidebook.

SAFETY DATA SHEET

GENERAL STORAGE CODE GREEN

Section 1 Chemical Product and Company Information

Science Take-Out
80 Office Park Way
Pittsford, NY 14534
(585)764-5400

CHEMTREC 24 Hour Emergency
Phone Number (800) 424-9300
For laboratory use only. Not for drug, food or household use

.

Product	Methyl red 0.025% solution; Bromothymol Blue 0.025% solution
Synonyms	"Insulin Indicator" (simulated)

Section 2 Hazards Identification

This substance or mixture has not been classified at this time according to the Globally Harmonized System (GHS) of Classification and Labeling of Chemicals.

Signal word: Not classified
Pictograms: Not classified
Target organs: None known

GHS Classification: Not classified
GHS Label information: Not classified
Precautionary Statement: Not classified

Supplementary information:
Do not breathe vapors, spray or mist. Do not get in eyes, on skin, or on clothing. Wear protective gloves/protective clothing/eye protection/face protection. Wash hands thoroughly after handling. Get medical attention if you feel unwell.

Ca Prop 65 - This product does not contain any chemicals known to the State of California to cause cancer, birth defects, or any other reproductive harm.

Section 3 Composition / Information on Ingredients

Chemical Name	CAS #	%	EINECS
Water	7732-18-5	99.95%	231-791-2
Methyl red, sodium salt	845-10-3	0.025%	212-682-9
Bromothymol blue, sodium salt	34722-90-2	0.025%	252-169-7

Section 4 First Aid Measures

INGESTION: MAY BE HARMFUL IF SWALLOWED. Call physician or Poison Control Center immediately. Induce vomiting only if advised by appropriate medical personnel. Never give anything by mouth to an unconscious person.

INHALATION: MAY BE HARMFUL IF INHALED. MAY CAUSE RESPIRATORY TRACT IRRITATION. Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

EYE CONTACT: MAY CAUSE EYE IRRITATION. Check for and remove contact lenses. Flush thoroughly with water for at least 15 minutes, lifting upper and lower eyelids occasionally. Get immediate medical attention.

SKIN ABSORPTION: MAY CAUSE SKIN IRRITATION. Remove contaminated clothing. Flush thoroughly with mild soap and water. If irritation occurs, get medical attention.

Section 5 Fire Fighting Measures

Suitable Extinguishing Media: Carbon dioxide, dry chemical, dry sand, alcohol foam.

Protective Actions for Fire-fighters: In fire conditions, wear a NIOSH/MSHA-approved self-contained breathing apparatus and full protective gear. Use water spray to keep fire-exposed containers cool.

Specific Hazards: In fire conditions, water may evaporate from this solution which may cause hazardous decomposition products to be formed as dust or fume.

Section 6 Accidental Release Measures

Personal Precautions: Evacuate personnel to safe area. Use proper personal protective equipment as indicated in Section 8. Provide adequate ventilation.

Environmental Precautions: Avoid runoff into storm sewers and ditches which lead to waterways.

Containment and Cleanup: Absorb with inert dry material, sweep or vacuum up and place in a suitable container for proper disposal. Wash spill area with soap and water.

Section 7 Handling and Storage

Precautions for Safe Handling: Read label on container before using. Do not wear contact lenses when working with chemicals. Keep out of reach of children. Avoid contact with eyes, skin and clothing. Do not inhale vapors, spray or mist. Use with adequate ventilation. Avoid ingestion. Wash thoroughly after handling. Remove and wash clothing before reuse.

Conditions for Safe Storage: Store in a cool, well-ventilated area away from incompatible substances. Protect from light.

Section 8 Exposure controls / Personal Protection

Exposure Limits:

Chemical Name	ACGIH (TLV)	OSHA (PEL)	NIOSH (REL)
Methyl red	None established	None established	None established
Bromothymol Blue	None established	None established	None established

Engineering controls: Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower and fire extinguishing material. Personnel should wear safety glasses, goggles, or faceshield, lab coat or apron, appropriate protective gloves. Use adequate ventilation to keep airborne concentrations low.

Respiratory protection: None should be needed in normal laboratory handling at room temperatures. If misty conditions prevail, work in fume hood or wear a NIOSH/MSHA approved respirator.

Section 9 Physical and Chemical Properties

Appearance: Liquid, clear, blue-green.
Odor: No odor.
Odor threshold: Data not available.
pH: Data not available
Melting/Freezing point: Approx. 0°C (32°F) (water)
Boiling point: Approx. 100°C (212°F) (water)
Flash point: Data not available

Evaporation rate (Water = 1): <1
Flammability (solid/gas): Data not available.
Explosion limits: Lower/Upper: Data not available
Vapor pressure (mm Hg): 14 (water)
Vapor density (Air = 1): 0.7 (water)
Relative density (Specific gravity): Approx. 1.0 (water)
Solubility(ies): Complete in water.

Partition coefficient: Data not available
Auto-ignition temp.: Data not available
Decomposition temp.: Data not available
Viscosity: Data not available.
Molecular formula: Mixture
Molecular weight: Mixture

Section 10 Stability and Reactivity

Chemical stability: Stable
Hazardous polymerization: Will not occur.

Conditions to avoid: Excessive temperatures which cause evaporation. Protect from light.
Incompatibilities with other materials: Strong oxidizers, reducing agents.
Hazardous decomposition products: Carbon oxides, nitrogen oxides and sodium oxides.

Section 11 Toxicological Information

Acute toxicity: Oral-rat TDLo: 12000 mg/kg [Methyl red]
Serious eye damage/irritation: Data not available
Germ cell mutagenicity: Data not available
Skin corrosion/irritation: Data not available
Respiratory or skin sensitization: Data not available
Carcinogenity: Data not available

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity: Data not available
Aspiration hazard: Data not available
STOT-single exposure: Data not available
STOT-repeated exposure: Data not available

Potential health effects:
Inhalation: May be harmful if inhaled.
Ingestion: May be harmful if swallowed.
Skin: May cause irritation.
Eyes: May cause irritation.

Signs and symptoms of exposure: To the best of our knowledge the chemical, physical and toxicological properties have not been thoroughly investigated. Specific data is not available. Exercise appropriate procedures to minimize potential hazards.
Additional information: RTECS #: DG8960000 [Methyl red]

Section 12 Ecological Information

Toxicity to fish: No data available
Toxicity to daphnia and other aquatic invertebrates: No data available
Toxicity to algae: No data available
Persistence and degradability: No data available
Bioaccumulative potential: No data available
Mobility in soil: No data available
PBT and vPvB assessment: No data available
Other adverse effects: An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.

Section 13 Disposal Considerations

These disposal guidelines are intended for the disposal of catalog-size quantities only. Federal regulations may apply to empty container. State and/or local regulations may be different. Dispose of in accordance with all local, state and federal regulations or contract with a licensed chemical disposal agency.

Section 14 Transport Information

UN/NA number: Not applicable
Hazard class: Not applicable
Exceptions: Not applicable
Shipping name: Not Regulated
Packing group: Not applicable
2012 ERG Guide # Not applicable
Reportable Quantity: No
Marine pollutant: No

Section 15 Regulatory Information

A chemical is considered to be listed if the CAS number for the anhydrous form is on the Inventory list.

Component	TSCA	CERLCA (RQ)	RCRA code	DSL	NDSL	WHMIS Classification
Methyl red, sodium salt	Listed	Not Listed	Not Listed	Listed	Not Listed	Not Listed
Bromothymol blue, sodium salt	Listed	Not Listed	Not Listed	Listed	Not Listed	Not Listed

Section 16 Additional Information

The information contained herein is furnished without warranty of any kind. Employers should use this information only as a supplement to other information gathered by them and must make independent determinations of suitability and completeness of information from all sources to assure proper use of these materials and the safety and health of employees.
NTP: National Toxicology Program, IARC: International Agency for Research on Cancer, OSHA: Occupational Safety and Health Administration, STOT: Specific Target Organ Toxicity, SE: Single Exposure, RE: Repeated Exposure, ERG: Emergency Response Guidebook.

FICHE TECHNIQUE DE SÛRETÉ

GÉNÉRAL CODE D'ENTREPOSAGE VERT

Section 1 L'information de produit chimique et de compagnie

Science Take-Out
80 Office Park Way
Pittsford, NY 14534
(585)764-5400

CHEMTREC 24 Numéros De Téléphone De Secours D'Heure (800) 424-9300
Pour l'usage de laboratoire seulement.
Pas pour l'usage de drogue, de nourriture ou de ménage.

Produit	Solution de tampon pH3
Synonymes	"O Minutes Blood Plasma"

Section 2 Identification De Risques

Cette substance ou un mélange n'a pas été classé à ce moment selon le Système général harmonisé (SGH) de classification et d'étiquetage des produits chimiques.

Mention d'avertissement: AVERTISSEMENT
Pictogrammes: Aucune requise
Les organes cibles: Aucun connu.

Classification par le GHS:
Skin irritation (Category 3)
Eye irritation (Category 2B)

Renseignements sur l'étiquette GHS: Mention de danger(s):
H316: Provoque une légère irritation cutanée.
H320: Provoque une irritation des yeux.

Déclarations de précaution(s):
P264: Se laver les mains soigneusement après manipulation.
P305+P351+P338: EN CAS DE CONTACT AVEC LES YEUX: Rincer avec précaution à l'eau pendant plusieurs minutes. Enlever les lentilles de contact si la victime en porte et si elles peuvent être facilement enlevées. Continuer à rincer.

P332+P313: En cas d'irritation cutanée: Obtenir des soins médicaux.
P337+P313: Si l'irritation oculaire persiste: Obtenir des soins médicaux.

CA Prop 65 - Ce produit ne contient pas de produits chimiques connus à l'État de Californie pour causer le cancer, des malformations congénitales, ou toute autre atteinte à la reproduction.

Section 3 Composition / Information Sur Des Ingrédients

Nommé Chimique	CAS #	%	EINECS
L'eau	7732-18-5	99.74%	231-791-2
Biphthalate de potassium	877-24-7	1.08%	212-889-4
Acide chlorhydrique	7647-01-0	0.18%	231-595-7

Section 4 Mesures De Premiers Soins

INGESTION: Appeler un médecin ou un centre antipoison immédiatement. Provoquer le vomissement seulement si elle est informée par le personnel compétent médicaux. Ne jamais rien donner par la bouche à une personne inconsciente.

INHALATION: Sortir au grand air. Si elle ne respire pas, pratiquer la respiration artificielle. Si la respiration est difficile, donner de l'oxygène. Obtenir des soins médicaux.

CONTACT AVEC LES YEUX: Vérifier et enlever les lentilles de contact. Rincer abondamment à l'eau pendant au moins 15 minutes, en soulevant les paupières inférieures et supérieures de temps en temps. Obtenez une attention médicale immédiate.

ABSORPTION PAR LA PEAU: Enlever les vêtements contaminés. Rincer soigneusement avec du savon doux et d'eau. En cas d'irritation, consulter un médecin.

Section 5 Mesures De Lutte Contre l'Incendie

Moyens d'extinction: Utilisez des supports adaptés pour éteindre le feu à l'appui.

Actions de protection pour les sapeurs-pompiers: En cas d'incendie, porter un appareil respiratoire NIOSH / MSHA approuvé autonome et un équipement complet de protection. Utiliser un jet d'eau pour maintenir incendie refroidir les conteneurs exposés.

Dangers spécifiques: En cas d'incendie, des gaz irritants et très toxiques peuvent être générés par la décomposition thermique ou la combustion.

Section 6 Mesures De Déchargement Accidentel

Précautions personnelles: Évacuer le personnel vers la zone sûre. Utiliser un équipement de protection personnelle comme indiqué dans la Section 8. Assurer une ventilation adéquate.

Précautions environnementales: Éviter tout ruissellement vers les égouts pluviaux et les fossés qui aboutissent aux voies navigables.

Confinement et de nettoyage: Absorbez avec le matériel sec inerte, balayez ou nettoyez à l'aspirateur vers le haut et placez dans un récipient approprié pour la disposition appropriée. Laver la zone de déversement avec du savon et de l'eau.

Section 7 Manipulation Et Stockage

Précautions pour la manutention en toute sécurité: Lire l'étiquette sur le contenant avant d'utiliser. Ne pas porter de lentilles cornéennes lorsque vous travaillez avec des produits chimiques. Tenir hors de portée des enfants. Éviter tout contact avec les yeux, la peau et les vêtements. Ne pas inhaler les vapeurs, les embruns ou le brouillard. Utiliser avec une ventilation adéquate. Éviter l'ingestion. Bien se laver après la manipulation. Retirer et laver les vêtements avant de les réutiliser.

Conditions de stockage: Stocker dans un endroit frais et bien aéré, loin des substances incompatibles.

Section 8 Commandes D'Exposition / Protection Personnelle

Limites d'exposition:

Nommé Chimique	ACGIH (TLV)	OSHA (PEL)	NIOSH (REL)
Aucun	Aucun établi.	Aucun établi.	Aucun établi.

Contrôles d'ingénierie: Les installations d'entreposage ou d'utilisation de ce matériel doit être équipé d'une douche oculaire et une douche de sécurité et le matériel d'extinction d'incendie. Le personnel doit porter des lunettes de sécurité, des lunettes, ou un écran facial, une blouse de laboratoire ou tablier, des gants protecteurs appropriés. Utiliser une ventilation adéquate pour maintenir les concentrations atmosphériques faible.

Protection respiratoire: Aucun ne devrait être nécessaire dans le laboratoire normal manipulant aux températures ambiantes. Si les conditions brumeuses prévaloir, travailler dans la hotte ou de porter un masque respiratoire approuvé NIOSH / MSHA.

Section 9 Propriétés Physiques Et Chimiques

Apparence: Clair, liquide incolore.
Odeur: Aucun odeur.
Seuil de l'odeur: Données non disponibles.
pH: 3.0
Point de fusion / congélation: Environ 0°C (32°F) (eau)
Point d'ébullition: Environ 100°C (212°F) (eau)
Point d'éclair: Données non disponibles

Taux d'évaporation (Eau = 1): <1
Inflammabilité (solide / gaz): Données non disponibles.
Limites d'explosivité: Bas / Max: Données non disponibles
Pression de vapeur (mm Hg): 14 (eau)
Densité de vapeur (Air = 1): 0.7 (eau)
Densité relative (gravité spécifique): Environ 1.0 (eau)
Solubilité (s): Complet dans l'eau.

Coefficient de partage: Données non disponibles
Auto-inflammation: Données non disponibles
Température de décomposition: Données non disponibles.
Viscosité: Données non disponibles.
Formule moléculaire: Mélange
Poids moléculaire: Mélange

Section 10 Stabilité Et Réactivité

Stabilité chimique: Stable **Polymérisation dangereuse:** N'aura pas lieu.
Conditions à éviter: Les températures excessives qui causent l'évaporation.
Incompatibilités avec d'autres matériaux: Acides, alcalis, et l'air changera la capacité de l'amortisseur.
Produits de décomposition dangereux: Oxyde de carbone et gaz de chlore.

Section 11 L'Information Toxicologique

Toxicité aiguë: Données non disponibles
La corrosion de la peau et l'irritation: Données non disponibles
Des lésions oculaires graves / irritation: Données non disponibles
Respiratoire ou sensibilisation de la peau: Données non disponibles
Mutagénicité des cellules germinales: Données non disponibles
Cancérogène: Données non disponibles
NTP: Aucun composant de ce produit présent à des niveaux supérieurs ou égaux à 0,1% n'a été identifié comme cancérigène reconnu ou présumé par NTP.
IARC: Aucun composant de ce produit présent à des niveaux supérieurs ou égaux à 0,1% n'a été identifié comme cancérigène probable, possible ou confirmé par IARC.
OSHA: Aucun composant de ce produit présent à des niveaux supérieurs ou égaux à 0,1% n'a été identifié comme cancérigène ni comme cancérigène possible par OSHA.
Reproductive toxicity: Données non disponibles
STOT-exposition unique: Données non disponibles.
STOT-une exposition répétée: Données non disponibles
Risque d'aspiration: Données non disponibles
Effets d'une surexposition:
Inhalation: Peut être nocif en cas d'inhalation.
Ingestion: Peut être nocif en cas d'ingestion.
Peau: Peut causer une légère irritation.
Yeux: Peut causer une légère irritation.
Les signes et les symptômes de l'exposition: Pour le meilleur de notre connaissance les propriétés chimiques, physiques et toxicologiques n'ont pas été étudiées à fond. Les données spécifiques n'est pas disponible. Exercice des procédures appropriées afin de minimiser les dangers potentiels.
Informations complémentaires: RTECS #: Données non disponibles

Section 12 L'Information Écologique

Toxicité pour les poissons: Pas de données disponible
Toxicité pour les daphnies et autres invertébrés aquatiques: Pas de données disponible
Toxicité pour les algues: Pas de données disponible
Persistance et dégradabilité: Pas de données disponible **Potentiel de bioaccumulation:** Pas de données disponible
Mobilité dans le sol: Pas de données disponibles **Évaluation PBT et vPvB:** Pas de données disponibles
Autres effets indésirables: Un danger pour l'environnement ne peut pas être exclu dans l'éventualité d'une manipulation ou d'élimination.

Section 13 Considérations De Disposition

Ces lignes directrices sont destinées à l'élimination de la disposition d'un catalogue de taille seules les quantités. Les règlements fédéraux peuvent s'appliquer aux contenants vides. Des réglementations nationales et / ou local peut être différent. Éliminer conformément à toutes les réglementations locales, provinciales et fédérales ou d'un contrat avec une agence élimination des produits chimiques sous licence..

Section 14 L'Information De Transport

Numéro UN / NA: Non applicable **Nom d'expédition:** Non réglé
Classe de danger: Non applicable **Groupe d'emballage:** Non applicable **Quantité à déclarer:** Non **Polluant marin:** Non
Exceptions: Non applicable **2012 ERG Guide #:** Non applicable

Section 15 L'Information De Normalisation

Un produit chimique est considéré comme inscrit si le numéro CAS pour la forme anhydre est sur la liste d'inventaire.

Composant	TSCA	CERLCA (RQ)	RCRA code	DSL	NDSL	Classification SIMDUT
Bipthalate de potassium	Listed	Not Listed	Not Listed	Listed	Not Listed	Produit non contrôlé
Acide chlorhydrique	Listed	5,000 lbs (2270 kg)	Not Listed	Listed	Not Listed	E

Section 16 L'Information Additionnelle

Les informations contenues dans ce document sont fournis sans garantie d'aucune sorte. Les employeurs devraient considérer cette information seulement comme complément à d'autres informations recueillies par eux et doivent prendre des décisions indépendantes de la pertinence et l'exhaustivité de l'information de toutes les sources afin d'assurer une utilisation correcte de ces matériaux et de la sécurité et la santé des employés. NTP: National Toxicology Program, IARC: International Agency for Research on Cancer, OSHA: Occupational Safety and Health Administration, STOT: Specific Target Organ Toxicity, SE: Single Exposure, RE: Repeated Exposure.

FICHE TECHNIQUE DE SÛRETÉ

GÉNÉRAL CODE D'ENTREPOSAGE VERT

Section 1 L'information de produit chimique et de compagnie

Science Take-Out
80 Office Park Way
Pittsford, NY 14534
(585)764-5400

CHEMTREC 24 Numéros De Téléphone De Secours D'Heure (800) 424-9300
Pour l'usage de laboratoire seulement.
Pas pour l'usage de drogue, de nourriture ou de ménage.

Produit	Solution de tampon pH7
Synonymes	"30 Minutes Blood Plasma", "120 Minutes Blood Plasma"

Section 2 Identification De Risques

Cette substance ou un mélange n'a pas été classé à ce moment selon le Système général harmonisé (SGH) de classification et d'étiquetage des produits chimiques.

Mention d'avertissement: AVERTISSEMENT
Pictogrammes: Aucune requise
Les organes cibles: Aucun connu.

Classification par le GHS:
Skin irritation (Category 3)
Eye irritation (Category 2B)

Renseignements sur l'étiquette GHS: Mention de danger(s):
H316: Provoque une légère irritation cutanée.
H320: Provoque une irritation des yeux.

Déclarations de précaution(s):
P264: Se laver les mains soigneusement après manipulation.
P305+P351+P338: EN CAS DE CONTACT AVEC LES YEUX: Rincer avec précaution à l'eau pendant plusieurs minutes. Enlever les lentilles de contact si la victime en porte et si elles peuvent être facilement enlevées. Continuer à rincer.

P332+P313: En cas d'irritation cutanée: Obtenir des soins médicaux.
P337+P313: Si l'irritation oculaire persiste: Obtenir des soins médicaux.

CA Prop 65 - Ce produit ne contient pas de produits chimiques connus à l'État de Californie pour causer le cancer, des malformations congénitales, ou toute autre atteinte à la reproduction.

Section 3 Composition / Information Sur Des Ingrédients

Nommé Chimique	CAS #	%	EINECS
L'eau	7732-18-5	98.15%	231-791-2
Phosphate de potassium, monobasique	7778-77-0	1.72%	231-913-4
Hydroxide de sodium	1310-73-2	0.13%	215-185-5

Section 4 Mesures De Premiers Soins

INGESTION: Appeler un médecin ou un centre antipoison immédiatement. Provoquer le vomissement seulement si elle est informée par le personnel compétent médicaux. Ne jamais rien donner par la bouche à une personne inconsciente.

INHALATION: Sortir au grand air. Si elle ne respire pas, pratiquer la respiration artificielle. Si la respiration est difficile, donner de l'oxygène. Obtenir des soins médicaux.

CONTACT AVEC LES YEUX: Vérifier et enlever les lentilles de contact. Rincer abondamment à l'eau pendant au moins 15 minutes, en soulevant les paupières inférieures et supérieures de temps en temps. Obtenez une attention médicale immédiate.

ABSORPTION PAR LA PEAU: Enlever les vêtements contaminés. Rincer soigneusement avec du savon doux et d'eau. En cas d'irritation, consulter un médecin.

Section 5 Mesures De Lutte Contre l'Incendie

Moyens d'extinction: Utilisez des supports adaptés pour éteindre le feu à l'appui.

Actions de protection pour les sapeurs-pompiers: En cas d'incendie, porter un appareil respiratoire NIOSH / MSHA approuvé autonome et un équipement complet de protection. Utiliser un jet d'eau pour maintenir incendie refroidir les conteneurs exposés.

Dangers spécifiques: En cas d'incendie, des gaz irritants et très toxiques peuvent être générés par la décomposition thermique ou la combustion.

Section 6 Mesures De Déchargement Accidentel

Précautions personnelles: Évacuer le personnel vers la zone sûre. Utiliser un équipement de protection personnelle comme indiqué dans la Section 8. Assurer une ventilation adéquate.

Précautions environnementales: Éviter tout ruissellement vers les égouts pluviaux et les fossés qui aboutissent aux voies navigables.

Confinement et de nettoyage: Absorbez avec le matériel sec inerte, balayez ou nettoyez à l'aspirateur vers le haut et placez dans un récipient approprié pour la disposition appropriée. Laver la zone de déversement avec du savon et de l'eau.

Section 7 Manipulation Et Stockage

Précautions pour la manutention en toute sécurité: Lire l'étiquette sur le contenant avant d'utiliser. Ne pas porter de lentilles cornéennes lorsque vous travaillez avec des produits chimiques. Tenir hors de portée des enfants. Éviter tout contact avec les yeux, la peau et les vêtements. Ne pas inhaler les vapeurs, les embruns ou le brouillard. Utiliser avec une ventilation adéquate. Éviter l'ingestion. Bien se laver après la manipulation. Retirer et laver les vêtements avant de les réutiliser.

Conditions de stockage: Stocker dans un endroit frais et bien aéré, loin des substances incompatibles.

Section 8 Commandes D'Exposition / Protection Personnelle

Limites d'exposition:

Nommé Chimique	ACGIH (TLV)	OSHA (PEL)	NIOSH (REL)
Phosphate de potassium	Aucun établi.	Aucun établi.	Aucun établi.

Contrôles d'ingénierie: Les installations d'entreposage ou d'utilisation de ce matériel doit être équipé d'une douche oculaire et une douche de sécurité et le matériel d'extinction d'incendie. Le personnel doit porter des lunettes de sécurité, des lunettes, ou un écran facial, une blouse de laboratoire ou tablier, des gants protecteurs appropriés. Utiliser une ventilation adéquate pour maintenir les concentrations atmosphériques faible.

Protection respiratoire: Aucun ne devrait être nécessaire dans le laboratoire normal manipulant aux températures ambiantes. Si les conditions brumeuses prévaloir, travailler dans la hotte ou de porter un masque respiratoire approuvé NIOSH / MSHA.

Section 9 Propriétés Physiques Et Chimiques

Apparence: Clair, liquide incolore.
Odeur: Aucun odeur.
Seuil de l'odeur: Données non disponibles.
pH: 7.0
Point de fusion / congélation: Environ 0°C (32°F) (eau)
Point d'ébullition: Environ 100°C (212°F) (eau)
Point d'éclair: Données non disponibles

Taux d'évaporation (Eau = 1): <1
Inflammabilité (solide / gaz): Données non disponibles.
Limites d'explosivité: Bas / Max: Données non disponibles
Pression de vapeur (mm Hg): 14 (eau)
Densité de vapeur (Air = 1): 0.7 (eau)
Densité relative (gravité spécifique): Environ 1.0 (eau)
Solubilité (s): Complet dans l'eau.

Coefficient de partage: Données non disponibles
Auto-inflammation: Données non disponibles
Température de décomposition: Données non disponibles.
Viscosité: Données non disponibles.
Formule moléculaire: Mélange
Poids moléculaire: Mélange

Section 10 Stabilité Et Réactivité

Stabilité chimique: Stable **Polymérisation dangereuse:** N'aura pas lieu.
Conditions à éviter: Les températures excessives qui causent l'évaporation.
Incompatibilités avec d'autres matériaux: Acides, alcalis, et l'air changera la capacité de l'amortisseur.
Produits de décomposition dangereux: La décomposition thermique rapportera les phosphates et l'oxyde et/ou les hydroxydes de sodium.

Section 11 L'Information Toxicologique

Toxicité aiguë: Oral-rat LD50: 3,200 mg/kg [Phosphate de potassium]
La corrosion de la peau et l'irritation: Données non disponibles
Des lésions oculaires graves / irritation: Données non disponibles
Respiratoire ou sensibilisation de la peau: Données non disponibles
Mutagénicité des cellules germinales: Données non disponibles
Cancérogène: Données non disponibles
NTP: Aucun composant de ce produit présent à des niveaux supérieurs ou égaux à 0,1% n'a été identifié comme cancérigène reconnu ou présumé par NTP.
IARC: Aucun composant de ce produit présent à des niveaux supérieurs ou égaux à 0,1% n'a été identifié comme cancérigène probable, possible ou confirmé par IARC.
OSHA: Aucun composant de ce produit présent à des niveaux supérieurs ou égaux à 0,1% n'a été identifié comme cancérigène ni comme cancérigène possible par OSHA.
Reproductive toxicity: Données non disponibles
STOT-exposition unique: Données non disponibles.
STOT-une exposition répétée: Données non disponibles
Risque d'aspiration: Données non disponibles
Effets d'une surexposition:
Inhalation: Peut être nocif en cas d'inhalation.
Ingestion: Peut être nocif en cas d'ingestion.
Peau: Peut causer une légère irritation.
Yeux: Peut causer une légère irritation.
Les signes et les symptômes de l'exposition: Pour le meilleur de notre connaissance les propriétés chimiques, physiques et toxicologiques n'ont pas été étudiées à fond. Les données spécifiques n'est pas disponible. Exercice des procédures appropriées afin de minimiser les dangers potentiels.
Informations complémentaires: RTECS #: TC661500 [Phosphate de potassium]

Section 12 L'Information Écologique

Toxicité pour les poissons: Pas de données disponible
Toxicité pour les daphnies et autres invertébrés aquatiques: Pas de données disponible
Toxicité pour les algues: Pas de données disponible
Persistance et dégradabilité: Pas de données disponible **Potentiel de bioaccumulation:** Pas de données disponible
Mobilité dans le sol: Pas de données disponibles **Évaluation PBT et vPvB:** Pas de données disponibles
Autres effets indésirables: Un danger pour l'environnement ne peut pas être exclu dans l'éventualité d'une manipulation ou d'élimination.

Section 13 Considérations De Disposition

Ces lignes directrices sont destinées à l'élimination de la disposition d'un catalogue de taille seules les quantités. Les règlements fédéraux peuvent s'appliquer aux contenants vides. Des réglementations nationales et / ou local peut être différent. Éliminer conformément à toutes les réglementations locales, provinciales et fédérales ou d'un contrat avec une agence élimination des produits chimiques sous licence..

Section 14 L'Information De Transport

Numéro UN / NA: Non applicable **Nom d'expédition:** Non réglé
Classe de danger: Non applicable **Groupe d'emballage:** Non applicable **Quantité à déclarer:** Non **Polluant marin:** Non
Exceptions: Non applicable **2012 ERG Guide #:** Non applicable

Section 15 L'Information De Normalisation

Un produit chimique est considéré comme inscrit si le numéro CAS pour la forme anhydre est sur la liste d'inventaire.

Composant	TSCA	CERLCA (RQ)	RCRA code	DSL	NDSL	Classification SIMDUT
Phosphate de potassium	Listed	Not Listed	Not Listed	Listed	Not Listed	Produit non contrôlé
Hydroxide de sodium	Listed	1,000 lbs (454 kg)	D002	Listed	Not Listed	E

Section 16 L'Information Additionnelle

Les informations contenues dans ce document sont fournis sans garantie d'aucune sorte. Les employeurs devraient considérer cette information seulement comme complément à d'autres informations recueillies par eux et doivent prendre des décisions indépendantes de la pertinence et l'exhaustivité de l'information de toutes les sources afin d'assurer une utilisation correcte de ces matériaux et de la sécurité et la santé des employés. NTP: National Toxicology Program, IARC: International Agency for Research on Cancer, OSHA: Occupational Safety and Health Administration, STOT: Specific Target Organ Toxicity, SE: Single Exposure, RE: Repeated Exposure.

Date de révision: 12 May, 2015 Remplace:

FICHE TECHNIQUE DE SÛRETÉ

GÉNÉRAL CODE D'ENTREPOSAGE VERT

Section 1 L'information de produit chimique et de compagnie

Science Take-Out
80 Office Park Way
Pittsford, NY 14534
(585)764-5400

CHEMTREC 24 Numéros De Téléphone
De Secours D'Heure (800) 424-9300
Pour l'usage de laboratoire seulement.
Pas pour l'usage de drogue, de nourriture ou de ménage.

Produit	Solution de tampon pH9
Synonymes	"60 Minutes Blood Plasma", "90 Minutes Blood Plasma"

Section 2 Identification De Risques

Cette substance ou un mélange n'a pas été classé à ce moment selon le Système général harmonisé (SGH) de classification et d'étiquetage des produits chimiques.

Mention d'avertissement: AVERTISSEMENT
Pictogrammes: Aucune requise
Les organes cibles: Aucun connu.

Classification par le GHS:
Eye irritation (Category 2B)

Renseignements sur l'étiquette GHS: Mention de danger(s):
H316: Provoque une légère irritation cutanée.
H320: Provoque une irritation des yeux.

Déclarations de précaution(s):
P264: Se laver les mains soigneusement après manipulation.
P305+P351+P338: EN CAS DE CONTACT AVEC LES YEUX: Rincer avec précaution à l'eau pendant plusieurs minutes. Enlever les lentilles de contact si la victime en porte et si elles peuvent être facilement enlevées. Continuer à rincer.

P337+P313: Si l'irritation oculaire persiste: Obtenir des soins médicaux.

CA Prop 65 - Ce produit ne contient pas de produits chimiques connus à l'État de Californie pour causer le cancer, des malformations congénitales, ou toute autre atteinte à la reproduction.

Section 3 Composition / Information Sur Des Ingrédients

Nommé Chimique	CAS #	%	EINECS
L'eau	7732-18-5	99.18%	231-791-2
Chlorure de potassium	7447-40-7	0.40%	231-211-8
Acide borique	10043-35-3	0.33%	233-139-2
Hydroxide de sodium	1310-73-2	0.09%	215-185-5

Section 4 Mesures De Premiers Soins

INGESTION: Appeler un médecin ou un centre antipoison immédiatement. Provoquer le vomissement seulement si elle est informée par le personnel compétent médicaux. Ne jamais rien donner par la bouche à une personne inconsciente.

INHALATION: Sortir au grand air. Si elle ne respire pas, pratiquer la respiration artificielle. Si la respiration est difficile, donner de l'oxygène. Obtenir des soins médicaux.

CONTACT AVEC LES YEUX: Vérifier et enlever les lentilles de contact. Rincer abondamment à l'eau pendant au moins 15 minutes, en soulevant les paupières inférieures et supérieures de temps en temps. Obtenez une attention médicale immédiate.

ABSORPTION PAR LA PEAU: Enlever les vêtements contaminés. Rincer soigneusement avec du savon doux et d'eau. En cas d'irritation, consulter un médecin.

Section 5 Mesures De Lutte Contre l'Incendie

Moyens d'extinction: Utilisez des supports adaptés pour éteindre le feu à l'appui.

Actions de protection pour les sapeurs-pompiers: En cas d'incendie, porter un appareil respiratoire NIOSH / MSHA approuvé autonome et un équipement complet de protection. Utiliser un jet d'eau pour maintenir incendie refroidir les conteneurs exposés.

Dangers spécifiques: En cas d'incendie, des gaz irritants et très toxiques peuvent être générés par la décomposition thermique ou la combustion.

Section 6 Mesures De Déchargement Accidentel

Précautions personnelles: Évacuer le personnel vers la zone sûre. Utiliser un équipement de protection personnelle comme indiqué dans la Section 8. Assurer une ventilation adéquate.

Précautions environnementales: Éviter tout ruissellement vers les égouts pluviaux et les fossés qui aboutissent aux voies navigables.

Confinement et de nettoyage: Absorbez avec le matériel sec inerte, balayez ou nettoyez à l'aspirateur vers le haut et placez dans un récipient approprié pour la disposition appropriée. Laver la zone de déversement avec du savon et de l'eau.

Section 7 Manipulation Et Stockage

Précautions pour la manutention en toute sécurité: Lire l'étiquette sur le contenant avant d'utiliser. Ne pas porter de lentilles cornéennes lorsque vous travaillez avec des produits chimiques. Tenir hors de portée des enfants. Éviter tout contact avec les yeux, la peau et les vêtements. Ne pas inhaler les vapeurs, les embruns ou le brouillard. Utiliser avec une ventilation adéquate. Éviter l'ingestion. Bien se laver après la manipulation. Retirer et laver les vêtements avant de les réutiliser.

Conditions de stockage: Stocker dans un endroit frais et bien aéré, loin des substances incompatibles.

Section 8 Commandes D'Exposition / Protection Personnelle

Limites d'exposition:

Nommé Chimique	ACGIH (TLV)	OSHA (PEL)	NIOSH (REL)
Chlorure de potassium	Aucun établi.	Aucun établi.	Aucun établi.

Contrôles d'ingénierie: Les installations d'entreposage ou d'utilisation de ce matériel doit être équipé d'une douche oculaire et une douche de sécurité et le matériel d'extinction d'incendie. Le personnel doit porter des lunettes de sécurité, des lunettes, ou un écran facial, une blouse de laboratoire ou tablier, des gants protecteurs appropriés. Utiliser une ventilation adéquate pour maintenir les concentrations atmosphériques faible.

Protection respiratoire: Aucun ne devrait être nécessaire dans le laboratoire normal manipulant aux températures ambiantes. Si les conditions brumeuses prévaloir, travailler dans la hotte ou de porter un masque respiratoire approuvé NIOSH / MSHA.

Section 9 Propriétés Physiques Et Chimiques

Apparence: Clair, liquide incolore.
Odeur: Aucun odeur.
Seuil de l'odeur: Données non disponibles.
pH: 9.0
Point de fusion / congélation: Environ 0°C (32°F) (eau)
Point d'ébullition: Environ 100°C (212°F) (eau)
Point d'éclair: Données non disponibles

Taux d'évaporation (Eau = 1): <1
Inflammabilité (solide / gaz): Données non disponibles.
Limites d'explosivité: Bas / Max: Données non disponibles
Pression de vapeur (mm Hg): 14 (eau)
Densité de vapeur (Air = 1): 0.7 (eau)
Densité relative (gravité spécifique): Environ 1.0 (eau)
Solubilité (s): Complet dans l'eau.

Coefficient de partage: Données non disponibles
Auto-inflammation: Données non disponibles
Température de décomposition: Données non disponibles.
Viscosité: Données non disponibles.
Formule moléculaire: Mélange
Poids moléculaire: Mélange

Section 10 Stabilité Et Réactivité

Stabilité chimique: Stable **Polymérisation dangereuse:** N'aura pas lieu.
Conditions à éviter: Les températures excessives qui causent l'évaporation.
Incompatibilités avec d'autres matériaux: Acides, alcalis, et l'air changera la capacité de l'amortisseur.
Produits de décomposition dangereux: Oxyde de bore et gaz de chlore.

Section 11 L'Information Toxicologique

Toxicité aiguë: Données non disponibles
La corrosion de la peau et l'irritation: Données non disponibles
Des lésions oculaires graves / irritation: Données non disponibles
Respiratoire ou sensibilisation de la peau: Données non disponibles
Mutagénicité des cellules germinales: Données non disponibles
Cancérogène: Données non disponibles
NTP: Aucun composant de ce produit présent à des niveaux supérieurs ou égaux à 0,1% n'a été identifié comme cancérigène reconnu ou présumé par NTP.
IARC: Aucun composant de ce produit présent à des niveaux supérieurs ou égaux à 0,1% n'a été identifié comme cancérigène probable, possible ou confirmé par IARC.
OSHA: Aucun composant de ce produit présent à des niveaux supérieurs ou égaux à 0,1% n'a été identifié comme cancérigène ni comme cancérigène possible par OSHA.
Reproductive toxicity: Données non disponibles
STOT-exposition unique: Données non disponibles.
STOT-une exposition répétée: Données non disponibles
Risque d'aspiration: Données non disponibles
Effets d'une surexposition:
Inhalation: Peut être nocif en cas d'inhalation.
Ingestion: Peut être nocif en cas d'ingestion.
Peau: Peut causer une légère irritation.
Yeux: Peut causer une légère irritation.
Les signes et les symptômes de l'exposition: Pour le meilleur de notre connaissance les propriétés chimiques, physiques et toxicologiques n'ont pas été étudiées à fond. Les données spécifiques n'est pas disponible. Exercice des procédures appropriées afin de minimiser les dangers potentiels.
Informations complémentaires: RTECS #: Données non disponibles

Section 12 L'Information Écologique

Toxicité pour les poissons: Pas de données disponible
Toxicité pour les daphnies et autres invertébrés aquatiques: Pas de données disponible
Toxicité pour les algues: Pas de données disponible
Persistance et dégradabilité: Pas de données disponible **Potentiel de bioaccumulation:** Pas de données disponible
Mobilité dans le sol: Pas de données disponibles **Évaluation PBT et vPvB:** Pas de données disponibles
Autres effets indésirables: Un danger pour l'environnement ne peut pas être exclu dans l'éventualité d'une manipulation ou d'élimination.

Section 13 Considérations De Disposition

Ces lignes directrices sont destinées à l'élimination de la disposition d'un catalogue de taille seules les quantités. Les règlements fédéraux peuvent s'appliquer aux contenants vides. Des réglementations nationales et / ou local peut être différent. Éliminer conformément à toutes les réglementations locales, provinciales et fédérales ou d'un contrat avec une agence élimination des produits chimiques sous licence..

Section 14 L'Information De Transport

Numéro UN / NA: Non applicable **Nom d'expédition:** Non réglé
Classe de danger: Non applicable **Groupe d'emballage:** Non applicable **Quantité à déclarer:** Non **Polluant marin:** Non
Exceptions: Non applicable **2012 ERG Guide #:** Non applicable

Section 15 L'Information De Normalisation

Un produit chimique est considéré comme inscrit si le numéro CAS pour la forme anhydre est sur la liste d'inventaire.

Composant	TSCA	CERLCA (RQ)	RCRA code	DSL	NDSL	Classification SIMDUT
Phosphate de potassium	Listed	Not Listed	Not Listed	Listed	Not Listed	Produit non contrôlé

Section 16 L'Information Additionnelle

Les informations contenues dans ce document sont fournis sans garantie d'aucune sorte. Les employeurs devraient considérer cette information seulement comme complément à d'autres informations recueillies par eux et doivent prendre des décisions indépendantes de la pertinence et l'exhaustivité de l'information de toutes les sources afin d'assurer une utilisation correcte de ces matériaux et de la sécurité et la santé des employés. NTP: National Toxicology Program, IARC: International Agency for Research on Cancer, OSHA: Occupational Safety and Health Administration, STOT: Specific Target Organ Toxicity, SE: Single Exposure, RE: Repeated Exposure.

Date de révision: 12 May, 2015 Remplace:

FICHE TECHNIQUE DE SÛRETÉ

GÉNÉRAL CODE D'ENTREPOSAGE VERT

Section 1 L'information de produit chimique et de compagnie

Science Take-Out
80 Office Park Way
Pittsford, NY 14534
(585)764-5400

CHEMTREC 24 Numéros De Téléphone De Secours D'Heure (800) 424-9300
Pour l'usage de laboratoire seulement.
Pas pour l'usage de drogue, de nourriture ou de ménage.

Produit	Rouge de méthyl, 0.025% solute; Blue de bromothymol, 0.025% solute
Synonymes	"Insulin Indicator"

Section 2 Identification De Risques

Cette substance ou un mélange n'a pas été classé à ce moment selon le Système général harmonisé (SGH) de classification et d'étiquetage des produits chimiques.

Mention d'avertissement: Non classé
Pictogrammes: Non classé
Les organes cibles: Aucun connu.

Classification par le GHS: Non classé

Renseignements sur l'étiquette GHS: Mention de danger(s): Non classé
Déclarations de précaution(s): Non classé

Des renseignements supplémentaires:
Ne pas respirer les vapeurs, les embruns ou le brouillard. Éviter tout contact avec les yeux, la peau ou les vêtements. Porter des gants de protection / des vêtements de protection / un équipement de protection des yeux / du visage. Se laver les mains soigneusement après manipulation. Consulter un médecin en cas de malaise.

CA Prop 65 - Ce produit ne contient pas de produits chimiques connus à l'État de Californie pour causer le cancer, des malformations congénitales, ou toute autre atteinte à la reproduction.

Section 3 Composition / Information Sur Des Ingrédients

Nommé Chimique	CAS #	%	EINECS
L'eau	7732-18-5	99.95%	231-791-2
Rouge de méthyle, sel sodique	845-10-3	0.025%	212-682-9
Bleu de bromothymol, sel sodique	34722-90-2	0.025%	252-169-7

Section 4 Mesures De Premiers Soins

INGESTION: PEUT ÊTRE NOCIF EN CAS D'INGESTION. Appeler un médecin ou un centre antipoison immédiatement. Provoquer le vomissement seulement si elle est informée par le personnel compétent médicaux. Ne jamais rien donner par la bouche à une personne inconsciente.

INHALATION: PEUT ÊTRE NOCIF EN CAS D'INHALATION. PEUT IRRITER LES VOIES RESPIRATOIRES. Sortir au grand air. Si elle ne respire pas, pratiquer la respiration artificielle. Si la respiration est difficile, donner de l'oxygène. Obtenir des soins médicaux.

CONTACT AVEC LES YEUX: PEUT CAUSE L'IRRITATION DES YEUX. Vérifier et enlever les lentilles de contact. Rincer abondamment à l'eau pendant au moins 15 minutes, en soulevant les paupières inférieures et supérieures de temps en temps. Obtenez une attention médicale immédiate.

ABSORPTION PAR LA PEAU: PEUT CAUSER UNE IRRITATION DE LA PEAU. Enlever les vêtements contaminés. Rincer soigneusement avec du savon doux et d'eau. En cas d'irritation, consulter un médecin.

Section 5 Mesures De Lutte Contre l'Incendie

Moyens d'extinction: Dioxyde de carbone, produit chimique sec, du sable sec, mousse anti-alcool.

Actions de protection pour les sapeurs-pompiers: En cas d'incendie, porter un appareil respiratoire NIOSH / MSHA approuvé autonome et un équipement complet de protection. Utiliser un jet d'eau pour maintenir incendie refroidir les conteneurs exposés.

Dangers spécifiques: En cas de feu, de l'eau peut s'évaporer à partir de cette solution, qui peut causer les produits dangereux de décomposition à être formée comme poussière ou vapeur.

Section 6 Mesures De Déchargement Accidentel

Précautions personnelles: Évacuer le personnel vers la zone sûre. Utiliser un équipement de protection personnelle comme indiqué dans la Section 8. Assurer une ventilation adéquate.

Précautions environnementales: Éviter tout ruissellement vers les égouts pluviaux et les fossés qui aboutissent aux voies navigables.

Confinement et de nettoyage: Absorbez avec le matériel sec inerte, balayez ou nettoyez à l'aspirateur vers le haut et placez dans un récipient approprié pour la disposition appropriée. Laver la zone de déversement avec du savon et de l'eau.

Section 7 Manipulation Et Stockage

Précautions pour la manutention en toute sécurité: Lire l'étiquette sur le contenant avant d'utiliser. Ne pas porter de lentilles cornéennes lorsque vous travaillez avec des produits chimiques. Tenir hors de portée des enfants. Éviter tout contact avec les yeux, la peau et les vêtements. Ne pas inhaler les vapeurs, les embruns ou le brouillard. Utiliser avec une ventilation adéquate. Éviter l'ingestion. Bien se laver après la manipulation. Retirer et laver les vêtements avant de les réutiliser.

Conditions de stockage: Stocker dans un endroit frais et bien aéré, loin des substances incompatibles.

Section 8 Commandes D'Exposition / Protection Personnelle

Limites d'exposition:

Nommé Chimique	ACGIH (TLV)	OSHA (PEL)	NIOSH (REL)
Rouge de méthyle	Aucun établi.	Aucun établi.	Aucun établi.

Contrôles d'ingénierie: Les installations d'entreposage ou d'utilisation de ce matériel doit être équipé d'une douche oculaire et une douche de sécurité et le matériel d'extinction d'incendie. Le personnel doit porter des lunettes de sécurité, des lunettes, ou un écran facial, une blouse de laboratoire ou tablier, des gants protecteurs appropriés. Utiliser une ventilation adéquate pour maintenir les concentrations atmosphériques faible.

Protection respiratoire: Aucun ne devrait être nécessaire dans le laboratoire normal manipulant aux températures ambiantes. Si les conditions brumeuses prévaloir, travailler dans la hotte ou de porter un masque respiratoire approuvé NIOSH / MSHA.

Section 9 Propriétés Physiques Et Chimiques

Apparence: Liquide, clair, incolore bleu-vert.
Odeur: Aucun odeur.
Seuil de l'odeur: Données non disponibles.
pH: Données non disponibles.
Point de fusion / congélation: Environ 0°C (32°F) (eau)
Point d'ébullition: Environ 100°C (212°F) (eau)
Point d'éclair: Données non disponibles

Taux d'évaporation (Eau = 1): <1
Inflammabilité (solide / gaz): Données non disponibles.
Limites d'explosivité: Bas / Max: Données non disponibles
Pression de vapeur (mm Hg): 14 (eau)
Densité de vapeur (Air = 1): 0.7 (eau)
Densité relative (gravité spécifique): Environ 1.0 (eau)
Solubilité (s): Complet dans l'eau.

Coefficient de partage: Données non disponibles
Auto-inflammation: Données non disponibles
Température de décomposition: Données non disponibles.
Viscosité: Données non disponibles.
Formule moléculaire: Mélange
Poids moléculaire: Mélange

Section 10 Stabilité Et Réactivité

Stabilité chimique: Stable **Polymérisation dangereuse:** N'aura pas lieu.
Conditions à éviter: Les températures excessives qui causent l'évaporation. Protéger de la lumière.
Incompatibilités avec d'autres matériaux: Comburante fortes, l'agents reducteurs.
Produits de décomposition dangereux: Oxydes de carbone, l'oxydes d'azote et l'oxydes de sodium.

Section 11 L'Information Toxicologique

Toxicité aiguë: Oral-rat TDLo: 12000 mg/kg [Rouge de méthyle]
La corrosion de la peau et l'irritation: Données non disponibles
Des lésions oculaires graves / irritation: Données non disponibles
Respiratoire ou sensibilisation de la peau: Données non disponibles
Mutagénicité des cellules germinales: Données non disponibles
Cancérogène: Données non disponibles
NTP: Aucun composant de ce produit présent à des niveaux supérieurs ou égaux à 0,1% n'a été identifié comme cancérigène reconnu ou présumé par NTP.
IARC: Aucun composant de ce produit présent à des niveaux supérieurs ou égaux à 0,1% n'a été identifié comme cancérigène probable, possible ou confirmé par IARC.
OSHA: Aucun composant de ce produit présent à des niveaux supérieurs ou égaux à 0,1% n'a été identifié comme cancérigène ni comme cancérigène possible par OSHA.
Reproductive toxicity: Données non disponibles
STOT-exposition unique: Données non disponibles.
STOT-une exposition répétée: Données non disponibles
Risque d'aspiration: Données non disponibles
Effets d'une surexposition:
Inhalation: Peut être nocif en cas d'inhalation.
Ingestion: Peut être nocif en cas d'ingestion.
Peau: Peut causer une légère irritation.
Yeux: Peut causer une légère irritation.
Les signes et les symptômes de l'exposition: Pour le meilleur de notre connaissance les propriétés chimiques, physiques et toxicologiques n'ont pas été étudiées à fond. Les données spécifiques n'est pas disponible. Exercice des procédures appropriées afin de minimiser les dangers potentiels.
Informations complémentaires: RTECS #: DG8960000 [Rouge de méthyle]

Section 12 L'Information Écologique

Toxicité pour les poissons: Pas de données disponible
Toxicité pour les daphnies et autres invertébrés aquatiques: Pas de données disponible
Toxicité pour les algues: Pas de données disponible
Persistance et dégradabilité: Pas de données disponible **Potentiel de bioaccumulation:** Pas de données disponible
Mobilité dans le sol: Pas de données disponibles **Évaluation PBT et vPvB:** Pas de données disponibles
Autres effets indésirables: Un danger pour l'environnement ne peut pas être exclu dans l'éventualité d'une manipulation ou d'élimination.

Section 13 Considérations De Disposition

Ces lignes directrices sont destinées à l'élimination de la disposition d'un catalogue de taille seules les quantités. Les règlements fédéraux peuvent s'appliquer aux contenants vides. Des réglementations nationales et / ou local peut être différent. Éliminer conformément à toutes les réglementations locales, provinciales et fédérales ou d'un contrat avec une agence élimination des produits chimiques sous licence..

Section 14 L'Information De Transport

Numéro UN / NA: Non applicable **Nom d'expédition:** Non réglé
Classe de danger: Non applicable **Groupe d'emballage:** Non applicable **Quantité à déclarer:** Non **Polluant marin:** Non
Exceptions: Non applicable **2012 ERG Guide #:** Non applicable

Section 15 L'Information De Normalisation

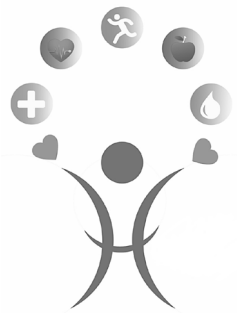
Un produit chimique est considéré comme inscrit si le numéro CAS pour la forme anhydre est sur la liste d'inventaire.

Composant	TSCA	CERLCA (RQ)	RCRA code	DSL	NDSL	Classification SIMDUT
Rouge de méthyle, sel sodique	Listed	Not Listed	Not Listed	Listed	Not Listed	Not Listed
Bleu de bromothymol, sel sodique	Listed	Not Listed	Not Listed	Listed	Not Listed	Produit non contrôlé

Section 16 L'Information Additionnelle

Les informations contenues dans ce document sont fournis sans garantie d'aucune sorte. Les employeurs devraient considérer cette information seulement comme complément à d'autres informations recueillies par eux et doivent prendre des décisions indépendantes de la pertinence et l'exhaustivité de l'information de toutes les sources afin d'assurer une utilisation correcte de ces matériaux et de la sécurité et la santé des employés. NTP: National Toxicology Program, IARC: International Agency for Research on Cancer, OSHA: Occupational Safety and Health Administration, STOT: Specific Target Organ Toxicity, SE: Single Exposure, RE: Repeated Exposure.

Health in Our Hands



What controls my health?

Lesson 3:

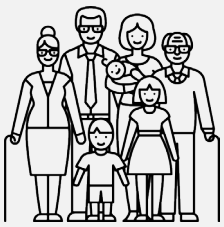
How does Monique's family affect her diabetes?

Genetic factors and environment al factors both influence health. Genetic factors are passed along from parents to their children. Some genes affect traits like hair color, while others affect traits that make us more likely to get certain diseases like diabetes. The good news is that your environment, including diet and exercise, can keep you healthy. Ultimately YOU are in charge of your health!

For discussion at home:
How is it that Monique the only one in her family with diabetes?

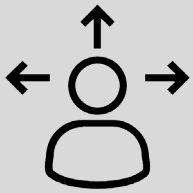
Key Point #1

Genetic factors affect many things about us. Some genes determine the color of our hair, our height, and some make us more likely to get diseases like diabetes.



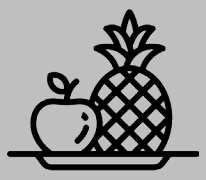
Key Point #2

Every day we make decisions about the food we eat and the activities we do. These choices can also affect our risk for getting diabetes just like genetic factors do.

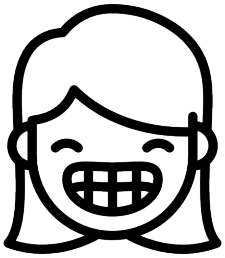


Key Point #3

Genetic factors and our lifestyles work together to determine whether or not we will develop diabetes. The good news is that even if you have genes for diabetes, a *healthy diet* can help you prevent, control, and even reverse diabetes.



Explore more and share: Looking at genetics



The following are all genetic traits inherited from your parents. Compare with your friends, people in your family, or people in your neighborhood. Are you the same or different? You may be very similar to friends who look nothing like you and very different from your own family members. This is because of genetics!

Trait 1: Freckles or no freckles?

Trait 2: Curly or straight hair?

Trait 3: Dimples or no dimples?

Goal: Learn how to identify different genetic traits among your family and friends.

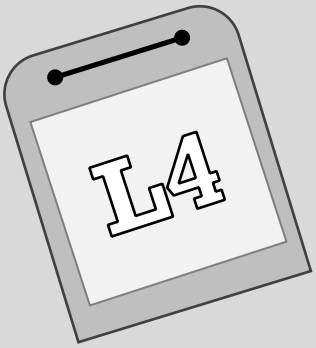
How can I control my health?

Eat right.
Look for a new recipe that only uses ingredients that are whole grains (like brown rice and wheat bread), fruits, vegetables, and proteins (like chicken or beans).

Get active.
There are many ways to get active! This can mean the gym but it can also mean just be going for a walk with a friend or playing your favorite sport.

Be mindful.
Come up with small changes you can make to improve your health such as taking the stairs instead of the elevator.

What's coming next?



Lesson #4: How does where Monique lives and what she does affect her diabetes?

Next lesson, we will further explore how the environment affects Monique's diabetes by conducting an experiment on plants through computer simulation. Students will be investigating the following questions:

1. How does the environment affect the growth of plants with the same genetics?
2. What can we learn Monique's diabetes by studying the plants?
   - How does where Monique lives affect her diabetes?
   - How do Monique's activities affect her diabetes?

Get involved…

Run in the next CRIM race, or maybe volunteer! The Crim Fitness Foundation …encourages people to lead healthy lifestyles by integrating physical activity, healthy eating, and mindfulness into their daily lives.

Find out details at https://crim.org/

About us

We are CREATE for STEM Institute at MSU. Funded by Science Education Partnership Award (SEPA) granted by the National Institutes of Health (NIH), the project is developing a new generation of learning materials that blends school and community learning experiences to teach genomics (the study of all the genes of an organism and gene-environment relationships) and evolution.

Instagram

Follow HIOH on Instagram at ***health_in_our_hands***

Partners: UMichigan, Flint Public Schools, Concord Consortium, Community-Based Organization Partners, Sloan Museum, Flint Public Library

Lesson 3: How does Monique's family affect her diabetes?

Unit Driving Question:	Materials	Suggested lesson time

What controls my health?
 	
Sub-Driving Question:
How does Monique's family affect her diabetes?
	• Computer
	• Projector
	• Markers
	• Materials for bead activity (for each group)
	  ○ 3 cups labeled Mom, Dad, and Child
	  ○ 12 beads: 8 black, 2 blue, 1 yellow, 1 red
		4 days

Framing the Lesson

Purpose
The purpose of this lesson is to explain to the students the genetic mechanism that underlies the inheritance of traits. Then, the students will continue to develop their models regarding Monique's diabetes and further investigate the Driving Question: **What controls my health?**

Learning Goals
- The students use models to predict how patterns of inheritance can affect variation in the inheritance of diabetes.
- The students revise their model by adding how genetic factors affect diabetes.

Building Coherence
In this lesson, the students investigate the importance of inheritance and the genetic mechanism of single or multi-factorial genes that underlie Monique's health. They collect and analyze data and use simulations to answer some of the questions they generated in Lesson 1. The students also review their model and add components related to the genetic mechanism of inheritance.

Overview of the Lesson

Activity 1: What does it mean to inherit genetic factors?
The students will discuss their ideas about inheritance and Type 2 diabetes. They will look at pictures of a family to identify some genetic factors that might be inherited.

Activity 2: How can genetic factors be inherited?
The students will collect data on tongue rolling and arm span. They will use this data to explore the population variation of the inheritance patterns of single and multi-factorial genes.

Activity 3: How do genetic factors influence the inheritance of diabetes?
The students will use beads and cups to simulate the inheritance of risk factors for diabetes. Students will identify the offspring as having high, medium, or low risk of diabetes based on the number and type of risk factors inherited during the simulation.

Wrapping-up the activities - revisiting the Driving Question Board
The students will revisit the ***Driving Question Board (DQB)*** and reflect upon their learning.

Activity 4: Modeling - Why does Monique have diabetes?
The students will revise their models and add the effect of genetic factors on Monique's diabetes. Then, they will share their models with the whole class, discuss similarities and differences among the components of their models, and evaluate the relationships presented.

Connection to NGSS

Target Performance Expectations

MS-LS3-2. Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information* and sexual reproduction results in offspring with genetic variation.

Disciplinary core idea	Science and engineering practices	Crosscutting concepts
LS3.A: Inheritance of Traits • Genetic material from each biological parent is inherited by offspring and contributes to the variation in their traits.	**Developing and Using Models** • Develop and use a model to describe phenomena.	**Patterns** • Patterns can be used to identify cause and effect relationships. **Cause and effect** • Cause and effect relationships may be used to predict phenomena in natural systems.

How these elements are integrated and embedded in this lesson

In this lesson, students will use a model to predict how patterns of inheritance can affect variation in the inheritance of diabetes. Students will also collect data to compare single (tongue rolling) and multifactor (arm span) inheritance patterns, and will use this data to develop **models** to explain how these patterns of inheritance can cause the variation of diabetes in Monique and her family members.

* The grayed out part of the PE will not be discussed in this lesson

Connection to Students' Lives

Link to out-of-school activity and everyday life

- Encourage the students to involve their family members by collecting their data of various characteristics, including tongue rolling and arm span, that they did in the class.

Link to career-awareness

- This lesson provides an opportunity to introduce careers related to genetics. One suggestion could be to contact local universities, research institutes, or hospitals to obtain possible speakers with careers related to genetics. For example, genetics counselors help families understand genetic risks and diseases.

Instructional Sequence

Introducing the Lesson

1. **Keeping coherence using the DQB** - Remind students of their questions related to Monique and diabetes on the Driving Question Board (DQB). Tell students that in this lesson they will further investigate the case study of Monique to determine "***How does Monique's family affect her diabetes?***" Tell the students that they should pay particular attention to the questions that they had clustered around that Sub-Driving Question.

2. **Introducing the lesson** - Discuss with the whole class why they think Monique had diabetes but no one else who lives at her house has it. Ask the students to use information about the causes of diabetes from the Driving Question Board to help them with their ideas.

Activity 1 - What does it mean to inherit genetic factors?

1. **Drawing from prior knowledge** - Discuss inheritance of traits, specifically of diabetes, with the students. Encourage the students to expose their prior knowledge by using the following prompts:
    - What do you think it means to *inherit* something?
    - What kinds of things can people *inherit*?
    - Do you think we *inherit* characteristics from our parents?

2. **Exploring patterns of inheritance** - Introduce the picture of the family (see picture below) and lead a discussion with the entire class to expose their prior knowledge using the following prompts:
    - What do you think the children inherit from their Mom?
    - What do you think the children inherit from their Dad?
    - Do you think that girls only inherit traits from their mother and boys from their father? What evidence might you have from this family or your own family to support your understanding?
    - As far as we can see from the picture, are there any characteristics that all the children inherited?
    - As far as we can see from the picture, are there any characteristics that none of the children inherited?
    - Why do you think the children do not look exactly like their parents?

3. **Discussing** - Discuss the relationship between genetic factors and characteristics, with an emphasis on diabetes. Then, refer to the picture of the family and illustrate this relationship comparing differences and similarities in the children and their parents.

Activity 2 - How can genetic factors be inherited?

1. **Introducing core terms of observations -** Discuss with the students the differences between observation and experimentation. Explain that the purpose of this investigation is to collect data and understand how characteristics in a large group of people can vary or be different.

Observation vs. Experimentation

- ***Observation*** - The action or process of measuring variables of interest without assigning treatments to the subjects; a procedure carried out under natural conditions to discover an unknown effect.
- ***Experimentation*** - The action or process of manipulating, or changing, natural conditions in order to test or establish a hypothesis; a procedure carried out under controlled conditions to discover an unknown effect.

2. **Conducting an observation** - In pairs, ask the students to observe their partner attempting to roll their tongue and to measure their partner's arm-span. Tell the students to fill out their worksheet (see below - worksheet 2) and also post their results in a Class Data Table, which will be drawn on the whiteboard. Tell the students to wait until everybody has posted their results, and then continue to the *data analysis: Comparing traits in the class population* part of the worksheet.

While the students work in pairs, circulate in the class and support the students, while also encouraging them to share their thinking and consult their peers about their data analysis and conclusions.

3. **Discussing** - Lead a class discussion about their data analysis and answers to the worksheet:
   - How are the charts similar and different? Do you see a pattern in this data?
   - What might affect how long your arms are? (length of bones in arms and hands, width from shoulder to shoulder, etc.)
   - What might affect your ability to roll your tongue? (control over the muscles in your tongue)
   - What does the data tell you about the amount of variation there is between people for these two traits?

   Emphasize the relationship between genetic factors and variation of traits, using the following prompts:
   - Do you think that traits that have very little variation, like tongue rolling, might be caused by a single genetic factor or many genetic factors? Why? {Traits that have very little variation might be caused by only one genetic factor.}

- Do you think that traits that have a lot of variation, like arm span, might be caused by a single genetic factor or many genetic factors? Why? {Traits that have much variation are usually caused by many different genetic factors and are called multifactorial traits.}
- In which of these ways do you think diabetes might be inherited?

Emphasize the relationship between their observations and diabetes:

- Do you think diabetes is inherited more like tongue rolling or more like arm span?
- Could the way that it is inherited help us explain why Monique was the only one in her household to have Type 2 diabetes?

4. **Sharing with families** - Introduce other traits (e.g. earlobes (attached or not) and thumbs (hitchhiker's or not)) that are inherited, and ask students to compare them with their peers. Encourage them to explore expressions of these traits within their family.

Activity 3 - How do genetic factors influence the inheritance of diabetes?

Tell students that they will be investigating the genetic factors that cause Type 2 diabetes. Remind the students of the article they read in Lesson 2 and of the organs that are involved in Type 2 diabetes: What organs are involved in Type 2 diabetes? List organs on the board as students identify them: pancreas, stomach, heart, etc. Discuss the importance of the pancreas and the function of insulin.

1. **Simulating the genetic basis of diabetes** - In pairs, have the students complete the worksheet for *Activity 3: How do genetic factors influence the inheritance of diabetes?* (see below), and the handout of a pedigree. Tell the students to stop before the *Data analysis: Comparing results with other teams* section.

	While the students work in pairs, circulate in the class and support the students as they model inheritance with the beads. Be sure the students: • Understand the representations of the various components: Mom, Dad, and Child cups; beads; various beads' colors; and random pick of beads. • Follow correctly the instructions on the worksheet. • Label the beads and key correctly. • Complete the pedigree correctly.

2. **Sharing and Discussing** - Ask the students to share with the class the risk factors for the siblings in their simulation. Discuss the various results with the class:
    - Do all the siblings have similar risk factors for diabetes? Why?
    - Which sibling has the highest risk for diabetes?
    - How is inheritance of arm span similar to the inheritance of diabetes? (both are determined by multiple genes)
    - How does the simulation with the beads help us understand why Monique is the only one in her family with diabetes?

    It is important for students to understand that the simulation with beads does not fully represent how the genetic information of parents is inherited to their children. For example,
    - Genetic information of organisms is not color-coded or round-shaped like beads
    - There are more than six genetic factors that can influence inheritance of diabetes
    - They put the beads back into cups that represent Mom and Dad, but genetic information is not being reused.

    Emphasize the fact that models have limitations because their purpose is to explain certain aspects (not all) of phenomena. For example, we reuse the beads so we will not use so many beads, but in reality, genetic information is not reused. *At the end of the discussion*, instruct the students to complete their worksheets.

Wrapping-up the activities - revisiting the Driving Question Board

With the class, revisit the ***Driving Question Board (DQB)***. Prompt the students to reflect upon their learning using the following prompts:

1. Which questions on the DQB have we answered, and which remain open?
    - Students should attach their answers/artifacts of investigation onto the DQB next to the questions they relate to.

2. After completing the activities in the lesson, do you have any additional questions?
    - Any new questions should be added to the board near the SDQ they relate to.

Activity 4 - Modeling: Why does Monique have diabetes?

In this activity, the students revisit their models and revise them according to what they have learned. The modeling activity in this lesson has two goals:

1. Support the students' understanding of models and modeling.
2. Continue developing a model of Monique's diabetes.

NOTE: Students **revise the models they generated in the previous lesson, by adding more components and changing them.**

Developing models of Monique's diabetes

1. **Developing a model Monique's diabetes - *guided modeling*** – Start with a class discussion about Monique's diabetes. **For this part, use the presentation for lesson 3.** Make sure to:
    - Break the task into the smaller steps and engage in "peer-review" processes often
    - Let the students work individually or in pairs on their devices to develop their models of Monique's diabetes. Circle among them, and discuss their models with them as they work using the prompts. Emphasize the various phases of the modeling cycle and use the scaffolding prompts.
    - Have the students fill out the online-worksheet as they develop their models, and the online reflections at the end of the process. Review students' reflections in a class discussion.

	While the students experience using the *SageModeler*, circle in the class, support the students, and encourage them to share their thinking and consult with their peers about their models. Students' models can vary. However, since the models need to explain the relationships among the components, make sure the models include: ***Components*** • Genetic factors • Genetic risks factors • Family (parents, brothers, sisters, siblings) • Inheritance ***Relationships and labels*** • The relationships among the components • The relationship between the components and Monique's diabetes

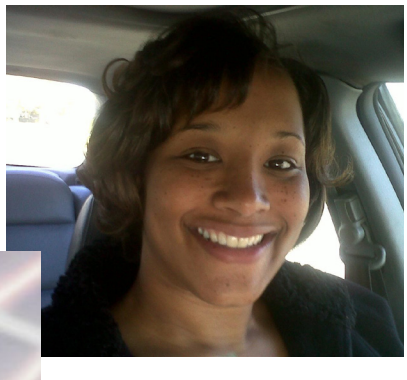
Discuss with the students:

- The similarities and differences between the models
- The models' strengths and weaknesses
- Ways to improve the various models

	A discussion which shares insights from the various models and compares among them is extremely important as it will scaffold the students' second revision of their models in the following step. Use questions to prompt the students to critically examine their peers' models. ***Components:*** • *Components identity* - What components are included in each model? Are key components included? • *Number of components* - How many components are indicated in the model? Are MORE components necessarily better? • *Grouping of components* - How can we group the various components? Why should we group components—does it improve our models? Is the grouping meaningful? ***Relationships among components:*** • *Explicit relationships among the components* - Are the relationships among the components indicated? Do these relationships make sense? Are the indicated relationships important? ***General features:*** • *Complexity of the model* - How complex is the model? • *Organization* - How well is the model organized? Is the organization meaningful?

Activity 1: What does it mean to inherit genetic factors?

Mother



When the mother was young

Father

When the father was young

Children from mom and dad

1. **What genetic factors do you think the children inherited from their mom?**
2. **What genetic factors do you think the children inherited from their dad?**

Why don't any of the children look identical to their Mom or Dad? All of the children inherited some characteristics from each parent. These inherited characteristics are called **traits.** Sometimes we can see the traits, and sometimes we cannot. We can see your eyes, but we cannot see your allergies.

Traits are caused by genetic factors that you receive from your parents. Children inherit half of their genetic factors from each parent. For example, "brown eyes" is trait, and it is caused by genetic factors that affect eye colors. Each child gets a different combination of genetic factors. These differences cause them to look different.

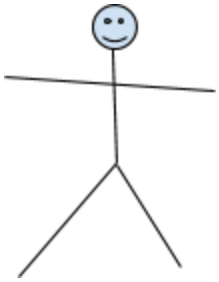
People in the same family can look different because they inherited different genetic factors. Everyone can have 2 legs, but some people have short legs and some people have long legs. This is called inherited variation. We will explore these differences in our next investigation.

Activity 2: How can genetic factors be inherited?

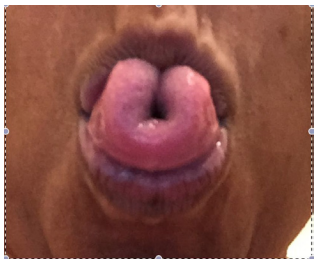
In our reading, we learned that diabetes may be an inherited trait. However, in the first video about Monique (click here to watch the video again), she said that she was the only person in her household to have diabetes.

Why do you think that no one else in Monique's household has diabetes if it is inherited?

To answer this question, we are going to examine two traits: "arm span" and "tongue rolling:"



Arm span



Tongue rolling

Do we all look the same? Why are we very different in some ways and not very different in others?
Let's investigate!

1. Get with your partner. Try to roll your tongue. Watch as your partner tries to roll his or her tongue. Record the results for each of you in the data table.

2. Get a metric measuring tape or meter stick. Stretch out your arms. Have your partner measure your arm span by measuring from fingertip to fingertip in centimeters.

3. Repeat Step 3 for your partner. Record your results in the data table.

Name	Tongue rolling: yes/no	Arm Span in Centimeters

When you have finished collecting data for **your group**, post your data on the class data table.

Data analysis: Comparing traits in the class population

1. After the whole class has recorded their data, look at the charts. How are they similar and different? Do you see a pattern in this data?

2. What might affect how long your arms are? What might affect your ability to roll your tongue?

3. What does the data tell you about the amount of variation there is between people for these two traits?

4. Can you think of another trait that might be inherited more like tongue rolling?

5. Can you think of another trait that might be inherited more like arm span?

Activity 3: How do genetic factors influence the inheritance of diabetes?

Some traits have very little variation—either you have the trait or you don't. These traits are usually due to one genetic factor (e.g. tongue rolling).

Other traits have much variation in the population. Such traits are usually influenced by more than one genetic factor (e.g. arm span).

Do you think diabetes is inherited more like tongue rolling or arm span? Could the way that diabetes is inherited explain why Monique is the only one in her household to have Type 2 diabetes?

Let's investigate!

Each parent has different genetic information, or **genetic factors**. These genetic factors are randomly transmitted to their children in a process called *inheritance*. Children *inherit* their genetic factors from both parents—their father and their mother. Each child receives half of the genetic information from the father and half of the genetic information from the mother.

Scientists have discovered that there are many genetic factors that affect the way the pancreas functions, and that can cause people to have a higher risk of Type 2 diabetes. These are called **genetic risk factors** for diabetes because they may increase the risk of someone developing Type 2 diabetes. These are some examples of genetic factors that may increase diabetes risk:

- The pancreas does not produce the *correct type* of insulin.
- The pancreas does not produce insulin at the *correct time*.
- The pancreas does not produce the *correct amount* of insulin.

The more of these **genetic risk factors** you *inherit*, the higher your risk to develop Type 2 diabetes.

How can we predict the risk factors for the children if the mother has one high risk factor for Type 2 diabetes, and the father has 3 high risk factors for Type 2 diabetes?

Materials:
Colored pencils/markers
Disposable cups
1 bag of colored beads (blue, red, yellow, and black)
Handout of pedigree

Developing your model:

1. Get the following equipment: a blank handout of pedigree, which shows patterns of inheritance; colored pencils; 3 disposable cups; and an assortment of colored beads (red, yellow, blue, black).

2. Fill in the *key* on the handout of pedigree with your choices of bead colors to represent the genetic risk factors for Type 2 diabetes.

3. In this model, each of Monique's parents have 6 genetic factors. **What can you use to represent the genetic factors?**

4. Choose one cup that will represent the mother. Write **Mom** on the cup. Mom will have 5 **genetic factors** that are not risk factors for diabetes and 1 **genetic risk factor** for Type 2 diabetes. Look at the list of risk factors above, and think: ***which risk factor will the mother have?*** Place in **Mom's** cup 5 black beads, and 1 colored bead to represent that risk factor. Label it in your *key*.

5. Choose one cup that will represent the father. Write **Dad** on the cup. Dad will have 3 **genetic factors** that are not risk factors for diabetes and 3 **genetic risk factors** for Type 2 diabetes. Look at the list of risk factors above, and think: ***which risk factor will the father have?*** Place in **Dad's** cup 3 black beads, and 3 different colored beads to represent the various risk factors. Label it in your *key*.

6. On the pedigree, record the colors of the beads present in both the **Mom** and **Dad** cups by drawing colored dots in the blank squares with the colored pencils/markers.

7. Look at the **genetic risk factors**. Who is at the most risk for diabetes, Mom or Dad? Why do you think so?

8. Label the third cup **Child**. A child must also have 6 **genetic factors**, from which: 3 are *inherited* from the father, and three are *inherited* from the mother.

9. With closed eyes, mix the **Mom** and **Dad** cups. Then, randomly draw out 3 beads from **Mom** and 3 beads from **Dad**, and put them in the cup labeled **Child**.

10. On the pedigree, draw colored dots according to the beads' colors in the **Child** cup. These dots represent the **first child's genetic factors**, inherited from his or her parents.

11. Return the beads to the appropriate parent. Make sure the mother and father still have the same genetic risk factors: **Mom**: 5-black, 1-colored; **Dad**: 3-black, 1-blue, 1-red, 1-yellow).

12. Repeat steps 9-11 for each son or daughter in the second row of the pedigree (5 children).

13. Look at each child's combination of colored beads, which represent their **genetic factors**. Label each individual in your pedigree as low, medium, or high risk for Type 2 diabetes. Make a key to show how you made your determination.

Which child has the highest risk for diabetes?

Claim:_____

Evidence from model:_____

_____

_____

Why do you think this child has the highest risk for diabetes?_____

_____

_____

Data analysis: Comparing results with other teams

1. Was the data for every group in the class the same? Why or why not?

2. How could this data help us explain why Monique has diabetes but no one else in her household has diabetes?

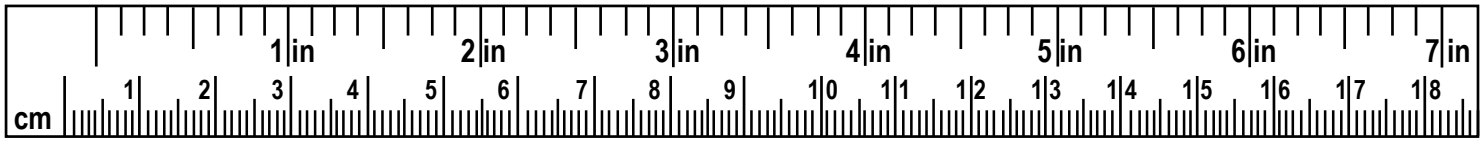
3. Do you think that every child that has high genetic risk factors for diabetes will get diabetes? Why or why not?

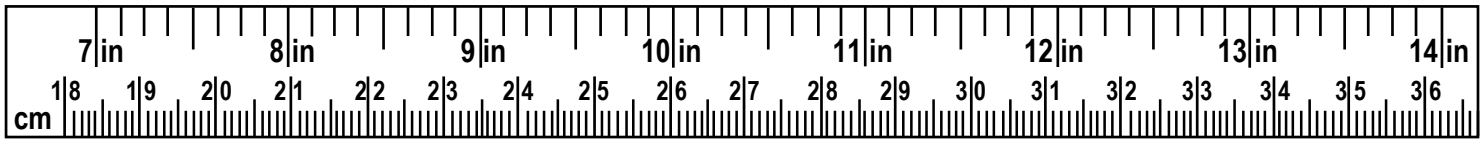
Printable Measuring Tape

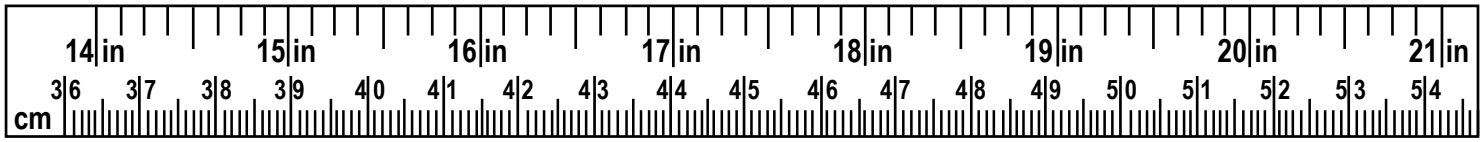
Printing instructions

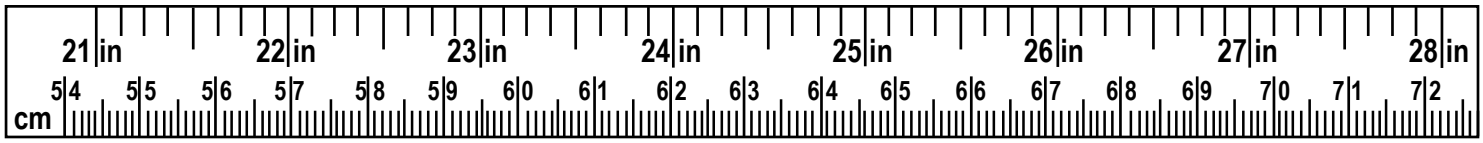
Please note if this page is not printed correctly the units of measure will not be accurate.This page should be printed on standard 8 ½ X 11 paper. Do not select or change any default print margin's, if necessary select to print 'outside print margins'. Please ensure NO OPTIONS for printing are checked.

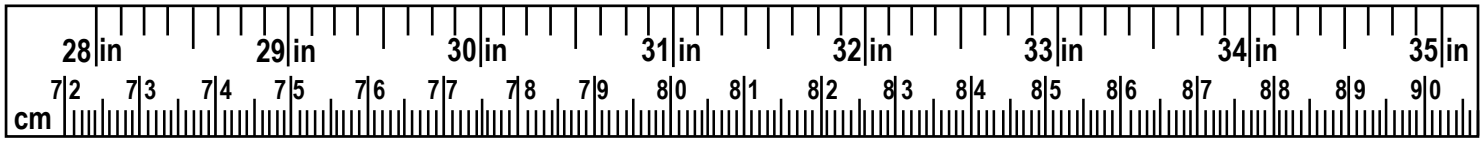
To assemble, cut along dotted lines. Line up and tape the whole number unit of measure on the right hand side with the corresponding number of the left hand side. If you have a straight ruler or a measuring cup, after printing compare the unit of measure to ensure accuracy.

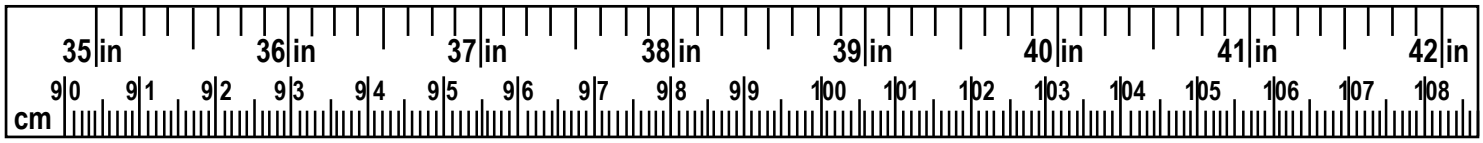


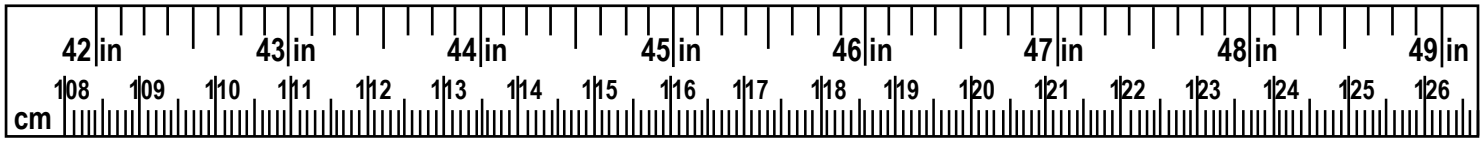










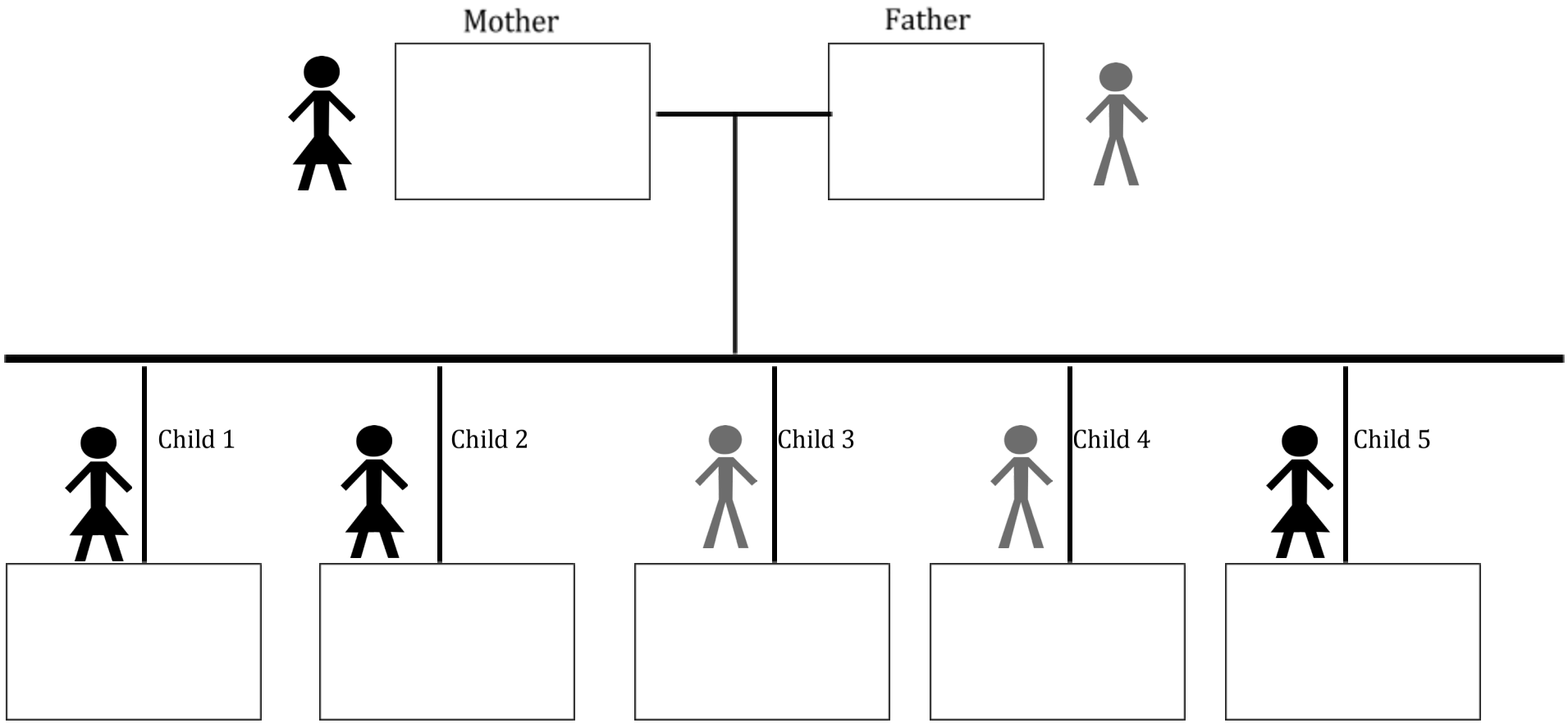


CREATE for STEM Institute

Health In Our Hands

What is our Risk of Developing Diabetes?

Inheritance of Multiple Genetic Factors for Diabetes



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Key

Black beads: genetic factors that do **NOT** contribute to diabetes. Organs related to diabetes work correctly.

Genetic risk factor for diabetes:

_____beads - pancreas does not produce the correct type of insulin
_____beads - pancreas does not produce insulin at the correct time
_____beads - pancreas does not produce the correct amount of insulin

clipart male:http://www.clipartpanda.com/categories/stick-people-clip-art
Clipart female:http://www.clker.com/clipart-16623.html

Scaffolding the student's modeling

Modeling can be difficult to teach and learn, especially for teachers and students who are new to modeling as a scientific practice. Students' modeling can be improved if their thinking is scaffolded (supported) by a series of prompts at each step of the modeling cycle. For "What Controls My Health, challenges to students' thinking were identified and specific prompts designed to help support students throughout the process. There are quite a few prompts to use to scaffold modeling in the instructional sequence of every lesson, so in this section, we provide a background and rationale for their use.

Below is a table that shows the cognitive and metacognitive challenges that were identified and the prompts that were designed *for teachers to use in discussion* to scaffold students' thinking at each stage of the modeling cycle. Some of the generic challenges are about science content (domain-general challenges) and some are specific to learning about diabetes and gene-environment interaction (domain-specific challenges). Some prompts were designed as generic for domain-general challenges, and some were designed as context-specific for domain-specific challenges. Here are some definitions to clarify terms:

- Cognitive scaffolds – scaffolds aimed at supporting skills necessary to encode, memorize, and recall information
- Metacognitive scaffolds – scaffolds aimed at supporting skills that enable learners to understand and monitor their cognitive processes.
- Generic scaffolds – scaffolds aimed at supporting a general understanding of the framework for modeling regardless of the science content area
- Context-specific scaffolds – scaffolds aimed at supporting an understanding of the context-specific modeling task, and the content knowledge to be used

Students' challenges (*cognitive* or *metacognitive*)	**Generic prompts**	**Context-specific prompts**
Planning		
Identifying what they know about the phenomenon that needs to be integrated into the models (*metacognitive*)		What is the question you are trying to answer about Monique's diabetes? What are the components of your model about Monique's Type II diabetes? Make a list!
Identifying measurable components to be included in the model (*cognitive*)	Why is it necessary to have quantitative components? How can you find out if the components are quantitative?	Are the components quantitative? Can they answer the question HOW MUCH of this component affects Monique's diabetes?

Categorizing the components that needed to be included in the model (*cognitive*)	Why is it important to categorize the components? How can you categorize them?	Do the components have something in common? Can they be organized into categories, such as genetic or environmental factors?
Building		
Organize the components and the relationships between them on their actual models (*cognitive*)		How are the components related? How do they affect Monique's diabetes? Describe the relationships between the components.
Identifying the direction of cause and effect relationships between the components (cognitive)	How are cause and effect relationships between components represented in models? What does the direction of the arrow represent?	What are the cause and effect relationships between the components in your model? Do the arrows in your model represent correctly the causes and effects of Monique's diabetes?
Testing		
Identifying errors in their models (*metacognitive & cognitive*)		Does your model make sense? Does your model explain the causes and effects of Monique's diabetes? Are there any components missing? Are the relationships correct?
Revising		
Identifying their new knowledge and how it relates to the phenomenon (*metacognitive*)		Think about what you just learned about type II diabetes: What new components should be added to your model? How do they relate to the other components?
Identifying the components and relationships to be added to the models (*cognitive*)		
Using the feedback (provided by teacher or peers) to revise their models to better capture the mechanism underlying the process of diabetes (*metacognitive*)		What feedback did you receive about your model? How can you use the feedback to improve your model to better explain Monique's diabetes? What needs to be changed?

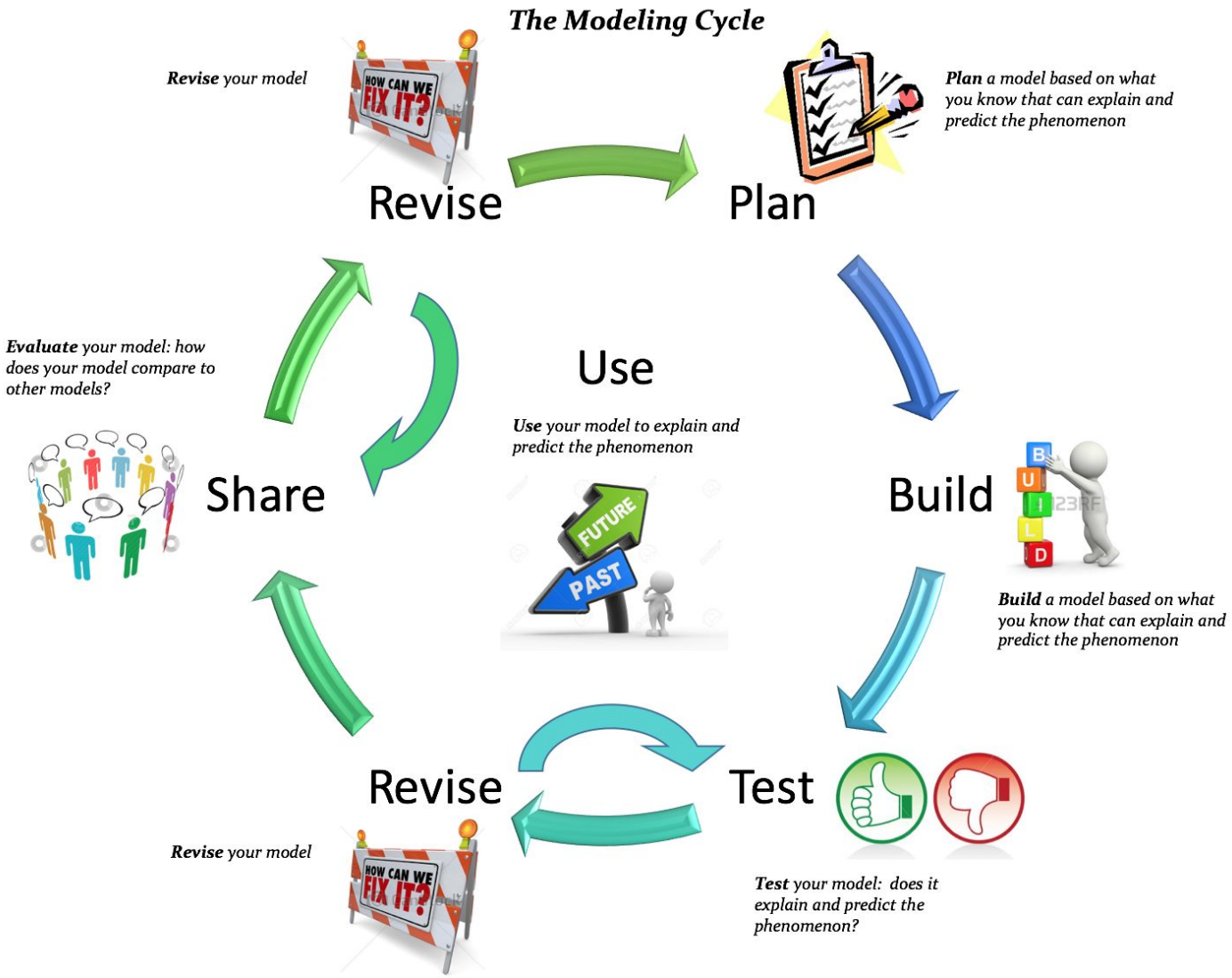
Using insights from other students' models to revise and improve their own (*metacognitive*)		Look at other models of Monique's diabetes: How are they similar or different than yours? Are the ways they explain Monique's diabetes better? How can you use them to improve your own model?
Sharing		
Communicating their models not only by describing the components and the relationships between them, but also by providing an overview of the gene-environment interactions that lead to diabetes (*cognitive*)		What question about Monique's diabetes is your model trying to answer? Why does Monique have diabetes according to your model?
Providing feedback to their peers on the core aspects of modeling to help them improve their models (*cognitive*)	What are the core ideas of models?	Does the model explain and predict Monique's diabetes?

Developing your model

Definitions:

- A **phenomenon** is a fact or situation that we can observe, explain and predict.
- A **model** is a visual representation of a phenomenon. A model explains and predicts a phenomenon.

The modeling cycle:



CREATE for STEM Institute

HealthInOurHands

Why does Monique have diabetes?

Step 1: Planning

1. What is the question you are trying to answer about your ***Monique's diabetes***? What **new information** did we learn about diabetes?

_____

_____

2. What are the **new** components of your model that will explain Monique's diabetes? Make a list!

_____

_____

_____

3. Be sure to use components that can answer the question HOW MUCH - do they increase or decrease Monique's diabetes?.
4. Can the components be organized into categories? Categorize them!

Categories:					
Components:	_____	_____	_____	_____	_____

Step 2: Building

Open SageModeler and start developing your model
https://concord.org/projects/building-models

1. Use components from your list - you can add/omit components
2. Choose pictures to express each component
3. How are the components related? Use the arrows to describe the relationships (cause to effect).

Step 3 & 4: Testing and Revising

Make sure that:

- ❑ Does your model make sense? Does your model explain why Monique has diabetes? Does your model explain the causes and effects of Type 2 diabetes?
- ❑ Are any components missing? Are the relationships correct?

Revise your model if necessary!

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Step 5: Sharing

1. Explain your model - what question about diabetes is your model trying to answer?

_____

2. Why does Monique have diabetes according to your model?

_____

_____

_____

Step 6: Revising

1. What feedback did you receive about your model? How can you improve your model to better explain diabetes? What needs to be changed?

_____

_____

_____

2. Look at other models of Monique's diabetes: How are they similar or different than yours? Are the ways they explain Monique's diabetes better? How can you use them to improve your own model?

_____

_____

_____

Thinking About My Model

1. Score your model - How well does your model explain why Monique has Type 2 diabetes?

Circle score (1=not well, 6=very well)
1 2 3 4 5 6

Explain your score: _____

_____

_____

2. Was it easy to think of the **new components** and the **relationships** that you should add to your model to explain and predict Monique's diabetes?

Circle score (1=not at all, 6=very much)
1 2 3 4 5 6

How did you think of them? _____

_____

_____

3. Did the class discussion about the models help you improve your own model about Monique's diabetes?

Circle score (1=not at all, 6=very much)
1 2 3 4 5 6

Why? What changes did you make to your model following the class discussion?_____

_____

_____

4. When you are asked to model a phenomenon, what should you do? (*hint - look at the modeling cycle*)

_____

_____

_____

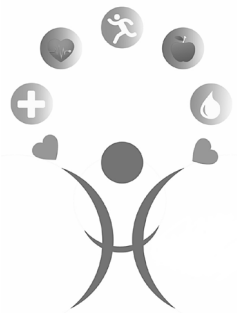
_____

_____

_____

_____

Health in Our Hands



What controls my health?

Lesson 4: How does where Monique lives and what she does affect her diabetes?

Have you ever wondered why one flower in a bunch dies faster than the others? Often times, this is because of the environment. The environment includes everything that surrounds us. For example, a plant's environment includes sunlight, soil, and water. Not all plants get the same amount of these three things, so some plants are healthier than others. The environment has an impact on human health in a similar way. The air we breathe, where we grocery shop, where we work, and where we play all affect our health. The good news is that we do have some control over our environment, so we can make changes to improve our health.

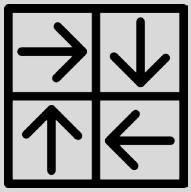
For discussion at home: How can the environment affect diabetes?

Key Point #1

The environment and our genetics work together to determine our health. Ask your child to explain about how Monique's environment and genetics work together to affect her diabetes.

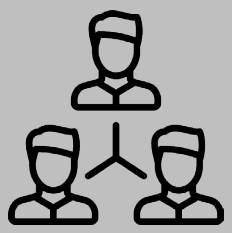
Key Point #2

Everyone has different environments that affect their health differently. Ask your student to share more about the plant experiment they did in class.



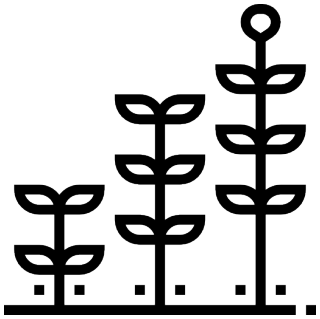
Key Point #3

Where we live and work and what we eat affects our health. Ask your student what environmental factors can impact their health?



Explore more and share: Watering Plants

Ask an adult at home to help with this activity



Materials: Dirt, 4 seeds from one kind of plant (grass or bean seeds work well), and a cup or jar (a plastic bottle cut in half works too).

Step 1: Plant four seeds

Step 2: Label the cups: water, juice, soda, and milk (pick at least two of these depending on what you have at home).

Step 3: "Water" each plant according to its label every day. Watch how the plants grow differently! Make sure all the plants get the same amount of sunlight.

Goal: Understand how different "waters" impact the health of the plant.

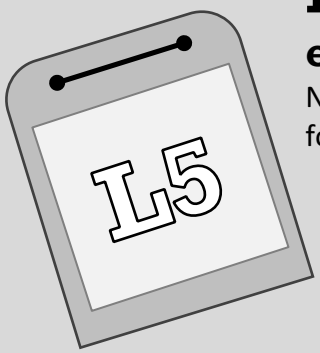
How can I control my health?

Eat right
Eat more color! Different foods give us different nutrients. The more colorful your plate is the more balanced and healthy your meal is.

Get active
Make a list of activities you like to do. Where can you do these activities? Try to do one thing off this list every day!

Be mindful
Brainstorm a list of environmental factors that affect you and your family. In what ways can you improve your environment?

What's coming next?



Lesson #5: How do Monique's characteristics and environment affect her diabetes?

Next lesson, students will learn about health through a sand rat simulation. The following questions will be covered:

1. Can we use a computer simulation to see what affects the health of rats?
2. What can we learn about Monique's diabetes by experimenting on sand rats?
3. How do Monique's characteristics and environment affect her diabetes?
4. How do genetic factors influence the inheritance of diabetes?

Get involved…

Find out more about careers in health! Flint has a wealth of schools that prepare young people for careers in health. Find out more:

Michigan State University College of Medicine-Flint Campus http://www.msufame.msu.edu/;
University of Michigan – Flint School of Health Professions and Studies https://www.umflint.edu/shps ;
Kettering University https://www.kettering.edu/programs-and-degrees/pre-med

About us

We are CREATE for STEM Institute at MSU. Funded by Science Education Partnership Award (SEPA) granted by the National Institutes of Health (NIH), the project is developing a new generation of learning materials that blends school and community learning experiences to teach genomics (the study of all the genes of an organism and gene-environment relationships) and evolution.

Instagram

Follow HIOH on Instagram at ***health_in_our_hands***

Partners: UMichigan, Flint Public Schools, Concord Consortium, Community-Based Organization Partners, Sloan Museum, Flint Public Library

Lesson 4: How does where Monique lives and what she does affect her diabetes?

Unit Driving Question:	Materials	Suggested lesson time
What controls my health? **Sub-Driving Question:** How does where Monique lives and what she does affect her diabetes?	• Computer • Projector	3 days

Framing the Lesson

Purpose
In this lesson, students plan and carry out investigations using simulations to explore the effect of environmental factors on Monique's diabetes and the Sub-Driving Question: "How does where we live and what we do affect our health?"

Learning Goals
- The students plan and carry out investigations to identify environmental factors that affect the growth and health of organisms.
- The students revise their model by adding cause and effect of environmental factors on diabetes.

Building Coherence
In the previous lesson, the students learned about the effects of genetic factors on one's traits. In this lesson, students explore the effects of environmental factors on the growth, development and health of organisms. Combined together, these lessons introduce the students to gene-environment interactions and the effect of these interactions on organisms' traits.

Overview of the Lesson

Activity 1: How does the environment affect the growth of plants of the same genetic composition?
The students will investigate the effect of environmental factors on the growth of plants using a simulation. Students will plan a class experiment, collect data in pairs, share and discuss their results, and draw evidence-based conclusions.

Activity 2: How does where Monique lives and what she does affect her health?
In this discussion, the students will link the plant simulation to diabetes and discuss the environmental factors that affect health. The discussion will also emphasize the changes that Monique and individuals can make to their environments to improve their health. This discussion is important, as it paves the way towards the community action projects that the students will conduct in Lesson 7.

Wrapping-up the activities - revisiting the Driving Question Board
The students will revisit the ***Driving Question Board (DQB)*** and reflect upon their learning.

Activity 3: Modeling: Why does Monique have diabetes?
The students will revise their models and add the effect of environmental factors on Monique's diabetes. Then, they will share their models with the whole class, discuss similarities and differences among the components of their models, and evaluate the relationships presented.

Connection to NGSS

Target Performance Expectations

MS-LS1-5. Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.
MS-LS3-2. Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation.

Disciplinary core idea	Science and engineering practices	Crosscutting concepts
LS3.A: **Growth and Development of organisms** • Genetic factors as well as local conditions affect the size of the adult plant. **Inheritance of Traits** • Variations of inherited traits between parent and offspring arise from genetic differences that result from the subset of chromosomes (and therefore genes) inherited.	**Planning and carrying out investigations** • Plan an investigation individually and collaboratively, and in the design: identify independent and dependent variables and controls, what tools are needed to do the gathering, how measurements will be recorded, and how many data are needed to support a claim. **Analyzing and interpreting data** • Analyze and interpret data to provide evidence for phenomena **Constructing explanations** • Construct an explanation that includes qualitative or quantitative relationships between variables that predict(s) and/or describe(s) phenomena. **Developing and Using Models** • Develop and use a model to describe phenomena.	**Patterns** • Patterns can be used to identify cause and effect relationships. **Cause and effect** • Cause and effect relationships may be used to predict phenomena in natural systems.

How these elements are integrated and embedded in this lesson

In this lesson, students will use a model (plant simulation) to investigate how the environment can influence the development and/or growth of organisms. They will collect and use data to develop models to explain how the environment can affect Monique's diabetes.

Connection to Students' Lives

Link to out-of-school activity and everyday life

- Encourage students to relate the effect of environmental factors on growth, development, and health to their own lives. How does where they live affect their health? Who works or volunteers in their community to improve the environment? For example, is there a garden in their neighborhood or schoolyard? How does a public health department make sure that everyone is healthy?

Instructional Sequence

Introducing the Lesson

1. **Keeping coherence using the DQB** - Remind students of their questions related to Monique and diabetes on the Driving Question Board (DQB). Tell students that in this lesson they will further investigate the case study of Monique to determine "How does where Monique lives and what she does affect her diabetes?" Tell the students that they should pay particular attention to the questions that they had clustered around that Sub-Driving Question.

2. **Introducing the lesson** - Show the students a video of Monique (2:44 minutes) detailing the changes she had made in her environment following her diagnosis with diabetes (e.g. diet, exercise, availability of healthy food). Encourage the students to describe the environmental factors that had a negative and a positive impact on Monique's diabetes.

Activity 1 - How does the environment affect the growth of plants of the same genetic composition?

In this section of the lesson, the students will conduct a *structured inquiry*. They will use the simulation to examine the effect of environmental factors on plant growth and development.

Structured inquiry
In *structured inquiry*, the students investigate a teacher-presented question through a prescribed procedure and receive explicit step-by-step guidelines at each stage, leading to a predetermined outcome. The process is similar to following a recipe.

Use the presentation to support teaching.

1. **Introducing core terms of experimentation** - Introduce and explain to the students the core terms of experimentation: inquiry, inquiry question, observations *vs*. experimentation, dependent variable, independent variable, controlled variables. **Use slides 1-6 for this part.**

	When conducting experiments, the students should to be familiar with the following terms: ***Independent variable*** - a variable whose variation does not depend on another variable. In an experiment, it is the variable one chooses to change or manipulate, to determine an effect on other variables. ***Dependent variable*** - a variable whose value depends on another variable. In an experiment, it is the variable that changes in response to other variables being changed. ***Controlled variable*** - In an experiment, this is a variable that is not changed. This enables the experimenter to fairly test the relationship between the independent and dependent variables. ***An inquiry question*** - a specific type of question which supports investigation and requires the gathering and analyzing of data to propose a potential answer.

2. **Introducing the plant simulation** - Expose the students to the plant simulation. Explain the advantages of using simulations for experimentation (see teacher's guide for further details). **Use slide 7 for this part.**

	Prompt a discussion about the role of simulation in science using questions, for example: • Why do you think scientists use simulations? • When do you think using a simulation can be useful? • Can you think of some examples of phenomena that you think would be useful to experiment with in a simulation?

3. **Planning experiments -** Discuss with the entire class the experimentation procedure:
   a. *Brainstorm* possible independent and dependent variables for the students to test using the simulation.
   b. Introduce the *inquiry question* that the students will be investigating using the simulation (as this is a *structured inquiry*, all the student teams will be conducting the same experiment).

   Use slide 8 for this part.

Scaffolding students using *learning strategies*

1. **What are learning strategies** - Remind the students what learning strategies are, and emphasize the importance of learning strategies for efficient learning (see teacher's guide).

2. **Remind what *Brainstorming* is and how it can be used** - Brainstorming is a strategy for generating ideas. It includes generating a list of spontaneous ideas which are associated with a specific topic. For effective brainstorming, (a) focus on quantity, (b) withhold criticism, (c) welcome unusual and wild ideas, and (d) combine and improve ideas.

3. **Scaffold *Brainstorming*** - Together with the entire class, use the *brainstorming* strategy to generate as many questions as possible about the effect of environmental factors on plant growth.
   a. **Generating "anchors:"** Tell the students to rely on their experience with plants for their brainstorming. First, ask them to think of as many possible factors as they can that might affect plant growth; these are the independent variables. Then, ask them to think of as many as possible factors that are associated with plant growth; these are the dependent variables.
   b. **Examples*** of *dependent* and *independent* variables:
      - ***Examples of independent variables:*** light, shade, water, type of soil, nutrients, temperature
      - ***Examples of dependent variables:*** plants' height, number of leaves, number of buds, number of flowers, number of small branches, green color

   This is not an exhaustive list

4. **Conducting experiments -** In pairs or in a class discussion, the students will plan and conduct their own experiments to explore the effect of environmental factors on the plants' growth. In their teams, the students will detail their:
   a. *Independent variable:* amount of sunlight
   b. *Dependent variable:* growth of plant (plants' height, color of leaf, and number of survived plants)
   c. *Controlled variables:* type of plant (genetic makeup), number of seeds, availability of water, time
   d. *Inquiry question:* What is the effect of the *amount of sunlight* on *plants' growth*?
   e. *An example of experiment design*:
      - Select the plant with purple flowers.
      - Seed 4 plants in each row with a different amount of sunlight.
      - Click play button.
      - Observe and record the plants' height.

Use slide 9 for this part.

5. **Analyzing data** - To draw conclusions from the simulation, the students will follow two steps: (a) collecting data in a results table; and (b) plotting data in a graph and drawing conclusions.
    a. ***Recording data in a results table*** - Discuss with the students the use of a *results table* as a means to record their results. Then, have the students complete the following table while running their simulation. **Use slide 10 for this part.**

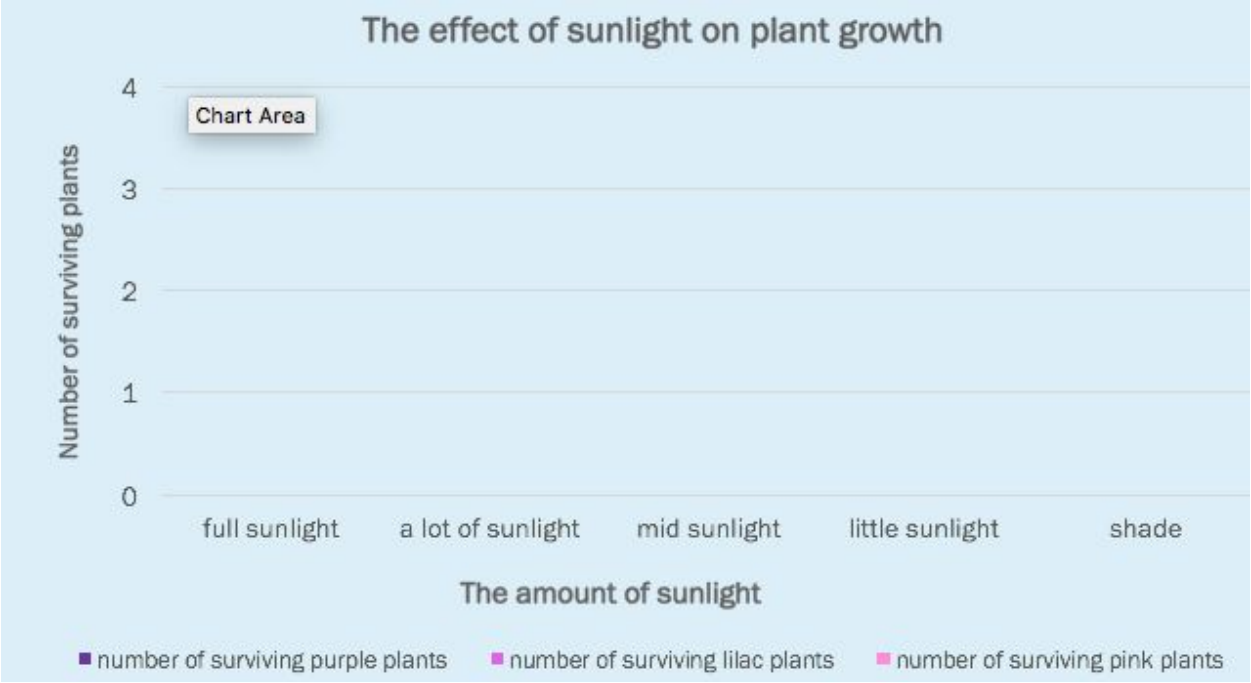
Type of plants	Amount of sunlight					Number of surviving plants
	Full sun	a lot of sun	mid sun	little sun	shade	

    b. ***Plotting data in a graph and drawing conclusions*** - Have the students plot their data on a graph and draw a conclusion about the relationship between the two variables: *amount of sunlight* and *plants' growth*. **Use slide 11 for this part.**

Plotting graphs
Graphs and charts are ways of visually representing the relation between variables' quantities. They can make difficult data easier or quicker to understand. Different types of charts are used depending on the type of data; for example, if it is recorded in numbers or by word description, or if it exists in categories or is continuous.

Emphasize: X, Y labels…
- The **X-axis** is the horizontal axis. It is labeled with the **independent** variable.
- The **Y-axis** is the vertical axis. It is labeled with the **dependent** variable.

It is very important to label each axis so that whoever is looking at your graph/chart knows what the numbers on each axis represent.



6. **Sharing and discussing** - With the entire class, share and discuss the results and conclusions of the plant simulation by developing **scientific explanations** which include **Claim, Evidence, and Reasoning (CER)**. Use the following prompts to encourage the students to share their results and conclusions and to explain the effect of environmental factors on traits:
    - What pattern can you find from the data?
    - What claim can you make about the effect of environmental factors on plants' growth? What evidence do you have that support your claim?
    - What are the similarities and differences between your claims and those of other teams?

    Use slide 12-14 for this part.

Scaffolding students using *learning strategies*

1. **What are learning strategies** - Explain what learning strategies are, and emphasize the importance of learning strategies for effective learning (see teacher's guide).

2. **Explain what *scientific explanation* is and how it can be used** - Scientists try to explain how and why a natural phenomenon occurs. Scientific explanations consist of a claim, evidence, and reasoning (CER). The claim is a testable statement that expresses the answer or conclusion to a question or problem. Evidence is scientific data that supports the claim. The reasoning describes how or why the evidence can be used to support the claim by using scientific ideas and principles.

3. **Model *CER*** - Guide students to draw a conclusion about the relationship between environment and the growth of plants based on the data that they collected from the simulation.

4. **Instructional tips** - Ask the students to explain 1) what their conclusions are, 2) what their evidence is (from data that they collected from the simulation), and 3) what scientific principle connects the evidence and claim. Then, share explanations with the whole class. Students' explanations can vary based on how they planned and conducted the experiment.

5. **An example** CER
   - An example of claim: The environment affects the growth of a plant.
   - An example of evidence: When the amount of sunlight increased, the height of plants increased.
   - An example of reasoning: Amount of sunlight is one of the environmental factors. Because we used plants with the same genetic make-up, the amount of sunlight was the only factor that changed. Growth of plants can be measured by its height.

Activity 2 - How does where Monique lives and what she does affect her diabetes?

Discussing - Lead a class discussion on the effect of environmental factors on health. Address the following topics:

- The relationship between the ***plants simulation*** and ***human health***. Prompt students' discussion using questions, such as:
  a. How is the plants simulation related to Monique? How is it related to our health?
  b. How do the conclusions from the simulation advance our understanding of diabetes? How do these conclusions advance our understanding of human health?

- The possibility of ***changing the environment and improving health***
    1. What environmental factors impacted Monique's health when she lived at home?
    2. Why do you think Monique's family did not react to the same environment the same way that Monique did?
        a. Use the simulation to show students that changing the type of plant can affect difference in plants' growth. Encourage students to connect what they observed to answer why other family members didn't get diabetes.
    3. Why did Monique need to change her environment?
    4. How did changing the environment affect Monique?
    5. How can where we live and what we do impact or health? What is your evidence?

	It is important to emphasize that while we can't control everything, some of our ***health is in our hands***, and we can control some of the environmental factors that affect our health. This issue will be further reinforced by the community action projects in lessons 6 and 7.

- Emphasize that the ***determinants of health*** include:
    1. The social and economic environment
    2. The physical environment
    3. The person's individual characteristics (remind students of the previous
    4. lesson) and behaviors.

Wrapping-up the activities - revisiting the Driving Question Board

With the class, revisit the ***Driving Question Board (DQB)***. Prompt the students to reflect upon their learning using the following prompts:

1. Which questions on the DQB have we answered, and which remain open?
    - Students should attach their answers/artifacts of investigation onto the DQB next to the questions they relate to.

2. After completing the activities in the lesson, do you have any additional questions?
    - Any new questions should be added to the board near the SDQ they relate to.

Activity 3 - Modeling: Why does Monique have diabetes?

In this activity, the students revisit their models and revise them according to what they have learned. The modeling activity in this lesson has two goals:

1. Support the students' understanding of models and modeling.
2. Continue developing a model of Monique's diabetes.

NOTE: Students **revise the models they generated in the previous lesson, by adding more components and changing them.**

Developing models of Monique's diabetes

1. **Developing a model Monique's diabetes - *guided modeling*** – Start with a class discussion about Monique's diabetes. **For this part, use the presentation for lesson 4.** Make sure to:
    - Break the task into the smaller steps and engage in "peer-review" processes often
    - Let the students work individually or in pairs on their devices to develop their models of Monique's diabetes. Circle among them, and discuss their models with them as they work using the prompts.Emphasize the various phases of the modeling cycle and use the scaffolding prompts.
    - Have the students fill out the online-worksheet as they develop their models, and the online reflection at the end of the process. Review students' reflections in a class discussion.

While the students experience using the *SageModeler*, circle in the class, support the students, and encourage them to share their thinking and consult with their peers about their models. Students' models can vary. However, since the models need to explain the relationships among the components, make sure the models include:

Components

- Environmental factors
- Exercise
- Healthy food
- Eating habits
- Healthy lifestyle

Relationships and labels

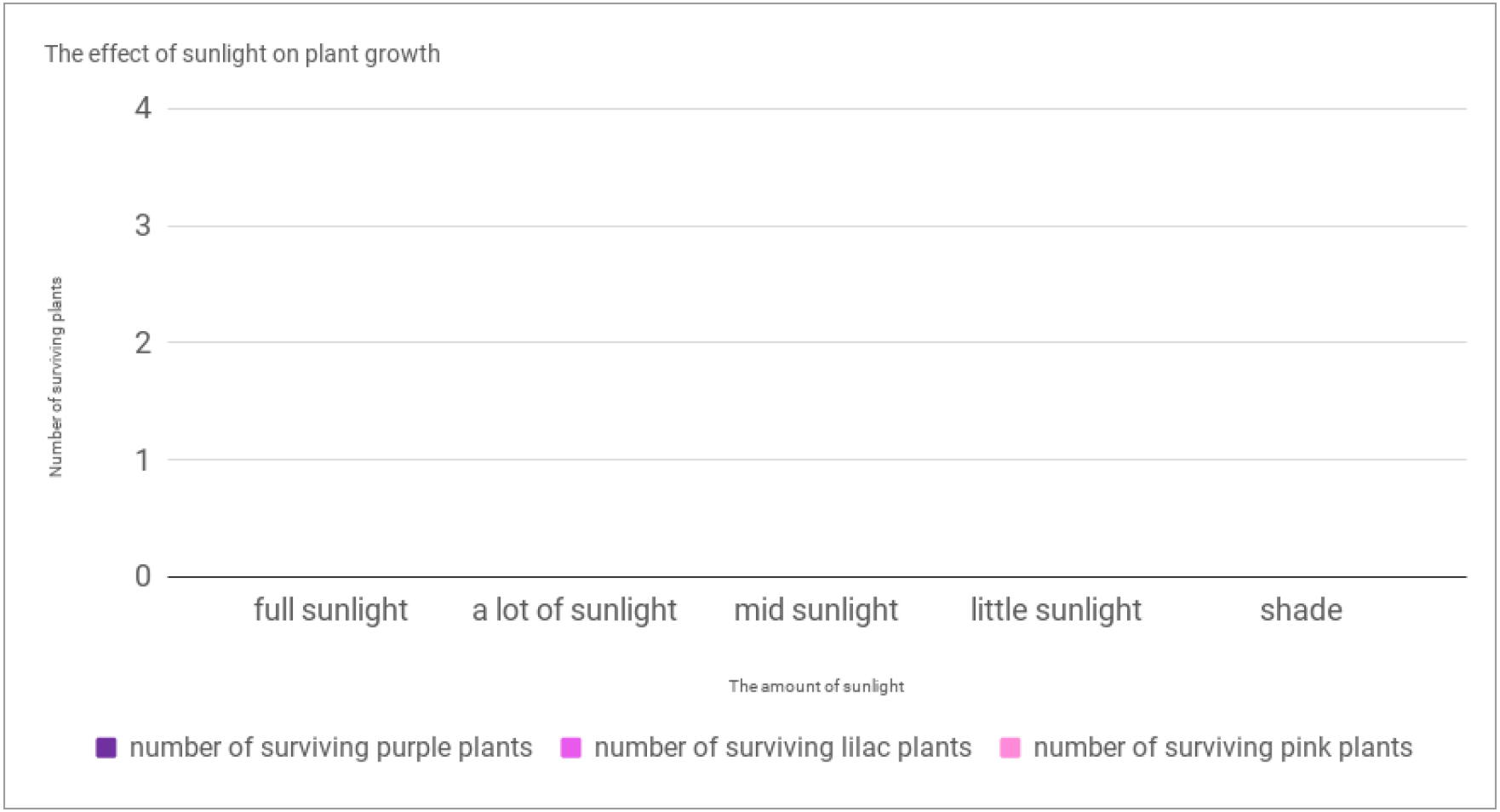
- The relationships among the components
- The relationship between the components and Monique's diabetes

Discuss with the students:

- The similarities and differences between the models
- The models' strengths and weaknesses
- Ways to improve the various models

	A discussion which shares insights from the various models and compares among them is extremely important, as it will scaffold the students' revision of their models in the following step. Use questions to prompt the students to critically examine their peers' models. ***Components:*** • *Components' identity* - What components are included in each model? Are key components included? • *Number of components* - How many components are indicated in the model? Are MORE components necessarily better? • *Grouping of components* - How can we group the various components? Why should we group components—does it improve our models? Is the grouping meaningful? ***Relationships among components:*** • *Explicit relationships among the components* - Are the relationships among the components indicated? Do these relationships make sense? Are the indicated relationships important? ***General features:*** • *Complexity of the model* - How complex is the model? • *Organization* - How well is the model organized? Is the organization meaningful?

type of plants	full sunlight	a lot of sunlight	mid sunlight	little sunlight	shade
number of surviving purple plants	0	0	0	0	0
number of surviving lilac plants	0	0	0	0	0
number of surviving pink plants	0	0	0	0	0



Scaffolding the student's modeling

Modeling can be difficult to teach and learn, especially for teachers and students who are new to modeling as a scientific practice. Students' modeling can be improved if their thinking is scaffolded (supported) by a series of prompts at each step of the modeling cycle. For "What Controls My Health, challenges to students' thinking were identified and specific prompts designed to help support students throughout the process. There are quite a few prompts to use to scaffold modeling in the instructional sequence of every lesson, so in this section, we provide a background and rationale for their use.

Below is a table that shows the cognitive and metacognitive challenges that were identified and the prompts that were designed *for teachers to use in discussion* to scaffold students' thinking at each stage of the modeling cycle. Some of the generic challenges are about science content (domain-general challenges) and some are specific to learning about diabetes and gene-environment interaction (domain-specific challenges). Some prompts were designed as generic for domain-general challenges, and some were designed as context-specific for domain-specific challenges. Here are some definitions to clarify terms:

- Cognitive scaffolds – scaffolds aimed at supporting skills necessary to encode, memorize, and recall information
- Metacognitive scaffolds – scaffolds aimed at supporting skills that enable learners to understand and monitor their cognitive processes.
- Generic scaffolds – scaffolds aimed at supporting a general understanding of the framework for modeling regardless of the science content area
- Context-specific scaffolds – scaffolds aimed at supporting an understanding of the context-specific modeling task, and the content knowledge to be used

Students' challenges (*cognitive* or *metacognitive*)	**Generic prompts**	**Context-specific prompts**
Planning		
Identifying what they know about the phenomenon that needs to be integrated into the models (*metacognitive*)		What is the question you are trying to answer about Monique's diabetes? What are the components of your model about Monique's Type II diabetes? Make a list!
Identifying measurable components to be included in the model (*cognitive*)	Why is it necessary to have quantitative components? How can you find out if the components are quantitative?	Are the components quantitative? Can they answer the question HOW MUCH of this component affects Monique's diabetes?

Categorizing the components that needed to be included in the model (*cognitive*)	Why is it important to categorize the components? How can you categorize them?	Do the components have something in common? Can they be organized into categories, such as genetic or environmental factors?
Building		
Organize the components and the relationships between them on their actual models (*cognitive*)		How are the components related? How do they affect Monique's diabetes? Describe the relationships between the components.
Identifying the direction of cause and effect relationships between the components (cognitive)	How are cause and effect relationships between components represented in models? What does the direction of the arrow represent?	What are the cause and effect relationships between the components in your model? Do the arrows in your model represent correctly the causes and effects of Monique's diabetes?
Testing		
Identifying errors in their models (*metacognitive & cognitive*)		Does your model make sense? Does your model explain the causes and effects of Monique's diabetes? Are there any components missing? Are the relationships correct?
Revising		
Identifying their new knowledge and how it relates to the phenomenon (*metacognitive*)		Think about what you just learned about type II diabetes: What new components should be added to your model? How do they relate to the other components?
Identifying the components and relationships to be added to the models (*cognitive*)		
Using the feedback (provided by teacher or peers) to revise their models to better capture the mechanism underlying the process of diabetes (*metacognitive*)		What feedback did you receive about your model? How can you use the feedback to improve your model to better explain Monique's diabetes? What needs to be changed?

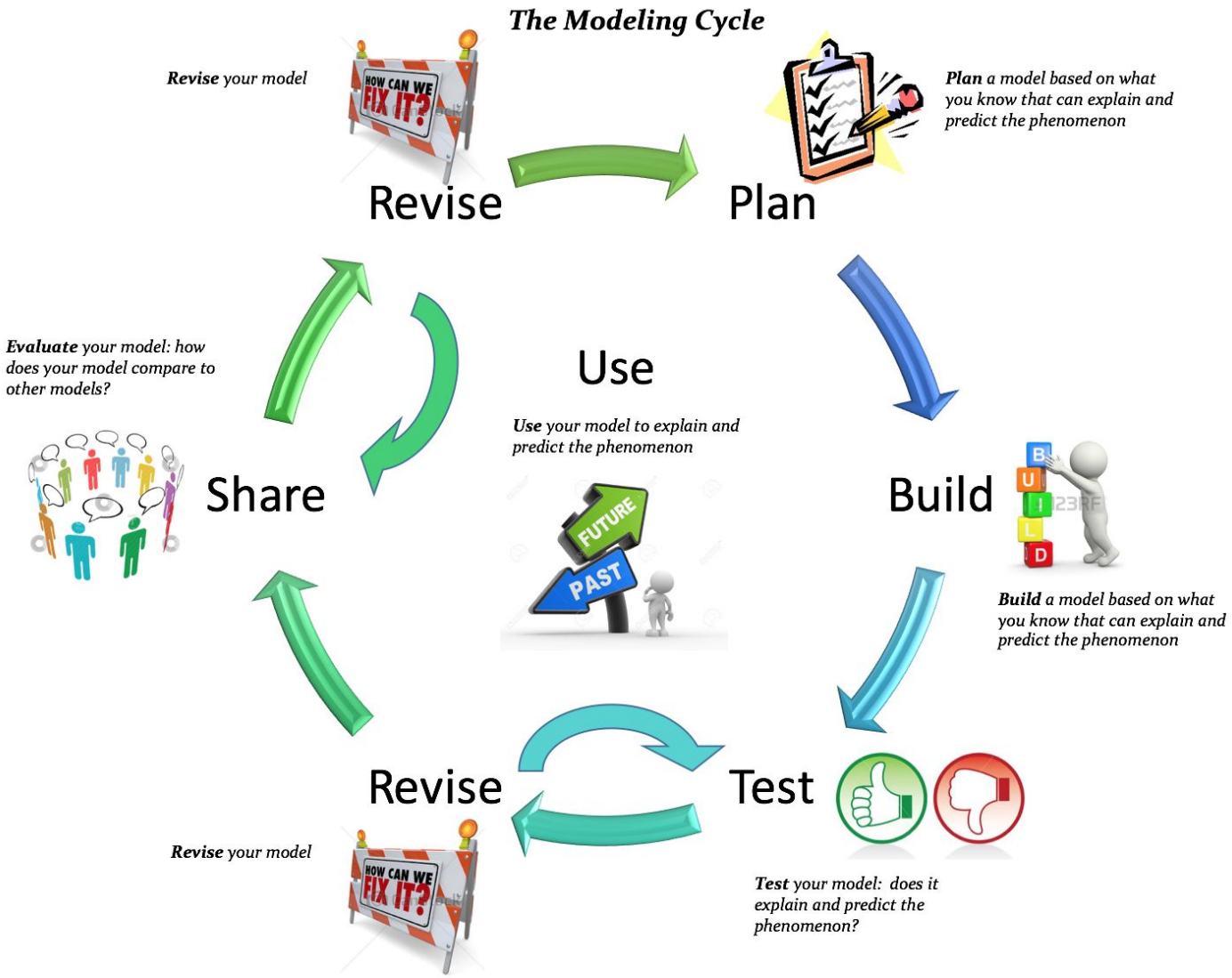
Using insights from other students' models to revise and improve their own (*metacognitive*)		Look at other models of Monique's diabetes: How are they similar or different than yours? Are the ways they explain Monique's diabetes better? How can you use them to improve your own model?
Sharing		
Communicating their models not only by describing the components and the relationships between them, but also by providing an overview of the gene-environment interactions that lead to diabetes (*cognitive*)		What question about Monique's diabetes is your model trying to answer? Why does Monique have diabetes according to your model?
Providing feedback to their peers on the core aspects of modeling to help them improve their models (*cognitive*)	What are the core ideas of models?	Does the model explain and predict Monique's diabetes?

Developing your model

Definitions:

- A **phenomenon** is a fact or situation that we can observe, explain and predict.
- A **model** is a visual representation of a phenomenon. A model explains and predicts a phenomenon.

The modeling cycle:



CREATE for STEM Institute

HealthInOurHands

Why does Monique have diabetes?

Step 1: Planning

1. What is the question you are trying to answer about your ***Monique's diabetes***? What **new information** did we learn about diabetes?

_____

_____

2. What are the **new** components of your model that will explain Monique's diabetes? Make a list!

_____

_____

_____

3. Be sure to use components that can answer the question HOW MUCH - do they increase or decrease Monique's diabetes?.
4. Can the components be organized into categories? Categorize them!

Categories:					
Components:	_____	_____	_____	_____	_____

Step 2: Building

Open SageModeler and start developing your model
https://concord.org/projects/building-models

1. Use components from your list - you can add/omit components
2. Choose pictures to express each component
3. How are the components related? Use the arrows to describe the relationships (cause to effect).

Step 3 & 4: Testing and Revising

Make sure that:

- ❑ Does your model make sense? Does your model explain why Monique has diabetes? Does your model explain the causes and effects of Type 2 diabetes?
- ❑ Are any components missing? Are the relationships correct?

Revise your model if necessary!

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Step 5: Sharing

1. Explain your model - what question about diabetes is your model trying to answer?

_____

2. Why does Monique have diabetes according to your model?

_____

_____

_____

Step 6: Revising

1. What feedback did you receive about your model? How can you improve your model to better explain diabetes? What needs to be changed?

_____

_____

_____

2. Look at other models of Monique's diabetes: How are they similar or different than yours? Are the ways they explain Monique's diabetes better? How can you use them to improve your own model?

_____

_____

_____

Thinking About My Model

1. Score your model - How well does your model explain why Monique has Type 2 diabetes?

Circle score (1=not well, 6=very well)
1 2 3 4 5 6

Explain your score: _____
_____
_____

2. Was it easy to think of the **new components** and the **relationships** that you should add to your model to explain and predict Monique's diabetes?

Circle score (1=not at all, 6=very much)
1 2 3 4 5 6

How did you think of them? _____
_____
_____

3. Did the class discussion about the models help you improve your own model about Monique's diabetes?

Circle score (1=not at all, 6=very much)
1 2 3 4 5 6

Why? What changes did you make to your model following the class discussion?_____
_____
_____

4. When you are asked to model a phenomenon, what should you do? (*hint - look at the modeling cycle*)
_____
_____
_____
_____
_____
_____
_____

Health in Our Hands

What controls my health?

Lesson 5:

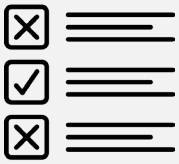
How do Monique's characteristics and environment affect her diabetes?

Scientists use computer simulations to do science experiments. Using a computer simulation, the sixth graders will design experiments on sand rats to see if changing the rats' diet affects whether or not they get diabetes. Students will ask questions, plan an experiment, collect data, and search the data for patterns to learn something new about diabetes. They will discover that in sand rats, just like in humans, a sugar-heavy diet can increase the risk for diabetes. But genes can also increase risk of for disease even with a healthy diet. People with a family history of diabetes need to be even more careful with their diet. We can change our habits, but we cannot change our genes.

For discussion at home:
How is the sand rats simulation related to Monique's diabetes?

Key Point #1

To answer a research question, you can design and carry out an experiment, collect data, analyze the results, and use your new information to make conclusions and revise your ideas.



Key Point #2

Both genetic factors in the body and environmental factors in the world affect the growth and health of a living thing.

Key Point #3

Eating too much sugar can cause weight gain, and weight gain is one risk for developing diabetes.

Explore More: Asking Scientific Questions

Ask a research question about something in your house, and try an experiment to answer it.

Example 1: What will and won't stick to a magnet?
Example 2: What happens if I soak a penny in different liquids like soda, water, vinegar, or soap?

Goal: Learning to ask questions about things in your environment is a great way to learn something new!

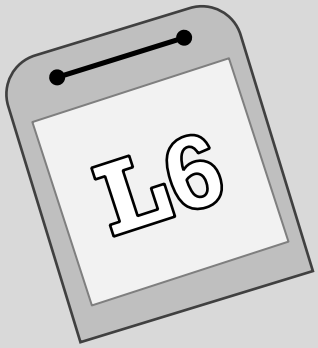
How can I control my health?

Eat right
Cut down on drinks with sugar like soda and juice. Also chocolate milk. For every drink you have that is not water, drink a glass of water as well.

Get fit
You can experiment with your health as well. Try exercising right after you wake up for a few days and in the evening for a few days. Which works better for you?

Be mindful
Next time you eat, use all your senses. How does it smell, feel, taste, sound, and look? Can you describe the food using words from each of your senses?

What's coming next?



Lesson #6: What can I do to make my environment healthier?

Next lesson, students will learn how to figure out how much sugar is in food and whether it is a healthy amount. They will plan a healthy snack for Monique and also consider personal actions they can be taken to improve their health. Students will address the following questions:

1. How can we tell how much sugar is in our food?
2. How do our food choices affect our health?
3. Are there ways we control our health?

Get involved...

1. Help you child look for hidden sugars! Your student will be a detective to find hidden sugars from food in your house. You may be surprised to see the different kinds of sugars and where you find them.
2. Talk about making one choice as a family that can affect everyone's health. How can family members work together to reduce the amount of sugar they are eating?

About us

We are CREATE for STEM Institute at MSU. Funded by Science Education Partnership Award (SEPA) granted by the National Institutes of Health (NIH), the project is developing a new generation of learning materials that blends school and community learning experiences to teach genomics (the study of all the genes of an organism and gene-environment relationships) and evolution.

Instagram

Follow HIOH on Instagram at ***health_in_our_hands***

Partners: UMichigan, Flint Public Schools, Concord Consortium, Community-Based Organization Partners, Sloan Museum, Flint Public Library

Lesson 5: How do Monique's characteristics and environment affect her diabetes?

Unit Driving Question:	Materials	Suggested lesson time
What controls my health? **Sub-Driving Question:** How do Monique's characteristics and environment affect her diabetes?	• Computer • Projector	3 days

Framing the Lesson

Purpose
In this lesson, students plan and carry out investigations using simulations of sand rats to explore how the environment and genetic information affect the growth of organisms.

Learning Goals
- The students plan and carry out investigations to identify that both genetic factors and environmental factors affect the growth and health of organisms.
- The students revise their models to include the interaction of both environment and genetic factors on organisms' traits.

Building Coherence
In Lessons 2 and 3, the students learned about the effects of genetic factors on one's traits. They also learned about the effect of environmental factors on one's traits in Lesson 4. This lesson helps students understand how gene-environment interactions affect the growth, development, and health of organisms using sand rats as examples. This will guide students to think about how both their genetic information and environment affect their health in the next lesson.

Overview of the Lesson

Activity 1: How does food affect the health of sand rats?
The students will investigate the effect of both genetic information and environmental factors on the health of sand rats using a simulation. After being introduced to the sand rats, their natural habitat, and nutrition through a short video (23 seconds), the students will plan and carry out an experiment using the simulation to collect and analyze data. They will then share and discuss their results and draw evidence-based conclusions.

Wrapping-up the activities - revisiting the Driving Question Board
The students will revisit the ***Driving Question Board (DQB)*** and reflect upon their learning.

Activity 2: Modeling: Why does Monique have diabetes?
The students will revise their models and add the effect of environmental factors on Monique's diabetes. Then, they will share their models with the whole class, discuss similarities and differences among the components of their models, and evaluate relationships presented.

Connection to NGSS

Target Performance Expectations

MS-LS1-5. Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.
MS-LS3-2. Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation.
MS-LS4-4. Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment.

Disciplinary core idea	Science and engineering practices	Crosscutting concepts
LS1.B: Growth and Development of Organisms • The growth of an animal is controlled by genetic factors, food intake, and interactions with other organisms, and each species has a typical adult size range **Variation of inheritance** • In each kind of organism there is variation in the traits themselves, and different kinds of organisms may have different versions of the trait. The environment also affects the traits that an organism develops — differences in where they grow or in the food they consume may cause organisms that are related to end up looking or behaving differently.	**Planning and carrying out investigations** • Plan an investigation individually and collaboratively, and in the design: identify independent and dependent variables and controls, what tools are needed to do the gathering, how measurements will be recorded, and how much data are needed to support a claim. **Analyzing and interpreting data** • Analyze and interpret data to provide evidence for phenomena **Constructing explanations** • Construct an explanation that includes qualitative or quantitative relationships between variables that predict(s) and/or describe(s) phenomena. **Developing and Using Models** • Develop and use a model to describe phenomena.	**Patterns** • Patterns can be used to identify cause and effect relationships. **Cause and effect** • Cause and effect relationships may be used to predict phenomena in natural systems.

How these elements are integrated and embedded in this lesson

In this lesson, students will use a model (sand rat simulation) to identify how genetic factors and environmental factors can influence the development, growth, and/or health of organisms. Based on the data, the students will explain the influence of gene-environment interaction on organisms.

Connection to Students' Lives

Link to out-of-school activity and everyday life

- Encourage students to relate the effect of gene-environmental interactions on growth, development, and health to their own lives.

Link to career-awareness

- Introduce what scientists do. Scientists ask questions about the world of nature and try to answer them based on the evidence. Let students know that what they do in this lesson is very similar to what scientists do: they plan and carry on investigation, collect and analyze data (sometimes using simulations), and draw evidence-based conclusions.

Instructional Sequence

Introducing the Lesson

1. **Keeping coherence using the DQB -** Remind students of their questions related to Monique and diabetes on the Driving Question Board (DQB). Tell students that in this lesson they will further investigate the case study of Monique to determine "How do Monique's characteristics and environment affect her diabetes?" Tell the students that they should pay particular attention to the questions that they had clustered around that Sub-Driving Question.

Activity 1 - How does food affect the health of sand rats?

In this activity, the students will use a simulation to plan and carry out investigations. The activity is designed as a process in which students progress from *structured* to *guided* to *open* inquiry. However, teachers can decide which type of inquiry to perform in their class according to their class abilities and experience. They will use the simulation to examine the effect of environmental factors on the health of sand rat.

Structured inquiry
In *structured inquiry*, the students investigate a teacher-presented question through a prescribed procedure and receive explicit step-by-step guidelines at each stage, leading to a predetermined outcome. The process is similar to following a recipe.

Guided inquiry
In guided inquiry, students investigate questions and procedures that teachers present to them, but the students themselves, working collaboratively, decide the processes to be followed and the solutions to be targeted. Teachers can use guided inquiry to develop stronger science process skills in their students. The amount of scaffolding needed can decrease over time, and investigations can move from teacher-driven to student-driven.

Open inquiry
In open inquiry, the students investigate questions of their choice by developing a research plan and procedures unique to their question. Open inquiry does not imply minimum guidance, in fact - this type of inquiry requires much scaffolding from the teacher in order to engage students in a productive and effective process.

Use the presentation to support teaching.

1. **Reminder about core terms of experimentation** - Remind and explain to the students the core terms of experimentation: inquiry, inquiry question, observations *vs*. experimentation, dependent variable, independent variable, controlled variables. **Use slides 1-6 for this part.**

	When conducting experiments, the students should be familiar with the following terms: ***Independent variable*** - a variable whose variation does not depend on another variable. In an experiment, it is the variable one chooses to change or manipulate, to determine an effect on other variables. ***Dependent variable*** - a variable whose value depends on another variable. In an experiment, it is the variable that changes in response to other variables being changed. ***Controlled variable*** - In an experiment, this is a variable that is not changed. This enables the experimenter to fairly test the relationship between the independent and dependent variables. ***An inquiry question*** - a specific type of question which supports investigation and requires the gathering and analyzing of data to propose a potential answer.

2. **Introducing the sand rats** - Show the students a video of sand rats in their natural habitat (video of sand rat **Use slide 7 for this part**). Discuss the reasons why scientists use sand rats to investigate diabetes using the Reading: Why do scientists use animals in research? (**Use slide 8 for this part**)

3. **Introducing the sand rats simulation** - Expose the students to the sand rats simulation. First, let the students play with the simulation and find out what variables they can manipulate by themselves. Then, use students' experience to show and explain about the various features of the simulation and the data it can provide (**Use slide 9 for this part**)
    - The type of sand rats
        i. The sand rats' health diabetes (diabetic vs. healthy)
        ii. The sand rats' risk of diabetes (high vs. low)
        iii. The sand rats' gender (male vs. female)
    - The type of food - sugary vs. non-sugary food
    - Measurements
        i. The sand rats' weight (thin, heavy, obese)
        ii. Number of diabetic rats

4. ***Structured inquiry***
   Continue to use the presentation to support teaching. Have the students fill out the worksheet as you plan and carry out the investigation together: *Activity 1: How does food affect the health of sand rats?*

Planning experiments - Discuss with the entire class the experimentation procedure:

a. *Brainstorm* possible independent and dependent variables for the students to test using the simulation.
b. Introduce the *inquiry question* that the students will be investigating using the simulation (as this is a *structured inquiry*, all the student teams will be conducting the same experiment).

Use slide 10 for this part.

Scaffolding students using *learning strategies*

1. **What are learning strategies -** Remind students what learning strategies are, and emphasize the importance of learning strategies for efficient learning (see teacher's guide).

2. **Remind students what *Brainstorming* is and how it can be used** - Brainstorming is a strategy for generating ideas. It includes generating a list of spontaneous ideas which are associated with a specific topic. For effective brainstorming, (a) focus on quantity, (b) withhold criticism, (c) welcome unusual and wild ideas, and (d) combine and improve ideas.

3. **Scaffold *Brainstorming*** - Together with the entire class, use the *brainstorming* strategy to generate as many questions as possible about the effect of environmental factors on sand rats.
   a. **Generating "anchors:"** Tell the students to rely on their knowledge about sand rats for their brainstorming. First, ask them to think of as many possible factors as they can that might affect the sand rats' health; these are the independent variables. Then, ask them to think of as many factors as possible that are associated with sand rats' health; these are the dependent variables.
   b. **Examples*** of *dependent* and *independent* variables:
      - ***Examples of independent variables:*** the sand rats' risk of diabetes, their gender, or types of food they eat
      - ***Examples of dependent variables:*** weight of the sand rats, or the number of diabetic sand rats

* ***This is not an exhaustive list***

Conducting experiments - In pairs or in a class discussion, the students will plan and conduct their own experiments to explore the effect of food on the health of sand-rats. In their teams, the students will detail their:

c. *Independent variable:* type of food
d. *Dependent variable:* number of diabetic sand-rats

e. *Controlled variables:* number of sand rats in the pens, risk for diabetes, gender, etc.
f. *Inquiry question:* What is the effect of *food* on *the health of sand-rats*?
g. *An example of experiment design*:
    - Select sand-rats with the same diabetes risk and the same gender for both pens.
    - Give sugary food to one pen and non-sugary food to the other
    - Click play button.
    - Observe and record the number of diabetic sand-rats.

Use slide 11 for this part.

Analyzing data - To draw conclusions from the simulation, the students will follow two steps: (a) collecting data in a results table; and (b) plotting data in a graph and drawing conclusions.

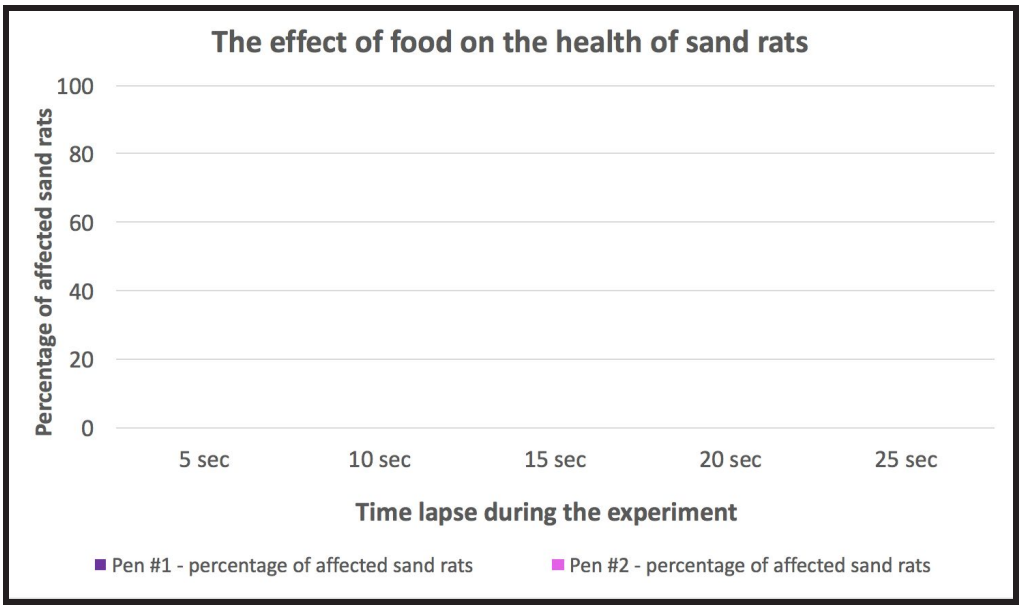
a. ***Recording data in a results table*** - Discuss with the students the use of a *results table* as a means to record their results. Then, have the students complete the following table while running their simulation. **Use slide 12 for this part.**

Time lapse (sec)	Pen 1			Pen 2		
	Total number of sand rats	Number of affected sand rats	Percentage of affected sand-rats	Total number of sand rats	Number of affected sand rats	Percentage of affected sand-rats

b. ***Plotting data in a graph and drawing conclusions*** - Have the students plot their data on a graph and draw a conclusion about the relationship between the two variables: *type of food* and *health of sand rats*. **Use slide 13 for this part.**

Plotting graphs
Graphs and charts are ways of visually representing the relation between variables' quantities. They can make difficult data easier or quicker to understand. Different types of charts are used depending on the type of data; for example, if it is recorded in numbers or by word description, or if it exists in categories or is continuous.
Emphasize: X, Y labels…
- The **X-axis** is the horizontal axis. It is labeled with the **independent** variable.
- The **Y-axis** is the vertical axis. It is labeled with the **dependent** variable.

It is very important to label each axis so that whoever is looking at your graph/chart knows what the numbers on each axis represent.



Sharing and discussing - With the entire class, share and discuss the results and conclusions of the plant simulation by developing **scientific explanations** which include **Claim, Evidence, and Reasoning (CER)**. Use the following prompts to encourage the students to share their results and conclusions and to explain the effect of environmental factors on traits:

- What pattern can you find from the data?
- What **claim** can you make about the effect of types of food on the health of sand-rats? What **evidence** do you have that support your claim? What is your **reasoning**: how does your experiment relate to what have you learned about the effects of the environment and genetics on the health of organisms? Why do some sand rats have the trait for diabetes and others do not?
- What are the similarities and differences between your claims and those of other teams?

Use slide 14 for this part.

Scaffolding students using *learning strategies*

1. **What are learning strategies** - Explain what learning strategies are, and emphasize the importance of learning strategies for effective learning (see teacher's guide).

2. **Explain what *scientific explanation* is and how it can be used** - Scientists try to explain how and why a natural phenomenon occurs. Scientific explanations consist of claims, evidence, and reasoning (CER). The claim is a testable statement that expresses the answer or conclusion to a question or problem. Evidence is scientific data that supports the claim. The reasoning describes how or why the evidence can be used to support the claim using scientific ideas and principles.

3. **Model *CER*** - Guide students to draw a conclusion about the relationship between genetic and environmental factors and the health of sand rats based on the data that they collected from the simulation.

4. **Instructional tips** - Ask the students to explain 1) their conclusions, 2) theirevidence (data that they collected from the simulation), and 3) what scientific principle connects the evidence and claim. Then, share them with whole class. These can vary by student based on how he or she planned and conducted the experiment.

5. **Example *CER***
   - An example of claim: Environment affects the diabetes of sand rats.
   - An example of evidence: When the parents had sugary food, the number of diabetic sand rat offspring increased.
   - An example of reasoning: Eating too much sugar can cause weight gain, and weight gain can increase an organism's risk for developing diabetes.

5. ***Guided inquiry***

   Continue to use the presentation to support teaching. **Use slide 15 for this part.** Discuss the claim on slide 15 with the students. Then, have the students conduct a guided inquiry in order to answer the question. In pairs, the students will plan and conduct their own experiments to answer the question, using *Activity 1: How does food affect the health of sand rats?*

While the students work in pairs, circulate around the class and support the students, encouraging them to share their thinking and consult their peers about their plans for their experiment(especially page 2, # 1-3 in the handouts). This should be a discussion with students sharing their questions and how to test them, rather than a didactic sequential interaction only with the teacher. Encourage students to ask the following questions to other groups:

- How many pens will you need to use for your investigation? Explain the reason for each pen.
- What type of sand rats will you put in each pen? Explain your reasoning.
- How many sand rats will you put in each pen? Explain why.
- What kind of data will you collect from the simulation?
- How does the data you collect help you answer your question?

Sharing and discussing - With the entire class, share and discuss the students' results. Use the following prompts:

- About the experiment:
  - What was the design of your experiment?
  - How many times did you repeat the simulation and why?
  - Did your experiment help you answer your question?
- Results and conclusions:
  - What pattern can you find from the data?
  - What **claim** can you make about the effect of types of food on the health of sand-rats? What **evidence** do you have that support your claim? What is your **reasoning**: how does your experiment relate to what have you learned about the effects of the environment and genetics on the health of organisms? Why do some sand rats have the trait for diabetes and others do not?
  - What are the similarities and differences between your claims and those of other teams?

Use slide 16 for this part.

Scaffolding students using *learning strategies*

2. **What are learning strategies** - Explain what learning strategies are, and emphasize the importance of learning strategies for effective learning (see teacher's guide).

5. **Explain what *scientific explanation* is and how it can be used** - Scientists try to explain how and why a natural phenomenon occurs. Scientific explanations consist of claims, evidence, and reasoning (CER). The claim is a testable statement that expresses the answer or conclusion to a question or problem. Evidence is scientific data that supports the claim. The reasoning describes how or why the evidence can be used to support the claim using scientific ideas and principles.

6. **Model *CER*** - Guide students to draw a conclusion about the relationship between genetic and environmental factors and the health of sand rats based on the data that they collected from the simulation.

7. **Instructional tips** - Ask the students to explain 1) their conclusions, 2) theirevidence (data that they collected from the simulation), and 3) what scientific principle connects the evidence and claim. Then, share them with whole class. These can vary by student based on how he or she planned and conducted the experiment.

5. **Example *CER***
   - An example of claim: Environment affects the diabetes of sand rats.
   - An example of evidence: When the parents had sugary food, the number of diabetic sand rat offspring increased.
   - An example of reasoning: Eating too much sugar can cause weight gain, and weight gain can increase an organism's risk for developing diabetes.

6. ***Open inquiry***
   Continue to use the presentation to support teaching. **Use slide 17 for this part.** In pairs, the students will plan and conduct their own experiments to answer their own generated question, using *Activity 1: How does food affect the health of sand rats?*

	While the students work in pairs, circulate around the class and support the students, encouraging them to share their thinking and consult their peers about their plans for their experiment (especially page 2, # 1-3 in the handouts). This should be a discussion, with students sharing their questions and how to test them, rather than a didactic sequential interaction only with the teacher. Encourage students to ask the following questions to other groups: • How many pens will you need to use for your investigation? Explain the reason for each pen. • What type of sand rats will you put in each pen? Explain your reasoning. • How many sand rats will you put in each pen? Explain why. • What kind of data will you collect from the simulation? • How does the data you collect help you answer your question?

Sharing and discussing - With the entire class, share and discuss the students' results by developing **scientific explanations** which include **Claim, Evidence and Reasoning (CER)**. Use the following prompts:

- About the experiment:
  - What was your inquiry question?
  - What was the design of your experiment?
  - How many times did you repeat the simulation and why?
  - Did your experiment help you answer your question?
- Results and conclusions:
  - What pattern can you find from the data?
  - What claim can you make about the effect of environmental factors on sand rats' health? What evidence do you have that supports your claim? What is your reasoning?
  - What are the similarities and differences between your claims and those of other teams?

Use slide 18 for this part.

	Scaffolding students using *learning strategies* 1. **What are learning strategies** - Explain what learning strategies are, and emphasize the importance of learning strategies for effective learning (see teacher's guide). 2. **Explain what *scientific explanation* is and how it can be used** - Scientists try to explain how and why a natural phenomenon occurs. Scientific explanations consist of claims, evidence, and reasoning (CER). The claim is a testable statement that expresses the answer or conclusion to a question or problem. Evidence is scientific data that supports the claim. The reasoning describes how or why the evidence can be

	used to support the claim using scientific ideas and principles. 3. **Model *CER*** - Guide students to draw a conclusion about the relationship between genetic and environmental factors and the health of sand rats based on the data that they collected from the simulation. 4. **Instructional tips** - Ask the students to explain 1) their conclusions, 2) their evidence (data that they collected from the simulation), and 3) what scientific principle connects the evidence and claim. Then, share them with the whole class. These can vary by student based on how he or she planned and conducted the experiment. 5. **Example *CER*** ● An example of claim: The environment affects the diabetes of sand rats. ● An example of evidence: Simulation shows that when sand rats have more sugary food, the number of sand rats with diabetes increase. ● An example of reasoning: Eating too much sugar can cause weight gain, and weight gain can increase an organism's risk for developing diabetes.

7. **Summary discussion** - Have a class discussion about the interactions of gene and environment (**Use slide 19-20 for this part**), e.g.:

    - If two people eat different foods, will the impact on their bodies be different?
    - If the same person eats different foods, will those foods have a different impact on his or her body?
    - What would happen if two different people eat the same food? Will the foods impact their bodies the same or differently?

Wrapping-up the activities - revisiting the Driving Question Board

With the class, revisit the ***Driving Question Board (DQB)***. Prompt the students to reflect upon their learning using the following prompts, and adjust the DQB as appropriate:

1. Which questions on the DQB have we answered, and which remain open?
    - Students should attach their answers/artifacts of investigation onto the DQB next to the questions they relate to.

2. After completing the activities in the lesson, do you have any additional questions?
    - Any new questions should be added to the board near the SDQ they relate to.

Activity 2 - Modeling: Why does Monique have diabetes?

In this activity, the students revisit their models and revise them according to what they have learned. The modeling activity in this lesson has two goals:

1. Support the students' understanding of models and modeling.
2. Continue developing a model of Monique's diabetes.

NOTE: Students **revise the models they generated in the previous lesson, by adding more components and changing them.**

Developing models of Monique's diabetes

1. **Developing a model Monique's diabetes - *guided modeling*** – Start with a class discussion about Monique's diabetes. **For this part, use the presentation for lesson 5.** Make sure to:
    - Break the task into the smaller steps and engage in "peer-review" processes often
    - Let the students work individually or in pairs on their devices to develop their models of Monique's diabetes. Circle among them, and discuss their models with them as they work using the prompts. Emphasize the various phases of the modeling cycle and use the scaffolding prompts.
    - Have the students fill out the online-worksheet as they develop their models, and the online reflection at the end of the process. Review students' reflections in a class discussion.

While the students experience using the *SageModeler*, circle in the class, support the students, and encourage them to share their thinking and consult with their peers about their models. Students' models can vary. However, since the models need to explain the relationships among the components, make sure the models include:

Components

- Genetic factors
- Environmental factors

Relationships and labels

- The relationships among the components
- The relationship between the components and Monique's diabetes

Discuss with the students:

- The similarities and differences between the models
- The models' strengths and weaknesses

- Ways to improve the various models

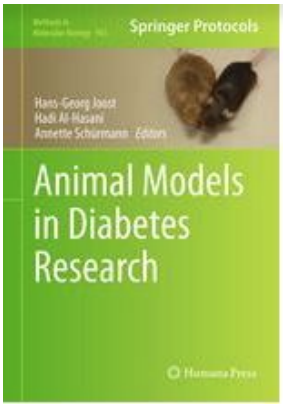
	A discussion which shares insights from the various models and compares among them is extremely important, as it will scaffold the students' revision of their models in the following step. Use questions to prompt the students to critically examine their peers' models. ***Components:*** ● *Components identity* - What components are included in each model? Are key components included? ● *Number of components* - How many components are indicated in the model? Are MORE components necessarily better? ● *Grouping of components* - How can we group the various components? Why should we group components—does it improve our models? Is the grouping meaningful? ***Relationships among components:*** ● *Explicit relationships among the components* - Are the relationships among the components indicated? Do these relationships make sense? Are the indicated relationships important? ***General features:*** ● *Complexity of the model* - How complex is the model? ● *Organization* - How well is the model organized? Is the organization meaningful?

Activity 1: How does food affect the health of sand rats?
Reading: Why Do Scientists Use Animals in Research?

New and better ways for treating diseases are found by using animals in scientific research. Scientists can learn more about health problems and make sure new medical treatments work safely. Many different types of animals can be used as models for studying diseases in humans. Rats, mice, rabbits, dogs, cats, frogs, and fish are some of the animals that are used.

Why animals?

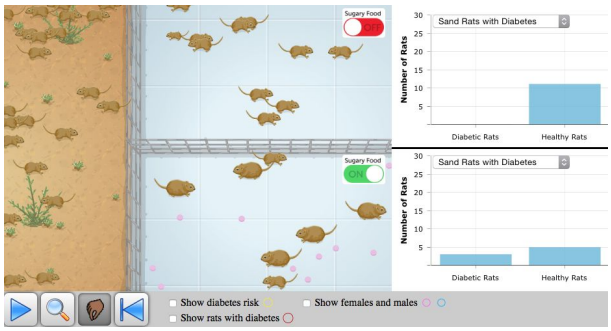
Scientists can only study certain health problems in living organisms. Some animals are very similar to humans. They can share many of the same health problems. Many animals have a much shorter life than humans. Sand rats live about 1–1.5 years and they can reproduce at the age of 3–7 months. They are easy to study because they can be observed throughout their lifespan or for many generations.



Scientists can also control the diet, temperature, or lighting in the environment where the animal lives. This would be hard to do with humans. Sand rats live in desert areas, and their main natural food is a plant called the saltbush. This plant gives them food that is low in calories. When they eat regular laboratory food with higher calories, they gain too much weight. They also develop Type 2 diabetes very quickly. Scientists who want to learn about the relationships between food, weight gain, and Type 2 diabetes investigate with sand rats.

Is there any other way?

Scientists try not to use animals for their research. Sometimes computer models can be used to develop and test new medicines. Scientists look for ways to reduce the number of animals used for research. They also try to replace animals with other research methods whenever possible.



Names of students in this group:

_____

Activity 1: How does food affect the health of sand rats?

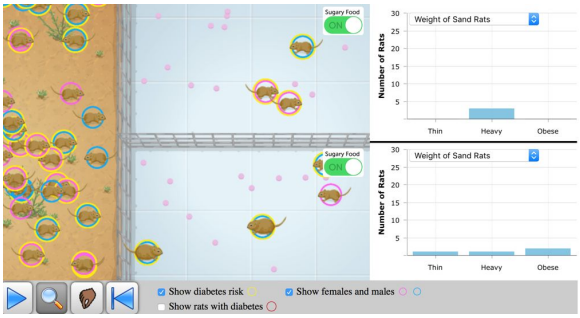
Animal research is used to study diabetes using sand rats. Even though we can't conduct research on real sand rats, we can use a software program to simulate this research. You will use this simulation to investigate the relationship between inheritance, environmental factors and diabetes.

What can we manipulate in the simulation?

- **Type of sand rats:**
  - The sand rats' health (diabetic vs. healthy)
  - The sand rats' risk for diabetes (high vs. low)
  - The sand rats' gender (male vs. female)

- **Type of food:**
  - Sugary vs. non-sugary food

- **Measurements:**
  - The sand rats' weight (normal, heavy, obese)
  - Number of diabetic sand rats



Let's Investigate!

Step 1 - Planning the inquiry question

Discuss with your partner what question you would like to investigate. This question may change as you begin to plan your investigation. Make sure to keep track of any changes.

Question: _____

_____

_____

Dependent variable: _____

Independent variable: _____

Step 2 - Planning and carrying out the experiment

1. Which sand rats will you choose for Pen #1 and Pen #2? What are your criteria for choosing the sand rats?

   _____

   _____

   What characteristics do the sand rats have in each pen? Fill in the chart below.

Type of sand rats:	**Pen 1** **# of sand rats**	**Pen 2** **# of sand rats**
Male /without diabetes risk		
Female /without diabetes risk		
Male /with diabetes risk		
Female / with diabetes risk		
Total # of sand rats placed in the pen		

2. What data will you collect? _____

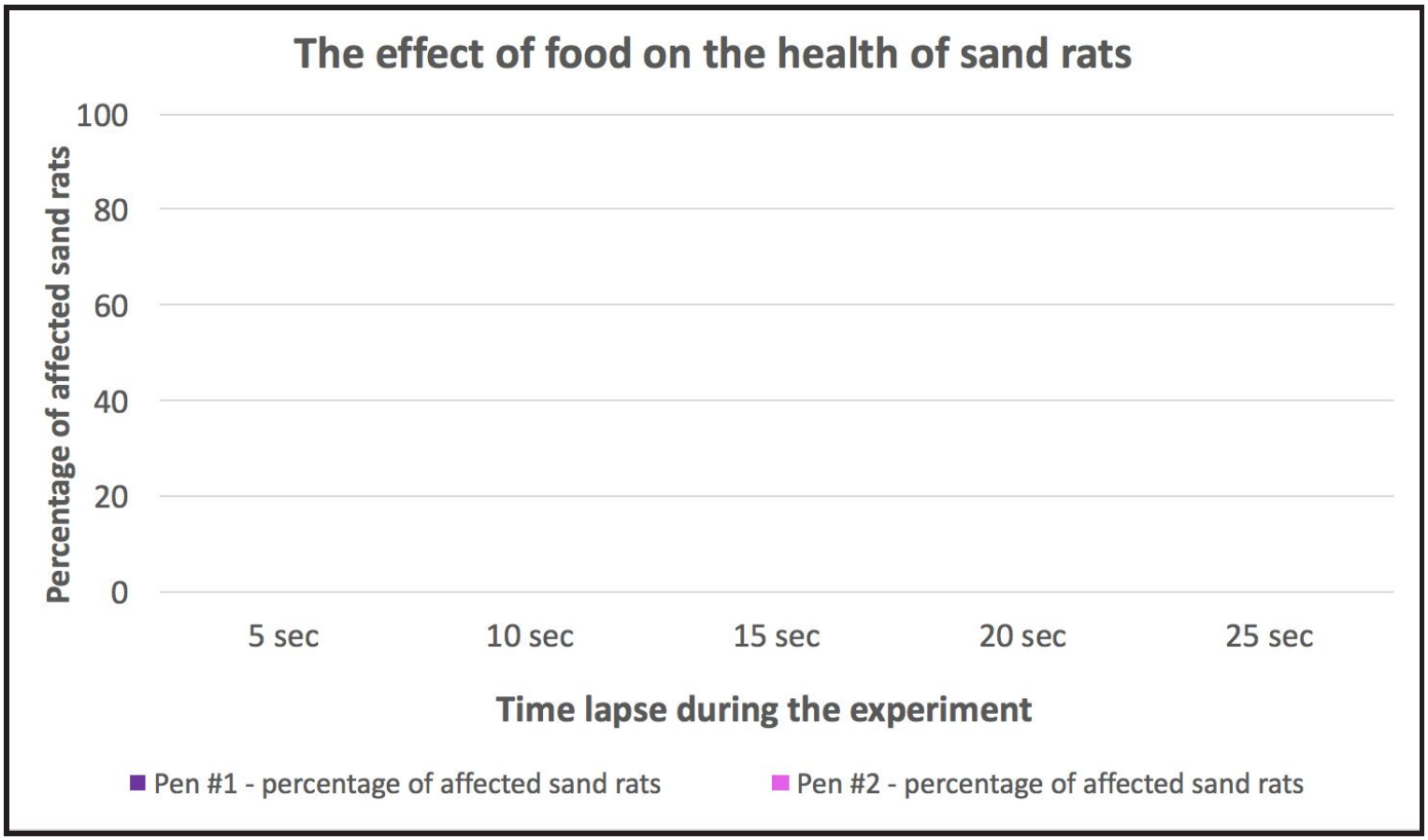
   _____

Step 3 – Analyzing data

Run your experiment. Stop the simulation every 5 sec. At the end of each run, record the results in the *Result Table*. Run your investigation several times, until you think you have collected enough data.

Time lapse (sec)	Pen #1			Pen #2		
	Total number of sand rats	Number of affected sand rats	Percentage of affected sand rats	Total number of sand rats	Number of affected sand rats	Percentage of affected sand rats
5						
10						
15						
20						
25						

Plot the graph here:



Step 4 – Interpreting data and communicating information

1. What **pattern** can you find in the data? Discuss with your partner the trends and record them here.

_____

_____

_____

2. What **claim** can you make about the effect of environmental factors on sand rats' health? What evidence do you have that support your claim? What is your reasoning?

_____

_____

_____

3. How does your investigation help explain **Monique's diabetes**?

_____

_____

_____

4. How can your investigation help answer the driving question: **What controls my health**?

_____

_____

_____

Scaffolding the student's modeling

Modeling can be difficult to teach and learn, especially for teachers and students who are new to modeling as a scientific practice. Students' modeling can be improved if their thinking is scaffolded (supported) by a series of prompts at each step of the modeling cycle. For "What Controls My Health, challenges to students' thinking were identified and specific prompts designed to help support students throughout the process. There are quite a few prompts to use to scaffold modeling in the instructional sequence of every lesson, so in this section, we provide a background and rationale for their use.

Below is a table that shows the cognitive and metacognitive challenges that were identified and the prompts that were designed *for teachers to use in discussion* to scaffold students' thinking at each stage of the modeling cycle. Some of the generic challenges are about science content (domain-general challenges) and some are specific to learning about diabetes and gene-environment interaction (domain-specific challenges). Some prompts were designed as generic for domain-general challenges, and some were designed as context-specific for domain-specific challenges. Here are some definitions to clarify terms:

- Cognitive scaffolds – scaffolds aimed at supporting skills necessary to encode, memorize, and recall information
- Metacognitive scaffolds – scaffolds aimed at supporting skills that enable learners to understand and monitor their cognitive processes.
- Generic scaffolds – scaffolds aimed at supporting a general understanding of the framework for modeling regardless of the science content area
- Context-specific scaffolds – scaffolds aimed at supporting an understanding of the context-specific modeling task, and the content knowledge to be used

Students' challenges (*cognitive* or *metacognitive*)	**Generic prompts**	**Context-specific prompts**
Planning		
Identifying what they know about the phenomenon that needs to be integrated into the models (*metacognitive*)		What is the question you are trying to answer about Monique's diabetes? What are the components of your model about Monique's Type II diabetes? Make a list!
Identifying measurable components to be included in the model (*cognitive*)	Why is it necessary to have quantitative components? How can you find out if the components are quantitative?	Are the components quantitative? Can they answer the question HOW MUCH of this component affects Monique's diabetes?

Categorizing the components that needed to be included in the model (*cognitive*)	Why is it important to categorize the components? How can you categorize them?	Do the components have something in common? Can they be organized into categories, such as genetic or environmental factors?
Building		
Organize the components and the relationships between them on their actual models (*cognitive*)		How are the components related? How do they affect Monique's diabetes? Describe the relationships between the components.
Identifying the direction of cause and effect relationships between the components (cognitive)	How are cause and effect relationships between components represented in models? What does the direction of the arrow represent?	What are the cause and effect relationships between the components in your model? Do the arrows in your model represent correctly the causes and effects of Monique's diabetes?
Testing		
Identifying errors in their models (*metacognitive & cognitive*)		Does your model make sense? Does your model explain the causes and effects of Monique's diabetes? Are there any components missing? Are the relationships correct?
Revising		
Identifying their new knowledge and how it relates to the phenomenon (*metacognitive*)		Think about what you just learned about type II diabetes: What new components should be added to your model? How do they relate to the other components?
Identifying the components and relationships to be added to the models (*cognitive*)		
Using the feedback (provided by teacher or peers) to revise their models to better capture the mechanism underlying the process of diabetes (*metacognitive*)		What feedback did you receive about your model? How can you use the feedback to improve your model to better explain Monique's diabetes? What needs to be changed?

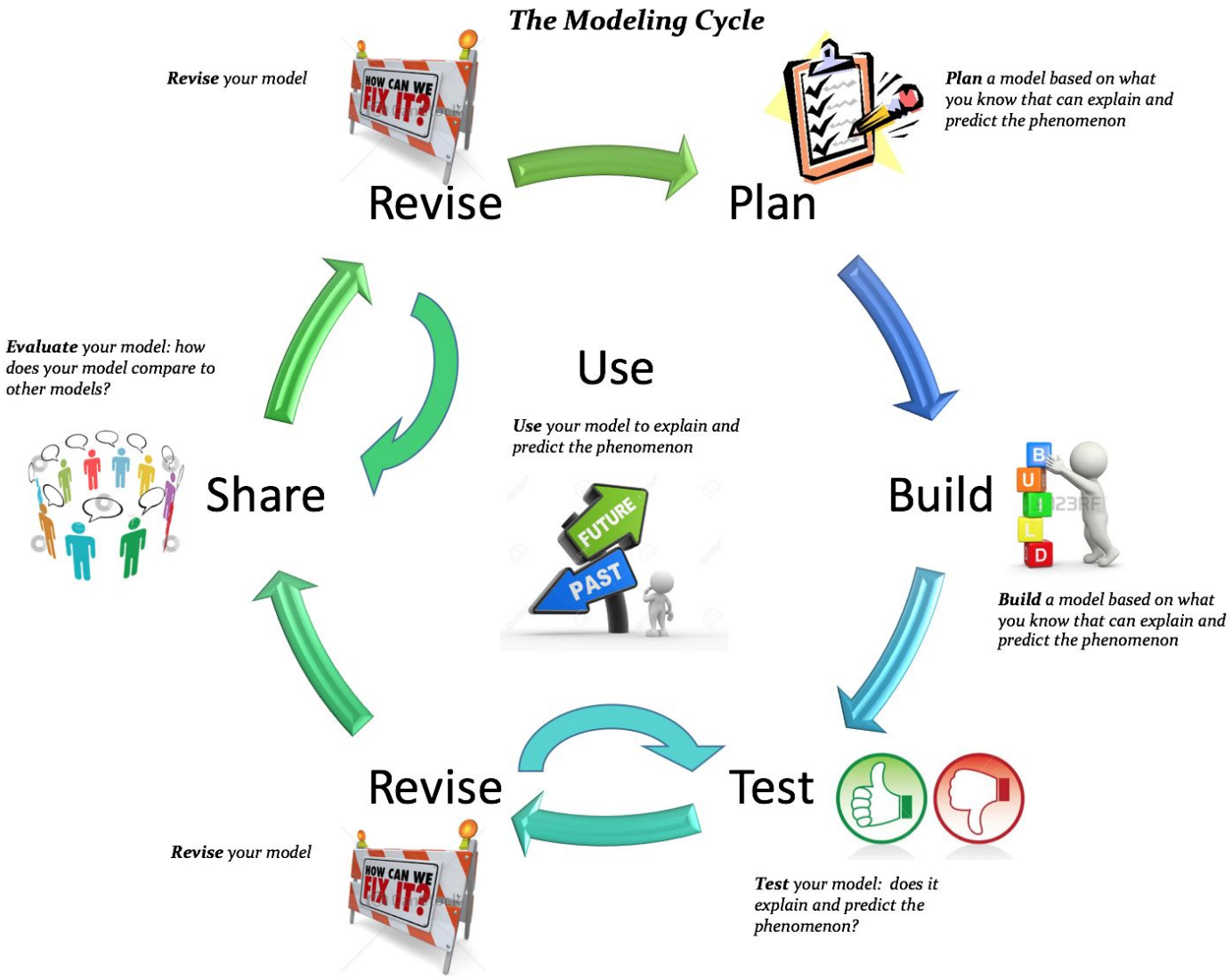
Using insights from other students' models to revise and improve their own (*metacognitive*)		Look at other models of Monique's diabetes: How are they similar or different than yours? Are the ways they explain Monique's diabetes better? How can you use them to improve your own model?
Sharing		
Communicating their models not only by describing the components and the relationships between them, but also by providing an overview of the gene-environment interactions that lead to diabetes (*cognitive*)		What question about Monique's diabetes is your model trying to answer? Why does Monique have diabetes according to your model?
Providing feedback to their peers on the core aspects of modeling to help them improve their models (*cognitive*)	What are the core ideas of models?	Does the model explain and predict Monique's diabetes?

Developing your model

Definitions:

- A **phenomenon** is a fact or situation that we can observe, explain and predict.
- A **model** is a visual representation of a phenomenon. A model explains and predicts a phenomenon.

The modeling cycle:



CREATE for STEM Institute

HealthInOurHands

Why does Monique have diabetes?

Step 1: Planning

1. What is the question you are trying to answer about your ***Monique's diabetes***? What **new information** did we learn about diabetes?

_____

_____

2. What are the **new** components of your model that will explain Monique's diabetes? Make a list!

_____

_____

_____

3. Be sure to use components that can answer the question HOW MUCH - do they increase or decrease Monique's diabetes?.
4. Can the components be organized into categories? Categorize them!

Categories:					
Components:	_____	_____	_____	_____	_____

Step 2: Building

Open SageModeler and start developing your model
https://concord.org/projects/building-models

1. Use components from your list - you can add/omit components
2. Choose pictures to express each component
3. How are the components related? Use the arrows to describe the relationships (cause to effect).

Step 3 & 4: Testing and Revising

Make sure that:

- ❑ Does your model make sense? Does your model explain why Monique has diabetes? Does your model explain the causes and effects of Type 2 diabetes?
- ❑ Are any components missing? Are the relationships correct?

Revise your model if necessary!

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Step 5: Sharing

1. Explain your model - what question about diabetes is your model trying to answer?

_____

2. Why does Monique have diabetes according to your model?

_____

_____

_____

Step 6: Revising

1. What feedback did you receive about your model? How can you improve your model to better explain diabetes? What needs to be changed?

_____

_____

_____

2. Look at other models of Monique's diabetes: How are they similar or different than yours? Are the ways they explain Monique's diabetes better? How can you use them to improve your own model?

_____

_____

_____

Thinking About My Model

1. Score your model - How well does your model explain why Monique has Type 2 diabetes?

Circle score (1=not well, 6=very well)
1 2 3 4 5 6

Explain your score: _____
_____
_____

2. Was it easy to think of the **new components** and the **relationships** that you should add to your model to explain and predict Monique's diabetes?

Circle score (1=not at all, 6=very much)
1 2 3 4 5 6

How did you think of them? _____
_____
_____

3. Did the class discussion about the models help you improve your own model about Monique's diabetes?

Circle score (1=not at all, 6=very much)
1 2 3 4 5 6

Why? What changes did you make to your model following the class discussion?_____
_____
_____

4. When you are asked to model a phenomenon, what should you do? (*hint - look at the modeling cycle*)
_____
_____
_____
_____
_____
_____
_____

Optional activity - Grass plant investigation

Materials for each student group:

4 large plastic cups
4 small clear plastic cups
Grass seed mixtures:

- **Mixture #1 –normal:** 88% Gulf Annual Ryegrass; 10% Charger II Perennial Ryegrass-PVP protected variety

- **Mixture #2- drought resistant:** 40% Pennington AFT 258 Tall Fescue; 20% Rebel XLR Tall Fescue; 20% VirtueII Tall Fescue; 7% Pennington ASC 295 Red Fescue; 7% Survivor Chewings Fescue; 6% Blue Bonnet Kentucky Blue Grass

Activity

In this activity, the students will conduct a *Guided inquiry*. They will grow plants to examine the effect of genetic and environmental factors on the growth of plants.

	***Guided inquiry*** In guided inquiry, students investigate questions and procedures that teachers present to them, but the students themselves, working collaboratively to decide the processes to be followed and the solutions to be targeted.

1. **Introducing the plants** –To fully understand Monique's case, students need to collect more information. Explain that the students cannot do experiments on Monique but they can use other living things such as plants to find out if their genetic information and/or environment can affect their traits.

2. **Reminding core terms of experimentation** - Remind the students of the core terms of experimentation: dependent variable, independent variable, controlled variables.

	When conducting experiments, the students should to be familiar with the following terms: I***ndependent variable*** - a variable whose variation does not depend on another variable. In an experiment, it is the variable one chooses to change, or manipulate, to determine an effect on other variables. ***Dependent variable*** -a variable whose value depends on another variable. In an experiment, it is the variable that changes in response to other variables being changed. ***Controlled variable*** - In an experiment, this is a variable that is not changed. This enables the experimenter to fairly test the relationship between the independent and dependent variables. ***An inquiry question*** - a specific type of question that supports investigation and requires the gathering and analyzing of data to propose a potential answer.

3. **Modeling experimentation -** Conduct a classroom discussion and demonstration of the experimentation procedure:
   - **B*rainstorm*** possible independent and dependent variables for the students to test using the simulation.
   - ***Develop inquiry questions*** that the students are able to investigate using the simulation; as this is a *guided inquiry*, the students can choose their inquiry question and design their own experiment.
   - ***Plan* and *conduct*** the experiment using the simulation according to the inquiry question.
   - ***Record and analyze data*** using a *result table* and a *graph*. Model the class how to draw conclusions from the graph.

	**Scaffolding students using *learning strategies*** **What are learning strategies:** Remind students what learning strategies are, and emphasize the importance of learning strategies for efficient learning (see teacher's guide) **Remind what *Brainstorming* is and how it can be used** - Brainstorming is a strategy for generating ideas. It includes generating a list of spontaneous ideas that are associated with a specific topic. For effective brainstorming: (a) focus on quantity; (b) withhold criticism; (c) welcome unusual and wild ideas; and (d) combine and improve ideas. **Scaffold *Brainstorming*** - Together with the entire class, use the *brainstorming* strategy to generate as many questions as possible the effect of environmental factors on plant's growth. **Generating "anchors"**: Tell the students to rely on their knowledge about plants for their brainstorming. First, ask them to think of as many possible factors as the can that might affect the plants' growth; these are the independent variables. Then, ask them to think of as many as possible factors that are associated with plants' growth; these are the dependent variables. **Examples*** of *dependent* and *independent* variables: • ***Examples of independent variables:*** type of soil, amount of sun, amount of water • ***Examples of dependent variables:*** height of plants, color of plants; plant survival *** This is not an exhaustive list***

4. **Planning the experiments** - In pairs, the students will plan their own experiment using the worksheet

	While the students work in pairs, circulate around the class and support the students, while also encouraging them to share their thinking and consult their peers about their experimental plans. This should be a discussion with students sharing their questions and how to test them, rather than a didactic sequential interaction only with teacher.

5. **Conducting the experiments** –The students will plant the seeds according to their planned experiment:
    a. **Planting the seeds and labeling accordingly:**
        i. **Planting to examine the effect of environmental factors on plants' growth** – the students should plant *the same type of seeds* (normal OR drought resistant) in two cups and place them in *different environment* (normal AND drought conditions)
        ii. **Planting to examine the effect of genetic factors on plants' growth** – these students should plant *different type of seeds* (normal AND drought resistant) in two cups and place them in *the same environments* (normal OR drought conditions)

    b. **Growing plants** - according to the planned experiment (students need to plan or know in advance how much water they will add and how often they will water to each cup for normal and/or drought condition):
        i. **Normal conditions** - daily watered and full sun or grow lamp
        ii. **Drought conditions** – little water and full sun or grow lamp

    c. **Collecting data** - measure and record growth every 2-3 days

    d. **Analyzing data** – according to the students' worksheet

6. **Sharing and discussing** - With the entire class, share and discuss the questions the students generated, and their results. Use the following prompts:
    - What was your inquiry question?
    - What was the design of your experiment?
    - What do your results tell you?
    - Did your experiment help you answer your question?

    Share and discuss the results and conclusions of their experiments by developing **scientific explanations** that include **Claim-Evidence and Reasoning (CER)**. Use the following prompts to encourage the students to share their results and conclusions:
    - What pattern did you find in the data? What were your findings?
    - What claim can you make about the effect of environmental factors on plants' growth? What evidence do you have that support your claim?
    - What claim can you make about the effect of genetic factors on plants' growth? What evidence do you have that support your claim?
    - What are the similarities and differences between your claims and those of other teams?

STRATEGY	**Scaffolding students using *learning strategies*** **What are learning strategies:** Explain to students what learning strategies are, and emphasize the importance of learning strategies for effective learning (see teacher's guide) **Explain what a *scientific explanation* is and how it can be used** - Scientists try to explain how and why a natural phenomenon occurs. Scientific explanations consist of claims, evidence and reasoning (CER). The claim is a testable statement that expresses the answer or conclusion to a question or problem. Evidence is scientific data that supports the claim. The reasoning describes how or why the evidence can be used to support the claim using scientific ideas and principles. **Model *CER*** - Guide students to draw a conclusion about the relationship between genetic and environmental factors and plant growth based on the data that they collected from the simulation. **Instructional tips**: Ask the students to explain; 1) what are their conclusions, 2) what is their evidence (data that they collected from the simulation), and 3) what scientific principle connects the evidence and claim. Then share their explanations with whole class. These can vary by student based on how they planned and conducted the experiment. **An example CER** ● **An example of claim**: The environment affects the growth of plants. ● **An example of evidence**: The seeds of the same genetic composition grew differently in different environmental conditions. ● **An example of reasoning**: Plants grown from normal seeds are adapted to an environment where water is not a limiting factor. Therefore, they need water and develop well in the normal conditions. They are not adapted to drought conditions and therefore dry up and die when they are not watered.

Have a class discussion about the interactions of gene and environment, e.g.,

- If two people eat different foods, will what each of them eat impact differently in their body?
- If the same person eats different foods, will those foods have a different impact in his or her body?
- What would happen if two different people eat same food? Will the foods impact their bodies the same or differently?

Group names: _____

Activity 1: How does the genetic composition of plants affect their growth?

Congratulations! You have been chosen to conduct experiments with real plants!

Let's Investigate!

Discuss with your partner what question you would like to investigate. This question may change as you begin to plan your investigation. Make sure to keep track of any changes.

Question: _____
_____
_____
_____

Plan your experiment:
(a) How are you going to examine your research question? _____
_____
_____
_____

(b) Identify the variables in your experiment:

Independent variable: _____
_____

Dependent variable: _____
_____

Controlled variable: _____
_____

Set up the experiment:

1. Fill the 4 large cups ¾ full of moist potting soil.

2. Sprinkle about 1 tablespoon of grass seed over the soil in each cup **according to your planned experiment**.
3. Water each cup with about 25 mL of water and cover with an inverted smaller clear plastic cup. This creates a tiny greenhouse and reduces evaporation from the cup.
4. Place all 4 cups under a desk lamp or grow light for a few hours each day, and water **according to your planned experiment**.
5. Remove the clear plastic cup from over the grass plants if the grass grows too tall to fit inside.
6. When plants start to grow, cut each cup of grass to the same height. This is will enable you to easily compare the height of the plants in each condition.
7. Measure growth every 2-3 days for 2 weeks

Collect and analyze data:
(a) Collect your data in the table below:

Date	Plants in experimental conditions 1	Plants in experimental conditions 2	Notes

(b) Using your data, plot a graph in the space below:

Discuss and draw conclusions:

1. What **patterns** can you find in your data and graph that can help you answer your question? Discuss with your partner any trends that you see and record them here.

_____

_____

_____

2. Write a **claim** to answer your investigation question. Use your data as **evidence** to support your claim.

_____

_____

_____

3. How does this investigation give you information that you can add to your model of Monique's health?

_____

_____

_____

4. How does your investigation help us answer our driving question about "What controls Monique's diabetes?" Does this help us explain why Monique has diabetes?

_____

_____

_____

Group names: _____

Activity 2: How does the environment affect the growth of plants?

Congratulations! You have been chosen to conduct experiments with real plants!

Let's Investigate!

Discuss with your partner what question you would like to investigate. This question may change as you begin to plan your investigation. Make sure to keep track of any changes.

Question: _____
_____
_____
_____

Plan your experiment:
(a) How are you going to examine your research question? _____
_____
_____
_____

(b) Identify the variables in your experiment:

Independent variable: _____
_____

Dependent variable: _____
_____

Controlled variable: _____
_____

Set up the experiment:

1. Fill the 4 large cups ¾ full of moist potting soil.

2. Sprinkle about 1 tablespoon of grass seed over the soil in each cup **according to your planned experiment.**
3. Water each cup with about 25 mL of water and cover with an inverted smaller clear plastic cup. This creates a tiny greenhouse and reduces evaporation from the cup.
4. Place all 4 cups under a desk lamp or grow light for a few hours each day, and water **according to your planned experiment**.
5. Remove the clear plastic cup from over the grass plants if the grass grows too tall to fit inside.
6. When plants start to grow, cut each cup of grass to the same height. This is will enable you to easily compare the height of the plants in each condition.
7. Measure growth every 2-3 days for 2 weeks

Collect and analyze data:
(a) Collect your data in the table below:

Date	Plants in experimental conditions 1	Plants in experimental conditions 2	Notes

(b) Using your data, plot a graph in the space below:

Discussing and drawing conclusions:

1. What **patterns** can you find in your data or graph that can help you answer your question? Discuss with your partner any trends that you see and record them here.

_____

_____

_____

2. Write a **claim** to answer your investigation question. Use your data as **evidence** to support your claim.

_____

_____

_____

3. How does this investigation give you information that you can add to your model of Monique's health?

_____

_____

_____

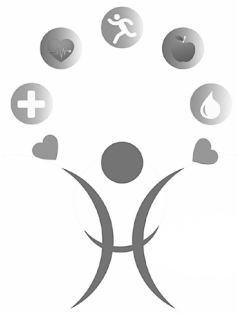
4. How does your investigation help us to answer our driving question about "What controls Monique's diabetes?" Does this help us explain why Monique has diabetes?

_____

_____

_____

Health in Our Hands



What controls my health?

Lesson 6:

What can I do to make my environment healthier?

What you eat is one of the environmental factors that can change your health and body just like the quality of the air you breathe. Eating a lot of sugar affects your body and can make you less able to digest sugar. Over time, this can lead to diabetes. Students will learn to read food labels and calculate the amount of sugar in a serving of food. They will also investigate the many names of sugar in the foods. There may be more added sugar in food we have in our homes than we realize!

For discussion at home:
Why are food labels important?

Key Point #1

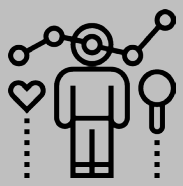
Many foods like fruit have healthy, natural sugar, but processed foods like cereal can have unhealthy, added sugar that increases the chance of getting diabetes.

Key Point #2

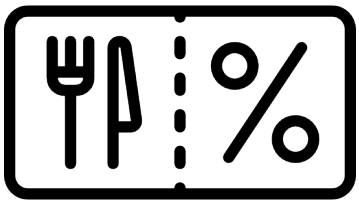
To figure out how much sugar is in a food, look at the nutritional label. Divide the grams of sugar by 4 to know the teaspoons of sugar in a serving.

Key Point #3

Children ages 2-18 should consume no more than 6 teaspoons (25 grams) of added sugar a day in the food they eat.



Explore More: Sweet Snacks



Step 1: Check the nutrition fact label of your **favorite snack** or search the internet to find out how many grams of sugar is in one serving.
Step 2: Divide the number of grams of sugar by 4 to get the teaspoons of sugar in a serving. Remember this number.
Step 3: Get a spoon and a see-through container. **One spoonful = 1 teaspoon.**
Step 4: Use the spoon to fill the glass with water, counting each spoonful until you have the same number as teaspoons from Step 2

Take a look at the glass: Is it a surprising amount of sugar?

Goal: Learn how to count how much sugar is in the foods you eat

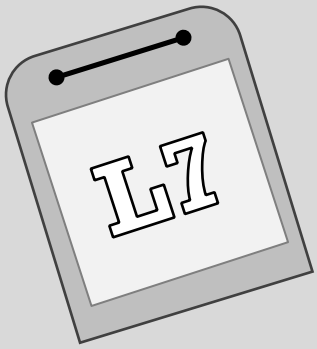
How can I control my health?

Eat right
Next time you have a snack, look at the nutrition fact label to see how big a serving is supposed to be. Eat only one serving. It is a little or a lot? Is it the same amount you usually eat as a serving?

Get fit
You can make your environment healthier by getting a good night's rest. Sixth graders should get 10 hours of sleep, and adults need at least 7 hours.

Be mindful
Next time you are on the computer, set an alarm to go off every 15 minutes. When it goes off, close your eyes, and breathe deeply 3 times. It will help you relax, and protect your eyes.

What's coming next?



Lesson #7: How can we work together to make our environment healthier?

Students will form research teams to start their community action project and come up with research questions about how to make their community healthier and the research tools to answer their questions. Students' projects will address the following questions:

1. What are obstacles to health in your community?
2. How do research projects turn data into action?
3. How can we effectively argue for a change in our community?

Get involved…

- **Discuss with your child:** What questions are their class considering for their community action project? What are your concerns about health do you have?
- **Save the date!** Students will be presenting the results of their community action projects in their class and in the community the week of December 11.

About us

We are CREATE for STEM Institute at MSU. Funded by Science Education Partnership Award (SEPA) granted by the National Institutes of Health (NIH), the project is developing a new generation of learning materials that blends school and community learning experiences to teach genomics (the study of all the genes of an organism and gene-environment relationships) and evolution.

Instagram

Follow HIOH on Instagram at ***health_in_our_hands***

Partners: UMichigan, Flint Public Schools, Concord Consortium, Community-Based Organization Partners, Sloan Museum, Flint Public Library

Lesson 6: What can Monique do to make her environment healthier?

Unit Driving Question:	Materials	Suggested lesson time
What controls my health? **Sub-Driving Question:** What can Monique do to make her environment healthier?	• Computer • Teaspoon (for each group) • Clear plastic cup (for each group) • Various types of snacks and drinks which include nutrition information: (a) Examples of snacks and drinks <u>without added sugar</u>: Fresh fruit and veggies, nuts, seeds, salad, plain yogurt, water, or milk; (b) Examples of unhealthy snack and drinks <u>with added sugar</u>: Coke, candy, pop-tarts, yogurt with sugar added, or chocolate cookies. • Healthy snacks for all students to eat at the end of the lesson.	4 days

Framing the Lesson

Purpose

The purpose of this lesson is to support students' understanding that food is one of the environmental factors that can affect their body. In this lesson, students calculate how much sugar is in the food they eat and discuss how individuals can make changes in their environment.

Learning Goals

- The students obtain, evaluate, and communicate information about their eating habits based on the data about hidden sugars in their food.
- The students use the models they have developed for Monique to explain what affects their own health.

Building Coherence

In the previous lessons, the students explored the effect of genetic and environmental factors on traits, specifically on health and diabetes. In this lesson, the students consider personal actions that can be taken to improve their health.

Overview of the Lesson

Activity 1: What can I do to eat healthier?

The students will interpret the *nutrition fact table* on food labels and calculate the amount of sugar in their food and usual diet. They will discuss the effects of ingesting too much sugar on one's health and consider ways to reduce sugar consumption, especially *added* sugar, in their diet.

Activity 2: What can I learn about my health from studying Monique's diabetes?

The students will revisit the DQB and their models and discuss how the knowledge they have gained about Monique's diabetes can be generalized to themselves.

Activity 3: Developing a consensus model and using the model to explain and predict Type 2 diabetes

In teams and through class discussions, the students will develop a *consensus* model. The students will then use this model to explain and predict Type 2 diabetes. Using *scenario cards* the students will address various possible scenarios related to gene-environment interactions, and use their models to explain the cases.

Connection to NGSS

Target Performance Expectations

MS-LS1-5. Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.

Disciplinary core idea	Science and engineering practices	Crosscutting concepts
LS1.B Growth and Development of Organisms • Genetic factors as well as local conditions affect the growth of the plants. (MS-LS1-5)	**Obtaining, communicating, and evaluating information** • Integrate qualitative and/or quantitative scientific and/or technical information in written text with that contained in media and visual displays to clarify claims and findings. **Using Mathematics and Computational Thinking** • Apply mathematical concepts and/or processes (e.g., ratio, rate, percent, basic operations, simple algebra) to scientific and engineering questions and problems. **Developing and using model** • Develop and/or use a model to predict and/or describe phenomena.	**Pattern** • Graphs, charts, and images can be used to identify patterns in data. **Cause and effect** • Cause and effect relationships may be used to predict phenomena in natural or designed systems. **Scale, proportion, and quantity** • Standard units are used to measure and describe physical quantities such as weight, time, temperature, and volume.

How these elements are integrated and embedded in this lesson

In this lesson, students explore the food they eat and consider the idea that some traits are influenced by environmental factors. They learn how to obtain nutritional information about food using a nutrition fact table. Then, they use mathematical calculations to determine how much added sugar is in the food they eat. Based on what they explored, students go back and revise their model by adding "food" as a component affecting one's health.

Connection to Students' Lives

Link to out-of-school activity and everyday life

- Encourage the students to share what they learn with their families.
- Encourage the students to share their community projects with their families, and discuss with them the inquiry question, research tools, conclusions, etc.

Link to career-awareness

- Introduce careers which involve collecting data to diagnose health conditions in people and identifying issues in communities affecting the health of the population. For example, nutritionists, dieticians, community health workers, and public health educators and researchers.

Teacher Preparation

Prepare and display various snacks and drinks (with nutrition information) including enough healthy food that all students can have a healthy snack following the activity. The students can also be invited to bring their favorite snacks and drinks the day before the class. If the whole container contains more than one serving size, prepare a sample of snacks and drinks by one serving size. Showing one serving size will enable the students to compare between a whole container and a serving size. For healthy snacks that are not packaged, such as whole fruits and vegetables, dried fruits and nuts, use an online calorie counter. Nutrition information is also available for common restaurant and fast food entrees.

Here are some useful links for nutrition information:

- https://supertracker.usda.gov/foodtracker.aspx
- http://www.calorieking.com/foods/

Instructional Sequence

Introducing the Lesson

1. **Keeping coherence using the DQB** - Remind students of their questions related to Monique and diabetes on the Driving Question Board (DQB). Tell students that in this lesson they will further investigate the case study of Monique to determine "What can Monique do to make her environment healthier?" Tell the students that they should pay particular attention to the questions that they had clustered around that Sub-Driving Question.

2. **Keeping coherence** - Revisit Monique's video (2:44 minutes) and emphasize the changes she made to her environment, focusing on her diet (e.g. how she started eating the "right food").

3. **Introducing another diabetic case** - Show the students a video clip of Tim (3:42 minutes), a diabetic child that adopted healthy shopping habits and pays attention to nutrition information labels on packages. Ask the students to summarize what Tim is doing in the video.

   ★ This lesson is the transition point from Monique to the students' own lives. Have students start to think about their own environment based on what they learned from Monique's case. Ask students to put additional questions about their environment on the DQB. All discussions from this point forward should relate to the students' own lives.

4. **Drawing from prior knowledge** - Lead a class discussion about natural and added sugar. Ask students what they know about natural sugar and added sugar. Possible questions for the classroom discussion:
   - What do you think natural sugar is?
   - Have you heard of "added sugar?"
   - What foods do you think contain natural sugar?
   - What foods do you think have added sugar?
   - What do you think natural sugar will do in your body?
   - What do you think added sugar will do in your body?

Activity 1 - What can I do to eat healthier?

1. **Introducing terms** - Introduce the students to the terms:
   - ***Natural sugar***: Some foods naturally contain sugar along with vitamins, minerals, and fiber. Foods like whole or cut up fruits and vegetables, and dairy (such as milk or yoghurt) contain natural sugar.

   - ***Added sugar***: Some foods contain sugar that is added beyond what is naturally contained. Foods like candy, desserts, and soft drinks have added sugar. They are high in sugar but low in vitamins, minerals, and fiber. Even milk, yogurt and "health bars" can have a lot of added sugar.

   - ***The nutrition facts label***: Project on the screen a sample nutrition facts label from a snack or drink that students usually like to eat or drink. Show the information to the students and explain the ways this information can be used. Focus on "serving size," "servings per container," and "sugars."

Important information to look for on a food label includes serving size, calories (and calories from fat), and nutrients (separated by which to limit and by requirements).

On May 20, 2016, the FDA announced the new Nutrition Facts label for packaged foods to reflect new scientific information, including the link between diet and chronic diseases such as obesity and heart disease. "The new label will make it easier for consumers to make better informed food choices" (FDA.gov).

Also, new sugar limits for children were announced on August 22, 2016. Children ages 2-18 should consume no more than 6 teaspoons (30 milliliters) of added sugar a day. That amount of sugar is equal to about 100 calories, or 25 grams (0.9 ounces) of sugar. http://www.livescience.com/55843-new-sugar-limits-for-kids-announced.html

How to Understand and Use the Nutrition Facts Label
http://www.fda.gov/Food/IngredientsPackagingLabeling/LabelingNutrition/ucm274593.htm

The FDA's Center for Food Safety and Applied Nutrition (CFSAN) has a wealth of educational materials that make it easy to understand and use the Nutrition Facts label, including:

- An interactive tool to explore the various sections of the label and download printable nutrition fact sheets to keep and share,

- The virtual world of Whyville, where young "citizens" can practice label-reading in the *online* community and develop skills for making healthy snack choices in the *real* world,

- Youth/community outreach resources,
- Nutrition fact sheets,
- And other multimedia.

Find these resources at:
http://www.fda.gov/Food/IngredientsPackagingLabeling/LabelingNutrition/ucm2002609 7.htm

2. **Calculating sugar in foods** - Show the students how to calculate the amount of sugar by serving size and by servings per container. Ask students to:
   - Find the *number of servings* per *container* - written on the food label.
   - Find the *number of grams of sugar* per *serving* - written on the food label.
   - Calculate the number of *sugar teaspoons* per *serving* - divide the *grams of sugar per serving* by *4* (there are 4g of sugar per teaspoon).
   - Calculate the number of *teaspoons of sugar* per *container* - multiply the number of *teaspoons of sugar per serving* by the number of *servings per container*.

   Visualize the amount of a serving size and the amount of added sugar to the students to reinforce their understanding of the quantities of sugar added to their food.

What is the difference between "naturally occurring sugar" and "added sugar?" (Why it is important to know the nutritional differences between foods with added sugars and natural sugars).

Naturally occurring sugar is the sugar found in whole, unprocessed foods such as milk, fruit, vegetables, and some grains. One of the most common natural sugars is **fructose**, which is found in fruit and in dairy products, such as milk and cheese, as **lactose**. Foods with natural sugar have an important role in staying healthy. The natural sugar is combined with fiber and essential nutrients that keep the body healthy and help prevent disease.

Added sugars can be found many foods including desserts, soda, and sports drinks. As opposed to sugar in unprocessed foods, the sugar uptake is not combined with fiber or other essential nutrients.

It is good to check all processed food because food manufacturers add chemically-produced sugar, typically high-fructose corn syrup, to foods and beverages, including crackers, flavored yogurt, tomato sauce, and salad dressing. Low-fat foods are often the worst offenders, as manufacturers use sugar to add flavor.

To determine if a food product has **added sugar**, check the ingredient list for these words: brown **sugar**, corn sweetener, corn syrup, dextrose, fructose, fruit juice concentrate, **glucose**, high-fructose corn syrup, honey, invert **sugar**, lactose, maltose, molasses, raw **sugar**, sucrose, syrup, and table **sugar**.

3. **Investigating the amount of added sugar in various foods** - Display some sample food packages with nutrition facts labels on the table. Divide students into small groups of three or four students. Ask each group to select one snack and one drink that they would recommend Monique to eat, and proceed according to ***Activity 1: Does the food we eat affect our health? Investigating Sugar in Food.***

4. **Sharing** - Gather and present the students' findings using a table.

   An example of a table:

	Choice of food (Q1 & Q2)	*Amount of sugar in grams per serving (Q4 & Q6)*	*Amount of teaspoons of sugar per container (Q5 & Q7)*
Team 1	snack:		
	drink:		
Team 2	snack:		
	drink:		

   Rank the foods in the table from "most sugar" to "least sugar" by serving size.

5. **Discussing** - Lead a class discussion based on your calculations of sugars in the foods:
   - Which combination of snack and drink is the better choice for a healthy diet? Explain your evidence. Is this a good snack for Monique? Explain your reasoning.
   - What information did you discover that is different from what you thought or expected?
   - What are some potential negative health effects of consuming so many extra calories from added sugar? In addition to diabetes, students can consider weight gain, tooth decay, heart disease.
   - How do people with diabetes deal with natural and/or added sugar?
     - People with diabetes have to control their consumption of carbohydrates even when sugar is not ADDED. This means watching how much bread, pizza, chips, etc. they are eating.
     - People inclined to have diabetes have to control "natural sugars" as well.
   - What can YOU do to "Rethink Your Drink," and how will this benefit your health? Would you choose Monique's snack and drink to eat after school? Why or why not?

   Note: Guide the students to realize that there are social factors that affect students' food choices, such as advertisement, design of packages, misleading information, social pressure, culture, and habits.

6. **Introducing how reversing a diet can affect diabetes** - Show the students a videos of SanDera Nation, who reversed her diabetes using plant-based dietary intervention. Ask the students to summarize the changes SanDera made to her eating habits, and how that those changes affected her diabetes. Have a discussion with the students about the take-away messages from SanDera's story.

7. **Investigating food at home** - Ask students to examine the amount of sugar in food at their home, and complete the worksheet ***Activity 1 : Does the food we eat affect our health? Investigating our choices***.

Activity 2 - What can I learn about my health from studying Monique's diabetes?

The goal of this activity is to demonstrate to the students that the knowledge they have gained throughout the unit about Monique's diabetes can be generalized to *their health*.

1. **Revisiting the DQB** - Revisit the DQB, the SDQ, and students' questions and answers, and discuss the various questions and answers with the students. Prompt them to reflect about the items on the DQB and about their specificity:
    - Do the items on the DQB apply only to ***Monique***, or can they be generalized to ***other people*** as well?
    - Do the items on the DQB apply only to ***diabetes***, or can they be generalized to ***other health issues*** as well?

    Then, help them make the generalization from ***Monique*** to ***us/my***, and from ***diabetes*** to ***health***, for example:
    - How does ***Monique's*** family affect her ***diabetes***? To - How does ***our*** family affect ***our health?***
    - How does where ***Monique*** lives and what she does affect her ***diabetes***? To - How does where ***we*** live and what we do affect ***our health***?
    - What can ***Monique*** do to make ***her*** environment healthier? To - What can ***I*** do to make ***my*** environment healthier?

    Then replace the DQ ***Why does Monique have diabetes*** with ***What controls my health?*** Review and revise the Sub Driving Questions: from ***Moniques' diabetes*** to ***my health***.

2. **Revisiting the models** - Project a student's model to the class, and prompt them to reflect about the the specificity of the model:
    - Does this model apply only to ***Monique***, or can it generalized to ***other people*** as well?

- Does this model apply only to ***diabetes***, or can it be generalized to ***other health issues*** as well?

As with the DQB, lead the students make the generalization from ***Monique*** to ***us/my***, and from ***diabetes*** to ***health.*** This connects their models to the Driving Question of the unit: ***What controls my health?***

Activity 3 - Developing a consensus model and using the model to explain and predict Type 2 diabetes

In this activity, the class will develop a *consensus model* – based on their individual models and through class discussion, the students, guided by the teacher, will develop a class model which represents as much as possible from the students' individual models.

Students will be able to:

1. Describe the process that led to the development of the class *consensus model*
2. Use their model to explain and predict the phenomenon of what controls health.

Developing a consensus model and generalizing to other health issues

1. **Developing models:** In teams, the students will compare their models. Each team will develop a list (according to the criteria below) of the components and relationships that are in their opinion essential for a model of Monique's diabetes.

   The collaboration script - In their teams, the students will follow the following script that shapes their behaviors:
   1. The students will present and explain their models to their groups
   2. Based on **<u>all</u>** the models in their teams, the students will generate a list of components and relationships. When discussing the components and relationship, the students should decide whether to suggest them for the class consensus model or not. They should detail their reasoning for their choice.

	To support the students in developing the components' list, instruct the students to ask themselves the following question: *What components are in each of the models, and which are important for Monique's Type 2 diabetes model?*

3. As the students generate the list of components, they should also suggest ways to categorize the components they are suggesting.

   Students' lists should look like this:

Component or relationship	For consensus models?		Reason	Category
	Yes	No		

Collaboration between students is not an easy task; students do not necessarily possess the skills to share ideas, listen to each other, and engage in a critical and productive discussion. The *collaboration script* structures the relationships between the students, and supports fruitful collaborations among the students.

2. **Class discussion:** Engage the students in a class discussion based on the different lists. Through this discussion, create a consensus class model using SageModeler. Project the process on the board.

3. **Generalizing the model to other health issues:** After completing the consensus model, the teacher will generalize the model: *diabetes* to *health issues*, *Monique* to *us*.

4. **Using the model to explain diabetes**: Using the scenario cards, students will address various possible scenarios related to genes-environment interactions, and use their models to explain the cases. There are several ways to use the scenario cards in class:
   a. **Are you ready for a challenge?** Students are individually called to the board, and each student picks up a card from the pile. The teacher challenges the student with the scenario described in the card. Then, the student uses the model to explain the scenario described in the cards.
   b. **Is your team ready for a challenge?** Divide the students into teams. Then, each team sends an emissary to choose a card. The teams work to solve the challenge and use their models to explain the scenario, and then send a representative to present their explanation. Following the representative's presentation of the team's answer, ask if any of the other team members have anything different to add, then ask the other teams to provide feedback.

Activity 1: Does the food we eat affect our health?
Investigating Sugar in Food

A nutritionist is an expert in food and what people should eat to be healthy. They give people advice about how to develop goals for a healthy lifestyle and what foods to eat and avoid to accomplish their goals.
Select a snack and a drink, and answer the following questions in a group.

Q1. What is the snack that your group selected?

_____

Q2. What is the drink that your group selected?

_____

Q3. See what other groups selected. Predict how much sugar is in the snacks and drinks that each group picked. Rank the the food from "most sugar in the whole container" to "least sugar in the whole container."

Make a list of snacks from "1–most sugar" to "10–least sugar"

1) _____ 6) _____
2) _____ 7) _____
3) _____ 8) _____
4) _____ 9) _____
5) _____ 10) _____

Make a list of drinks from "1–most sugar" to "10–least sugar"

1) _____ 6) _____

2) _____ 7) _____

3) _____ 8) _____

4) _____ 9) _____

5) _____ 10) _____

Q4. How much sugar (in grams) would you have eaten if you ate one serving size of the snack that your group selected?

_____

Q5. There are 4 grams of sugar per teaspoon. Calculate the number of teaspoons of sugar in one serving of your snack.

_____

_____

Q6. How much sugar (in grams) would you have if you drink one serving size of the drink that your group selected?

_____

Q7. There are 4 grams of sugar per teaspoon. Calculate the number of teaspoons of sugar in one serving of your drink.

_____

_____

Q8. What would you recommend that Monique should eat for a snack? Make sure to use the information that you found about the amount of sugar in foods.

_____

_____

Activity 1: Does the food we eat affect our health?
Investigating our choices

In class, you explored how much sugar is in food by using food labels. Did you know that there is hidden sugar in foods we eat? Sugar has many different names, depending on where it comes from and how it is made. If you're trying to limit the amount of sugar you eat, you need to learn the other names for sugar that are on food labels.

One way to find hidden sugar is to find words ending in ***'-ose'.*** Here are some examples: Sucr**ose**, Malt**ose**, Dextr**ose**, Fruct**ose**, Galact**ose**, Gluc**ose**, Lact**ose**, and High fruct**ose** corn syrup.

There are still more other names for sugar that you may see on food labels.

 sugar cane  sugar beet	**Sugar:** sugar cane or sugar beets **Cane juice, evaporated cane juice, cane juice solids, or cane juice crystals:** These sweeteners are made from sugar cane. The difference is in the how they are processed and the size and texture of the product.	**Caramel:** Made by burning sugar and combining it with other ingredients, caramel is used as a food coloring or flavoring.	**Molasses:** Molasses is made during the sugar-making process. It has a lower sugar content than other sugars and high nutritional value.
 agave plant	**Agave nectar:** It comes from the agave plant and is about 1.5 times sweeter than white sugar.		**Corn syrup:** This sugary syrup is made from corn and is found in many sweetened processed foods and beverages.
 Maple trees tapped	**Maple syrup:** This sweet syrup comes from maple trees. Holes are drilled in the tree trunk. The sap drips out and is caught in a bucket.		**Honey:** Honey is produced by bees from the flower nectar they have collected. It contains high amounts of natural sugar and calories but is more nutritious than white sugar.
	**Fruit juice or Fruit juice concentrate, Fruit juice crystals:** Fruit juice is the juice of pressed fruit. It contains the fruit's natural sugars.		**Malt syrup:** Malt syrup is created from barley and ground corn and is similar in consistency to honey.

1. Using the information above, you are going to be a detective to find hidden sugars from food in your house. Record the different kinds of sugars and where you find them.

The kinds of sugar	The names of products (list all)

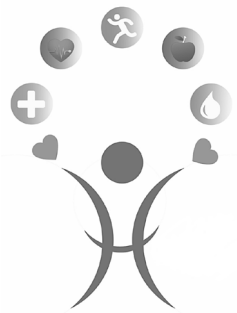
2. What are some of the ways food companies use words and images on packaging to catch your eye and encourage you to buy? How can a Nutrition Facts food label help you figure out what's really inside?

3. Does the information on a food label make a difference to you? How?

4. What can you tell your family members about what you find out?

Pictures: http://www.pubzi.com/sugar-cane-CY7YTDdZIBf.html; https://pixabay.com/en/dragon-tree-agave-leaves-plant-384360/; http://www.weblogtheworld.com/?attachment_id=175038humbs2.ebaystatic.com/d/l225/m/mnESkld9K4UWzE_D3lFBk2Q.jpg; http://www.publicdomainpictures.net/view-image.php?image=61337&picture=sugar-cane-plant-field; http://all-free-download.com/free-vector/download/corn_310464.html; https://pixabay.com/static/uploads/photo/2014/05/16/15/50/honey-bees-345620_960_720.jpg http://www.photos-public-domain.com/wp-content/uploads/2010/12/apples-red.jpg; http://www.kyivpost.com/media/images/data/uploads/d/iblock/en_articles/109811/7382/original_big.jp

Health in Our Hands



What controls my health?

Lesson 7:

How can we work together to make our community healthier?

Sometimes, there are obstacles to your health that you cannot control by yourself. For example, the grocery store may be far away, it's not safe to walk to school, or the foods available may be too high in added sugar. When community members come together, they have the power to change obstacles to their health. In this lesson, students will conduct community action projects to learn about the importance of making their community healthier.

- How does research turn data into action?
- How can we effectively argue for a change in our community?

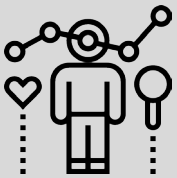
For discussion at home:
What are obstacles to health in your neighborhood?

Key Point #1

There can be obstacles to healthy eating and exercise in your school, community, or environment.

Key Point #2

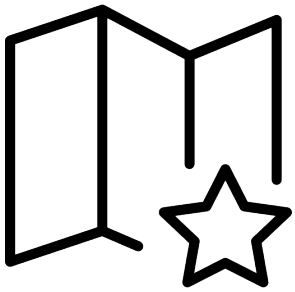
Scientists use models and research questions to design and carry out experiments that help their communities.



Key Point #3

To change obstacles in your environment, you can do research, draw conclusions, and work together to design solutions, build arguments, and take steps towards fixing the problem.

Explore More: Value Mapping



What are your values? Try an activity with your friends or family.
Choose the 5 most important values to you. Compare with others, and explain your answers.
Values: You can use the following list or come up with your own: peace, wealth, happiness, success, friendship, fame, power, justice, honesty, love, truth, creativity, independence, loyalty, respect, knowledge, freedom.
Goal: Deciding what matters to you when you make a decision can help you argue more effectively.

How can I control my health?

Eat right
Try eating more slowly. Drink water after every bite. Try to make smaller portions. Eating slowly helps you decide when you are full.

Make change
Identify a problem in your school or neighborhood. Figure out what would have to happen to solve it, and who could make those changes. Try to make a difference!

Share your voice
Research along with personal stories can be powerful. Write a letter or an email to your congressperson to ask for something you want for your community.

What's coming next?

Final Presentations: Plan to attend!

Lunch provided!

6th grade students will present the results of their community action projects to the community.

Date: TBD
Time: 10 a.m. – 1 p.m.
Place: TBD
Transportation: You can drive directly OR ride the school bus. To take the school bus, meet at your school at 8:45.
Parking: If you plan to drive to the event, directly, parking is onsite.

Get involved…

Listen to their voices!

Help our young people learn about the importance of working together to make a positive change in the health of their community.

About us

We are CREATE for STEM Institute at MSU. Funded by Science Education Partnership Award (SEPA) granted by the National Institutes of Health (NIH), the project is developing a new generation of learning materials that blends school and community learning experiences to teach genomics (the study of all the genes of an organism and gene-environment relationships) and evolution.

Instagram

Follow HIOH on Instagram at ***health_in_our_hands***

Partners: UMichigan, Flint Public Schools, Concord Consortium, Community-Based Organization Partners, Sloan Museum, Flint Public Library

Lesson 7: Community action project: How can we work together to make our community healthier?

Unit Driving Question:	Materials	Suggested lesson time
What controls my health? **Sub-Driving Question:** How can we work together to make our community healthier?	• Computer **Other materials could be needed depending on the inquiry question and investigation.*	4 weeks

Framing the Lesson

Purpose
There are obstacles to making healthy choices in one's environment. The purpose of this lesson is to support students' understanding that they can make their community healthier, and of the importance of such changes. In this lesson, students will conduct community action projects, discuss the data they have gathered, and develop ways to improve their neighborhood.

Learning Goals
- Students plan and carry out an investigation about obstacles to a healthy lifestyle in their environment.
- Students analyze data and communicate findings with peers to explain environmental factors in their neighborhoods that can be changed to make their environment healthier.
- Students revise their models by adding the action component to their health.

Building Coherence
In previous lessons, students considered how environmental factors can be changed by individual actions. This lesson continues by considering how collective actions can make the community healthier and why those changes are important.

Overview of the Lesson

Activity 1: Part 1. How can we work together to make our community healthier? Becoming a research team

In the community action project, the class will transform into a *research group* whose goal is to answer an inquiry question regarding a public health issue in students' environment. Within this research group, the students will be divided into several *research teams* which will collaboratively investigate the generated inquiry question. Each research team will examine the question using a different research tool. In the first activity, the students will (a) develop and choose their inquiry question, (b) design and develop their research tools, and (c) plan and carry out their investigations.

Activity 2: Part 2. How can we work together to make our community healthier? Suggesting evidence-based solutions

The students will continue their community projects. In this activity, the students will (a) analyze the data and draw conclusions from the various research tools, (b) share their findings with their peers and draw conclusions regarding their inquiry question while addressing ethical issues, and (c) suggest solutions and potential actions based on their findings.

Activity 3: Modeling - What can we do, individually and together, to make our community healthier?

The students will return to *SageModeler* and add the action component and its effect on their health. Then, they will share their models with the whole class, discuss similarities and differences among the components of their models, and evaluate the relationships presented.

Connection to NGSS

Target Performance Expectations

MS-LS1-5. Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.

Disciplinary core idea	Science and engineering practices	Crosscutting concepts
LS1.B Growth and Development of Organisms • Genetic factors as well as local conditions affect the growth of the adult plants. (MS-LS1-5)	**Asking Questions** • Ask questions that can be investigated within the scope of the classroom, outdoor environment, and museums and other public facilities with available resources and, when appropriate, frame a hypothesis based on observations and scientific principles **Planning and Carrying out Investigations** • Plan an investigation individually and collaboratively **Analyzing and Interpret Data** • Analyze and interpret data to provide evidence for phenomena. **Developing and using model** • Develop and/or use a model to predict and/or describe phenomena.	**Pattern** • Graphs, charts, and images can be used to identify patterns in data. **Cause and effect** • Cause and effect relationships may be used to predict phenomena in natural or designed systems.

How these elements are integrated and embedded in this lesson

In this lesson, students will conduct investigation to explain an inquiry question about health issues in their community. They start with generating their own inquiry questions then plan and carry out their investigations. They also analyze the data to draw conclusions and share their findings with their peers to suggest solutions and potential actions based on their findings. At the end, they revisit their model of Monique's diabetes and revise their models by adding action component and its effect on their health.

Connection to Students' Lives

Link to out-of-school activity and everyday life

- Through their community projects, the students will be empowered to take steps in making changes to their school or neighborhood environment to make it healthier.

Link to career-awareness

- Related careers include: community organizer, urban planner, public health researcher
- Community activists, public health and urban planners, and researchers from local universities can be invited to class to inspire student researchers and potentially support and play a role in their community action projects. Through these relationships, student researchers may wish to continue and deepen their experience in their community through afterschool and summer programs that may be located at schools, museums, libraries, other community-based organizations, or universities.

Instructional Sequence

Introducing the Lesson

1. **Keeping coherence using the DQB -** Remind students of their questions related to Monique and diabetes on the Driving Question Board (DQB). Tell students that in this lesson they will further investigate the case study of Monique to determine "What can Monique do to make her environment healthier?" Tell the students that they should pay particular attention to the questions that they had clustered around that Sub-Driving Question.

2. **Keeping coherence -** Revisit Monique's video (2:44 minutes) and emphasize the changes she made to her environment, focusing on her diet (e.g. how she started eating the "right food").

Activity 1 - Part 1: How can we work together to make our community healthier?
Becoming a research team

Community project rationale and relationship to the students' models
Models have explanatory and predictive power. Thus, models are helpful for problem solving by enabling informed decision-making based on an understanding of the underlying mechanisms of a phenomenon. In this curriculum, the students' generated model of gene-environment interaction will enable the students to decide upon the kind of community projects and actions that can be taken to improve the health of their community.

The community projects in this curriculum serve several purposes:

(a) They ***express the role of models and modeling in science***.
(b) They are the ***action component*** of the curriculum. Their major goal is to develop the students' ***Critical Science Agency***—how the students identify themselves within science in ways that advance their participation in their communities. The students view the world with a critical mindset and envision how to advance the world or change it into a more socially just and equitable place using science.
(c) They are the ***bond*** between the *school* and the *community*, both for the students' personal capital, such as family, friends, peers, and neighbors; and for local resources such as museums, libraries, universities, and social organizations. These bonds between schools and out-of-school organizations will provide a framework and support the realization of the students' action projects.

For more details about the community project, please refer to the teacher's guide.

1. **Introducing the role of models in science -** Lead a class discussion about the role of models and modeling in science. Use the following prompts to address these roles, and talk about the students' personal experiences during the process in which these roles were expressed:
    a. When did you feel that your model helped you to ***make sense*** of what was learned in class?
    b. When did you feel that your model helped you ***communicate your knowledge*** to others?
    c. When did you feel that your model helped you ***understand*** something about diabetes that you didn't understand before?

2. **Connecting models and action -** Lead a class discussion to connect the students' models and the upcoming community action projects:
    a. Explain to the students that because models can be used to ***explain*** and ***predict***, they can be ***used for problem solving***; they enable informed decision-making based on an understanding of the phenomenon. We can change things both as ***individuals*** and as a ***community***.

    b. Project a student's model to the class, and ask them to describe the gene-environment interaction and its relationship to diabetes based on that model. Prompt the students to think about the use of the model they have created:
        1. How can we use our models to make a change in our health?
        2. How can the model help us as ***individuals*** or as a ***community*** to make a change in our health?

    Prompt the students to discuss possible actions that can be undertaken to improve our health based on the model. Then, lead a general discussion about health. Emphasize ***determinants of health*** (the social and economic environment, the physical environment, the person's individual characteristics and behaviours) and their expression in the projected model.

3. **Introducing the community action projects** - Tell the students that in this lesson they will conduct community action projects, which focus on the environmental aspect of diabetes, to improve their own health as well as their community's health. Then, explain to the students what they will be doing during the projects.

	In the *community action project,* the class is transformed into a *research group* whose goal is to examine a health issue in the nearby environment that can be changed to improve the community's health. Together, the students will: (a) develop their inquiry question; (b) design the investigation; (c) collect and analyze data; (d) draw conclusions and generate potential actions; and (e) report back to their community (for more information please refer to the teacher's guide).

4. **Developing an inquiry question** - The first step in the community projects is to generate an inquiry question to be investigated. For this purpose, *brainstorm* together with the entire class to think of as many potential questions as possible. Write the questions on the board, as it is important to keep a record of the generated questions. Try to connect the students' questions with their model.

Scaffolding students using *learning strategies*

1. **What are learning strategies** - Remind the students what learning strategies are, and emphasize the importance of learning strategies for effective learning (see teacher's guide).

2. **Remind students what *Brainstorming* is and how it can be used** - Brainstorming is a strategy for generating ideas. It includes generating a list of spontaneous ideas which are associated with a specific topic. For effective brainstorming, (a) focus on quantity, (b) withhold criticism, (c) welcome unusual and wild ideas, and (d) combine and improve ideas.

3. **Scaffold *Brainstorming*** - Together with the entire class, use the *brainstorming* strategy to generate as many questions as possible regarding public health issues in students' environment.
   a. **Generating "anchors:"** Tell students to imagine their neighborhood in their minds in as many details as they can through a "health lens" based on the topics they have talked about in the curriculum; for example, their homes, family, habits, hobbies, exercise, recreational activities, after-school activities, sports, city facilities, schools, curriculums, markets, food-stores, restaurants, etc. All these aspects will serve as "anchors" for the next step of generating the inquiry question. Write these anchors on the board, and guide the students to use them to generate questions that connect these environmental factors to their health.
   b. **Generating questions***:

      Homes/Family/Habits/Culture (as an *anchor*)
      - How does my family's perception of a healthy lifestyle affect my health habits?
      - How does my culture affect my healthy lifestyle?

      Friends
      - How does social pressure at school affect my eating habits/exercise habits/healthy lifestyle?

      Hobbies/Recreational activities/After-school activities/Sports/Exercise
      - How does the "screens culture" affect children's/youth's healthy lifestyle? (e.g. watching TV and playing video games)
      - How do science/health exhibitions affect children's/youth's healthy lifestyle? (such as in museums or documentaries)
      - How do my recreational activities affect my healthy lifestyle?

      City facilities
      - How does access to exercise facilities in the neighborhood affect children's/youth's/adults' exercise habits?
      - How do commercial advertisements in my neighborhood affect my community's food consumption/healthy lifestyle?

	- How do the town's transportation facilities (roads for bicycle, safe sidewalk) affect my exercise habits or walking to school? - How do worries about neighborhood safety and crime affect my exercise habits or walking to school? ***Schools*** - How do school health, breakfast, or lunch programs affect the students'/ teachers' eating habits? - How do food choices in the cafeteria or sports events affect the students'/ teachers' eating habits? - How does the school curriculum affect my health? - How does exercise at school affect my health? ***Food stores/supermarkets/markets/restaurants*** - How do the arrangements of food in the supermarket/school cafeteria affect the eating habits of children/youth/adults? - How does access to healthy/fast food affect eating habits? - How does access to a farmer's market affect eating habits? - How does the distribution of restaurants or markets affect eating habits? - How does the price of foods affect consumption of food? - How does information about nutrition affect eating habits? ** This is not an exhaustive list*

	Connecting school and community together To improve the school-community partnership: 1. Ask the students to share the generated inquiry questions with their families and discuss with them the various choices. Encourage them to generate additional questions at home with their families, peers, and neighbors. 2. Contact local organizations and invite them to class to introduce their resources/exhibitions/facilities that may support the students' community projects and influence the choice of the inquiry question.

5. **Choosing an inquiry question -** Discuss the various inquiry questions and criteria for making a thoughtful choice with the class. Criteria could include:
   a. Interest
   b. Place-based issue of concern
   c. Resources and facilities to conduct the investigation
   d. Feasibility of making a change to the environment

6. **Generating the research tools** - Divide the class into *research teams*, each consisting of 4-6 students. Lead a class discussion about the content and behavioral perspectives of their work in the teams, and then let them develop their research tools:

   a. ***Content perspective:***
      i. Instruct the students in each *research team* to collaboratively develop a research tool to investigate the class inquiry question. Research tools and technologies could include:

Research tool	Useful technologies
1. Surveys	Google forms
2. Interviews	Videotape or audiotape and editing software (e.g. StoryCorps, movie maker)
3. Mapping	Google maps, GPS, Google street view, aerial photos, Google earth
4. Focus groups	Videotape or audiotape and editing software (e.g. movie maker)
5. Observations	Videotape or photographs, checklists
6. Photo-voice/Video-voice	Take pictures, videotape or audiotape and editing software (e.g.,movie maker)

ii. Discuss the differences and advantages of the various research tools and the reasons why a researcher would use either one.

iii. Instruct the research teams to develop different research tools from each other. Emphasize the importance of *triangulation*—collecting data from different aspects and viewpoints to answer the same inquiry question.

iv. Encourage the students to use technology in the designs of their research tools.

v. Present the students with the process they will use in their learning (the ***collaborative script***) in the *research teams:*
   1. Work in the *research teams* and develop the research tools
   2. Provide constructive feedback to other *research teams*
   3. In the *research teams*, make changes according to feedback and personal insights
   4. Plan data collection and analysis.

b. Behavioral perspective:

i. Encourage *within*-teams and *between*-teams collaboration. Explain the importance of both types of collaborations:
   1. *Within-teams collaboration* - multiple perspectives enhance creativity
   2. *Between-teams collaboration* - insights from other teams

ii. Highlight the importance of c*onstructive feedback*.

Providing constructive feedback
Have the students from the different *research teams* share their research tools with each other. Ask the students from the different *research teams* to provide constructive feedback to each other based on the discussions that they had in their own *research teams*. The feedback should include the following aspects:

> ***Strengths*** - What did you like about the other team's research tool?
> ***Weaknesses*** - How do you think the other team's research tool could be improved?
> ***Insights*** - How did looking at the other team's research tool help you improve your own research tool?

iii. For the technological aspects of the peer collaboration, please refer to the teacher's guide.

Bonding school and community together
To improve the school-community partnership:
Students (such as Public Health and Medical graduate students), AmeriCorps members, or other volunteers can be present in the classes and mentor the students as they design their research and develop their research tools. These mentors also can be role models and inform students about potential careers related to the curriculum.

7. **Sharing** - Lead a class discussion and share **examples** of various research tools. Ask the students to provide *constructive feedback* to each other based on the discussions that they had in their own *research teams*. The feedback should include: *Strengths*, *Weaknesses*, and *Insights* as described above. Instruct the students to continue to provide constructive feedback to each other. Then, they should review and finalize their research tools according to the feedback.

8. **Planning and conducting data collection** - In their *research teams*, instruct the students to plan their data collection.

Bonding school and community together
To improve the school-community partnership:
1. Students (such as Public Health and Medical graduate students), AmeriCorps, or other volunteers can be present in the classes and mentor the students as they plan and conduct the data collection.
2. Communicate with the students' families and remind them about the community projects. Emphasize the importance of their support to the project's success.

Activity 2 - Part 2: How can we work together to make our community healthier?
Suggesting evidence-based solutions

In this lesson, the students will continue their community action projects.

1. **Analyzing the data -** Lead a class discussion regarding ways to analyze the collected data. These could include:

Research tool	Useful technologies	Data presentation	Data analysis
1. Surveys	Google forms	Graphs	Draw a conclusion from the graphs
2. Interviews	Videotape or audiotape and editing software (e.g. movie maker)	Edited audiotape or videotape	Description of major themes, ideas, and conclusions
3. Mapping	Google maps, GPS, Google street view, aerial photos, Google earth	Screenshots or pictures	Add written explanations and conclusions
4. Focus groups	Videotape or audiotape and editing software (e.g. movie maker)	Edited audiotape or videotape	Description of major themes, ideas, and conclusions
5. Observations	Videotape or photographs, checklists	Edited audiotape or videotape, pictures	Description of major themes, ideas, and conclusions. Add written explanations and conclusions
6. Photovoice/ Video-voice	Videotape or audiotape and editing software (e.g. movie maker)	Photos with labels or video	Description of major themes, ideas, and conclusions using the SHOWED worksheet

2. **Sharing the findings** - Instruct the students to prepare a short presentation of their findings, and share it with the other *research teams*. The presentation should include:
    a. A description of their research tool and the rationale for using it
    b. A description of the data collection process
    c. A presentation of their data
    d. Evidence-based conclusions

    Encourage the students to provide constructive feedback to each other based on the discussions that they had in their own *research teams*. Emphasize the importance of evidence-based conclusions, and instruct the students to critically examine whether the team's conclusions are well-supported by their data.

Preparing for the final exhibition
In the final exhibition, each of the *research teams* will present their findings. Therefore, have the students design and develop posters or presentations which describe their findings and that could be presented later at the final exhibition.

3. **Revising the data analysis and conclusions -** Instruct the students to revise their findings and conclusions according to their peers' feedback and discussion in the class.

4. **Answering the inquiry question and designing solutions and potential actions** - Summarize the research team's main conclusions on the board. Then,
   a. Answer the class inquiry question through the integration of the team's conclusions. Emphasize the importance of evidence-based conclusions in answering the inquiry question. Be sure to address ethical issues regarding your answer to the inquiry question, and remind the students of their role-play.

   b. Together, think of possible solutions and potential actions to address the inquiry question. Write them on the board. Ask the students to share their findings and conclusions with their family and think of more actions that can be done.

An example of a table that can be used can be used for this purpose:

Research Team	**Main conclusions**
Research Team 1 *- surveys*	
Research Team 2 *- interview*	
Research Team 3 *- mapping*	
Research Team 4 *- Focus group*	
Research Team 5 *- observations*	
Research Team 6 *- Photovoice/Video-voice*	
Answer to class inquiry question:	
Possible solutions and potential actions:	

Preparing for the final exhibition
In the final exhibition, the *research team's* main conclusions and answer to the class inquiry question will be presented. Therefore, save a copy of the table with the research team's main conclusions, answer to the inquiry question, and possible solutions and potential actions in order to present it later as a poster or in a presentation.

Activity 3 - Modeling: What can we do, individually and together, to make our community healthier?

In this activity, the students revisit their models and revise them according to what they have learned. The modeling activity in this lesson has two goals:

1. Support the students' understanding of models and modeling.
2. Continue developing a model of Monique's diabetes.

NOTE: Students **revise the models they generated in the previous lesson, by adding more components and changing them.**

Developing models of Monique's diabetes

1. Remind the students that before the action projects, they have discussed two types of **generalizations** of their models:
    - From ***Monique*** to ***us***
    - From ***diabetes*** to ***health***

2. **Developing a model Monique's diabetes - *guided modeling*** – Start with a class discussion about Monique's diabetes. **For this part, use the presentation for lesson 7.** Make sure to:
    - Break the task into the smaller steps and engage in "peer-review" processes often
    - Let the students work individually or in pairs on their devices to develop their models of Monique's diabetes. Circle among them, and discuss their models with them as they work using the prompts.Emphasize the various phases of the modeling cycle and use the scaffolding prompts.
    - Have the students fill out the online-worksheet as they develop their models, and the online reflection at the end of the process. Review students' reflections in a class discussion.

While the students experience using the *SageModeler*, circle in the class, support the students, and encourage them to share their thinking and consult with their peers about their models. Students' models can vary. However, since the models need to explain the relationships among the components, make sure the models include:

Components

- Generalization from ***Monique's diabetes*** to ***my health***
- Personal action
- Collective action

Relationships and labels

- The relationships among the components
- The relationship between the components and Monique's diabetes

Discuss with the students:

- The similarities and differences between the models
- The models' strengths and weaknesses
- Ways to improve the various models

A discussion which shares insights from the various models and compares among them is extremely important, as it will scaffold the students' revision of their models in the following step. Use questions to prompt the students to critically examine their peers' models.

Components:

- *Components identity* - What components are included in each model? Are key components included?
- *Number of components* - How many components are indicated in the model? Are MORE components necessarily better?
- *Grouping of components* - How can we group the various components? Why should we group components—does it improve our models? Is the grouping meaningful?

Relationships among components:

- *Explicit relationships among the components* - Are the relationships among the components indicated? Do these relationships make sense? Are the indicated relationships important?

General features:

- *Complexity of the model* - How complex is the model?
- *Organization* - How well is the model organized? Is the organization meaningful?

Revisit the Unit's Driving Question - Emphasize that the model the students have just created addresses the Driving Question of the entire curriculum: ***Health in our hands: what controls my health?*** Discuss with the students how they might continue to use the model in their lives.

Scaffolding the student's modeling

Modeling can be difficult to teach and learn, especially for teachers and students who are new to modeling as a scientific practice. Students' modeling can be improved if their thinking is scaffolded (supported) by a series of prompts at each step of the modeling cycle. For "What Controls My Health, challenges to students' thinking were identified and specific prompts designed to help support students throughout the process. There are quite a few prompts to use to scaffold modeling in the instructional sequence of every lesson, so in this section, we provide a background and rationale for their use.

Below is a table that shows the cognitive and metacognitive challenges that were identified and the prompts that were designed *for teachers to use in discussion* **to scaffold students' thinking at each stage of the modeling cycle. Some of the generic challenges are about science content (domain-general challenges) and some are specific to learning about diabetes and gene-environment interaction (domain-specific challenges). Some prompts were designed as generic for domain-general challenges, and some were designed as context-specific for domain-specific challenges. Here are some definitions to clarify terms:**

- **Cognitive scaffolds – scaffolds aimed at supporting skills necessary to encode, memorize, and recall information**
- **Metacognitive scaffolds – scaffolds aimed at supporting skills that enable learners to understand and monitor their cognitive processes.**
- **Generic scaffolds – scaffolds aimed at supporting a general understanding of the framework for modeling regardless of the science content area**
- **Context-specific scaffolds – scaffolds aimed at supporting an understanding of the context-specific modeling task, and the content knowledge to be used**

Students' challenges (*cognitive* or *metacognitive*)	Generic prompts	Context-specific prompts
Planning		
Identifying what they know abou the phenomenon that needs to b integrated into the models (*metacognitive*)		What is the question you are trying to answer about Monique' diabetes? What are the components of you model about Monique's Type II diabetes? Make a list!
Identifying measurable components to be included in th model (*cognitive*)	Why is it necessary to have quantitative components? How can you find out if the components are quantitative?	Are the components quantitative Can they answer the question HOW MUCH of this component affects Monique's diabetes?

Categorizing the components tha needed to be included in the model (*cognitive*)	**Why is it important to categorize the components? How can you categorize them?**	**Do the components have something in common? Can they be organized into categories, suc as genetic or environmental factors?**
Building		
Organize the components and th relationships between them on their actual models (*cognitive*)		**How are the components related How do they affect Monique's diabetes? Describe the relationships between the components.**
Identifying the direction of cause and effect relationships between the components (cognitive)	**How are cause and effect relationships between components represented in models? What does the direction of the arrow represent?**	**What are the cause and effect relationships between the components in your model? Do the arrows in your model represent correctly the causes ar effects of Monique's diabetes?**
Testing		
Identifying errors in their model (*metacognitive & cognitive*)		**Does your model make sense? Does your model explain the causes and effects of Monique's diabetes?** **Are there any components missing? Are the relationships correct?**
Revising		
Identifying their new knowledge and how it relates to the phenomenon (*metacognitive*)		**Think about what you just learned about type II diabetes: What new components should b added to your model? How do they relate to the other components?**
Identifying the components and relationships to be added to the models (*cognitive*)		
Using the feedback (provided by teacher or peers) to revise their models to better capture the mechanism underlying the process of diabetes (*metacognitive*)		**What feedback did you receive about your model? How can you use the feedback to improve you model to better explain Monique's diabetes? What needs to be changed?**

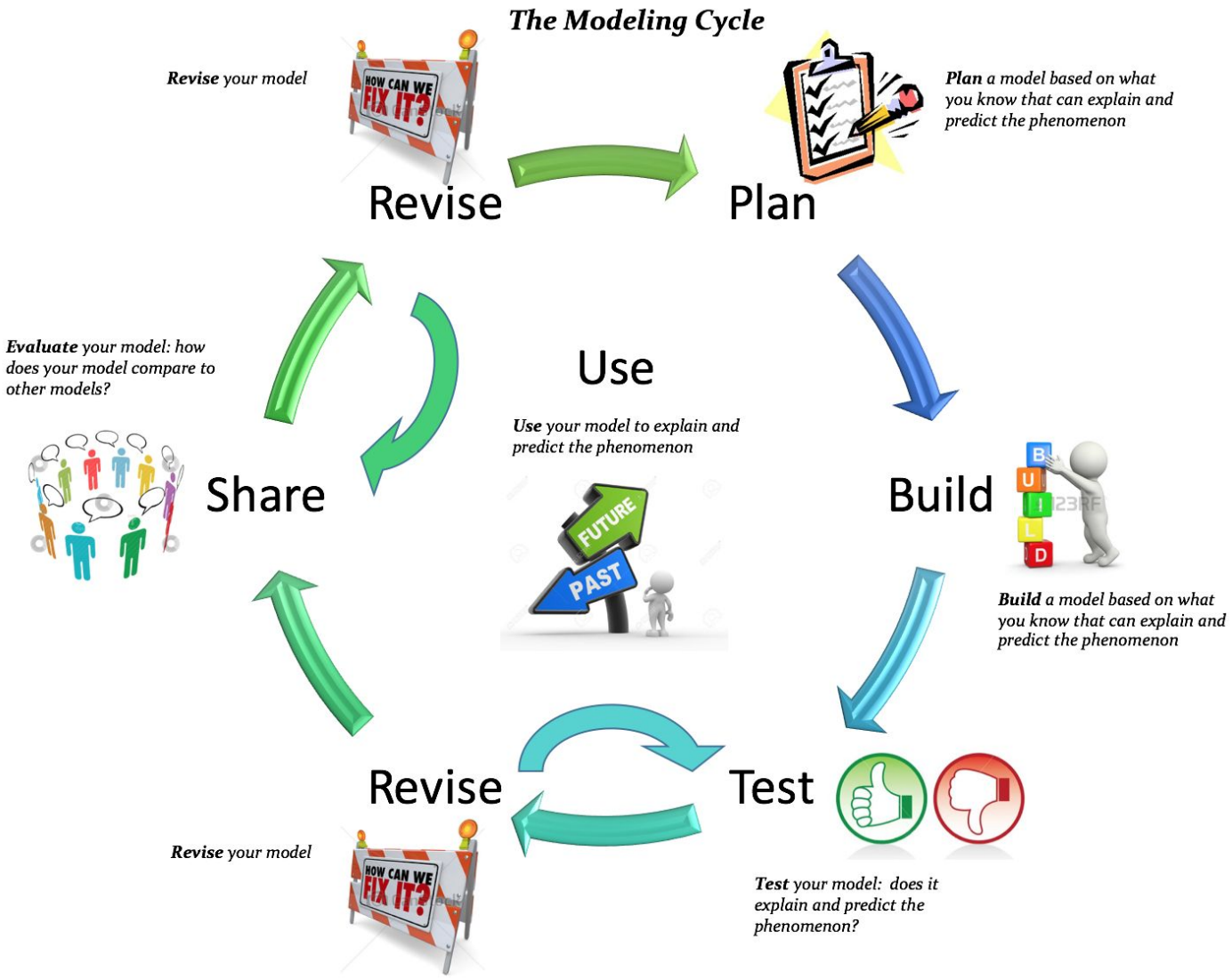
Using insights from other students' models to revise and improve their own (*metacognitive*)		**Look at other models of Monique's diabetes: How are the similar or different than yours? Are the ways they explain Monique's diabetes better? How can you use them to improve you own model?**
Sharing		
Communicating their models no only by describing the components and the relationshi between them, but also by providing an overview of the gene-environment interactions that lead to diabetes (*cognitive*)		**What question about Monique's diabetes is your model trying to answer? Why does Monique have diabetes according to your model?**
Providing feedback to their peer on the core aspects of modeling t help them improve their models (*cognitive*)	**What are the core ideas of models?**	**Does the model explain and predict Monique's diabetes?**

Developing your model

Definitions:

- A **phenomenon** is a fact or situation that we can observe, explain and predict.
- A **model** is a visual representation of a phenomenon. A model explains and predicts a phenomenon.

The modeling cycle:



CREATE for STEM Institute

HealthInOurHands

Why does Monique have diabetes?

Step 1: Planning

1. What is the question you are trying to answer about your ***Monique's diabetes***? What **new information** did we learn about diabetes?

_____

_____

2. What are the **new** components of your model that will explain Monique's diabetes? Make a list!

_____

_____

_____

3. Be sure to use components that can answer the question HOW MUCH - do they increase or decrease Monique's diabetes?.
4. Can the components be organized into categories? Categorize them!

Categories:					
Components:	_____	_____	_____	_____	_____

Step 2: Building

Open SageModeler and start developing your model
https://concord.org/projects/building-models

1. Use components from your list - you can add/omit components
2. Choose pictures to express each component
3. How are the components related? Use the arrows to describe the relationships (cause to effect).

Step 3 & 4: Testing and Revising

Make sure that:

- ❑ Does your model make sense? Does your model explain why Monique has diabetes? Does your model explain the causes and effects of Type 2 diabetes?
- ❑ Are any components missing? Are the relationships correct?

Revise your model if necessary!

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Step 5: Sharing

1. Explain your model - what question about diabetes is your model trying to answer?

_____

2. Why does Monique have diabetes according to your model?

_____

_____

_____

Step 6: Revising

1. What feedback did you receive about your model? How can you improve your model to better explain diabetes? What needs to be changed?

_____

_____

_____

2. Look at other models of Monique's diabetes: How are they similar or different than yours? Are the ways they explain Monique's diabetes better? How can you use them to improve your own model?

_____

_____

_____

Thinking About My Model

1. Score your model - How well does your model explain why Monique has Type 2 diabetes?

Circle score (1=not well, 6=very well)
1 2 3 4 5 6

Explain your score: _____
_____
_____

2. Was it easy to think of the **new components** and the **relationships** that you should add to your model to explain and predict Monique's diabetes?

Circle score (1=not at all, 6=very much)
1 2 3 4 5 6

How did you think of them? _____
_____
_____

3. Did the class discussion about the models help you improve your own model about Monique's diabetes?

Circle score (1=not at all, 6=very much)
1 2 3 4 5 6

Why? What changes did you make to your model following the class discussion?_____
_____
_____

4. When you are asked to model a phenomenon, what should you do? (*hint - look at the modeling cycle*)
_____
_____
_____
_____
_____
_____
_____

Photovoice Participant Worksheet- SHOWED

1) What do you **S**EE here?

2) What's really **H**APPENING here?

3) How does this relate to **O**UR lives?

4) **W**HY does this problem, concern, or strength exist?

5) How can this image **E**DUCATE the community policy makers, others?

6) What can we **D**O about it?

Adapted from materials produced by Erin Seedorf, University of Colorado Cancer Center

My name: _____

Thinking about my community project:

Something I learned about my health:_____
_____
_____

Something I learned about science: _____
_____
_____

Something I learned about myself: _____
_____
_____

Something I learned about my community/school: _____
_____
_____

1. **How much did you like doing the community project?**

1= not at all									10= very very much!
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**

Why? _____
_____
_____
_____

2. **Would you like to conduct another community project?**

1= not at all									10= very very much!
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**

Why? _____
_____
_____
_____

Health in Our Hands:
What controls our health?

Community projects guidelines April, 2017

The classes are listed in the following order:

1. Scott Davis
2. Sue Anderson
3. Catanja Harrison
4. Melanie Hemphill
5. Robyn Seelye
6. Annette Sparks
7. David Sutton
8. Bryan Yuille
9. Darlene McClendon
10. Kathy Savoie
11. Tom Lafferty

1. Scott Davis: How does raising awareness to the importance of eating healthy food using a Rap song affect children's food choices?

To answer this question, the students will conduct an experiment:

<table>
<tr><th>Before</th><th>Experiment</th><th>After</th></tr>
<tr><td>Learn about how to choose healthier foods by reading food labels (Lesson 6 activity 1)

Students' observations – take pictures of what the students have for breakfast/lunch.</td><td rowspan="3">Interview a local rapper/ poet from the community – interview a local artist to understand the process of writing a rap song. For example:
1. When did he start writing?
2. Why does he write?
3. What does he usually write about? Why?
4. How does he think of the lyrics?
5. How does he think of the music?
6. How did he decide to work in this field?

Maybe let him help writing the song?
Videotape + take pictures of the students with the artist!!

Designing and conducting the experiment:
1. The students will write a rap song which explains the mechanism of diabetes, and how the genes and the environment play a role in its development. Start by using student models of diabetes. Brainstorm before they write the song. Use the model to describe how we can control our health and use as many terms as possible from the lessons.
2. The students will go into Sue's class OR a 5th grade class. They will introduce themselves and sing the rap song to the students.</td><td>Students' observations – take pictures of what the students have for breakfast/lunch.</td></tr>
<tr><td>Students' Interviews – Interview the students about their food choices. For example:
1. What do you usually have for breakfast/lunch?
2. Do you think about how healthy or unhealthy the food is? Why or why not?
3. Do you think about the consequences of the food that you eat on your body? Why?
4. Do you think that children your age have healthy eating habits? Why or why not?</td><td>Students' Interviews – Interview the students about their food choices. For example:
1. Did the rap song change something in your choice of food for breakfast/lunch? Why?
2. After hearing our song - do you think about how healthy or unhealthy the food is? Why?
3. After hearing our song - Do you think about the consequences of the food that you eat on your body? Why?
4. Do you think that our song can affects children's eating habits? Why?</td></tr>
<tr><td>Interview with a nutritionist/dietician – ask the dietician about students' eating habits and whether students' choices can be influenced:
1. What do children usually have for breakfast/lunch?
2. Do children think about how healthy or unhealthy the food is? Why?
3. Do children think about the consequences of the food that they eat on their body? Why?
4. Do you think that children's eating habits can be changed? What are potential barriers?
5. How can we change children's eating habits?
6. Can raising awareness to healthy eating affect eating habits?

Videotape + take pictures of the students with the dietician!!</td><td>Students' surveys – survey the students about their food choices. For example:
1. Did the rap song change something in your choice of food for breakfast/lunch? (3-4 choices, such as, No, I didn't change anything; no, but it made me think about picking something else; yes, I chose something healthier)
2. After hearing our song - do you think about how healthy or unhealthy the food is? (4 choices)
3. After hearing our song - Do you think about the consequences of the food that you eat on your body? (4 choices)
4. Do you think that our song can affects children's eating habits? Why? (4 choices)</td></tr>
</table>

2. Sue Anderson: How does raising awareness using advertisements to the consequences of eating fried food affect children's food choices?

To answer this question, the students will conduct an experiment:

<table>
<tr><th>Before</th><th>Experiment</th><th>After</th></tr>
<tr><td>Learn about how to choose healthier foods by reading food labels (Lesson 6 activity)

Students' observations and quick survey – Display two types of food in class – fried and baked – and ask the kids to tell which they would like to eat by raising their hands – take a picture and count the number of students.</td><td rowspan="3">Interview an advertiser / communication strategist from the community – interview a local advertiser / communication strategist to understand the process of advertisement. For example:
1. How do you think of an idea that could make a good advertisement?
2. How do you come up with a slogan?
3. Are the colors important?
4. Do you come up with the idea by yourself or do you work in a group?
5. How did s/he decide to work in this field?

Maybe let him or her help with creating the advertisements?
Videotape + take pictures of the students with the advertiser / communication strategist!

Designing and conducting the experiment:
1. The students will create advertisements and slogans which explains why baked food is better than oily food.
2. The students will go into the 5th grade class. They will introduce themselves and advertise baked food.</td><td>Students' observations and quick survey – Display two types of food in class – fried and baked – and ask the kids to tell which they would like to eat by raising their hands – take a picture and count the number of students.</td></tr>
<tr><td>Students' Interviews – Interview the students about their food choices. For example:
1. What do you usually eat - fried or baked food? Why?
2. Do you think about how healthy or unhealthy the food is? Why?
3. Do you think about the consequences of the food that you eat on your body? Why?
4. Do you think that children your age prefer fried or baked food? Why?</td><td>Students' Interviews – Interview the students about their food choices. For example:
1. Did the advertisements change your choice of fried or baked food? Why?
2. After listening to our advertisement - are you thinking more about how healthy or unhealthy the food is? Why?
3. After listening to our advertisement – are you thinking more about the consequences of the food that you eat on your body? Why?
4. Do you think that our advertisement can affects children's eating habits? Why?</td></tr>
<tr><td>Interview with a dietician – ask the nutritionist/dietician about students' eating habits and whether students' choices can be influenced:
1. What do children usually prefer – fried or baked food? Why?
2. Do children think about how healthy or unhealthy the food is? Why?
3. Do children think about the consequences of the food that they eat on their body? Why?
4. Do you think that children's eating habits can be changed? What are potential barriers?
5. How can we change children's eating habits?
6. Can raising awareness to healthy eating affect eating habits?

Videotape + take pictures of the students with the dietician!!</td><td>Students' surveys – survey the students about their food choices. For example:
1. Did the advertisements change something in your choice of food for fried or baked food? (3-4 choices, such as, No, I didn't change anything; no, but it made me think about picking something else; yes, I chose something healthier)
2. After listening to our advertisement -- do you think about how healthy or unhealthy the food is? (4 choices)
3. After listening to our advertisement -- Do you think about the consequences of the food that you eat on your body? (4 choices)
4. After listening to our advertisement - can affects children's eating habits? Why? (4 choices)</td></tr>
</table>

3. Catanja Harrison: How does watching TV and playing video games affect children's healthy lifestyle?

To answer this question, the students will use various methodologies:

Methodologies
Students' surveys – Survey the students about their hobbies and lifestyles. For example: 1. How many hours a day do you watch television or playing video games? (4 choices) 2. How many times a week do you play sports after school? (4 choices) 3. How many times a week do you meet with friends after school? (4 choices) 4. How many minutes do you walk outside during a day? (4 choices) 5. What do you prefer to do after school? (watch television / play video-games / hang around with friends / play outside)
Students' Interviews – Interview the students about their hobbies and lifestyles. For example: 1. How many hours a day do you watch television or play video games? Why? 2. How many times a week do you play sports after school? Why? 3. How many times a week do you meet with friends after school? Why? 4. How many minutes do you walk outside during a day? Why? 5. What do you prefer to do after school? (watch television / play video-games / hang around with friends / play outside) Why?
Observation in a playground – Go to the playground, and count how many children at the age that they are examining are outside playing.
Photo-voice – students create online journal of one day in their life, with emphasis on their afterschool activities. Students take pictures to show: What do young people do after school? What opportunities are there for exercise and sports? What are the challenges or barriers to exercise and sports afterschool? What can we do to help students to exercise and be more active after school? (these questions can be displayed on the poster board with the best pictures from the group.
Interview with a specialist in sports – ask about the effect of sports on our body: 1. Why is it important to do sports? Why? 2. What may be the consequences of not doing any sports? Why? 3. How many times a week is it recommended to do sports? Why? 4. How can we help students to exercise and be more active after school? 5. What sports are recommended for teenagers? **Videotape + take pictures of the students with the sports specialist!!**
Interview with a nutritionist/dietician – ask whether the choices we make about how to spend our free time affects our health 1. How do after school activities affect students' eating habits? 2. Does watching a lot of television and playing video game affect eating habits? 3. What are calories? 4. Do calories from different sources of food have the same effect on the body? 5. How many calories should teenagers eat per day? 6. How does sport affect the number of calories teenagers should eat per day? 7. How can we help students to exercise and be more active after school? **Videotape + take pictures of the students with the dietician!!**

4. Melanie Hemphill: How does access to healthy food stores affect healthy eating habits?

To answer this question, the students will use various methodologies:

Methodologies
Adults' surveys – Survey adults about access to food stores. For example: 1. Does your local grocery store have a lot of healthy food? (4 choices) 2. Do you think that your neighborhood has places to buy healthy food? (4 choices) 3. How far are you from a grocery store with healthy food? (minutes by walking and minutes by driving) 4. How much time would you be willing to get to a grocery store with healthy food? (minutes by walking and minutes by driving)
Adults' Interviews – Interview adults about access to food stores. For example: 1. Does your local grocery store have a lot of healthy food? (4 choices) 2. Do you think that your neighborhood has access to healthy food? (4 choices) 3. How far are you from a grocery store with healthy food? (minutes by walking and minutes by driving) 4. How much time would you be willing to spend on your way to a grocery store with healthy food? (minutes by walking and minutes by driving) 5. What would help you buy more healthy food?
Observation in a food store – Go to a grocery store and examine which types of food are sold in the store **–** Are there many types of healthy food? Are there many types of unhealthy foods? What are the prices of healthy and unhealthy foods?
Photo-voice – students create online journal of one day in their life, with emphasis access to food stores. With adults, the students will video-tape the way from their home to a grocery store, and reflect on their way: What kind of food is available (accessible) in my neighborhood? What would help people in my neighborhood buy healthier food? What are barriers to buying food in my neighborhood? What types of food does the store offer? What are the prices of the healthy food versus the prices of unhealthy food? (these questions can be displayed on the poster board with the best pictures from the group.
Google map – use a map to highlight where big grocery stores are in located in Flint. Is there a store in each neighborhood? How much time is the walking/driving distance? Is there public transportation to all these stores? Are there neighborhoods who do not have access to these stores?
Interview a store owner – Interview a store owner to understand more about types of food available in the local community – 1. Which types of food do you have in your store? Why? 2. Which types of food do people mostly buy? 3. Is there a price difference between healthy and non-healthy food? Why? 4. Do people ask for healthier food? 5. Is the healthy food in your store in a front easily accessed area? 6. Do you think people in Flint's neighborhoods have access to healthy food? **Videotape + take pictures of the students with the store owner!!**
Interview the mobile grocery store owner – 1. Which types of food do you have in your store? Why? 2. Which types of food do people mostly buy? 3. Is there a price difference between healthy and non-healthy food? Why? 4. Do people ask for healthier food? 5. Is the healthy food in your store in a front easily accessed area? 6. Do you think people in Flint's neighborhoods have access to healthy food? **Videotape + take pictures of the students with the store owner!!**
Interview an urban planner - 1. What does an urban planner do? 2. Does access to healthy food play a role when planning a city? 3. What are potential barriers that may prevent people from buying healthy food?

4. How can a city plan encourage people to buy healthy foods? **Videotape + take pictures of the students with the urban planner!!**

5. Robyn Seelye:
(1) How does showing students the amount of sugar they eat in the morning affect their food choices the next day?
(2) How does eating chocolate affect students' energy levels?

Robyn, I suggest you choose **one** question for the entire class, and use many methodologies. I will layout the first question, and then we can discuss it. If you decide you want 2 questions, I can help with guidelines for the second questions as well. **An additional suggestion you could examine this question along age group and see if you get different results in different age groups. That way you have double the number of research methods that are listed in the table below.**

To answer this question, the students will conduct an experiment:

Before	Experiment	After
Students' observations and quick survey – Display different types of food in class that differ by the amount of sugar in them. Ask the kids to tell which they would like to eat by raising their hands. Take a picture and count the number of students for each product.	**Designing and conducting the experiment**: 1. The students will create posters indicating the amount of sugar in different products. 3. The students will go into a class. They will introduce themselves and explain about the amount of sugar in the different types of food. ****Robyn** – we have a ready-made activity about too much sugar in different types of food. You can either have the students prepare their own activity, or we can bring you ours. If you want it – just ask for it! **	**Students' observations and quick survey** – Display different types of food in class that differ by the amount of sugar in them. Ask the kids to tell which they would like to eat by raising their hands. Take a picture and count the number of students for each product.
Students' Interviews – Interview the students about their food choices. For example: 1. What do you usually eat – not sweet-sweet-very sweet? Why? 2. Do you think about how healthy or unhealthy the food is? Why? 3. Do you think about the consequences of the food that you eat on your body? Why? 4. Do you think that children your age prefer fried or baked food? Why?		**Students' Interviews** – Interview the students about their food choices. For example: 1. Did knowing the amount of sugar in each food type change something in your choice of the food? Why? 2. Does knowing the amount of sugar in each product make you think how healthy or unhealthy the food is? Why? 3. Does knowing the amount of sugar in each product make you think about the consequences of the food that you eat on your body? Why? 4. Do you think that knowing the amount of sugar in each type of food affect children's eating habits? Why?
Interview with a nutritionist/dietician – ask about students' eating habits and whether students' choices can be influenced: 1. Do children think about how healthy or unhealthy the food is? Why? 2. Do children think about the consequences of the food that they eat on their body? Why? 3. Do you think that children's eating habits can be changed? What are potential barriers? 4. How can we change children's eating habits? 5. Can raising awareness to healthy eating affect eating habits?		**Students' surveys** – Interview the students about their food choices. For example: 1. Did knowing the amount of sugar in each food type change something in your choice of the food? (4 choices) 2. Does knowing the amount of sugar in each product make you think how healthy or unhealthy the food is? (4 choices) 3. Does knowing the amount of sugar in each product make you think about the consequences of the food that you eat on your body? (4 choices)

Videotape + take pictures of the students with the dietician!!		4. Do you think that knowing the amount of sugar in each type of food affect children's eating habits? (4 choices)

6. Annette Sparks: How does … in the school's cafeteria affect students' food choices?

Annette, I am still not sure of what intervention you will be doing with the students. Basically, your research will look something like Sue's and Scott's – I copied their table below with some changes. . After you tell me what is the exact inquiry question is – I can fill the table accordingly.

To answer this question, the students will conduct an experiment:

Before	Experiment	After
Observation in the cafeteria -	**Designing and conducting the experiment**: ??....	**Observation in the cafeteria -**
Weighting food in the cafeteria -		**Weighting food in the cafeteria -**
Students' Interviews – Interview the students about their food choices. For example: 1. What do you usually eat … food? Why? 2. Do you think about how healthy or unhealthy the food is? Why? 3. Do you think about the consequences of the food that you eat on your body? Why? 4. Do you think that children your age prefer fried or baked food? Why?		**Students' Interviews** – Interview the students about their food choices. For example: 1. Did … change something in your choice of fried or baked food? Why? 2. After … - do you think about how healthy or unhealthy the food is? Why? 3. After … - Do you think about the consequences of the food that you eat on your body? Why? 4. Do you think that our …can affects children's eating habits? Why?
Interview with a dietician – ask the dietician about students' eating habits and whether students' choices can be influenced: 1. What do children usually prefer – … food? Why? 2. Do children think about how healthy or unhealthy the food is? Why? 3. Do children think about the consequences of the food that they eat on their body? Why? 4. Do you think that children's eating habits can be changed? What are potential barriers? 5. How can we change children's eating habits? 6. Can raising awareness to healthy eating affect eating habits? **Videotape + take pictures of the students with the dietician!!**		**Students' surveys** – Interview the students about their food choices. For example: 1. Did the … change something in your choice of food …? (4 choices) 2. After …. - - do you think about how healthy or unhealthy the food is? (4 choices) 3. After … - - Do you think about the consequences of the food that you eat on your body? (4 choices) 4. After … - can affects children's eating habits? Why? (4 choices)

7. David Sutton: ??

8. Bryan Yuille: How does knowledge about the causes and effects of diabetes affect students' food choices across different ages?

Before	Experiment	After
Students' observations – Enter the 5 classes that participate in the experiment while they are eating breakfast. Take pictures of the students and of their food choices. Make sure to include various grade levels.	**Designing and conducting the experiment**: 1. The students will divide into teams and select to which grade do they want to examine and why? 2. The students will create presentations which demonstrate what they learned in the unit. This might include students' model, and other artifacts. 3. Each team will go into a class. They will introduce themselves and present to the class.	**Students' observations** – Enter the same 5 classes that participated in the pre-experiment while they are eating breakfast. Take pictures of the students and of their food choices. Make sure to include various grade levels.
Students' Interviews – Interview the students about their food choices. For example: 1. What do you usually eat for breakfast? Why? 2. Do you think about how healthy or unhealthy the food you eat for breakfast is? Why? 3. Do you think about the consequences on your body of the food that you eat? Why? 4. Do you think that children your age make healthy food choices for breakfast? Why?		**Students' Interviews** – Interview the students about their food choices. For example: 1. Does knowing the causes and effects of diabetes change something in your choice of the food for breakfast? Why? 2. Does knowing the causes and effects of diabetes make you think how healthy or unhealthy the food is? Why? 3. Does knowing the causes and effects of diabetes make you think about the consequences of the food that you eat on your body? Why? 4. Do you think that knowing the causes and effects of diabetes affect children's eating habits? Why?
Interview with a nutritionist/dietician – ask about students' eating habits and whether students' choices can be influenced: 1. Do children think about how healthy or unhealthy the food they eat is? Why? 2. Do children think about the consequences of the food that they eat on their body? Why? 3. Do you think that children's eating habits can be changed? What are potential barriers? Are younger or older children easier to convince to change eating habits and food choices? 4. How can we change children's eating habits and food choices? 5. Can understanding the causes and effects of diabetes affect children's eating habits and food choice? Do you think that it might be dependent on the students' age? **Videotape + take pictures of the students with the dietician!!**		**Students' surveys** – Interview the students about their food choices. For example: 1. Does knowing the causes and effects of diabetes change something in your choice of the food for breakfast? (4 choices) 2. Does knowing the causes and effects of diabetes make you think how healthy or unhealthy the food is? (4 choices) 3. Does knowing the causes and effects of diabetes make you think about the consequences of the food that you eat on your body?? (4 choices) 4. Do you think that knowing the causes and effects of diabetes affect children's eating habits? (4 choices)

9. Darlene McClendon: How does raising awareness to the risk factors of diabetes using literature and song affect children's choices of food and physical activity?

Before	Experiment	After
Students' observations – Enter the 5 classes that participate in the experiment while they are eating breakfast. Take pictures of the students and of their food choices. Make sure to include various grade levels.	**Designing and conducting the experiment**: 4. The students will divide into teams and select to which grade do they want to examine and why? 5. The students will create presentations which demonstrate what they learned in the unit. This might include students' model, and other artifacts. 6. Each team will go into a class. They will introduce themselves and present to the class.	**Students' observations** – Enter the same 5 classes that participated in the pre-experiment while they are eating breakfast. Take pictures of the students and of their food choices. Make sure to include various grade levels.
Students' Interviews – Interview the students about their food choices. For example: 5. What do you usually eat for breakfast? Why? 6. Do you think about how healthy or unhealthy the food you eat for breakfast is? Why? 7. Do you think about the consequences on your body of the food that you eat? Why? 8. Do you think that children your age make healthy food choices for breakfast? Why?		**Students' Interviews** – Interview the students about their food choices. For example: 5. Does knowing the causes and effects of diabetes change something in your choice of the food for breakfast? Why? 6. Does knowing the causes and effects of diabetes make you think how healthy or unhealthy the food is? Why? 7. Does knowing the causes and effects of diabetes make you think about the consequences of the food that you eat on your body? Why? 8. Do you think that knowing the causes and effects of diabetes affect children's eating habits? Why?
Interview with a nutritionist/dietician – ask about students' eating habits and whether students' choices can be influenced: 6. Do children think about how healthy or unhealthy the food they eat is? Why? 7. Do children think about the consequences of the food that they eat on their body? Why? 8. Do you think that children's eating habits can be changed? What are potential barriers? Are younger or older children easier to convince to change eating habits and food choices? 9. How can we change children's eating habits and food choices? 10. Can understanding the causes and effects of diabetes affect children's eating habits and food choice? Do you think that it might be dependent on the students' age? **Videotape + take pictures of the students with the dietician!!**		**Students' surveys** – Interview the students about their food choices. For example: 5. Does knowing the causes and effects of diabetes change something in your choice of the food for breakfast? (4 choices) 6. Does knowing the causes and effects of diabetes make you think how healthy or unhealthy the food is? (4 choices) 7. Does knowing the causes and effects of diabetes make you think about the consequences of the food that you eat on your body?? (4 choices) 8. Do you think that knowing the causes and effects of diabetes affect children's eating habits? (4 choices)

10. Kathy Savoie: How does a fun "hands-on" activity of planting vegetables affect awareness to the importance of eating vegetables and eating habits?

To answer this question, the students will conduct an experiment:

Before	Experiment	After
Learn about how to choose healthier foods by reading food labels (Lesson 6 activity 1)	**Plan the activity in class –** Show the students pictures of bottle containers from the internet. Plan how the class is going to carry out the activity – which grade (I would recommend 4th grade so the kids are not too young to carry out the activity and answer the questions about their experience)? Will they be working with the kids in pairs (team up 6th grader with the younger student)? Will they be working in small groups? What should they do? Maybe even do one plant in the class with the entire class so they know what to do. For the activity to affect the students' awareness, maybe have the students think of short slogans that express the importance of eating vegetables and fruits. These slogans can be written on the containers or on little notes in the plants:  **Write down the plan to present at the final presentation!** **Carry out the activity –** After a short introduction between the kids, start the activity. **Take pictures of the pairs/teams as they work together for the final presentation. Take pictures of the kids with their plants or/and a group picture.**	**Students' Interviews** – Interview the students about their food choices. For example: 1. Did the plant activity affect your knowledge about the importance of eating fruits and vegetables? Why or why not? 2. After doing the plant activity –do you eat more fruits and vegetables? Why or why not? 3. After doing the plant activity – do you think about how healthy or unhealthy the food is? Why or why not? 4. After doing the plant activity –do you think about the consequences of the food that you eat on your body? Why? 5. Do you think you will try any of the foods that you planted?
Students' Interviews – Interview the students about their awareness to the importance of eating fruits and vegetables and their eating habits: 1. Why is it important to eat fruits and vegetables? 2. Do you like to eat fruits and vegetables? How many fruits and vegetables do you eat during a day? 3. Do you think about how healthy or unhealthy the food is? Why or why not? 4. Do you think about the consequences of the food that you eat on your body? Why? 5. Do you like to try new foods?		
Interview with a nutritionist/dietician – ask the dietician about students' eating habits and whether students' choices can be influenced: 1. Do children like to eat fruits and vegetables? Why? 2. Why is it important to eat fruits and vegetables? 3. How many fruits and vegetables should children eat per day? Per week? 4. Do children think about how healthy or unhealthy the food is? Why? 5. Do children think about the consequences of the food that they eat on their body? Why? 6. Do you think that children's eating habits can be changed? What are potential barriers? 7. How can we get children to try new foods? 8. Can raising awareness to healthy eating affect eating habits? **Videotape + take pictures of the students with the dietician!!**		**Students' surveys** – survey the students about their food choices. For example: 1. Did the plant activity change your knowledge about the importance of eating fruits and vegetables? (3-4 choices, such as: not at all; not much; a little; a lot) 2. Did the plant affect the number of vegetables and fruits you eat in a day? (3-4 choices) 3. Did the plant affect the way you think about how healthy or unhealthy the food is? (3-4 choices) 4. Did the plant affect the way you think about the consequences of the food that you eat on your body? (3-4 choices)