UWGSEO
GENOME SCIENCES EDUCATION OUTREACH

Health, Nutrition, and Type 2 Diabetes

Genome Sciences Education Outreach
UNIVERSITY OF WASHINGTON | VERSION 02.18

Lesson 1

Genes and the Environment

Time: 50 min

Lesson Objectives:
Students will be able to answer:

- Are most traits determined by genetic factors, environmental factors, or both?
- What are three environmental factors that impact health?

Prerequisite Knowledge
Students should have an understanding of the following terms: trait, gene, genetic factor, environmental factor

Overview

This lesson begins with an introduction to the themes explored in the unit through student participation in a Silent Chalk Talk conversation. Students then consider how health is influenced by both genetic and environmental factors. They discuss how these factors contribute to complex health conditions including type 2 diabetes, and develop an expanded understanding of what is considered an environmental factor for diseases like diabetes.

Enduring Understandings

Most traits are determined by a combination of genetic and environmental factors, including complex diseases like type 2 diabetes.

Type 2 diabetes is a complex condition that is heavily influenced by environmental factors such as access to resources, personal choice, product marketing, public policy, socio-economic status, and stress.

Essential Question:

How do genetics and environment play a role in our health?

Lesson Summary with Timings

Chalk Talk: Introduction to the unit	15 min
Nature vs Nurture continuum with sticky notes	10 min
Discussion: Where does the sticky note go?	15 min
Video: Lost in translation	10 min
Homework: Family tree of eating habits	

Health and Physical Education Standards

Through this lesson, students will gain competency towards the following standards:

Nutrition

5. **Disease Prevention:** Analyze and describe the relationship between nutritional choices, physical activity, and chronic diseases. H1. N5.HS

Wellness

1. **Dimensions of Health:** Analyze personal dimensions of health and design a plan to balance health. H1.W1.HS
2. **Disease Prevention:** Analyze prevention, lifestyle factors, and treatment of communicable and non-communicable diseases. H2.W2.HSa

   Assess personal risk factors and predict future health status. H2.W2.HSb
3. **Analyzing Influences**: Analyze how a variety of factors impact personal and community health. H2.W3.HS

Materials

Materials	Quantity
PowerPoint slide set for the unit, found at http://gsoutreach.gs.washington.edu/GEMNet	
Video clip #10 *Lost in Translation* from The Bigger Picture http://youthspeaks.org/thebiggerpicture/home/	
Continuum	1 per class
Chalk Talk poster instructions	1 per class
Chalk Talk Rules of Participation	1 per class
Large pieces of butcher paper or easel pad paper for Chalk Talk	6 per class
Colored markers for writing on Chalk Talk posters (3 x 6 posters)	18
Sticky notes	3-5 per student
Student Sheet 1: *Family Tree of Eating Habits*	1 per student
Looking ahead: Lesson 4 requires having a selection of food and beverage labels with nutritional information on hand for students to use. Ask students to bring in food labels from home or provide the labels for them.	

Procedure

Part I Engage Silent Chalk Talk: Introduction to the Unit (15 minutes)

Teacher Background: In Silent Chalk Talk, students explore and share their thoughts and ideas about how both genes and the environment influence type 2 diabetes by silently responding in writing to statements, questions and pictures posted on the classroom walls. The goal for this written (silent) conversation is that all students are given an equal voice, remarks are as anonymous as possible, and students feel safe to express their thoughts and feelings. Through the posters, students will get a sense of the breadth of topics about diabetes this curriculum will address. The posters should remain up around the room for the duration of the unit. Students will get a chance to add to the posters in subsequent lessons, allowing for an evolution of thought. Create the posters from the Teacher Resource--Silent Chalk Talk Posters using large blocks of butcher paper or easel pads. Be sure to leave enough space for students to add their comments over three to four days. If possible, use one color of marker per poster for each day. By doing so, student comments will be more anonymous and different colors will show whether a comment was written early in the unit or later in the unit.

Instructions:

1. Tell students that the class is beginning a unit that explores how both genes and the environment influence our health, and the focus of the unit will be on type 2 diabetes.
2. Show students the six posters placed around the room. Each explores a different aspect of type 2 diabetes, including social factors that contribute to the condition.
3. Before letting the students respond, read through each poster with students and ask for clarifying questions. Be careful to not discuss any opinion or give any information that may change students' responses. Merely ensure that they

understand what the questions or statement is addressing. It is important to leave this as vague as possible to allow for students to identify their own preconceived notions and/or misconceptions and to allow for evolution of thought throughout the lessons.

Field Test Q: Would a whole class consensus model be better than individual models?

4. Make sure that students understand that after contributing to each poster, they should return to their seats and draw a model or picture that illustrates the causes of type 2 diabetes. Students will return to and revise this picture during the unit.
5. Post and review rules of participation in a silent chalk talk from Teacher Resource -- Silent Chalk Talk Rules of Participation.
6. Give students 10 minutes to contribute to each poster at least once, either by responding to the primary comment on the poster, or responding to other students' comments.
7. Explain to students that they will be using these posters to continue a conversation over the next few days.

Part II Engage Nature vs Nurture 10 minutes

Teacher Note: The purpose of this exercise is to begin the conversation about the interplay of genetic and environmental factors, not to definitively answer where each should go on the continuum, many of which are not settled in the scientific and health care communities. The term "environment" is used quite broadly and encompasses factors such as access to resources, personal choice, and both the physical environment and the emotional/social environment. While there are many conditions that are very strongly tied to genes (i.e. Huntington's disease, in which just one copy of the altered gene can cause the condition) many common conditions are the result of a complex interplay between genes and environment. A torn knee ligament, for example, often has an environmental trigger such as stress caused by downhill skiing or playing football. Furthermore, even the same type of cancer can have a variety of causes. With breast cancer, for example, a person who inherits a mutated BRCA 1 or 2 gene has a stronger genetic tie to the condition. However, most new breast cancer diagnoses are to people who have no mutation in those genes and the condition is therefore thought to have a stronger tie to environmental factors.

8. Draw a large continuum in the front of the classroom, labeled as shown below.

Genes Environment

9. Project the following list of conditions that affect a person's health for the class.

Word List:

Alcohol Dependency	Methamphetamine Addiction
Alzheimer's Disease	Malaria
Gunshot wound	Stress
Breast Cancer	Torn Knee Ligaments
Huntington's Disease	Type 1 Diabetes
Type 2 Diabetes	Ebola
Mental Illness	Small pox

Please add any other things that you talk about in health class—add eating disorders?

10. Have students choose 3-5 conditions to write on a sticky note, one condition per note.
11. Ask students to attach the sticky note to the continuum in the place that best represents their understanding of whether the causes are mainly genetic, environmental, or somewhere in between.
12. Discuss where students placed their sticky notes. See if there is any consensus for a certain condition, and make sure to talk about the conditions that were left on the list and not represented on the continuum.

This activity could also be done as a 4 corners exercise. To do so, put a sign in each corner of the room representing a continuum from Genes to Environment. Read each health condition one at a time and let students move to the corner of the room that best represents their view for that condition. Give students in the same corner time to discuss their views before reporting back to the class. It may be helpful to stand next to any student representing a lone view and support that student. Keep the activity moving by not spending too much time on any one condition.

13. Leave up the continuum for the next few days, if possible. We will return to the placement of the sticky note representing type 2 diabetes.

Part III (Explain) Where does the sticky note go? 15 min

14. In pairs or small groups, have students brainstorm ways that one can determine if a condition is more strongly influenced by genes or the environment.
15. Have groups contribute to a class list, ultimately including the following points:

Conditions determined primarily through genes:

- Tend to run in families through Mendelian inheritance patterns. If students have studied Punnett squares in science, remind them of genetic inheritance. There are genetic conditions that result from changes to just one gene, such as Huntington's disease.
- Show more of a correlation in identical twins as compared to non-identical twins.
- Have one or more specific genes that increase susceptibility to a condition when variations occur in those genes.

Is ethnicity a genetic factor? It is true that some conditions, like type 2 diabetes, are more prevalent in certain ethnic groups within the United States. Culture, social conditions, and other environmental factors are also strongly tied to ethnicity.

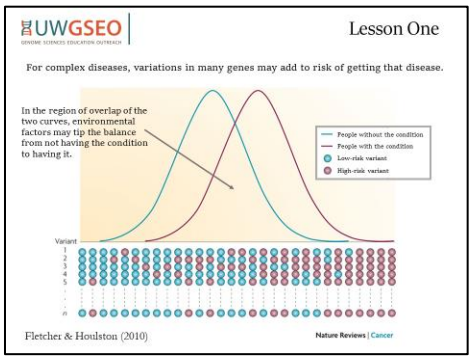
Conditions determined primarily through the environment may be caused by:

- Exposure to known toxins such as asbestos, hydrogen fluoride, or mustard gas.
- Contagions such bacteria, viruses, or fungus
- Damage done through physical impact

Conditions determined through a combination of genes and environment might be influenced by the following factors:

- The condition is determined by variations in many genes. Each gene variant may make a relatively small contribution to the total risk (or benefit) for that condition. All of the associated genes taken together may give a person a higher or lower genetic risk for that condition. For example, there are over 150 gene variants that have been associated with type 2 diabetes. However, none of them individually correspond a very high risk. Slide 3 helps to illustrate this concept.

Slide 3



- Nutrition: This varies from excellent to poor depending on the quality and amount of food a person eats
- Health care: Access to health care; whether there are barriers preventing people from receiving appropriate care and prevention
- Toxins: Environmental toxins, naturally occurring and those occurring from manufacturing
- Air quality: This includes poor air quality due to pollution from cars, dust storms, chemical sprays, etc., as well as good air quality that is free from these contaminants
- Exercise: Whether a person gets routine exercise
- Food access: A person's access to healthy food options within their communities
- Public spaces: Access or lack of access to sidewalks, parks, bike lanes
- Sanitation: Access to sewage and garbage disposal systems within the community, clean water supply, clean toilets
- Stress levels: Higher levels of stress contribute to poor health
- Sleep: Lack of sleep may contribute poor health

16. Tell student that the class will be exploring the complexity involved in this genes/environment question through a condition affecting our communities more and more: type 2 diabetes.

17. Ask students: From a public health perspective, where can we have the most impact—addressing genetic factors or environmental?

Part IV **Video: Lost in Translation** **10 min**

18. Tell students that teasing apart the genetic and environmental components of health is especially difficult because both genes and culture get passed on through families.
19. Ask students to think about ways that their family or friends share gestures of affection through food. What kinds of foods are offered in those gestures?
20. Watch the video #10 *Lost in Translation* produced by TheBiggerPicture.org and found here: https://www.youtube.com/watch?v=VrpR1LlF8Rs or here: http://youthspeaks.org/thebiggerpicture/home/

Lost in Translation,

Yosimar Reyes

Are there other/better videos to show? Depends on school audience? Message?

Closure

21. After watching the video, return to the continuum and class-compiled list from Part II and talk about ways in which anything might change, or how genetic and environmental factors apply to the video.

Homework

Please assign Student Sheet 1: *Family Tree of Eating Habits* as homework or give students time in class to complete their family tree (actual or fictional). This worksheet will be revisited in Lesson 3.

Students could continue to work on the picture they started during Chalk Talk for homework.

Extensions

The Bigger Picture organization offers a treasure trove of videos. Have students watch different videos and choose a favorite to share with a group tomorrow

Create an avatar (HeroForge.com?) - choose a strength and a weakness for your avatar, and come up with a (goal-setting) plan to implement strategies to achieve a personal health goal. (H6.W7.HS) or (**Decision-Making)** Predict potential short- and long-term outcomes of a personal health-related decision. H5.W6.HS

If students/teachers are interested in achieving a personal health goal, there are a lot of free **food tracker apps** available

YouAte: Students take pictures of what they eat during the day. No focus on calories per se, but a photo journal of intake. (Free; iTunes)

GoMeals lets you effortlessly track what you eat — whether that's at home or at a restaurant — as well as your activity levels. And if you have a condition like diabetes, there's also a section specifically for keeping track of your blood glucose levels.

MyPlate: Search the database of over 625,000 foods and 1,500 fitness items to track your daily caloric intake and burn. You can track your calories over time, write in your online food diary, watch a live food tracking app for users all over the country, and get calorie and exercise breakdowns. (Free; iTunes)

(more found here: http://www.redbookmag.com/body/healthy-eating/advice/g614/lose-weight-apps-tools/?slide=14)

Silent Chalk Talk Posters

Re-create these posters on large pieces of butcher paper or sticky notes. If possible, provide a different color marker each day students respond to the prompts.

<table>
<tr>
<td>Star the statement that best represents your view and write why.

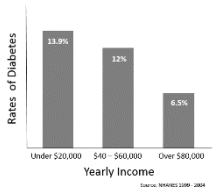
“All the health data show that we’re getting fatter and sicker as a country, but I don’t think a simple lack of willpower is the main problem. We need to stop talking about individual behavior around diet and exercise. We need to focus on the social conditions that are making people unhealthy.”

“People need to choose more activity, less screen time, and decide to eat in a healthy way. In the end, we are responsible for the lives we lead.”

(See teacher resource for copy master)</td>
<td>What causes type 2 diabetes?

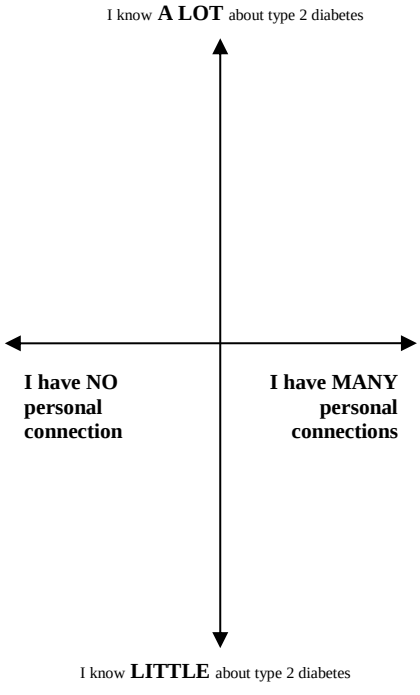
When finished with the Chalk Talk posters, return to your seat and draw/revise your own picture that illustrates the causes of type 2 diabetes.

(See teacher resource for copy master)</td>
<td>What does this graph mean to you?

(See teacher resource for copy master)</td>
</tr>
<tr>
<td>Type 2 diabetes can be prevented or controlled by…</td>
<td>Respond to this quote:

“As a culture, we’ve become upset by the tobacco companies advertising to children, but we sit idly by while the food companies do the very same thing. And we could make a claim that the toll taken on the public health by a poor diet rivals that taken by tobacco.”

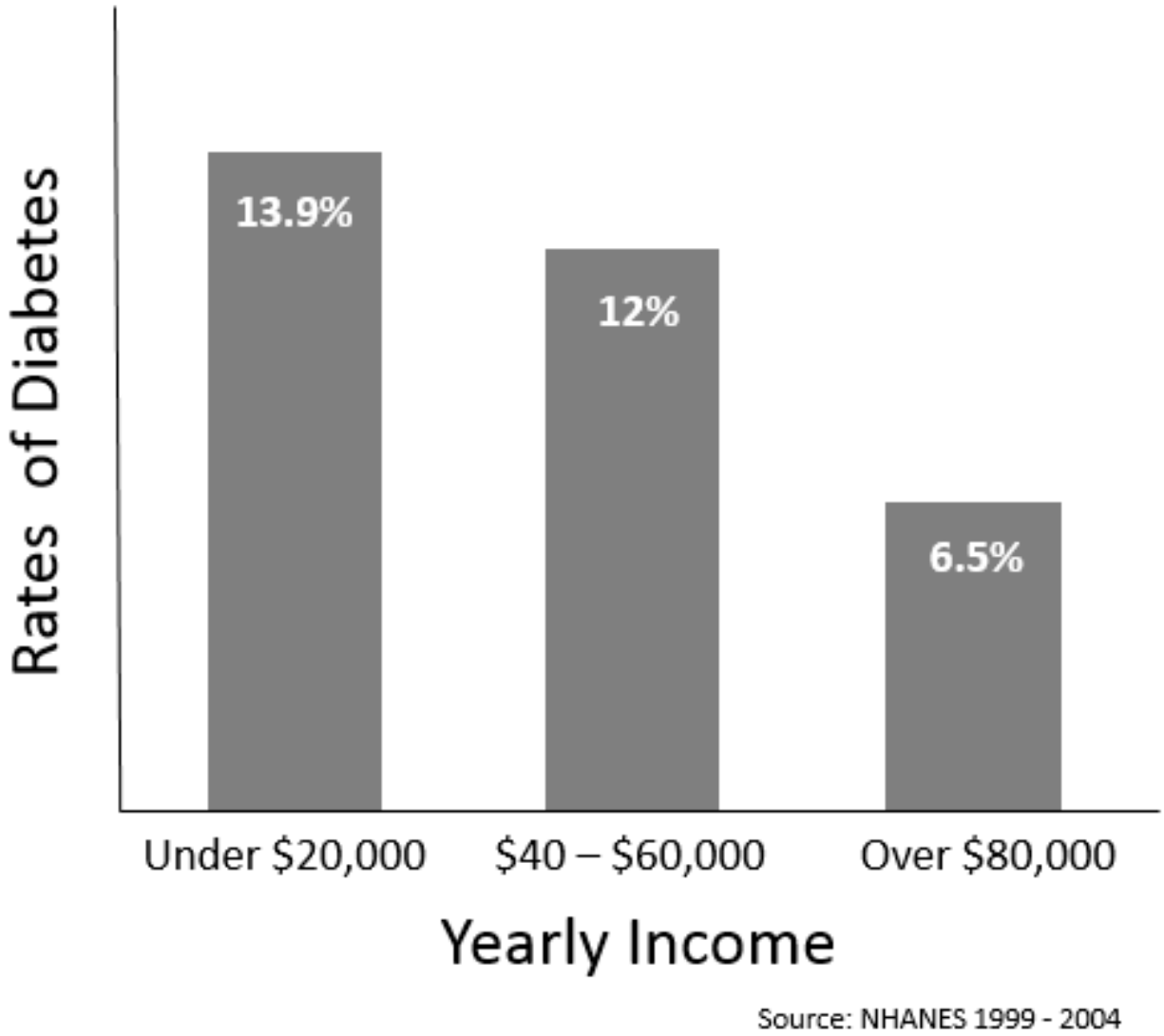
(See teacher resource for copy master)</td>
<td> 
</td>
</tr>
</table>

(Have students plot their own position/knowledge point using a different class color each day.)

Silent Chalk Talk Rules of Participation

1. Respond to the main comment anywhere on the poster.
2. Respond to others by drawing an arrow from their comment to yours.
3. If you agree with a comment, add an ! or ★ .
4. If you disagree with something, politely explain why.
5. Do not cross out or write over anyone else's comments.
6. Pictures are permissible, just keep them appropriate.
7. Keep all responses respectful.
8. No Talking.

Instructions: Print the following three pages and attach them to the Chalk Talk posters as shown on page x.



“As a culture, we’ve become upset by the tobacco companies advertising to children, but we sit idly by while the food companies do the very same thing. And we could make a claim that the toll taken on the public health by a poor diet rivals that taken by tobacco.”

Kelly Brownell, Professor of Psychology and Public Health, Yale University

When finished with the Chalk Talk posters, return to your seat and draw/revise your own picture that illustrates the causes of type 2 diabetes.

“All the health data show that we’re getting fatter and sicker as a country, but I don’t think a simple lack of willpower is the main problem. We need to stop talking about individual behavior around diet and exercise. **We need to focus on the social conditions that are making people unhealthy.**”

“People need to choose more activity, less screen time, and decide to eat in a healthy way. In the end, **we are responsible for the lives we lead**.”

Name_____ **Date**_____ **Period**_____

Track your family's eating habits. Start with your generation, and include 5-7 foods or drinks you often have. What about prior generations? For each generation, include a typical meal and beverage that they would have eaten when they were growing up. If you need to, ask a parent or grandparent.

You and your siblings	
You live in a: rural area __ town __ city __ In what country? Meals are mostly: cooked at home from scratch __ prepared at a grocery/store __ from a restaurant __ Your usual activity level: not very active __ moderately active __ very active __	
What are the most common foods you eat for breakfast, lunch, dinner, and snacks?	What are the most common drinks you have for breakfast, lunch, dinner, and snacks?
	What are some special treat foods, and how often do you have them?
Your parents and their siblings growing up	
They lived in a: rural area __ town __ city __ In what country? Meals were mostly: cooked at home from scratch __ prepared at a grocery/store __ from a restaurant __ Their usual activity level: not very active __ moderately active __ very active __	
What were the most common foods they ate?	What were the most common drinks they drank?
	What were some special treat foods, and how often did they have them?
Your grandparents and their siblings growing up	
They lived in a: rural area __ town __ city __ In what country? Meals were mostly: cooked at home from scratch __ prepared at a grocery/store __ from a restaurant __ Their usual activity level: not very active __ moderately active __ very active __	
What were the most common foods they ate?	What were the most common drinks they drank?
	What were some special treat foods, and how often did they have them?

After filling out the other side:

1. Mark any changes in diet between generations with a ☆
   What happened to your family's journey that affected that? (Did someone move? Change jobs?)

2. Circle the place on the family tree when you think eating habits were healthiest.
   Did it change over time? What factors were involved in that change?

3. Optional: Highlight anybody on the tree who has been diagnosed with type 2 diabetes.
   How were they effected by this? How did they treat/manage their condition?

Lesson 2

Our Environment: Access and Choice

Time: 50 min

Lesson Objectives:
Students will be able to answer:

- What is the most prevalent type of diabetes?
- What are two things associated with an *increased* risk for type 2 diabetes?
- What are two things associated with a *decreased* risk for type 2 diabetes?

Prerequisite Knowledge
Students should have an understanding of the following terms: trait, gene, genetic factor, environmental factor

Overview

Students are introduced to diabetes through a CDC power point that shows how the prevalence of both diabetes and obesity have increased dramatically in the United States between 1994 and 2015. By considering how the environment has changed during this time, student assess their own environmental factors for type 2 diabetes and consider how these factors interact to reduce or increase risk, and assess how access to resources and personal choice may increase or decrease risk factors over time. Lastly, students interpret data that shows the impacts of a change in environment for a group of people.

Enduring Understandings

Type 2 diabetes is a growing concern and occurs frequently in our communities.

Blood glucose levels are regulated to stay within a healthy range. Type 2 diabetes is the result of chronic high blood glucose levels and can develop over time as regulation of blood glucose levels fail.

Type 2 diabetes is a complex condition that is heavily influenced by environmental factors such as access to resources, personal choice, product marketing, public policy, socio-economic status, and stress.

Essential Question:

How do genetics and environment play a role in our health?

Lesson Summary with timings

Diabetes and Obesity over Time CDC PowerPoint	15 min
Assessing Environmental Access and Choice	20 min
Data Drop: Environmental Influences on the Pima	15 min

Health and Physical Education Standards

Through this lesson, students will gain competency towards the following standards:

Nutrition

1. **Food Groups and Nutrients**: Predict impact of consuming adequate or inadequate amounts of nutrients. H1.N1.HS

5. **Disease Prevention**: Analyze and describe the relationship between nutritional choices, physical activity, and chronic diseases. H1. N5.HS

Wellness

1. **Dimensions of Health**: Analyze personal dimensions of health and design a plan to balance health. H1.W1.HS
2. **Disease Prevention:** Analyze prevention, lifestyle factors, and treatment of communicable and non-communicable diseases. H2.W2.HSa

   Assess personal risk factors and predict future health status. H2.W2.HSb
3. **Analyzing Influences**: Analyze how a variety of factors impact personal and community health. H2.W3.HS

Materials

Materials	Quantity
PowerPoint slide set for the unit, found at http://gsoutreach.gs.washington.edu/GEMNet	
Computer and projector	1 per class
Student Sheet 2: *Environmental Influences and Options*	1 per student
Optional: Copy of the film Unnatural Causes from California Newsreel. It can be ordered from http://www.unnaturalcauses.org/	1 per class

Teacher Note

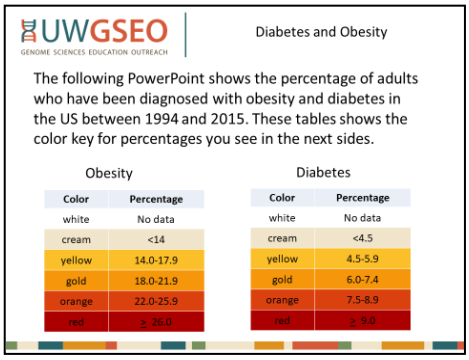
As in Lesson 1, the term "environment" is used quite broadly, and encompasses factors such as access to resources, personal choice, and both the physical environment and the emotional/social environment. The film ***Unnatural Causes***, available from California Newsreel, contains a 29-minute episode called Bad Sugar which addresses some of the social circumstances of health by making connections between diabetes, oppression, and empowerment in two Native American communities. This segment of the film would be ideal to show before this lesson, if possible.

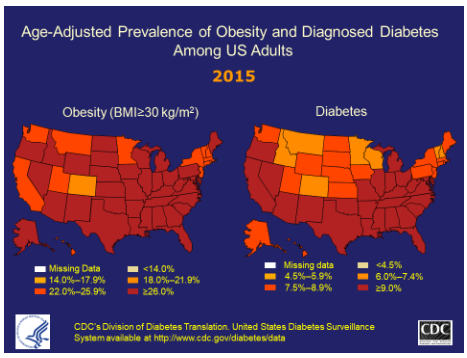
Procedure

Part I (Engage): Diabetes and Obesity over Time (PPT Presentation, 15 min)

1. Show the PowerPoint, L2 CDC Diagnosed Obesity and Diabetes, which maps the prevalence of these conditions in the United States from 1994-2015. The maps are color-coded to indicate the percent prevalence state by state and year by year. Field Test Q: Do we want diabetes AND obesity, or just diabetes? How do we address obesity? Let graphs do it?

Slide 4 through Slide 28





Age-Adjusted means that different populations (i.e. states) have been weighted to mirror the same age distributes as found in the US census data. This is done so that populations with younger or older members can be compared directly with each other.

Prevalence is the total number of people with diabetes at a certain time, divided by the population at risk.

2. Show the PowerPoint at least two times (by restarting at Slide 5) so that students can absorb the information.

3. Ask the class to brainstorm questions that come up for them as they watch the slide show.

Students may ask about changes to the survey method in 2011, as noted in the slide set. The changes 1) allowed survey calls to cell phone numbers in addition to land lines, and 2) changed data weighting methods to include more information about the survey taker, such as education level and marital status in addition to age, gender, and race.

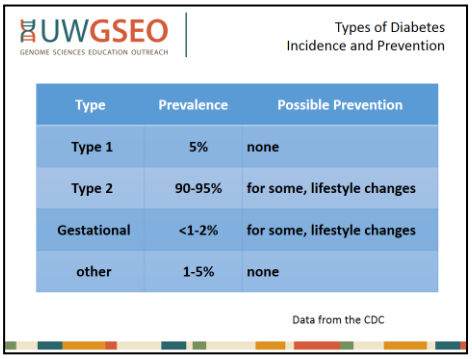
4. Tell students that while both obesity and diabetes are represented on the slides, we are focusing on diabetes in this unit. How do we address obesity here? Do we?

5. To see the ***local connection*** to this nationwide growth, have students view the statistics from their own county by going to https://www.cdc.gov/diabetes/data/county.html

6. After considering the data individually and in pairs, ask students to share their ideas about what the data indicate.

7. Show Slide 29 to raise the issue that the data include different types of diabetes, and that it is important to understand the differences for scientific study.

Slide 29



Type 1 diabetes has a strong genetic determination, and cannot be prevented. A healthy lifestyle in combination with medical treatment is important to prevent or delay complications.

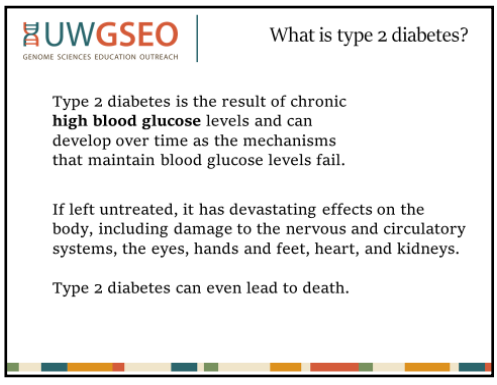
8. Ask students what they know about type 1 and type 2 diabetes, gestational diabetes and the other more general category. You may have to provide some of the background information given in the teacher notes, either as a short reading or direct instruction, to stimulate conversation.

9. Ask students which type of diabetes should be the focus if they want to make a difference in the trend of prevalence in the country. They should point out that type 2 diabetes is the biggest category and is preventable for most people, so a focus on t2d has the potential to reverse the trend.

10. Ask students to share what they know about type 2 diabetes.

11. Refer to Slide 30 for a definition of type 2 diabetes. Tell students that type 2 diabetes is the result of chronic high blood glucose levels and can develop over time as the mechanisms that maintain blood glucose levels fail. If left untreated, it has devastating effects of many organs and systems of the body, including the nervous and circulatory systems, as well as the eyes, hands and feet, heart, and kidneys. Type 2 diabetes can even lead to death.

Slide 30



Part II **Assessing Environmental Access and Choice** **(20 min)**

12. Tell students that they will be assessing their environmental risks for acquiring type 2 diabetes. If students don't feel comfortable assessing their own environmental risks, they may choose a fictional representative character to assess.

13. Tell students that a ***factor*** (genetic *or* environmental) can be positive or negative. A positive factor is considered ***protective***, and a negative factor is considered a ***risk***.

14. Pass out Student Sheet 2.1: *Environmental influences and options* for students to fill out. Allow students to tally their scores and answer the questions.

Note: The term ***risk*** is used here as it is in the field of public health. A person with increased risk for t2d will not automatically develop t2d. Rather, risk is a measure that compares an individual to population data. In other words, a person's risk of developing a disease given x, y, and z, is based on how many other people who have x, y, and z actually get the disease of concern.

15. Help students determine which environmental factors are issues of *access*, and which are issues of *choice*. For example, students may live in neighborhoods with good parks (providing access to exercise) but choose not to visit the park to walk, run, play Frisbee or otherwise exercise (an issue of choice). Conversely, students may not have access to a gym, but choose to run on a road.

16. Refer to the CDC slide set, and the correlation between obesity and type 2 diabetes. Are there items in the survey that would impact both conditions?

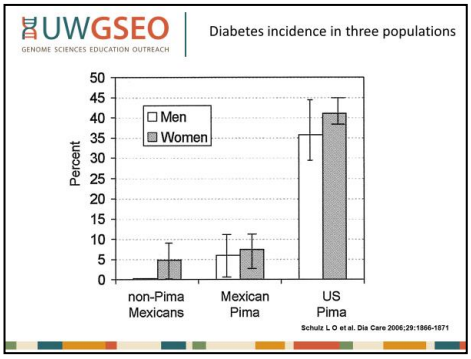
Note: Be sensitive to students who may be uncomfortable about their own body images. It's important to take a view of populations rather than focusing attention on individuals.

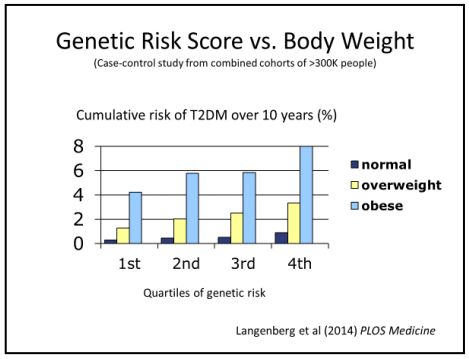
17. Be aware that not all the factors on the sheet are easily sorted into *access* or *choice* and be prepared to discuss areas of gray. If lack of time is a contributing factor to not exercising, is that an issue of choice or access? How does age factor into acquiring type 2 diabetes? Are high levels of stress a matter of access or choice?

Part III **Data Drop: Environmental Influences on the Pima** **(15 min)**

18. Show students Slide 31.

Slide 31





[Field test teachers: Genetic risk vs body weight is a second possible graph for this section. (text below relates to Pima slide only but we could build conversation around the second if you like it)

19. The Pima people are a group of Native Americans who have historically lived in southern Arizona, though some have lived across the border in Mexico.

20. Ask students levels of questions about the graph, ideally in a turn-pair-share style. First the literal question: *What does the graph show?* Make sure that students understand the structure of the graph, and what the x and y axis represent.

21. Give students some more background on the Pima: Within the US, most of the Pima population live in federally-recognized reservations. As rivers that supported their traditional way of life were damned and the water diverted to non-native farmers, the Pima received supplies from the federal government's commodity food program. The commodities included foods that were higher in fat and calories and lower in fiber than their traditional foods, such as canned meats, soups, and juices; pasta; cereal; rice; cheese; peanut butter; corn syrup; flour; dry, evaporated milk; and vegetable oil. These foods became a mainstay of Pima diets, rather than supplementing their traditional diets.

22. Ask students interpretive questions, such as: *What does the graph mean?* and "What are *the social implications of this data?"*
[Field test question: Is it better to switch #21 and 22—have students wrestle with what the graph means before telling them "the rest of the story"?]

Closure

23. Revisit the continuum from Lesson One and see where type 2 diabetes is placed. If necessary, move the sticky note with t2d to a place which better represents the class view.

Extension

Each environmental factor used in the survey is supported by research in the scientific community. Environmental risk cards that go into more detail about the factor and provide source information can be found in the *Appendix*. In addition to the 25 environmental risk cards, 6 cards describing genes that contribute to genetic risk can also be found there.

These cards can be used in a variety of ways depending on class time and teacher direction. Some examples include:

- Each student could be asked to provide more research about his or her card, possibly as a homework assignment, using the source information on the card.
- Students could share the information on the card in a round-robin exercise.
- Students could meet in groups of four to share information the cards, and then regroup with new students until students have heard from a range of their peers.

Sources

Chino, M., Haff, D. R., Dodge Francis, C. (2009). Patterns of Commodity Food Use among American Indians. Pimatisiwin: A Journal of Aboriginal and Indigenous Community Health, 7(2), 279-289. https://digitalscholarship.unlv.edu/env_occ_health_fac_articles/51

Environmental Influences and Options Student Sheet 2

Directions: Fill in the following table to the best of your ability. You will not be required to share your score unless you choose to. "In your community" means the distance you can walk in 15-20 minutes, or the area you drive through frequently.

Environmental Factor	Range	Score	
1. Number of fast food establishments (such as McDonald's or Burger King) or convenience stores that are in your community.	0 – 3 4+	0 +1	
2. Number of times you eat a meal at a fast food restaurant over the course of the week.	0 – 1 2 – 4 5 +	0 +2 +4	
3. Number of servings of fruit juice you drink per day.	0 – 1 2 – 4	0 +2	
4. Number of 12-ounce sugar-sweetened sodas you drink on an average day (one 36 ounce drink = 3 x 12-ounce drinks).	Add 2 points per 12 oz.		
5. Number of grocery stores in your community.	0 1 2+	+1 0 -1	
6. Number of Farmer's Markets, community gardens, or neighbors who share fresh produce in your community.	0 1 2+	+1 0 -1	
7. Number of servings of fruits and vegetables you have on an average day	Subtract 1 pt per serving		
8. Number of times per week you eat red meat (beef, pork, lamb)	0 – 1 2 – 4 5 +	0 +2 +4	
9. Number of times per week you eat whole grains	0 – 1 2 – 4 5 +	+4 0 -4	
10. Number of times per week you eat dessert, cookies and other sweets	0 – 1 2 – 4 5 +	0 +2 +4	
11. Number of local gyms or sports clubs such as the Boys & Girls Club or YMCA in your neighborhood.	0 1 2+	+1 0 -1	
12. Number of times you exercise for 30 minutes or more over the course of the week.	0-1 2-4 5+	+4 0 -4	
13. Number of safe, free places to be physically active, such as parks, trails, skate parks, etc., within walking distance of where you live.	0 1-2 3+	+1 0 -1	
14. Number of days a week you spend more than 2 hours watching TV.	0-1 2-4 5-7	-2 0 +2	
15. Number of days per week you spend more than 4 hours playing video games or being on a computer or on your smart phone.	0-1 2-4 5-7	-2 0 +2	
16. Are the sidewalks in your neighborhood in good repair and/or do you see other people walking?	Yes No	-1 +1	
17. Are there bike lanes, paved shoulders of roads, or other safe places to ride a bike, near where you live?	Yes No	-1 +1	

18. Number of times you bike or walk to a destination over the course of a week, 1/2 a mile or more.	Subtract 1 point per time		
19. Do you have bus access in your neighborhood or within walking distance of where you live?	Yes No	-2 +1	
20. Number of times you drive to destination less than 2 miles away from your home over the course of a week.	0-5 6+	0 +1	
21. Number of times per day you drink out of an older, hard plastic water bottle that is not BPA-free.	Add 1 point per time		
22. How many hours of sleep do you usually get every night?	Less than 5 5-9 >9	+1 -1 +1	
23. Do you live along a busy road?	Yes No	+1 -1	
24. What is your age?	Up to 45 46-64 65+	0 +2 +4	
25. How are your stress levels, on an average day? (Circle a number) 1 2 3 4 5 Not much Moderate Very stressed	Add the number you circled		

Total your *negative* scores here - plus Total your *positive* scores here: + = **Total Environmental Risk Score**

Assessment of Risk Score:

1. Do you consider your environmental risk to be high, low, or average? Why?

2. What total risk score would you list as "high risk?" What about "low risk?" Explain your answer.

3. Given your risk score, how would you alter or improve environment risk factors contributing to your risk score?

4. If you found out that your *genetic* risk score was high or low, how might this change your total risk score? How would you adjust your behavior in any way?

Access and Choice:

Look back at the environmental factors table. Some of the factors are issues of ***access*** (do you have access to many fast food restaurants in your neighborhood?) and some are issues of ***choice*** (how often do you eat at fast food restaurants?). Put a STAR next to the factors that represent a ***choice.***

Lesson 3 | Sugar: From Fuel to Toxin

Time: 50 minutes

Lesson Objectives:
Students will be able to answer:

- Where is glucose found in food and drinks?
- How do food choices impact blood glucose levels?

Overview

Students create paper models of different carbohydrates, including starch, fiber, sucrose, fructose and glucose, and make the connection between blood glucose regulation and type 2 diabetes. Students learn that although glucose is needed by every cell of the body for fuel, too much glucose can be toxic to tissues of the body.

Enduring understandings:

Glucose, the major energy source for all human cells, is released primarily through digestion of carbohydrates. Food choices impact blood glucose levels.

Blood glucose levels are regulated to stay within a healthy range. Type 2 diabetes is the result of chronic high blood glucose levels and can develop over time as regulation of blood glucose levels fail.

Type 2 diabetes is a serious condition with negative health consequences if left untreated.

Essential question:

Where is glucose in food and drinks, and what does it have to do with type 2 diabetes?

Lesson Summary with Timings

Where do sugars come from? A food paper model	20 min
PPT: Sugar: from fuel to toxin	20 min
Revisit Chalk Talk and revise models	10 min

Health and Physical Education Standards:
Through this lesson, students will gain competency in the following standards:

Nutrition

1. **Food Groups and Nutrients**
   Predict impact of consuming adequate or inadequate amounts of nutrients. H1.N1.HS

5. **Disease Prevention**: Analyze and describe the relationship between nutritional choices, physical activity, and chronic diseases. H1. N5.HS

Wellness

2. **Disease Prevention**
   Analyze prevention, lifestyle factors, and treatment of communicable and noncommunicable diseases. H2.W2.HSa

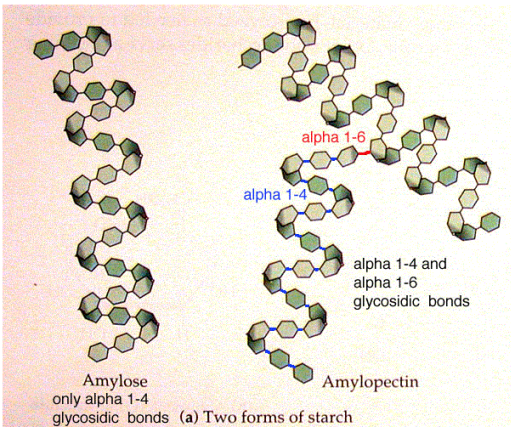
   Assess personal risk factors and predict future health status. H2.W2.HSb

3. **Analyzing Influences**
   Analyze how a variety of factors impact personal and community health. H2.W3.HS

Background on Carbohydrates

Glucose, a **monosaccharide**, is the primary energy molecule of the body. Surprisingly, much of the food we eat is not in the form of glucose. More commonly, glucose is found as part of **disaccharides** like sucrose (found in fruit) and lactose (in milk) or as a starch.

How is starch digested to glucose?



Starch, a **polysaccharide**, is a natural **polymer** of glucose, formed in a variety of plants by the chemical linkage of hundreds or even thousands of individual glucose units. Corn, wheat, potatoes and rice are main sources of starch used in the U.S. Other plants with high starch content (*e.g., cassava, milo, sorghum)* are more abundant in other parts of the world. The common starches differ in that they contain different amounts of two types of glucose polymers. One of these polymers is **amylose** (see figure to the right), a linear chain of 500 to 2000 glucose units. The other starch polymer, **amylopectin** (see figure to the right), has a tree-like shape, with linear chains like those in amylose connected at branch points. Each branch contains about 20 to 30 glucose units and the molecule is made up of several hundred branches.

Digestion of carbohydrates begins in the mouth. Saliva contains a large amount of alpha-amylase, an **enzyme** that breaks starch into smaller fragments. With the help of additional digestive enzymes, these fragments are broken down into **glucose.** Glucose molecules are then absorbed from the small intestine into the blood stream. Once in the blood stream, glucose is transported into cells with the help of **insulin**. Insulin is a small **protein hormone** that regulates the amount of glucose in the blood by stimulating cells to transport glucose in from the blood stream. Once in our cells, glucose can be broken down for energy. In addition to alpha-amylase, other digestive enzymes that are responsible for making glucose available to cells for energy include sucrase and lactase. Sucrase (also known as invertase) digests sucrose (*table sugar*; also found in foods containing high fructose corn syrup) to glucose plus fructose, and lactase digests lactose (*milk sugar*) to glucose plus galactose. Also, some foods contain glucose without enzyme digestion.

Starch is broken down to glucose in two stages, each requiring specific enzymes that act upon different portions of the molecule. Due to the size of the starch molecule and the specificity of the enzymes, starchy foods can take longer to digest than foods containing a predominance of mono- or di-saccharides (such as foods containing high fructose corn syrup). Foods that are digested more slowly release glucose into the blood stream more slowly.

Most **fiber** is also a polysaccharide and a natural polymer of glucose. **Fiber** is plant matter such as cellulose that cannot be broken down by human digestive enzymes, though bacteria in the human digestive tract can digest some types of fiber. Fiber is important to the diet because the roughage aids in digestion, and a high fiber meal can provide a feeling of fullness without adding calories. Fiber also slows down the rate of sugar absorption by the body.

Nordqvist, C. (2013, November 4). "What is fiber? What is dietary fiber? Fiber rich foods." Medical News Today. Retrieved from http://www.medicalnewstoday.com/articles/146935

Materials

Materials	Quantity
Computer and projector	1 per class
PowerPoint slide set for the unit, found at http://gsoutreach.gs.washington.edu/GEMNet	1 per class
Voice Over PowerPoint – Lesson 3 Analogy, found at https://gsoutreach.gs.washington.edu/GEMNet	1 per class
8.5 x 11 inch sheet of paper, *or* Teacher Copy Master 3.1	1 per student
Scissors	1 per student
Tape	1 per group
Background on Carbohydrates	teacher discretion
Teacher Copy Master 3.1 Carbohydrate Chains	1 per student
Teacher Copy Master 3.2 Call-out Boxes	1 per student
Student Sheet 3 – Blood Glucose and Type 2 Diabetes	1 per student

Presenting the Lesson

Point out for students that carbohydrates, including sugar, play an important role in nutrition. While the simple sugar glucose is fuel for every cell in the body, chronic high glucose levels can lead to glucose toxicity, debilitating illness, and type 2 diabetes. Where does the glucose in our body come from? Where do other sugars come from? Tell students that in today's lesson students are going to create a paper model of simple and complex sugars and learn more about the effects of high glucose levels on the body. The *Background on Carbohydrates* reading is not mandatory for students but can be used at the teacher's discretion depending on the level of the class.

Procedures

Part 1 (Engage and Explain): Modeling Carbohydrates (20 min)

1. Hand out a blank 8.5 x 11 inch piece of paper to each student.

2. Have students fold the paper down about an inch along the short side. "Accordion" the paper by folding it back and forth to the end (Figure 1).

3. Once flat, have students cut the paper into squares (Figure 2).

4. Lastly, have students snip the corners off the top and bottom of each square to create connected *6-sided* shapes to represent single-ring sugars such as ***glucose*** (Figure 3). ***Be careful*** to leave the midsection intact.

If time is short, print and cut out strips of simple sugars using Teacher Copy Master 3.1, then jump to Step 5.

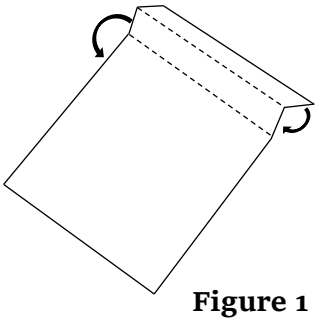


Figure 1

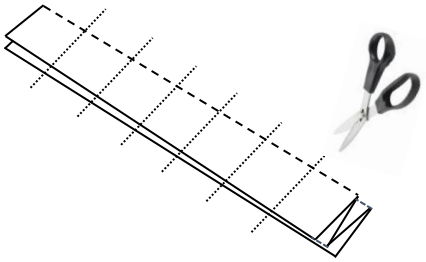


Figure 2

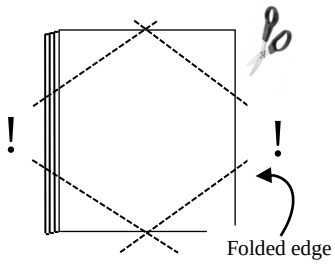


Figure 3

5. Have students unfold their paper models into chains. Tell students that these chains represent ***carbohydrates*** in the form of ***polysaccharides*** (poly = many; saccharide = sugar)**.**

6. Have students tape a few of the chains together to make longer chains. Encourage them to join chains with other individuals or groups to make both straight chains and branched chains.

7. These longer, more complex polysaccharide chains represent large carbohydrates such as **starch** and **cellulose**. The starches in our diets are found in foods such as *corn, rice, wheat,* and *potatoes*. These can be made up of hundreds or even thousands of individual units, which eventually get broken down through the action of enzymes into the single units.

Polysaccharides are often referred to as ***complex carbohydrates***.

Mono- and ***disaccharides*** are often referred to as ***simple carbohydrates***.

8. Choose one group of students to draw colored lines using a marker between the single units of one of the larger chains. (This will represent fiber.)

9. The chains with colored lines between units represent dietary ***fiber***. Fiber is plant matter such as cellulose that cannot be broken down by human digestive enzymes—we don't have the molecular scissors to cut the colored bond—though bacteria in the human digestive tract can digest some types of fiber. Fiber is important to the diet because the roughage aids in digestion, and a high fiber meal can provide a feeling of fullness without adding calories. Fiber also slows down the rate of sugar absorption by the body.

10. Ask each student to take *one* of his or her chains and cut or tear it into individual hexagons. Tell students that each hexagonal piece they just cut represents a single sugar, or ***monosaccharide,*** (mono = one) when detached from the chain.

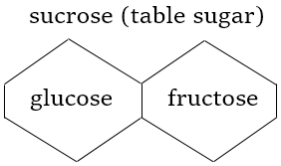
11. Explain that ***glucose*** is a monosaccharide, and have students label a few monosaccharide pieces as ***glucose***. Glucose is the fuel for cellular respiration—the way the body gains energy from food. Most of the starches in our diets (corn, wheat, rice, potatoes) are long chains of glucose. Corn syrup is pure glucose.

12. Explain that ***fructose*** is also a monosaccharide and have students label of few more monosaccharide pieces as ***fructose***. Fructose is a very sweet sugar found in some

plants such as fruits and berries. It is metabolized differently than glucose by the body. [Teacher note: fructose is a 5-ring sugar but will be represented the same way as glucose in this activity.]

13. Ask students to break another chain into groups of two hexagons. Each of these represents a ***disaccharide*** (di = two). ***Sucrose*** (table sugar) is a disaccharide.

14. ***Sucrose*** is made of two monosaccharides, ***fructose*** and ***glucose.*** These two monosaccharides are often found together. Have students label a few disaccharides sucrose and label the individual monosaccharides as fructose and glucose.



15. Explain that in the body ***enzymes*** are the "molecular scissors" that break the sugars apart so that the body can get energy from the individual units such as glucose.

16. Instruct students to clearly label their models of glucose, fructose, sucrose, and chains of starch and fiber, and tape the models in their notebooks.

Lactose, the sugar found in milk, is also a disaccharide. It is made up of the monosaccharides ***glucose*** and ***galactose***. This sugar is not as sweet as sucrose. People who are lactose intolerant are lacking the enzyme that breaks apart the double-ring sugar into the two single-ring sugars.

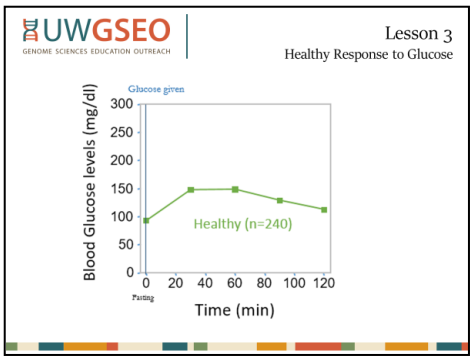
Note: If time allows, information about High Fructose Corn Syrup can be found as an extension with instructions at the end of this lesson.

Part II (Explain and Elaborate) Glucose: From Fuel to Toxin (20 min)

17. Remind students that type 2 diabetes is a problem with blood glucose regulation. Though glucose is needed by every cell of the body for fuel, too much can be toxic to tissues of the body.

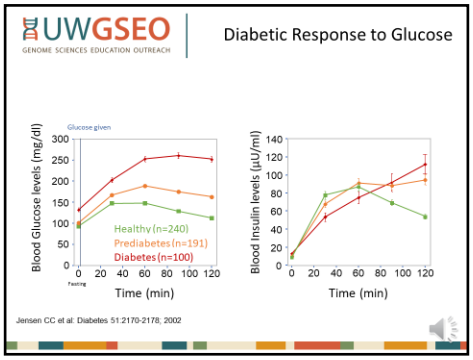
18. One way of looking at glucose levels in the blood is through graphs like Slide 32. It shows changes in blood glucose levels over time for a healthy person who was fasting at Time 0, given glucose to drink, and then had their blood glucose measured every half hour for two hours. Make sure that students understand the *x* and *y* axes of this graph and what they represent, as it will be helpful for the Lesson 3 Analogy Voice-Over PowerPoint (VOPP) they are about to watch.

Slide 32



19. Hand out Student Sheet 3 –*Blood Glucose and Type 2 Diabetes* for students to work with during and after they view the VOPP.

20. Show students the draft 10-minute Lesson 3 Analogy found at https://gsoutreach.gs.washington.edu/GEMNet. This can be watched as a class as a VOPP, narrated by the teacher using the presenter notes, or assigned for students to watch as homework after Lesson 2. The VOPP uses cars in traffic as an analogy for blood glucose levels, and introduces students to data showing different blood glucose and insulin levels for people with diabetes and without diabetes. Select slides are shown below.



21. Once students are familiar with the analogy, tell students that so often, we hear that "diet and exercise" help metabolic conditions such as type 2 diabetes. Ask them to use the analogy to discuss in groups specifically how exercise and diet might work to control blood sugar levels. Record student ideas, either in groups or as a class, as we will go into more detail about these topics in Lessons 4 and 5.

Part III (Elaborate) Revisiting Chalk Talk (10 min)

22. Give students a chance to revisit the Chalk Talk posters from Lesson 1 and make further comments on each poster. If possible, use a different color of marker on each poster so that today's comments can be distinguished from prior comments.

23. Have students revise the models they began in Lesson 1. Using the "callout" template found in Teacher Resource 3.2 allows students to zoom in and represent what is happening at the level of cells and tissues. Students can also draw their own call-out boxes on their models.

Part IV (Evaluate)

24. Return to the paper chain models and have students use the models to describe the cause of type 2 diabetes to a neighbor.

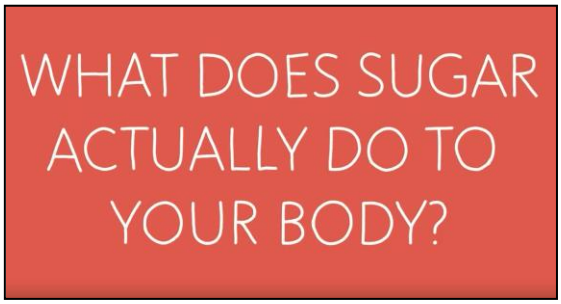
Homework

Students could be give some of the extension materials for homework.

Extension: High Fructose Corn Syrup (HFCS)

What does sugar actually do to your body?

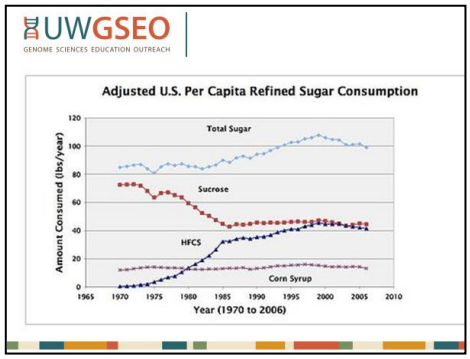
This video shows the impacts of sugar on the body, and highlights fructose metabolism: https://www.youtube.com/watch?v=utXcI3FqzeM&feature=youtu.be



Sugar consumption over time:

Show students this slide from the curriculum PowerPoint slide set.

Slide 33



- Ask students levels of questions about the graph, ideally in a turn-pair-share style. First the literal question: *What does the graph show?* Make sure that students understand the structure of the graph, and what the x and y axis represent.

- Ask students interpretive questions, such as: *What does the graph mean?* and "What are *the social implications of this data?"*

- If possible, have students research how and why HFCS began to take the place of sucrose in the 1970's. It time does not allow, share with students a short history of sweeteners in the U.S.: Up until the 1970's, sucrose (table sugar) made from sugar cane or sugar beets was the most commonly used sweetener. As demand for sugar increased and the prices for these commodities went up, food scientists started looking for a cheaper source of sweetener. Due in part to farm subsidies, corn was in surplus and corn starch was readily available. Corn syrup can be used as a sweetener (it is pure glucose) but it is not as sweet as sucrose. Using enzymes to convert about half of the glucose in corn starch to fructose, food scientists were able to create High Fructose Corn Syrup (HFCS). This provided a sugar source that was as sweet as sucrose, cheaper than sugar made from sugar cane or sugar beets, was made from a crop that grew in abundance in the US. In addition, HFCS is transported easily and dissolves well in liquids.

Glossary

Carbohydrate: Types of sugar, starch, and cellulose that are made of carbon, hydrogen and oxygen, usually in a ratio of 1:2:1.

Complex Carbohydrate: Another name for polysaccharides, or starches formed by longer saccharide chains. These take longer to break down than simple carbohydrates.

Disaccharide: di- (two) + saccharide (sugar). A sugar composed of two single sugars (monosaccharides). Examples are sucrose, lactose and maltose.

Dietary Fiber: A carbohydrate found in plant matter (such as cellulose) that cannot be broken down by human digestive enzymes. Fiber can be soluble and insoluble in water, and is sometimes referred to as roughage.

Enzyme: A biological molecule (a protein) that speeds up the rate of a chemical reaction.

Fructose: A simple, single-ringed sugar found in many plants that often bonds with glucose to make up the two-ringed sugar sucrose (table sugar).

Galactose: A simple, single-ringed sugar often found bonded with glucose to make up the two-ringed sugar lactose, found in milk.

Glucose: A simple, single-ring sugar that is the main source of energy for living organisms through the process of cellular respiration. It also is the building block of many carbohydrates.

Lactose: A two-ringed (disaccharide) sugar made of glucose + galactose sugars. It is the major sugar in milk. It can be broken down by the enzyme lactase.

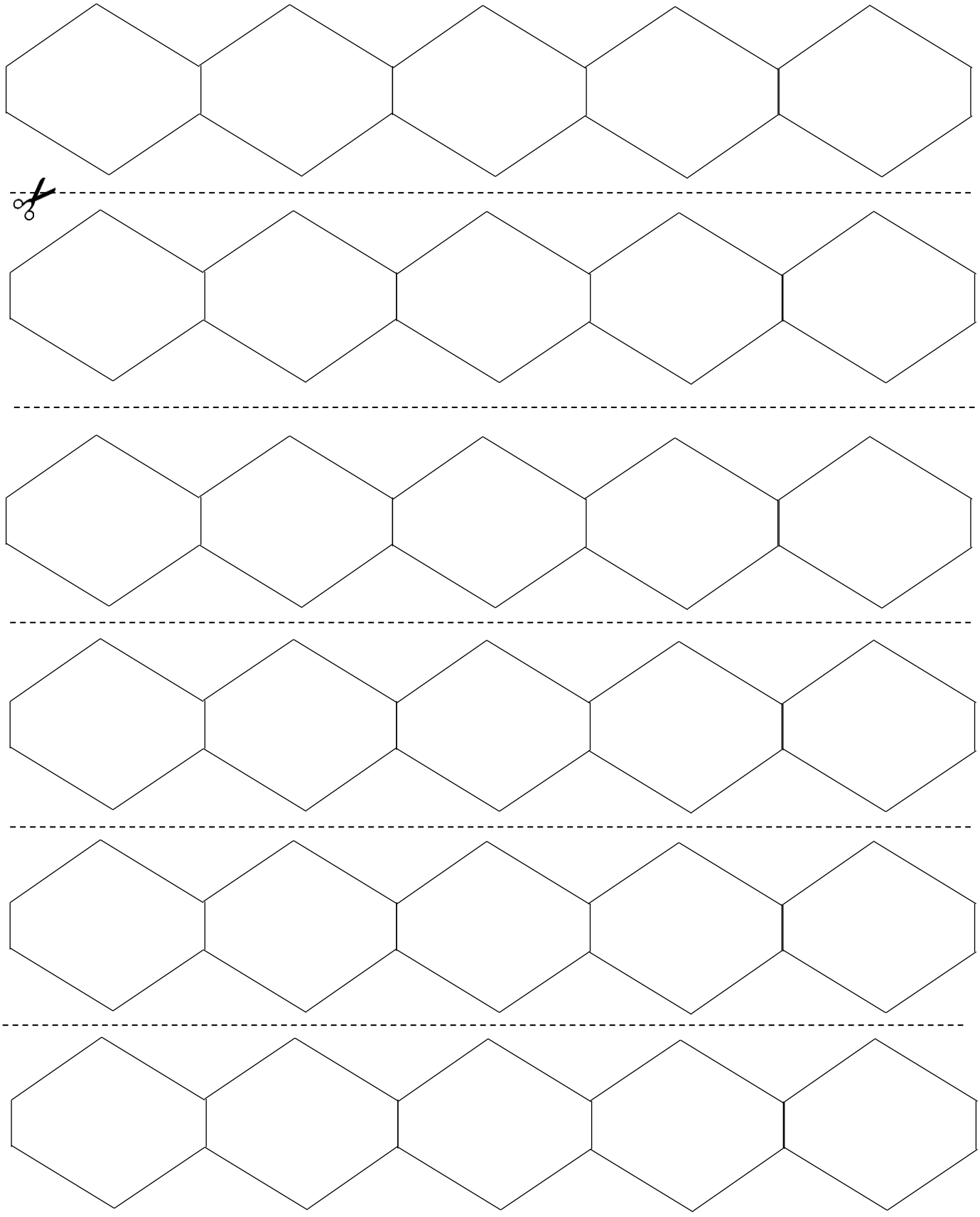
Monosaccharide: mono- (one) + saccharide (sugar). A simple, one-ring sugar such as glucose or fructose. Monosaccharides are the building blocks of more complex sugars.

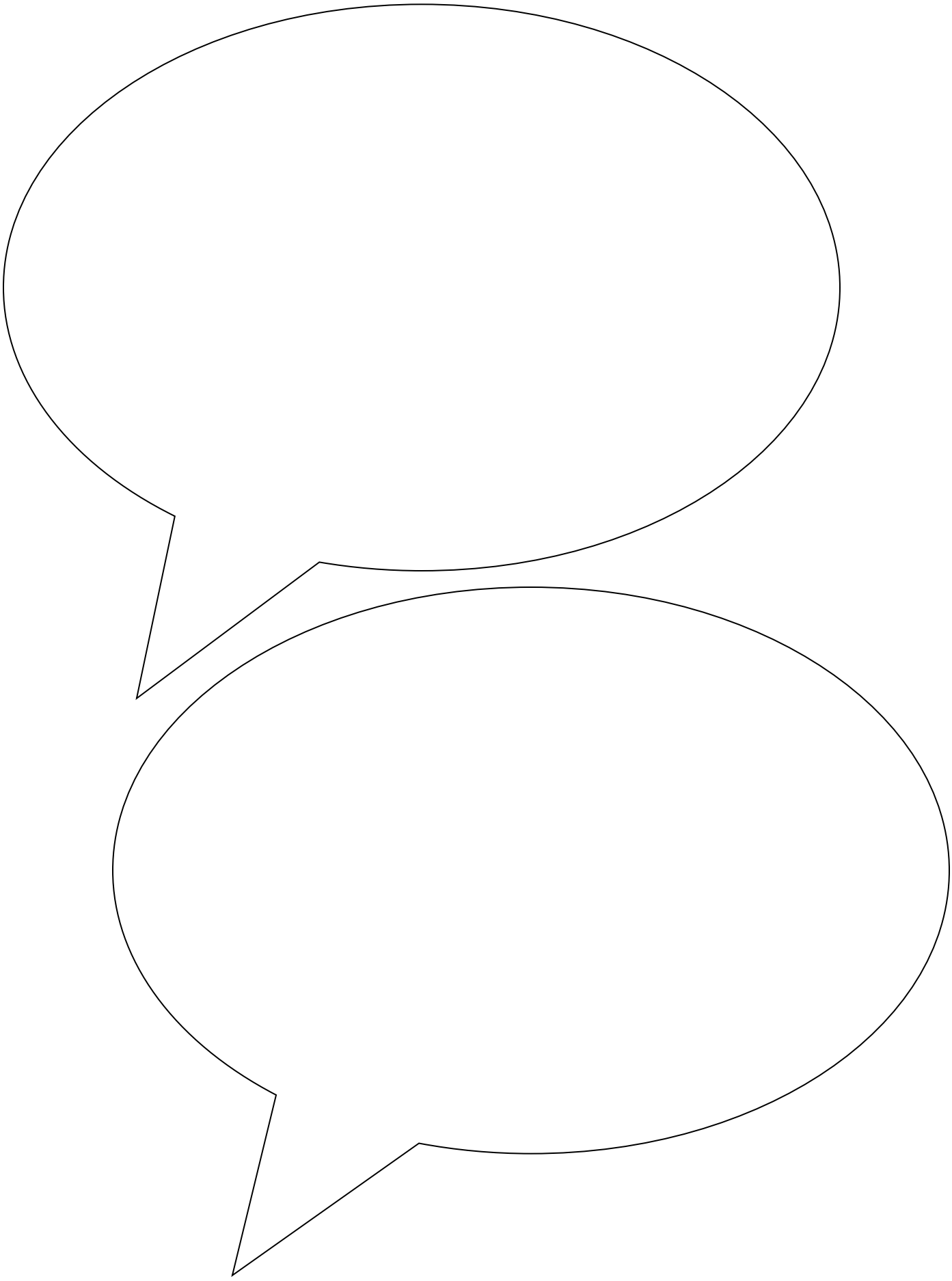
Polysaccharide: poly- (many) + saccharide (sugar). A carbohydrate made by repeating units; a complex sugar made of a chain of monosaccharides joined together by bonds.

Simple Carbohydrate: Another name for monosaccharides and/or disaccharides, (single or double ringed sugars).

Starch: A carbohydrate made of many glucose units joined together.

Sucrose: A two-ringed sugar (disaccharide) that is made up of glucose + fructose. It is used widely as a sweetener and made from sugar beets and sugar cane. It can be broken down by the enzyme sucrase.



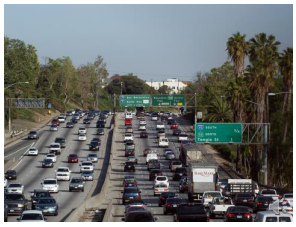
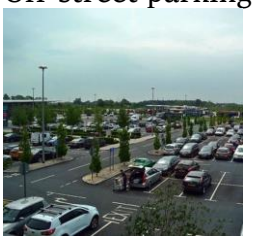


Blood Glucose and Type 2 Diabetes: An analogy Student Sheet 3

Name: _____ **Date:** _____ **Period:** _____

Note: Type 2 diabetes results from a problem with blood glucose regulation. Though glucose is needed by every cell of the body for fuel, too much can be toxic to tissues of the body.

1. In the analogy:

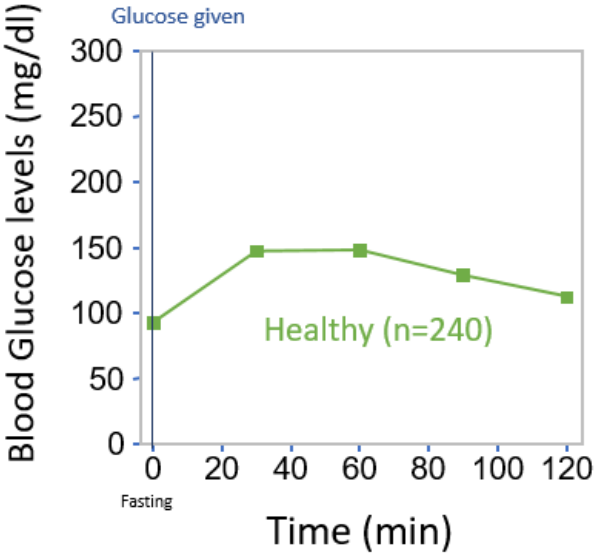
This: Represents this:	This: Represents this:
Cars 	Off-street parking 
Parking garages 	Gate guards 

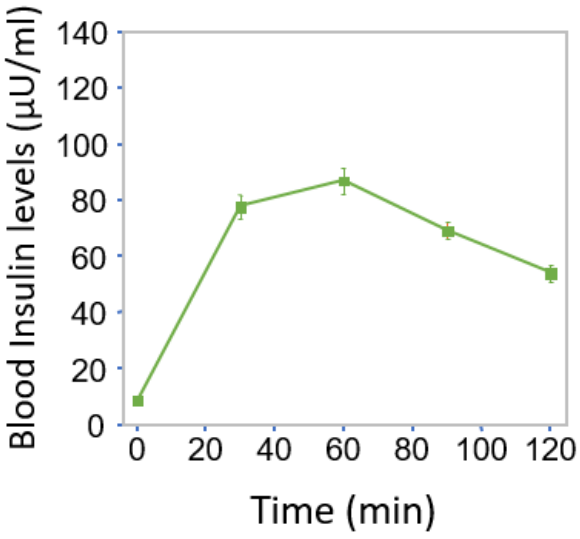
Type 2 diabetes results from two main factors: *insulin resistance* and *decreased insulin production* in the pancreas.

2. What is insulin resistance?

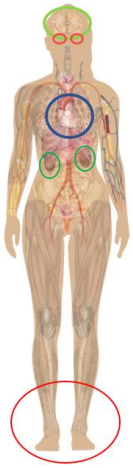
3. What happens when the pancreas cannot produce enough insulin?

4. The graphs below show a healthy person's blood glucose and insulin responses to a high-glucose meal. Add lines showing how a person with type 2 diabetes might respond to a high-glucose meal.





5. Which organs are impacted by type 2 diabetes? How are they impacted?



6. We always hear that "diet and exercise" are the best way to prevent type 2 diabetes. In what ways do both diet and exercise impact type 2 diabetes?

Lesson 4 | What Are We Eating?

Time: 50 minutes

Lesson Objectives:
Students will be able to answer:

- How can we tell what percentage of calories in food is derived from fat, carbohydrates and proteins?
- How is eating broccoli different than drinking soda for your body?

Prerequisite Knowledge
Prior understanding of macromolecules such as carbohydrates, proteins, and fats is helpful, but not necessary.

Overview

Students examine food and drink labels and calculate the percentage of proteins, fats, and carbohydrates different foods and drinks contain, and visually illustrate liquid sugars in a beverage. Students consider changes in diet over time, and figure out how different types of food impact blood glucose levels.

Enduring understandings:

Type 2 diabetes is caused by the effects of high blood glucose levels over time.

Type 2 diabetes can be prevented: factors contributing to a person's risk include good nutrition and exercise.

Essential question:

How are the foods we eat different, and what does this have to do with type 2 diabetes?

Lesson Summary with Timings:

Calculating Food and Drink Labels; Liquid Sugar Activity	25 min
What food or drink is that?	10 min
Data Drop: Does it matter what we eat?	10 min
Closure and review of Student Sheet 4	5 min

Health and Physical Education Standards

Through this lesson, students will gain competency towards the following standards:

Nutrition

1. **Food Groups and Nutrients**
   Predict impact of consuming adequate or inadequate amounts of nutrients. H1.N1.HS
   Evaluate resources for accessing valid and reliable information, products, and services for healthy eating. H3.N1.HS
2. **Beverages:** Analyze the impact of school rules and community and federal laws on beverage availability and choice. H2.N2.HS
3. **Label Literacy:** Cite evidence from Nutrition Facts labels useful for making informed and healthy choices. H5.N3.HS
5. **Disease Prevention:** Analyze and describe the relationship between nutritional choices, physical activity, and chronic diseases. H1. N5.HS

Wellness

2. **Disease Prevention:** Assess personal risk factors and predict future health status. H2.W2.HSb
6. **Decision-Making:** Predict potential short- and long-term outcomes of a personal health-related decision. H5.W6.HS

Materials

Materials	Quantity
PowerPoint slide set for the unit, found at http://gsoutreach.gs.washington.edu/GEMNet	
Teacher *Copy Master* of blank bar graphs	1 per class
Computers for students with access to **SuperTracker**: www.supertracker.usda.gov/foodapedia.aspx	1 per student or group
A variety of food labels, including nutritional content	4 per student
Calculator	1 per student
Tape or glue	1 per group
Green, red, and purple markers	1 each per student
Student Resource 4: *Calculating Food and Drink Labels*	1 per group
Student Sheet 4: *Calculating Food and Drink Labels*	1 per student
Sugar cubes *or* granulated sugar and scales *or* teaspoons	
Baggie and labelling pen	1 per group

Lesson Background and Preparation

- This lesson requires having a selection of food and beverage labels with nutritional information on hand for students to use. Ask students to bring in food labels from home, provide the labels for them, or make sure students have access to on-line nutritional information, such as through www.SuperTracker.usda.gov.

- This lesson focuses on the caloric contribution of different macromolecules in food and asks students to consider how much physical activity is needed to balance the caloric intake. If students haven't already learned about macromolecules in previous units, teachers may wish to teach about fats, proteins and carbohydrates, and their contributions to diet, role in the body, and how these macromolecules are stored. While helpful for the lesson, prior information about macromolecules is not crucial.

Procedures

Part 1 (Engage and Explain) Calculating Food and Drink Labels (25 min)

1. Show students the collection of labels or food/drink containers to be used in this lesson. Ask students, *"How can you tell what ingredients, nutrients and macromolecules foods contain?"* or *"How can you tell which foods are healthiest?"*

2. Pass out Student Resource 4: *Calculating Food and Drink Labels*.

3. Tell students that they will be assessing the nutritional labels from different foods and beverages, and calculating the total number of calories from fats, carbohydrates, and proteins.

4. Using the corn label on Student Resource 4 as a guide, demonstrate for students how to convert the number of grams of fats, carbohydrates and proteins from a food label into calories.

   Grams of Fat x **9** cal/gram = _____ calories from fat

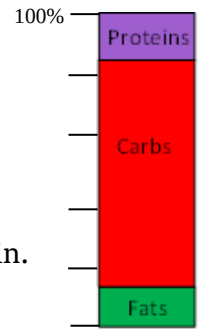
   Grams of Carbohydrate x **4** cal/gram = _____ calories from carbohydrates

   Grams of Protein x **4** cal/gram = _____ calories from proteins

   Total Calories: _____

5. Next, demonstrate for students how to find the relative percentage of calories that come from either fat, carbohydrates, or protein for that food.

   $$\frac{\text{Number of [fat] calories}}{\text{Total calories}} \times 100 = \text{percent calories from [fat]}$$



6. Lastly, show students how to graphically represent the relative percentages of calories using the bar graph. Make sure that students know to use green for fat, red for carbohydrates and purple for protein.

7. Have students complete Student Sheet 4 *Calculating Food and Drink Labels*, including the Liquid Sugar Activity described below.

8. When students finish graphing their nutritional labels, have them choose a beverage from their Student Sheet 4, or find a new one on the Food-A-Pedia section of Supertracker (https://www.supertracker.usda.gov/foodapedia.aspx).

9. Click on "nutrient info."

10. Have student groups represent the amount of sugar in their beverage of choice by putting the correct amount of sugar into a labelled baggie. Students can do this by *either* a) weighing the correct amount of table sugar in grams, *or* b) using sugar cubes to show the correct amount of sugar cubes (3g/1 cube) *or* c) converting grams of sugar into teaspoons (4g/tsp).

11. Tell students that liquid sugar is the biggest source of added sugar in the American diet, and set up a display area for all the baggies.

Challenge student who finish early to further subdivide the red carbohydrate bar in their graphs to represent fiber and sugar. The carbs not associated with fiber or sugars are starches.

Part II (Evaluate): What Food or Drink is That? (10 min)

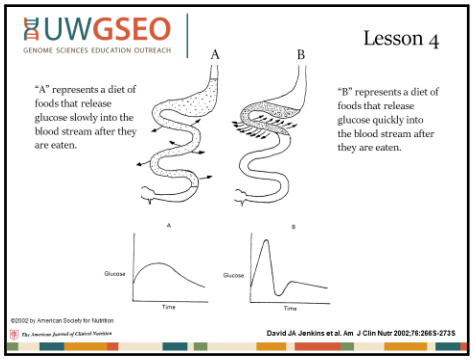
12. When students have finished Student Sheet 4 and illustrated the amount of sugar in a beverage, gather a selection of bar graphs and bags of sugar in a central location. It might be helpful to group similar-looking graphs in the same area.

13. Without showing the name of the food or drink, exhibit a graph or baggie of sugar and ask students to predict what type of food or drink it is.

14. Remind students that the red carbohydrate bar represents both sugars and fiber, which they learned about in Lesson 3. Sugars get absorbed quickly into the blood stream, causing blood glucose levels to go up quickly. Fiber helps slow the release of glucose into the blood stream.

15. Slide 35 shows a hypothetical schematic representing two kinds of diets. Ask students what sorts of foods might be represented in A (high fiber foods like beans, peas, nuts, broccoli) and B (low fiber foods like white bread, white rice, white pasta, and especially sugar drinks like soda).

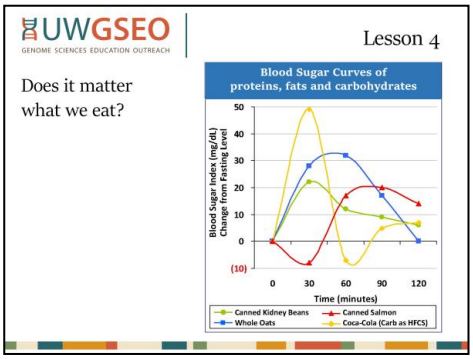
Slide 35



Part III (Elaborate) **Does it Matter What We Eat?** **(10 min)**

17. Show students Slide 36 and ask students questions about the graph, ideally in a turn-pair-share style. First a literal question: *What does the graph show?* Make sure that students understand the structure of the graph, and what the x and y axis represent.

Slide 36



Note: The data in this slide illustrate one person's blood glucose levels as self-monitored using a blood glucose meter after eating the foods mentioned. The data do not represent a large enough sample size or enough trials to be considered generalizable.

18. Next, ask students interpretive questions, such as: "*What does the graph mean?*" "*How does this tie to type 2 diabetes?*" and "*Are there social implications of this data?*"

19. Lastly, have students use the information in the slide and the car analogy from Lesson 3 to describe ***why it matters what we eat***. Some taking points could include:

When a person eats or drinks a carbohydrate, it is turned into glucose quickly if it is not bound as fiber. This means everything from oats, rice, potatoes, and corn to sodas and juices become car traffic in the analogy.

1) Type of food we eat matters: Drinking a can of coke rushes cars directly onto the roadways all at once, causing a temporary spike in traffic. The city responds by sending out a lot of gate guards (insulin) at once. In your body, flooding the circulatory system with a lot of sugar at one time causes the insulin levels to spike. Over time, this may be harmful to the pancreas. Eating foods that take longer to break down to glucose is helpful, as glucose is released more slowly into the bloodstream. Food high in fiber takes longer to break down, which is why coke and whole oats have different curves. This is why eating an apple is better for you than drinking a glass of apple juice.

2) Food volume matters: In Slide 36, the participant has eaten similar volumes of food for each type. However, if a person is consistently overeating (sending a huge number of cars into the city) the city responds as it should for a while. After time, the systems used to park the cars and get them off the road break down. Blood glucose levels are not well regulated.

3) Fat storage: Excess cars (glucose) are stored as fat in never ending parking garages. The fat impacts the whole system in many ways. One way is that components of fat are building blocks used to reduced lane width, which causes the traffic to back up even more. Visceral fat (the fat that is deposited around the belly and gut) is particularly resistant to insulin, which means that blood glucose levels keep building.

Part IV (Evaluation) Closure (5 min)

20. As a class, go over the answers to the questions on Student Sheet 4: *Calculating Food and Drink Labels*

Q2. How can nutrition fact labels be useful for making informed and healthy choices?
Nutrition fact labels are an important tool to help consumers know the nutritional content of food and beverages. The information helps consumers make healthy food and beverage choices by reducing fat, sugar, and salt intake, monitoring carbohydrates, comparing similar foods for nutritional value, knowing the caloric value of foods, and controlling for serving size.

Q3. Explain how the foods and beverages you consume are the same or different as those consumed by your parents or grandparents.
Answers will vary. The class could try to identify trends between generations over time. It may also be helpful to consider only beverages.

Note: Students might also be interested in researching where food labels come from, how food labels will change in the near future, who monitors them for accuracy, and what the acceptable margin of error is for the labels. It is interesting to note that although the labels are mandated by the FDA, the food company itself, not the FDA, is responsible for their accuracy. The law allows up to a 20% margin of error on food labels.

Teacher Resource
A great resource for the role of micro-nutrients can be found at *The Linus Pauling Institute* at the University of Oregon: http://lpi.oregonstate.edu/

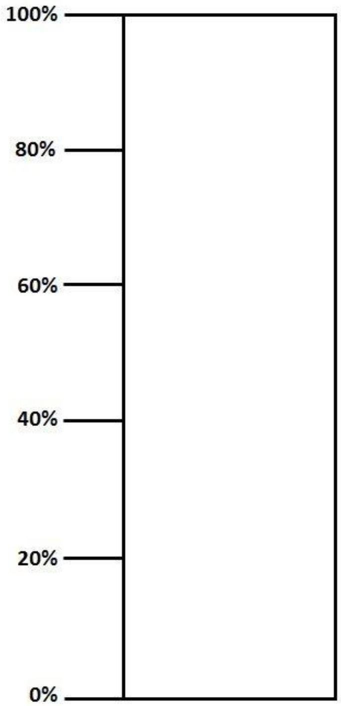
Homework
Student can finish Student Sheet 4 at home if needed, or write about the prompts in Step 18.

Extension/Homework
Ask students to research what kind of diet is the best for a person with diabetes. They are likely to find out that there is a lot of different, and conflicting, information on the internet. Research has shown that people on well-controlled diets tend to lose weight and lower blood glucose levels. What the diets all have in common, however, is they are restrictive in some important ways that leads to a caloric deficit. The "Danger Zone" of the American diet is the *combinations* of high fats and high carbs. These foods tend to be more processed, and have lower levels of fiber, vitamins, and nutrients.

Slide 37

Copy Master

Additional bar graphs for representing percentages of food calories



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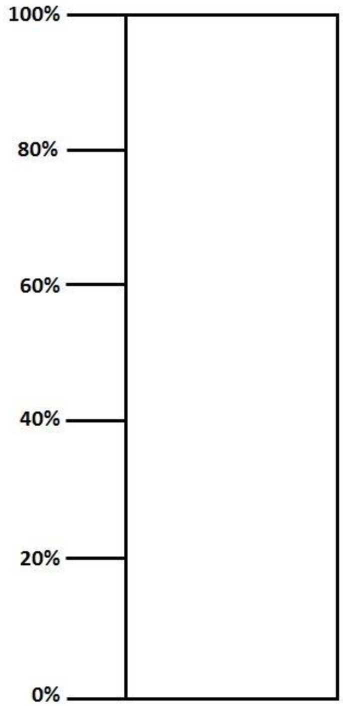
Total cal:



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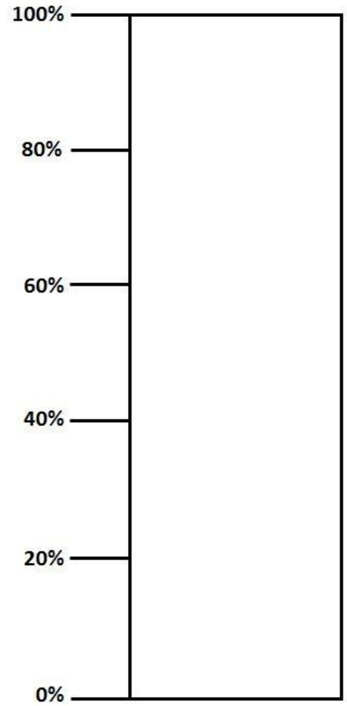

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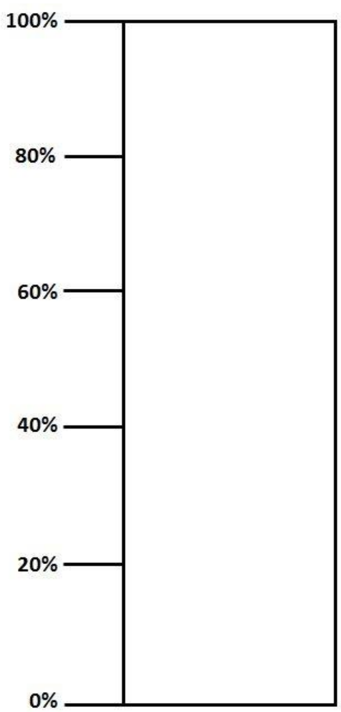

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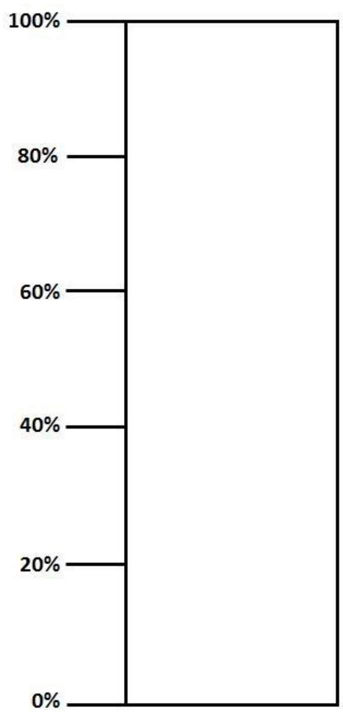

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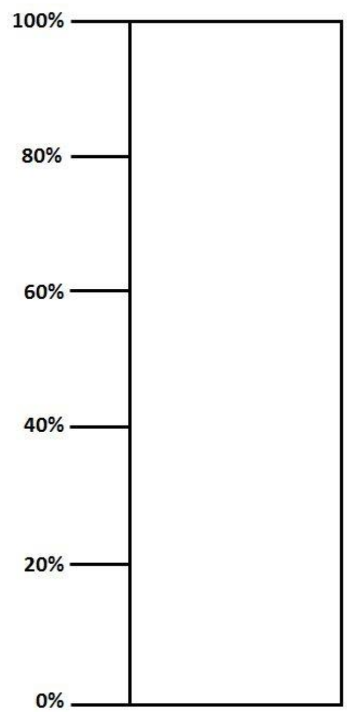


Name:
Total cal:

Example: Calculating Food and Drink Labels

1. Using the above label, calculate the total calories in Green Giant Whole Kernel Sweet Corn

   a. Grams of Fat __1__ x 9 calories/gram = __9__ calories

   b. Grams of Carbohydrates __20__ x 4 calories/gram = __80__ calories

   c. Grams of Protein __2__ x 4 calories/gram = __8__ calories

   d. Total calories: __97__ calories

   Note: *the total calculated calories may not be identical to the label because grams of nutrients are rounded for label printing. Use your calculated number of calories to find the percentages of calories for each type of food, not the number from the label.*

2. Calculate the percent calories of each of the food types (fat, carbs, and protein):

   Remember: $\frac{\text{Part of calories}}{\text{Whole (total) calories}}$ X 100 = percentage

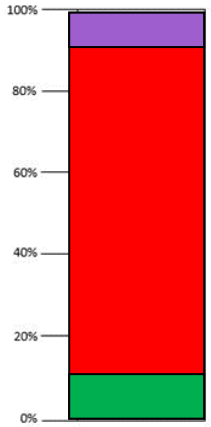
   a. % calories from fat = 9/97 fat calories/total calories x 100 = __9.3__ %

   b. % calories from carbs = 80/97 carb calories/total calories x 100 = __82.5__ %

   c. % calories from protein = 8/97 protein calories/total calories x 100= __8.2__ %

3. Represent the percentages from Step 2 as a bar, as you see here. Label the name of the food and provide the total calories per serving. ***Note:*** make sure to use the following colors:

fat (green), carbohydrates (red) and protein (purple).



Name: Sweet corn kernels, canned
Calories: 97

Calculating Food and Drink Labels Student Sheet 4

Name: _____ **Date:** _____ **Period:** _____

Use food labels or Food-A-Pedia (www.supertracker.usda.gov/foodapedia.aspx) to compare four different foods/beverages. Choose one food and one beverage that you regularly consume, and one food and one beverage frequently consumed by your parents or grandparents using the family tree of eating habits from Lesson One. Complete the calculations and fill out the bar graph.

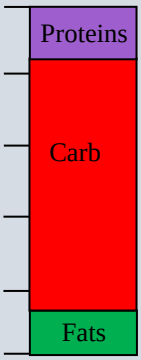
Things to remember…

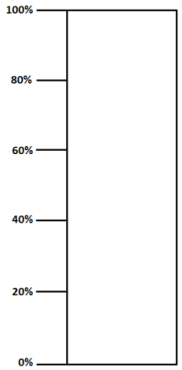
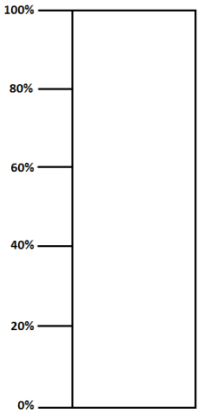
Grams of Fat x **9** cal/gram = _____ calories from Fat

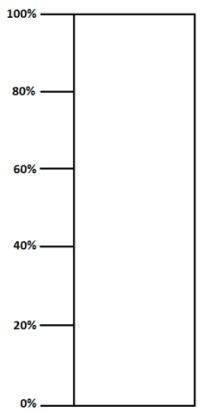
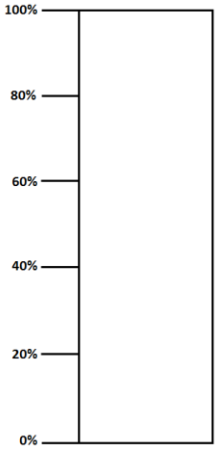
Grams of Carbohydrate x **4** cal/gram = _____ calories from Carbohydrates

Grams of Protein x **4** cal/gram = _____ calories from Proteins

$$\frac{\text{Part of calories}}{\text{Total calories}} \times 100 = \text{percent calories}$$



Food #1: A common food for you			**Total Calories:**
From the label… Grams of Fat: Grams of Carbs: Grams of Protein:	*Calculate the…* Calories from Fat: Calories from Carbs: Calories from Protein: Total calories:	*Calculate the…* % calories from Fat: % calories from Carbs: % calories from Protein:	
Food #2: A common drink for you			**Total Calories:**
From the label… Grams of Fat: Grams of Carbs: Grams of Protein:	*Calculate the…* Calories from Fat: Calories from Carbs: Calories from Protein: Total calories:	*Calculate the…* % calories from Fat: % calories from Carbs: % calories from Protein:	

Food #3: A common food for your parents/grandparents			**Total Calories:**
From the label… Grams of Fat: Grams of Carbs: Grams of Protein:	*Calculate the…* Calories From Fat: Calories from Carbs: Calories from Protein: Total calories:	*Calculate the…* % calories from Fat: % calories from Carbs: % calories from Protein:	
Food #4: A common drink for your parents/grandparents			**Total Calories:**
From the label… Grams of Fat: Grams of Carbs: Grams of Protein:	*Calculate the…* Calories From Fat: Calories from Carbs: Calories from Protein: Total calories:	*Calculate the…* % calories from Fat: % calories from Carbs: % calories from Protein:	

1. a. Choose one of your beverages or find a new one on Food-A-Pedia. Click on "nutrient info" to find the amount of sugar in that beverage and record it here:

   Amount of sugar _____

   b. Put that amount of sugar into a labelled baggie by *either* weighing the correct amount of table sugar in grams, *or* using sugar cubes to show the correct amount of sugar cubes (3g/1 cube) *or* converting grams of sugar into teaspoons (4g/tsp). What do you notice?

2. How can nutrition fact labels be useful for making informed and healthy choices?

3. Explain how the foods and drinks you consume are the same or different as those consumed by your parents or grandparents.

Lesson 5 | An Ounce of Prevention

Time: 50 minutes

Lesson Objectives:
Students will be able to answer:

- How can calories and exercise be analyzed using on-line tools?
- What are two important ways to help prevent type 2 diabetes?
- How can I make a meaningful contribution to the prevention of type 2 diabetes?

Overview

Students learn ways in which exercise can aid in treating and preventing type 2 diabetes, and determine durations of physical activity required for balancing calories consumed and calories burned. To wrap up the unit, students review their models, contribute to the Chalk Talk posters, and consider how they might make a meaningful contribution to the prevention of type 2 diabetes.

Enduring understandings:

Type 2 diabetes can be prevented: factors contributing to a person's risk include exercise and good nutrition.

Students can make a meaningful contribution to the prevention of type 2 diabetes.

Essential questions:

How does exercise impact type 2 diabetes?

Lesson Summary with Timings:

Why Exercise?	10 min
How Much Exercise?	15 min
Revisiting Chalk Talk and Models	20 min
Looking Forward: Call to Action Projects	5 min

Health and PE Standards: students will gain competency towards the following standards:

Nutrition

1. **Food Groups and Nutrients**: Evaluate resources for accessing valid and reliable information, products, and services for healthy eating. H3.N1.HS
4. **Caloric Intake and Expenditure:** Demonstrate how to balance caloric intake with caloric expenditure to maintain, gain, or reduce weight in a healthy manner. H7.N4.HS
5. **Disease Prevention:** Analyze and describe the relationship between nutritional choices, physical activity, and chronic diseases. H1. N5.HS

Wellness

1. **Dimensions of Health:** Analyze personal dimensions of health and design a plan to balance health. H1.W1.HS
2. **Disease Prevention:** Analyze prevention, lifestyle factors, and treatment of communicable and noncommunicable diseases. H2.W2.HSa
   Assess personal risk factors and predict future health status. H2.W2.HSb
3. **Analyzing Influences:** Analyze how a variety of factors impact personal and community health. H2.W3.HS
6. **Decision-Making:** Predict potential short- and long-term outcomes of a personal health-related decision. H5.W6.HS

Materials

Materials	Quantity
PowerPoint slide set for the unit, found at http://gsoutreach.gs.washington.edu/GEMNet	
Computers for students with access to: • **SuperTracker**: www.supertracker.usda.gov/foodapedia.aspx • **Activity Calculator**: www.caloriecontrol.org/healthy-weight-tool-kit/lighten-up-and-get-moving	1 per student or group
Fun-sized candy bar, or popular student snack	1 per class
Student Resource 5: *How Much Exercise?*	1 per group
Student Sheet 5: *Balancing Calories and Exercise*	1 per student
Student Sheet 5: *How Much Exercise?* KEY	1 per class
Looking Forward: Call to Action Projects	

Lesson Background and Preparation

- This lesson asks students to consider how much physical activity is needed to balance the caloric intake. While the balancing of "calories in = calories out" is a useful concept for students, it is helpful for students to know that not all calories are created equally. For example, 140 calories from a handful of nuts will digest slowly due to the fiber content, provide protein, and contribute to a feeling of fullness. 140 calories from a 12-oz can of sugared soda will dump 39 g of sugar into the blood stream without providing fiber or protein.

- The simple "calories in = calories out" calculations are complicated by number of factors. The number of calories each person extracts from food is impacted by which bacteria are in that person's gut, the type of the food, how that food is prepared, and how much energy a person uses to digest different foods.

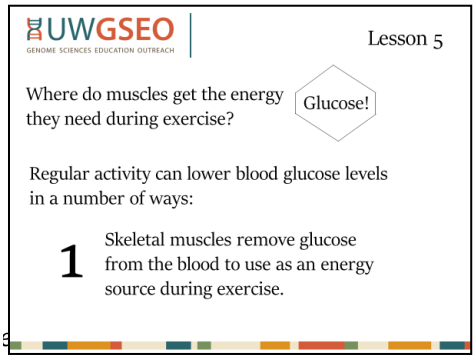
Procedures

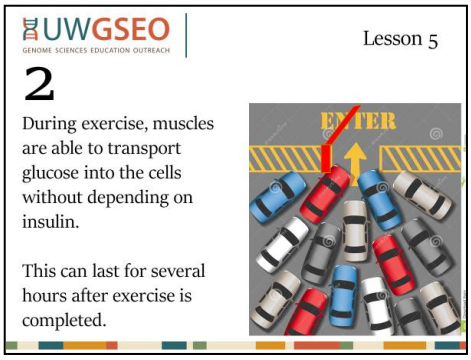
Part I (Engage and Explain) Why Exercise? (10 min)

1. Start the class by brainstorming benefits of exercise. A list could include numerous benefits such as better sleep, weight control, stress control, boosting of energy levels, strengthening of the heart and muscles, improvement of mood, as well as promoting fun and social activities.

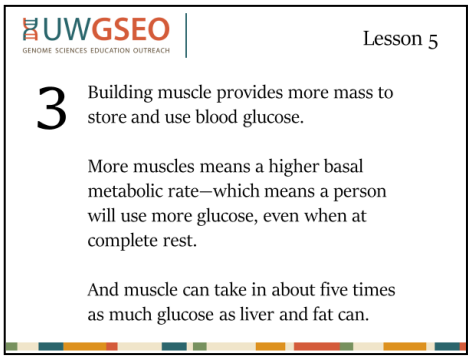
2. Ask students why exercise might be especially important in the prevention and treatment of type 2 diabetes, and show slides 38 – 41.

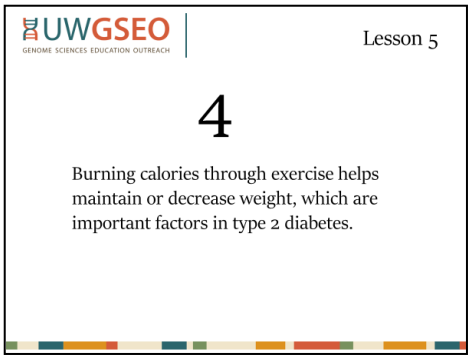
Slide 38-39





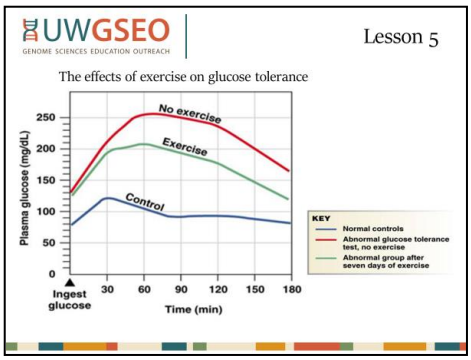
Slides 40-41





3. Slide 42 shows what should be a now-familiar blood glucose curve for normal controls, people with abnormal glucose tolerance (pre-diabetic or diabetic) before and after seven days of exercise.

Slide 42



Part II (Explore) **How Much Exercise?** **(15 minutes)**

4. Tell students that burning calories through exercise is an important part of maintaining or decreasing weight, which can be helpful in preventing type 2 diabetes. We often have an unrealistic understanding of how much exercise is needed, however.

5. Hold up a fun size candy bar (or popular student snack) and ask students, "How long would you have to walk briskly to burn off the calories in this snack? Have students write down their best guesses.

6. Using Student Resource 5: *How Much Exercise?* demonstrate for students how to find the calories of the snack that was just held up or the sandwiches listed on the Student Resource using the USDA's Food-A-Pedia section of the SuperTracker website (www.supertracker.usda.gov).

Food-A-Pedia is useful for looking up nutritional values of foods that do not come packaged, such as fruits and vegetables. Encourage students to research these foods, too.

7. Next, demonstrate the Activity Calculator at www.caloriecontrol.org/healthy-weight-tool-kit/lighten-up-and-get-moving.

8. Demonstrate the Activity Calculator with two different weights of people, real or fabricated. Students will notice that a heavier person burns more calories than does a lighter person doing the same activity for the same amount of time. This is due to differences in ***basal metabolic rates***, or the number of calories required to sustain cellular respiration and bodily functions of a person when at rest. A heavier person requires more calories to maintain their weight, and burns more calories when exercising. As a person loses weight, their caloric needs decrease.

9. Pass out Student Sheet 5: *Balancing Calories and Exercise*. Let students work independently or in groups to record information from four different foods or beverages and calculate the amount of activity needed to burn off calories from various foods. Make sure at least one of the four is a beverage.

10. Have students complete the questions on Student Sheet 5 as they proceed. Selected answers can be found on the Student Sheet 5: *Balancing Calories and Exercise* KEY.

Part III (Evaluate and Closure) Revisiting Chalk Talk and Models (20 min)

11. Give students a last chance to revisit the Chalk Talk posters from Lessons 1 and 3, and make further comments on each poster. If possible, use a different color of marker on each poster so that today's comments can be distinguished from prior comments.

12. Have students revise the models they last updated in Lesson 3. Using the "callout" template found in Teacher Resource 3.2 allows students to zoom in and represent what is happening at the level of cells and tissues, including muscles. Students can also draw their own call-out boxes on their models.

13. After adding to the Chalk Talk paper conversation a final time, the class can engage in a whole class discussion about what students observed and how their understanding and beliefs about the causes, preventions and impacts of type 2 diabetes have changed, or not, over time.

14. Give students a chance to view each other's models through a Gallery Walk or student presentations.

15. After viewing student work, have the class create a consensus model that builds on student models and incorporates major concepts presented throughout the unit.

Part IV (Closure) Looking Forward (5 min)

16. If students have a leadership/project component to their education, they could be encouraged to create a type 2 diabetes-themed Call to Action project. Relate to students that nature of the complex topic of type 2 diabetes lends itself well to extended learning through student projects, as detailed below.

Glossary
Basal metabolic rate: The rate at which an organism uses energy (burns calories) when at complete rest.

Looking Forward: Call to Action Projects

Type 2 diabetes is a complex condition that brings together issues of health care, scientific research, environmental influences, personal choice, access to resources, diet and exercise, social justice, public policy, and more. The nature of this complex topic lends itself well to extended learning through student projects. If students have a leadership/project component to their education, they could be encouraged to create a type 2 diabetes-themed Call to Action project, in which they synthesize and apply their learning throughout the unit by creating a product that demonstrates their understanding of type 2 diabetes, addresses a specific diabetes-related problem, and contributes to a solution. Successful Call to Action projects implement direct, meaningful, and relevant actions to make a contribution towards combatting diabetes within the students' communities.

Project Ideas
Ideas for projects may include:

- Educate peers and others on sugar content of common drinks
- Survey and analyze foods typically given at food banks
- Create a media literacy lesson for peers using food and drink marketing
- Develop a cookbook
- Enroll a team/create an educational table for a *Tour de Cure* or other event
- "Do This, Not That" (in parallel to book "Eat This, Not That")
- Develop a script for a "living room focus group"
- Propose public policy at local or state level to improve health
- Develop a monthly healthy menu plan for a family of four given a budget
- Assess the nutritional quality of school lunch programs
- Use a personal tracking device or health app to analyze one's own practices

Call to Action Resources

Name of resource
"A Call to Action on Diabetes." International Diabetes Federation. Nov. 2010. Web. <http://www.idf.org/webdata/Call-to-Action-on-Diabetes.pdf>. "A Health Literacy Curriculum for ESOL Learners (Intermediate Level) | Queens Library." A Health Literacy Curriculum for ESOL Learners (Intermediate Level) | Queens Library. Queens Library, 2012. Web. 22 May 2012. <http://www.queenslibrary.org/services/health-info/english-for-your-health/teacher-intermediate-level>. "American Diabetes Association: Diabetes." 1995-2012. Web. 22 May 2012. <http://www.diabetes.org/>.

"America's Move to Raise a Healthier Generation of Kids." Let's Move! USDA. Web. 29 May 2012. <http://www.letsmove.gov/>.

"Characteristics of an Effective Health Education Curriculum." Centers for Disease Control and Prevention. 29 Nov. 2011. Web. 29 May 2012. <http://www.cdc.gov/healthyyouth/sher/characteristics/index.htm>.

"Diabetes." WHO. 2012. Web. 22 May 2012. <http://www.who.int/mediacentre/factsheets/fs312/en/>.

"Diabetes Public Health Resource." Centers for Disease Control and Prevention. 2012. Web. 22 May 2012. <http://www.cdc.gov/diabetes/>.

"Final Rule: Nutrition Standards in the National School Lunch and School Breakfast Programs." United States Department of Agriculture. 25 May 2012. Web. 29 May 2012. <http://www.fns.usda.gov/cnd/Governance/Legislation/nutritionstandards.htm>.

Gill-Carey, O., and AT Hattersley. "Genetics and Type 2 Diabetes in Youth." National Center for Biotechnology Information. U.S. National Library of Medicine, 2007. Web. 29 May 2012. <http://www.ncbi.nlm.nih.gov/pubmed/17991132>.

"NHLBI-Portion Distortion Quiz." Stay Young At Heart. National Heart, Lung and Blood Institute. Web. 29 May 2012. <http://hp2010.nhlbihin.net/portion/index.htm>.

"NIH and the Weight of the Nation - Health Information - National Institutes of Health (NIH)." U.S National Library of Medicine. 15 May 2012. Web. 29 May 2012. <http://www.nih.gov/health/NIHandweightofthenation/>.

"NIH Research Featured in HBO Documentary Series on Obesity." National Heart, Lung and Blood Institute. National Institute of Health. Web. 29 May 2012. <http://www.nhlbi.nih.gov/news/press-releases/2012/nih-research-featured-in-hbo-documentary-series-on-obesity.html>.

"Succeed at Weight Loss with Lose It!" Lose It! -. Fit Now, Inc. Web. 29 May 2012. <http://www.loseit.com/>.

"SuperTracker." SuperTracker. United States Department of Agriculture. Web. 29 May 2012. <http://www.choosemyplate.gov/supertracker-tools/supertracker.html>.

"Type 2 Diabetes." MedlinePlus Medical Encyclopedia. U.S. National Library of Medicine, 19 Apr. 2012. Web. 29 May 2012. <http://www.nlm.nih.gov/medlineplus/ency/article/000313.htm>.

The Weight of the Nation resources:

"The Weight of the Nation." HBO. Home Box Office, Inc., 2012. Web. 29 May 2012. <http://theweightofthenation.hbo.com/>.

"The Weight of the Nation: A Model of Community Action." HBO. Home Box Office, Inc. Web. 29 May 2012. <http://theweightofthenation.hbo.com/films/bonus-shorts/healthy-mom-healthy-baby-the-risks-of-excess-weight>.

"The Weight of the Nation: Download Materials." HBO. Home Box Office, Inc. Web. 29 May 2012. <http://theweightofthenation.hbo.com/screenings/download-materials>.

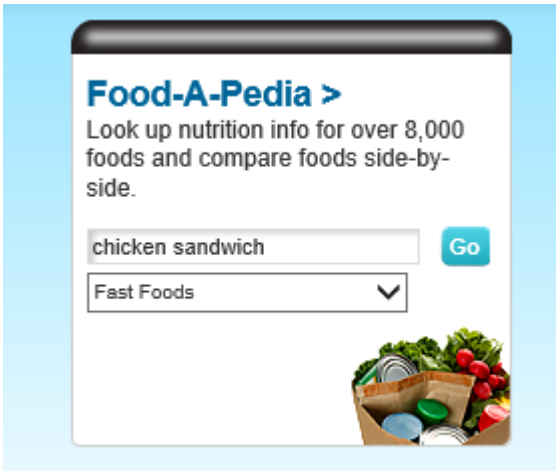
"The Weight of the Nation: Obesity and Type 2 Diabetes." HBO. Home Box Office, Inc. Web. 29 May 2012. <http://theweightofthenation.hbo.com/films/bonus-shorts/healthy-mom-healthy-baby-the-risks-of-excess-weight>.

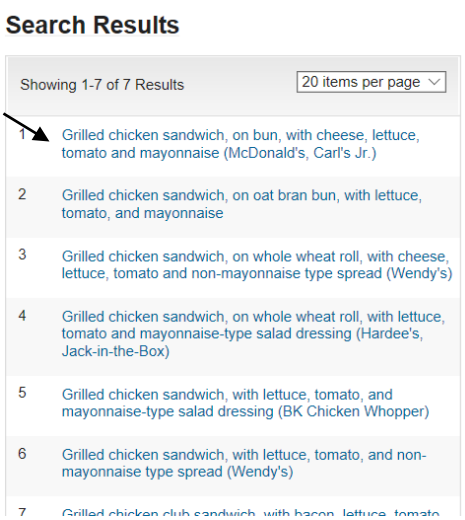
"The Weight of the Nation: Schools & Early Care." HBO. Home Box Office, Inc. Web. 29 May 2012. <http://theweightofthenation.hbo.com/themes/schools-and-early-care>.

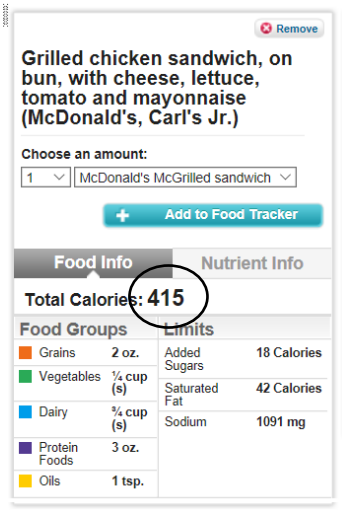
Example: How Much Exercise?

1. How many calories are in a McDonald's Grilled Chicken Sandwich vs. a McDonald's Big Mac?

   Go to: www.supertracker.usda.gov and enter the food category and type into Food-A-Pedia. Enter the type of food from the drop-down menu, and then enter the type of food. Next, choose the correct food from the search results:



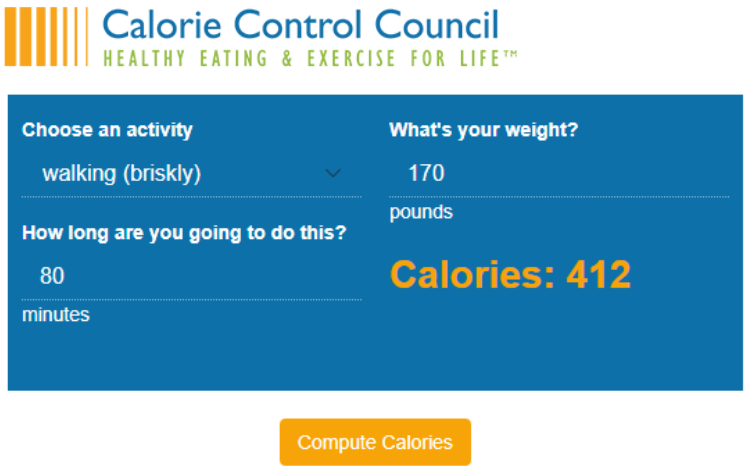




- McDonald's Grilled Chicken Sandwich: ___415___ calories
- McDonald's Big Mac: ___585___ calories

2. How long you would need to burn off the calories in the McDonald's Grilled Chicken Sandwich vs. the McDonald's Big Mac?

   Go to the Activity Calculator at: www.caloriecontrol.org/healthy-weight-tool-kit/lighten-up-and-get-moving: Choose your favorite physical activity, and determine the duration of activity needed to burn off the calories for each meal.



For example, a 170-pound person would need to walk briskly for an hour and 20 minutes to burn 412 calories—enough for the Grilled Chicken Sandwich.

Name: _____ **Date:** _____ **Period:** _____

1. Choose two snacks from the vending machine or from your home, and use Food-A-Pedia: www.supertracker.usda.gov/foodapedia.aspx or the labels to determine how many calories are in each of these snacks.

Food-A-Pedia is useful for looking up nutritional values of unprocessed foods that do not come packaged, such as fruits and vegetables. How about including a piece of fruit or vegetable as a snack?

   - Snack #1 _____: _____ calories
   - Snack #2 _____: _____ calories

2. Using the Activity Calculator: www.caloriecontrol.org/healthy-weight-tool-kit/lighten-up-and-get-moving: Choose a physical activity, and determine how long you would need to participate in this activity to burn off the calories from each of the two snacks.

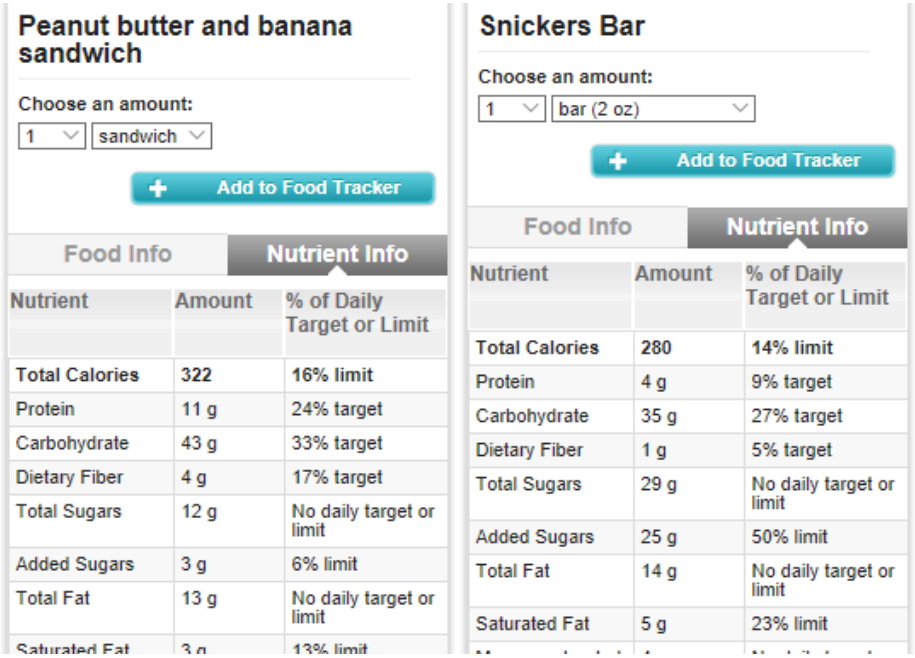
   - Activity chosen: _____
   - Duration of activity needed to burn of the calories in:
     - Snack #1 _____: _____
     - Snack #2 _____: _____

3. What do you think happens to excess calories (i.e., carbohydrates fats, or protein) that are not consumed (i.e., burned) during daily physical activity and metabolism?

4. Based on your answer to question 3, do you think it is important to be aware of the number of calories that you consume daily and whether you are getting a balanced diet of carbohydrates, fats and proteins? Why or why not?

5. Explain the role of exercise for someone who is pre-diabetic or has type 2 diabetes.

6. Which snack would be a better choice? Give three reasons to support your answer.



Peanut butter and banana sandwich

Choose an amount: 1 sandwich

+ Add to Food Tracker

Food Info | Nutrient Info

Nutrient	Amount	% of Daily Target or Limit
Total Calories	322	16% limit
Protein	11 g	24% target
Carbohydrate	43 g	33% target
Dietary Fiber	4 g	17% target
Total Sugars	12 g	No daily target or limit
Added Sugars	3 g	6% limit
Total Fat	13 g	No daily target or limit
Saturated Fat	3 g	13% limit

Snickers Bar

Choose an amount: 1 bar (2 oz)

+ Add to Food Tracker

Food Info | Nutrient Info

Nutrient	Amount	% of Daily Target or Limit
Total Calories	280	14% limit
Protein	4 g	9% target
Carbohydrate	35 g	27% target
Dietary Fiber	1 g	5% target
Total Sugars	29 g	No daily target or limit
Added Sugars	25 g	50% limit
Total Fat	14 g	No daily target or limit
Saturated Fat	5 g	23% limit

Balancing Calories and Exercise KEY Student Sheet 5

Name: _____ **Date:** _____ **Period:** _____

1. Choose two snacks from the vending machine or from your home, and use Food-A-Pedia: www.supertracker.usda.gov/foodapedia.aspx or the labels to determine how many calories are in each of these snacks.

Food-A-Pedia is useful for looking up nutritional values of unprocessed foods that do not come packaged, such as fruits and vegetables. How about including a piece of fruit or vegetable as a snack?

   - Snack #1 _____: _____ calories
   - Snack #2 _____: _____ calories

2. Using the Activity Calculator: www.caloriecontrol.org/healthy-weight-tool-kit/lighten-up-and-get-moving: Choose a physical activity, and determine how long you would need to participate in this activity to burn off the calories from each of the two snacks.

   - Activity chosen: _____
   - Duration of activity needed to burn of the calories in:
     - Snack #1 _____: _____
     - Snack #2 _____: _____

3. What do you think happens to excess calories (i.e., carbohydrates fats, or protein) that are not consumed (i.e., burned) during daily physical activity and metabolism?

   Excess calories from carbohydrates that are consumed but not burned during metabolism or additional physical activity can be stored as glycogen in the liver or muscles, or stored in adipose tissue as fat. Excess fat could be stored in adipose tissue as fat. Excess protein is often eliminated from the body.

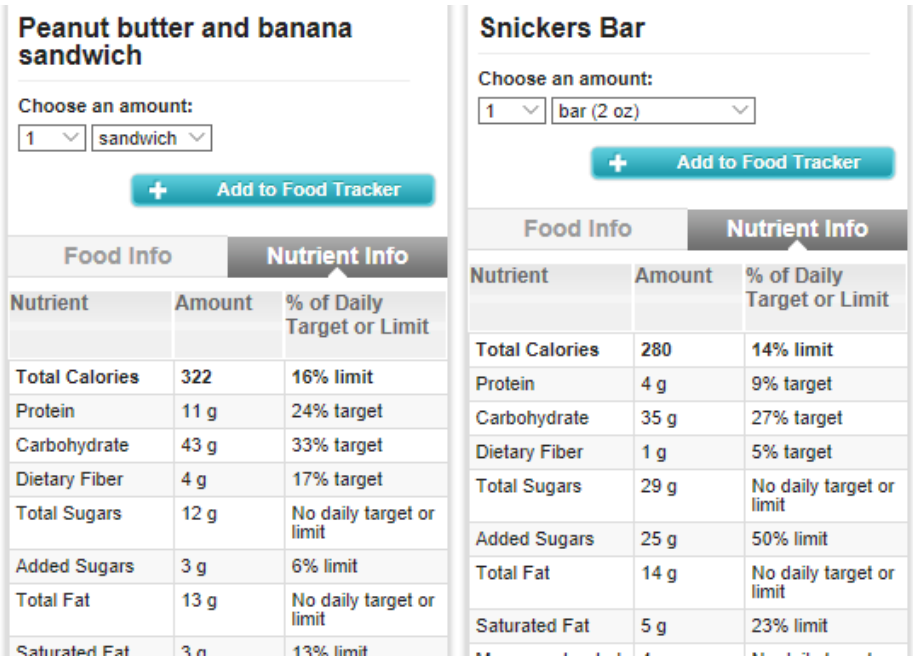
4. Based on your answer to question 3, do you think it is important to be aware of the number of calories that you consume daily and whether you are getting a balanced diet of carbohydrates, fats and proteins? Why or why not?

   It is important to know your balance of calories consumed versus burned, and to be aware that excess calories in the form of carbohydrates, fat and proteins are not stored in the same way. It may also be important to know that different forms of exercise (e.g., exercise intensities) burn different energy storages (e.g., fat versus glycogen).

5. Explain the importance of exercise for someone who is pre-diabetic or has type 2 diabetes.

   Exercise can lower blood glucose levels in many ways: 1) Skeletal muscles remove glucose from the blood to use as an energy source during exercise, 2) During exercise, muscles are able to transport glucose into the cells without depending on insulin, which can improve blood glucose levels for hours after exercise is completed, 3) Building muscle provides more mass to store and use blood glucose which creates a higher basal metabolic rate, 4) Burning calories through exercise helps maintain or decrease weight, which are important factors in type 2 diabetes.

6. Which snack would be a better choice? Give three reasons to support your answer.



Peanut butter and banana sandwich

Choose an amount: 1 sandwich

+ Add to Food Tracker

Food Info | Nutrient Info

Nutrient	Amount	% of Daily Target or Limit
Total Calories	322	16% limit
Protein	11 g	24% target
Carbohydrate	43 g	33% target
Dietary Fiber	4 g	17% target
Total Sugars	12 g	No daily target or limit
Added Sugars	3 g	6% limit
Total Fat	13 g	No daily target or limit
Saturated Fat	3 g	13% limit

Snickers Bar

Choose an amount: 1 bar (2 oz)

+ Add to Food Tracker

Food Info | Nutrient Info

Nutrient	Amount	% of Daily Target or Limit
Total Calories	280	14% limit
Protein	4 g	9% target
Carbohydrate	35 g	27% target
Dietary Fiber	1 g	5% target
Total Sugars	29 g	No daily target or limit
Added Sugars	25 g	50% limit
Total Fat	14 g	No daily target or limit
Saturated Fat	5 g	23% limit

While students might choose the Snickers Bar since it has fewer calories, it is important to note that the peanut butter sandwich 1) offers grains and fruit, both of which provide fiber which slows digestion and contributes to a feeling of fullness, 2) The sandwich has by far fewer empty calories, 3) The sandwich provides more protein, and 4) The sandwich has fewer sugars, and far fewer added sugars. If students dig a bit deeper on Food-A-Pedia, they will find that the sandwich also provides more minerals and vitamins.

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