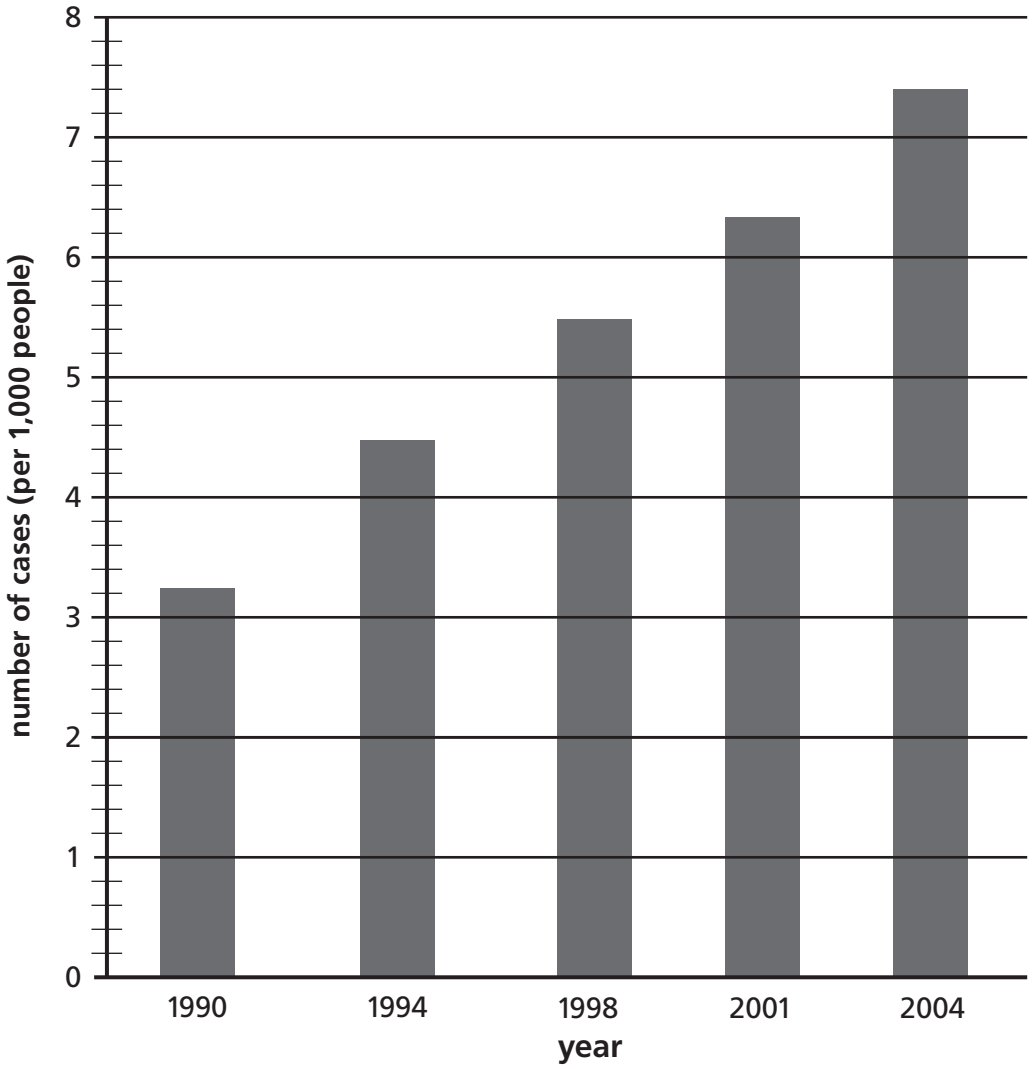
Diabetes in Native American Adolescents, Ages 15–19



Photographs of Nick and Kim

Nick

Kim

Photos provided by Bill Freeman.

1.3

Summarizing Diabetes

Directions: For each question, write a short answer for both type 1 and type 2 diabetes. You will start completing this chart in Lesson 1 and continue in later lessons. You will not be able to answer all questions during Lesson 1—just leave those blank for now.

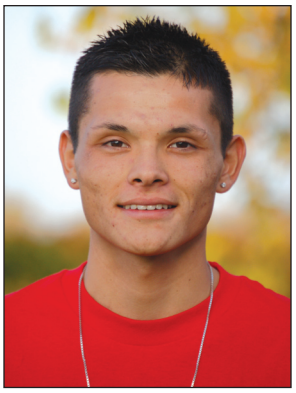
Question	Type 1 Diabetes	Type 2 Diabetes
What are the symptoms?		
What is wrong in the body?		
Who gets diabetes?		
How common is diabetes?		
Why is blood glucose (blood sugar) important in the body?		
Where does the glucose in the blood come from?		

1.3

Question	Type 1 Diabetes	Type 2 Diabetes
What body organ isn't working correctly?		
What controls the glucose concentration in the blood normally?		
What is the problem with insulin?		
Can people with diabetes have a good life? Explain.		
What do people do to manage their diabetes?		
Besides physical problems, how can diabetes affect a person's life?		
From whom can people with diabetes get information and help to keep their life in balance?		

1.4

Nick's Story



My name is Nicholas Scott. I'm 18 years old and I attend Northwest Indian College. I am from the Lummi Indian Reservation, located near Bellingham, Washington.

I was diagnosed with type 1 diabetes when I was 12 years old attending elementary school. Becoming a diabetic at such a young age was a child's worst nightmare. In my case, I did not know what was wrong with me. I came down with the most unbearable dehydration and flulike symptoms. I could not get enough fluids in my body so I kept on drinking glass after glass of water and juice. This process continued for about two weeks and, as I was at school, I always told my teacher that I needed to go to the bathroom and that I needed a drink of water. By the time my family took me to the doctor's office, I had lost about 20 pounds because of my lack of appetite and how many fluids were going in and out of my body.

My body was at the point in which I could no longer walk or comprehend what was going on. No one really said anything about my strange habits of going to the bathroom and drinking so much water and how tired and down I was. Then by the time I went to my family doctor, my blood sugar was so high it was unreadable by a blood sugar meter. I was rushed to the hospital where I was admitted and stayed for a week, not knowing that I was pretty much in a diabetic coma.

When I was able to get up out of the hospital bed, the first thing that the doctors and nurses did for me was teach me how to give my insulin shots in my arms and in my lower stomach, also how to regulate my diet and check my blood sugar. Over the years, I have learned how to change the amount of insulin I need and what different types of food are the best for my body. I've also learned that most of the people who get type 1 diabetes are mostly young—between when they are born and their teenage years. The one thing I learned that shocked me the most was that diabetes is most commonly found among Native Americans and I don't know why this is, but it just shows that Native Americans should take diabetes more seriously and be aware if it runs in your family. Most Native Americans get type 2 diabetes, but no matter what type of diabetes someone has, it is important to take it seriously.

After I had learned enough information about the disease, the hospital sent me home. I then went into diabetic depression. I no longer wanted to live because I thought there was no point in being part of this world if I was going to be stuck with this disease. Being the young kid I was, I felt that everything was being taken away from me, like my freedom to be a kid, and even a regular human being!

As life went along, I learned how to deal with my diabetes. I started to learn how to stay on a healthy diet and keep a well-organized schedule so I could manage my blood sugar level. The person who has helped me through my diabetes the most is my doctor, who I visit every three months. He has me on timed schedules for checking my blood sugar and, by the time the day is over, I usually check up to five times a day and give shots with every meal and every blood sugar check if needed. When I am playing sports or being more active than usual, I check my blood sugar beforehand because if my blood sugar is over 300*, I can't be active until it comes down because my body is too low on energy at that point and I could pass out or become very dehydrated. Every time I visit my doctor, I get my A1c checked to see how my diabetes is doing and how my blood sugar levels are. An A1c check is to see what my average blood sugar is for a three-month period.

Being healthy again is unbelievable. I never thought I could control the disease this well. To help my diet, I add in exercise daily. I play basketball to keep my body in shape, and to set an example for other kids who go through the same tasks that I do every day.

**300 milligrams / deciliter (mg/dL)*

1.5

Kim's Story

My name is Kimberly Marie Thiele. (My Dakota name is "Mahpiya Duta Winyan" which translates as "Red Cloud Woman." This name had been given to me by my grandmother from Canada.)

My life began on a summer day on July 17, 1987. I was born early, weighing only 3 pounds and 7 ounces. I developed yellow jaundice a couple of days later so I stayed for an extra week. Other than that, I was healthy and went home after two weeks. It took me awhile to catch up to the other kids my age but after awhile I caught up and grew up to be a healthy and happy little girl.

As I grew into my teen years, my life was good; I came from a two-parent family, had good friends, and enjoyed school. In January of 2003, I noticed that something was wrong. I was always thirsty, like really thirsty to the point where I started bringing a glass with a pitcher of water to my bedroom at night, and then of course, I was also urinating a lot, especially at night, maybe two, three times a night. I lost a lot of weight. It didn't really dawn on me to think that I may have some type of disorder like diabetes.

On April 26, 2003, in school, I had a headache, was tired, and weak. I called my father, and he came after me. We went to the clinic, and I signed up as a walk-in and waited. My name was called. They took my temp and blood pressure, etc., etc. My father asked if they could check my sugar. In the past weeks, little did I know, my father would wake up every time I went to the bathroom during the night. (He noticed how frequently I was visiting the restroom.) He suspected diabetes but didn't really think that could be it, after all, I was only 16 years old. The nurse did a blood sugar test, and my blood sugar was 670* that day. I was given a dose of insulin and was prescribed diabetes pills. (A year later, I was switched from pills to insulin.)

**670 milligrams / deciliter (mg/dL)*

I had been diagnosed with type 2 diabetes. After the doctor informed me I had diabetes, I was sent to talk to a dietitian and a public health nurse. Both of these people are also certified diabetes educators. They explained to me that the type of diabetes I had was usually found in older people but was increasingly being diagnosed in young children and teenagers. They also explained to me that I would have to do A1c testing every three to six months. (What an A1c test does is monitor the glucose control of diabetics over time; it also aids in treatment decisions.) They also taught me how to check my blood sugar and how often (twice a day), and explained that I could control my diabetes with diet and exercise.

When I was diagnosed, I never thought too much about it. It didn't really matter because I didn't know what diabetes was all about. On the other hand, my parents were heartbroken. It was heartbreaking for them because I was just 16, and they had seen what effects diabetes had on the human body and also the pain that it causes emotionally and physically.

After learning all about diabetes and that it is a lifelong disease with severe consequences if not taken care of, I went into denial big time. I told myself, "I don't have diabetes, how can I? I am only 16 years old." I wouldn't test my blood sugar, on some days I didn't take my insulin, and I ate whatever I wanted and whenever I wanted. My parents enrolled us in an educational counseling program taught by a nurse, but I wouldn't cooperate and didn't believe I needed to be there.

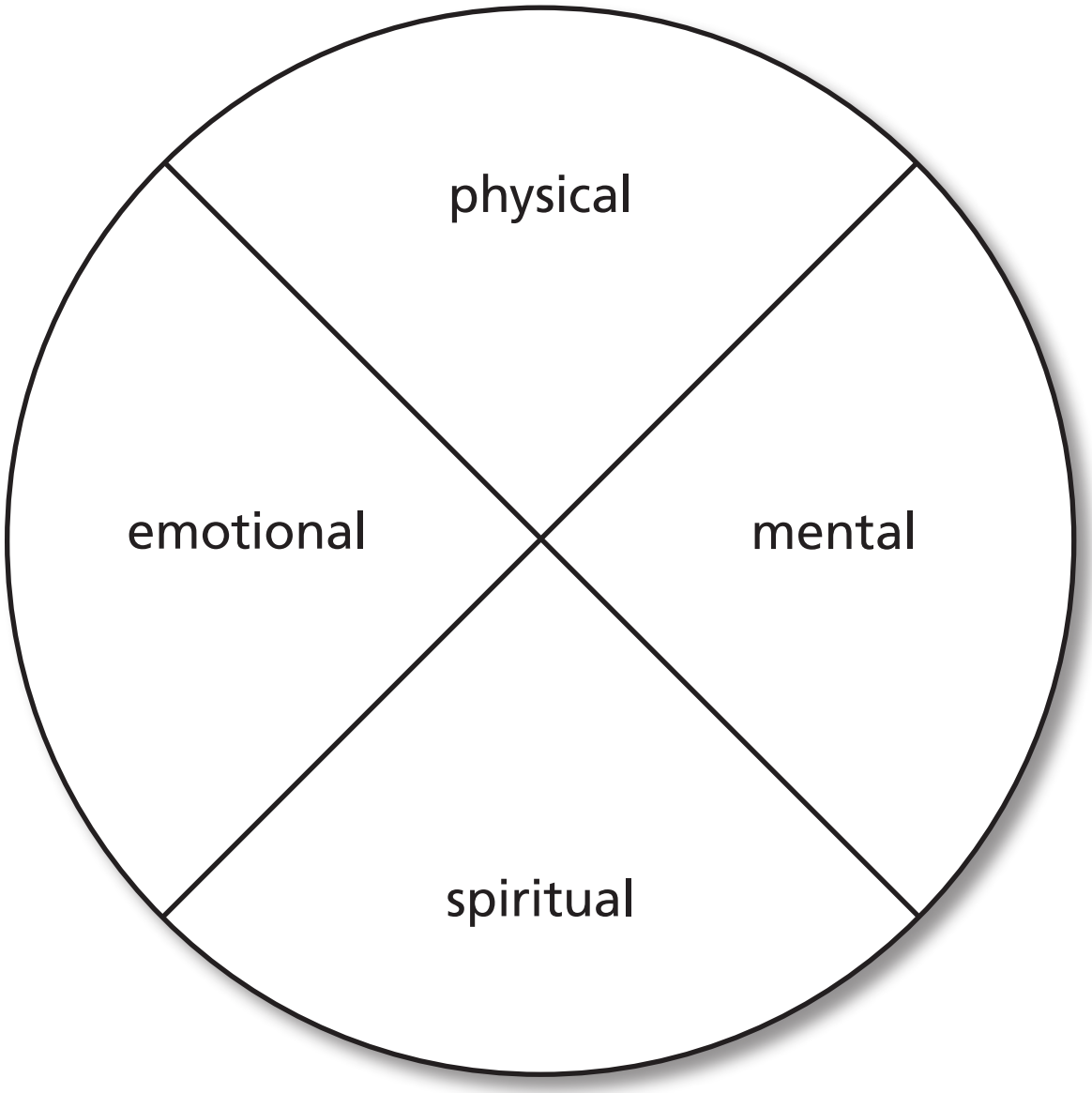
One day in school, my blood sugar became so low that I got a headache and was shaky, tingly, and confused. I got the scare of my life. After that incident, I was determined to take care of myself, and it went well for a while. Then I was back in denial and fell back into not taking care of myself again. I didn't want to be treated any different than anyone else. I figured at one point, what's the use? My death will have something to do with diabetes anyway.

1.5

In the spring of 2005, I suspected that I was pregnant, and in May it was confirmed. I didn't want to tell my parents and break their hearts again. I tried to wait a couple of more months to July when I would be turning 18 years old. I was told by my school counselor that, because of my health, if I didn't tell my parents that day that she would. I couldn't face them so I e-mailed my mom. (Yes, I know that sounds crazy but you just had to be there to understand the situation I was in.) We all went through accepting the fact, that yes, I was pregnant, and went from there. My parents supported me, especially my dad, who drove me once a month and then twice a week to the special prenatal clinic which was a 180-mile round-trip. Thank you, Dad, I love you.

1.6

Diabetes Affects the Balance in a Person's Life



1.7

Similarities and Differences

	Type 1 and Type 2 Diabetes
Similarities	
Differences	

2.1

Summarizing Digestion and Energy Production

People eat foods that are broken down by a process called _____. This process begins with enzymes in the saliva and continues as foods pass through the stomach and intestines. A main type of nutrient that the human body can use for energy is _____. After they are eaten, _____ are broken down into smaller molecules, including _____. This is the main type of sugar that circulates in the blood for cells to use. The cells use _____ to produce ATP, a chemical compound that stores energy the body can use. Calories are a measurement of the amount of energy that a food contains.

2.2

Understanding Concentration

Part 1

Directions: Work in your groups and follow the directions.

1. Decide who will get supplies from the supply table in the room.

You will need

- 5 plastic or paper cups
- 1 100-milliliter graduated cylinder
- 1 container of glucose testing strips
- 1 watch or clock with a second hand

2. Label each cup with the concentration of one of the solutions at the front of the room. The labels should read

- "0 grams per liter"
- "1.0 grm per liter"
- "2.5 grams per liter"
- "5.0 grams per liter"
- "Unknown glucose concentration"

3. Send one team member to get a sample of each solution from the large beakers at the front of the room. Use the graduated cylinder to measure 100 milliliters and pour it into the labeled cup. Rinse the cylinder with water between measurements.

4. For the next part of the investigation, you will take turns with the rest of your team members. One student will dip the test strip into one solution, another team member will time 30 seconds starting when the strip is pulled out of the solution, and all students will look at the color chart to determine the concentration. Team members should change roles for each test so everyone has a chance to do one of the tests.

5. Now get the container of glucose testing strips. Notice that there is a color chart on the side of the container. The test strips will change color depending on how much glucose is in the solution. When it is your turn to test one of the solutions, take one test strip from the container and dip the end of it into one of the solutions in your cups. Just dip it in and pull it out. Don't hold the strip in the solution. As soon as the strip is removed from the solution, begin timing for 30 seconds.

6. After 30 seconds, compare the color on the test strip with the chart on the side of the container. Determine what the concentration of the glucose solution is for each cup. Write your answers in the chart below.

Beaker Number	Concentration in Grams per Liter (g/L)	Color of Glucose Test Strip	Concentration in Milligrams per Deciliter (mg/dL)
1			
2			
3			
4			
5	Unknown		

7. Discuss the following questions with your team members. Write your answers in the space provided.

a. How does the concentration in grams per liter compare with the concentration in milligrams per deciliter?

b. What are some possible sources of error when measuring glucose concentrations this way?

c. Did the color of the test strip used on the unknown concentration exactly match the color chart? If not, how did you determine the concentration of that solution?

Part 2

1. Collect the materials that you will need for this part of the investigation.

You will need

- 1 plastic or paper cup
- 1 100-milliliter graduated cylinder
- 2 test strips
- 1 cup of 5 grams per liter glucose solution used in Part 1

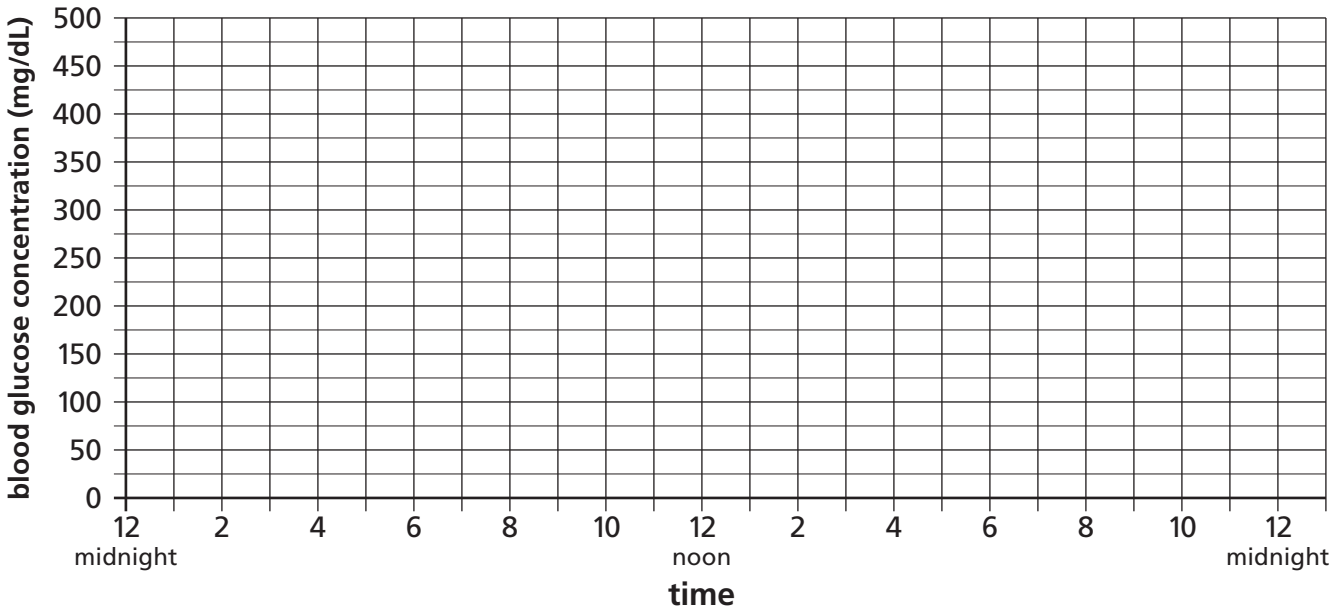
2. Have one team member get 100 milliliter of the sucrose solution that your teacher has at the front of the classroom.

3. Use the test strips again to measure the concentration in both cups. Write your results below.

4. What conclusions can you make based on your results?

2.3

What Happens to the Blood Glucose Concentration during One Day?



2.4

Sample Letter Requesting Loan of Glucose Meters

Dear Clinic Administrator or Diabetes Program Coordinator:

I teach high school biology at . I am currently planning to begin teaching a unit on type 2 diabetes to my students in about three weeks. As part of this unit, students do an experiment to measure glucose concentration in water solutions. This experiment will help them understand the concept of concentration. It will also help them understand the units of mg/dL, which are used to measure glucose concentration in humans.

I would like to borrow electronic glucose meters (glucometers) for my class to use. I anticipate needing a total of five meters and approximately 30 test strips for my class. Please be assured that students will not be testing any blood or body fluids. They will not be using lancets. The solutions that they will test are simply glucose and table sugar (sucrose) dissolved in water.

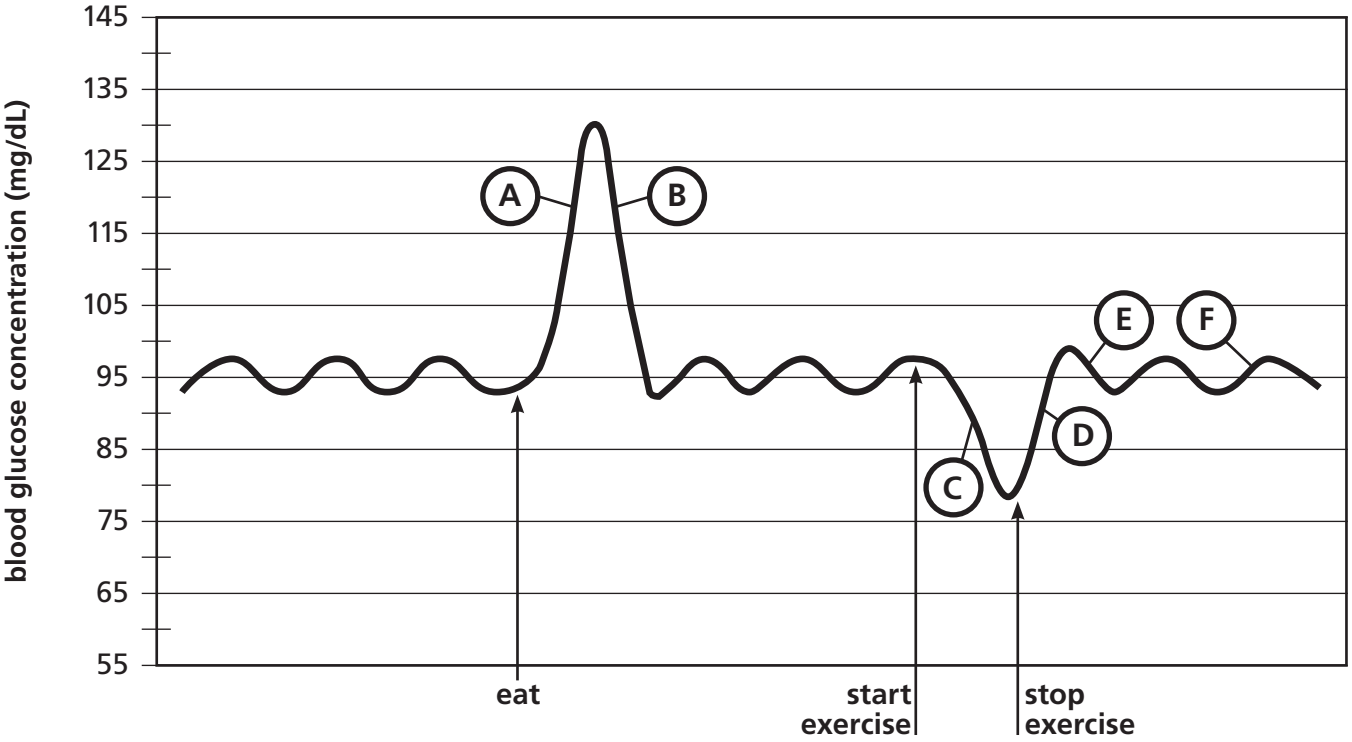
I hope that you will be able to help me with this request. If necessary, I can conduct the activity using a single meter, but fewer students will be able to actively participate. As you know, type 2 diabetes is a significant health issue, and I think this unit should help students understand more about what diabetes is and how it can be prevented or managed.

Thank you for considering this request. Please let me know if you need any additional information.

Best wishes,

3.1

Blood Glucose Concentration



1. Use what you have learned about blood glucose to explain what is happening at each of the points indicated on the graph. Keep in mind that the ***only*** time that the person eats is shown on the graph. When the person starts and stops exercising is also shown on the graph. Keep these facts in mind as you analyze the graph.

Point	Is Blood Glucose Concentration Increasing or Decreasing?	What Causes the Change in the Blood Glucose Concentration?
A		
B		
C		
D		
E		
F		

3.1

2. What is the highest concentration of blood glucose shown on the graph?

3. What is the lowest concentration of blood glucose shown on the graph?

4. Do you think the blood glucose concentration would ever get close to 0 in a healthy person, even one who goes for a long time (maybe even a couple of days) without eating? Explain your answer.

5. What is the concentration around which the blood glucose is fluctuating?

6. Based on the information shown on the graph, does the blood glucose ever stay at one specific concentration or is it always changing?

7. Think about points D–F on the graph. Would you say that there is something inside the body or outside the body that is causing these small fluctuations in the blood glucose concentration? Explain your answer.

3.2

Controlling the Situation

Part 1

Directions: As you take part in the class discussion, answer the following questions:

a. What is the fuel for the car? _____

b. What part of the car uses the fuel? _____

c. What part of the car carries the fuel to the engine? _____

d. What part of the car makes it go faster? _____

e. What part of the car makes it slow down? _____

f. What decides if the car is going too fast or too slow? _____

g. What is the driver doing right before making a decision? _____

_____

h. What does the driver do after making a decision? _____

Part 2

Directions: Use the information provided to draw a graph of the speed of the car.

1. You turn from a city street where the speed limit is 40 miles per hour onto a highway where the speed limit sign says 55 mph. What do you do?

2. You see something on the road in front of you. Because it is far away, you can't tell what it is, so you make a decision about your speed. What do you do?

3. When you get closer, you see that it is just a big piece of tire from a semitruck. You again make a decision about your speed. What do you do?

4. Next you see a sign saying that the speed limit is 70 miles per hour. What do you do?

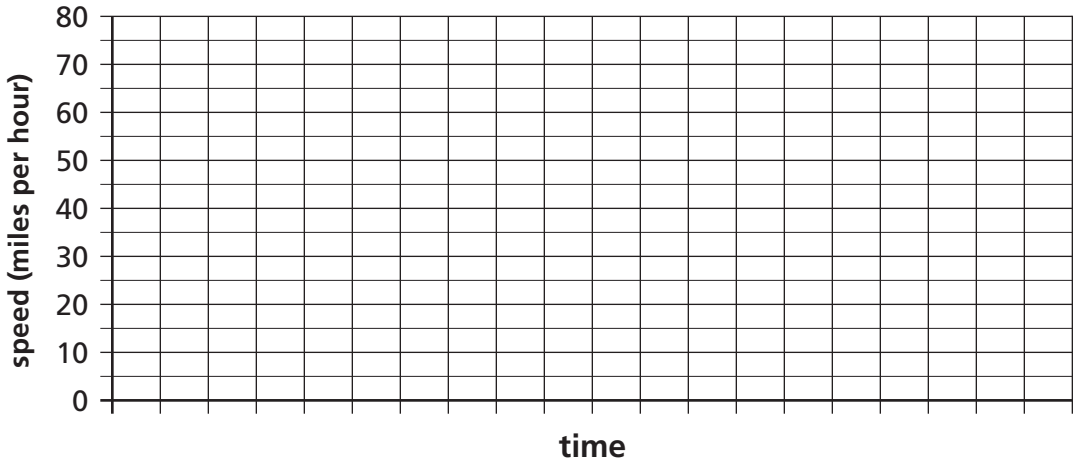
5. Then you see a state police car up ahead. The police officer is standing next to the road talking to someone who has car trouble. How do you adjust your speed?

6. You get past the police car, and the road ahead is clear. What do you do?

7. Up ahead, you see several cars and notice that you are coming up behind them quickly. What do you do?

8. After a little while, you notice that the cars in front of you are moving faster again. What do you do?

9. You see a sign telling you the speed limit is 65 miles per hour. It is a clear day, and the road is good. What do you do?



3.3

How Does the Body Regulate Glucose?

Part 1

Directions: Complete the second column of the table as you take part in the class discussion. What parts of the body have some similarity to the car scenario?

The Car	The Body
Gasoline	
Engine	
Gas line	
Accelerator	
Brakes	
Driver	

Part 2

The body normally keeps the blood glucose concentration between about 70 and 140 milligrams per deciliter. To do this, your body has to have a way to determine when the amount of glucose in the blood is either low or high. Two hormones play important roles in keeping the glucose concentration in this normal range. Hormones are a type of chemical messenger in the body. They are released from specialized cells or glands into the blood.
The blood carries them to other cells where they cause a specific response. The two hormones that regulate glucose in the body are insulin and glucagon. Both hormones are made by cells in the pancreas.

Insulin and glucagon have opposite effects to control the concentration of glucose in the blood. The pancreas always makes and releases small amounts of insulin and glucagon. As you have learned, when a person eats carbohydrates, they are broken down into glucose, and the amount of glucose in the blood increases. The body detects this increase in blood glucose and triggers specific cells in the pancreas to release insulin. The insulin acts on many other cells in the body so they can take up the glucose. This lowers the concentration of glucose in the blood. Glucagon is released from the pancreas when the concentration of glucose in the blood is low. Glucagon stimulates primarily the cells of the liver to release stored glucose into the blood. This makes the blood glucose concentration increase.

It is the controlled release of both of these hormones that keeps the blood glucose concentration within the normal range. Eating carbohydrates stimulates the release of insulin from cells of the pancreas. The glucose inhibits or "turns off" the release of glucagon from the pancreas. Insulin in the blood also inhibits the release of glucagon. When the concentration of glucose in the blood is low, the cells in the pancreas that produce glucagon are stimulated and they release their hormone into the blood. This coordinated release of insulin and glucagon and is an example of a feedback system. A feedback system can be defined as a situation in which one activity of a body system affects another, which in turn affects the first. Feedback systems are important ways in which the body maintains balance. A high blood glucose concentration triggers the release of insulin. When the blood glucose concentration decreases, it signals the pancreas to stop releasing insulin. When the blood glucose concentration is low, cells in the pancreas are stimulated to release glucagon. When the blood glucose concentration increases, the cells release much less glucagon.

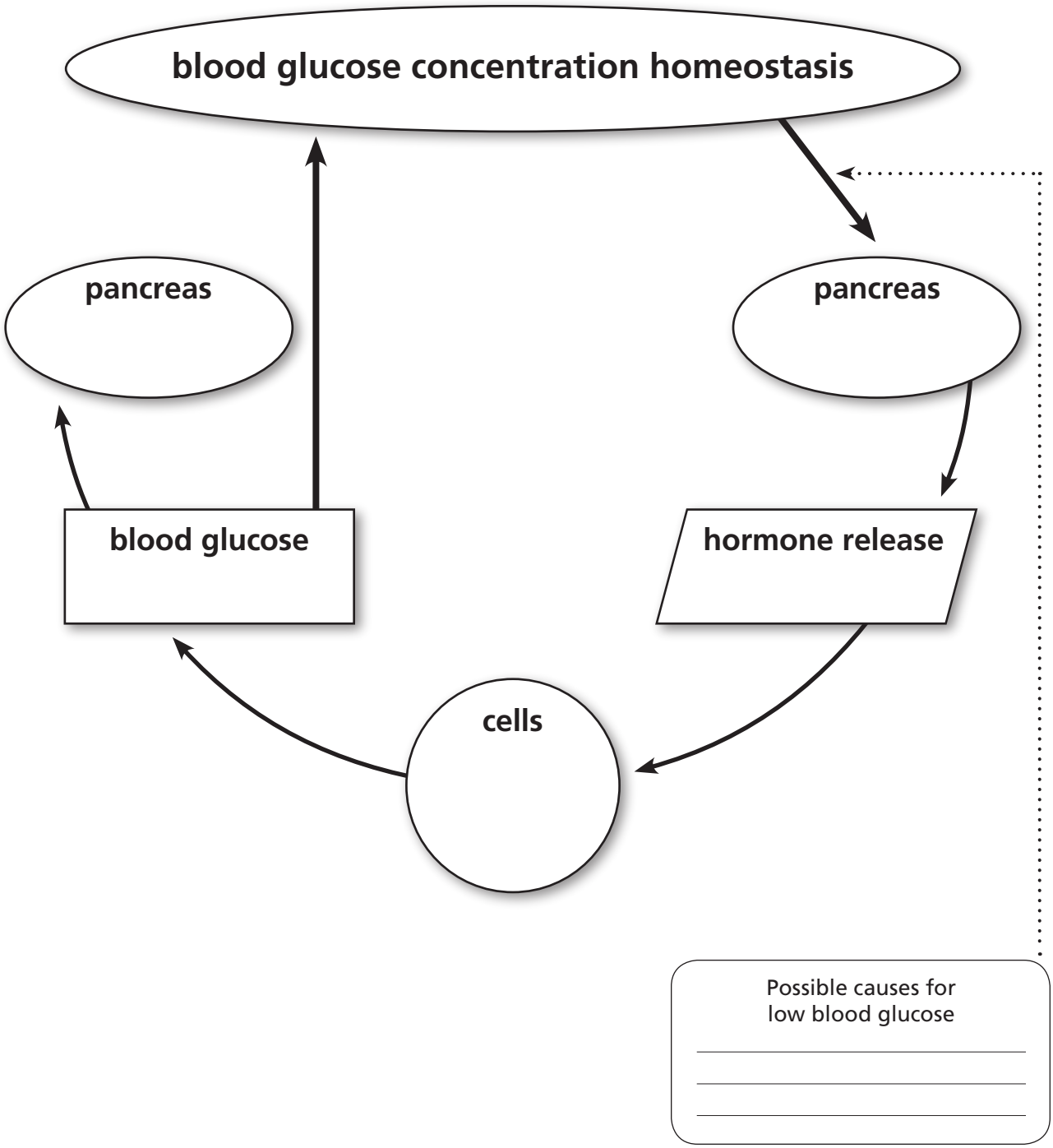
The cells of the pancreas can sense small changes in blood glucose concentration. Because they are so sensitive, the cells of the pancreas can respond to changes before the blood glucose concentration can increase or decrease much. This is also a constant process. If a person eats a meal with a lot of carbohydrates, a larger amount of insulin will be released. If a person eats a meal with less carbohydrates, the pancreas releases a smaller

amount of insulin. In the same way, the amount of glucagon that is released depends on how close or how far below normal the blood glucose concentration is.

The actions of insulin and glucagon to control the amount of glucose in the blood, along with feedback mechanisms that can either turn on or turn off the release of these hormones into the blood, are all part of homeostasis. Homeostasis refers to the processes used by the body to maintain conditions within a narrow range. For example, the body normally maintains blood glucose concentrations at around 95 milligrams per deciliter (mg/dL) in a healthy person. After a person eats and the blood glucose concentration is high, insulin works to lower the level to around 95 milligrams per deciliter (mg/dL). If the blood glucose concentration is low, glucagon released into the blood functions to increase the concentration. Therefore, by making adjustments to raise or lower the blood glucose concentration, the body can maintain a relatively stable environment.

3.4

Directions: Use your knowledge of homeostasis, insulin, and glucagon to fill in the blanks on the diagram below.



3.5

Possible causes for high blood glucose

_____

_____

_____

cells

hormone release

blood glucose

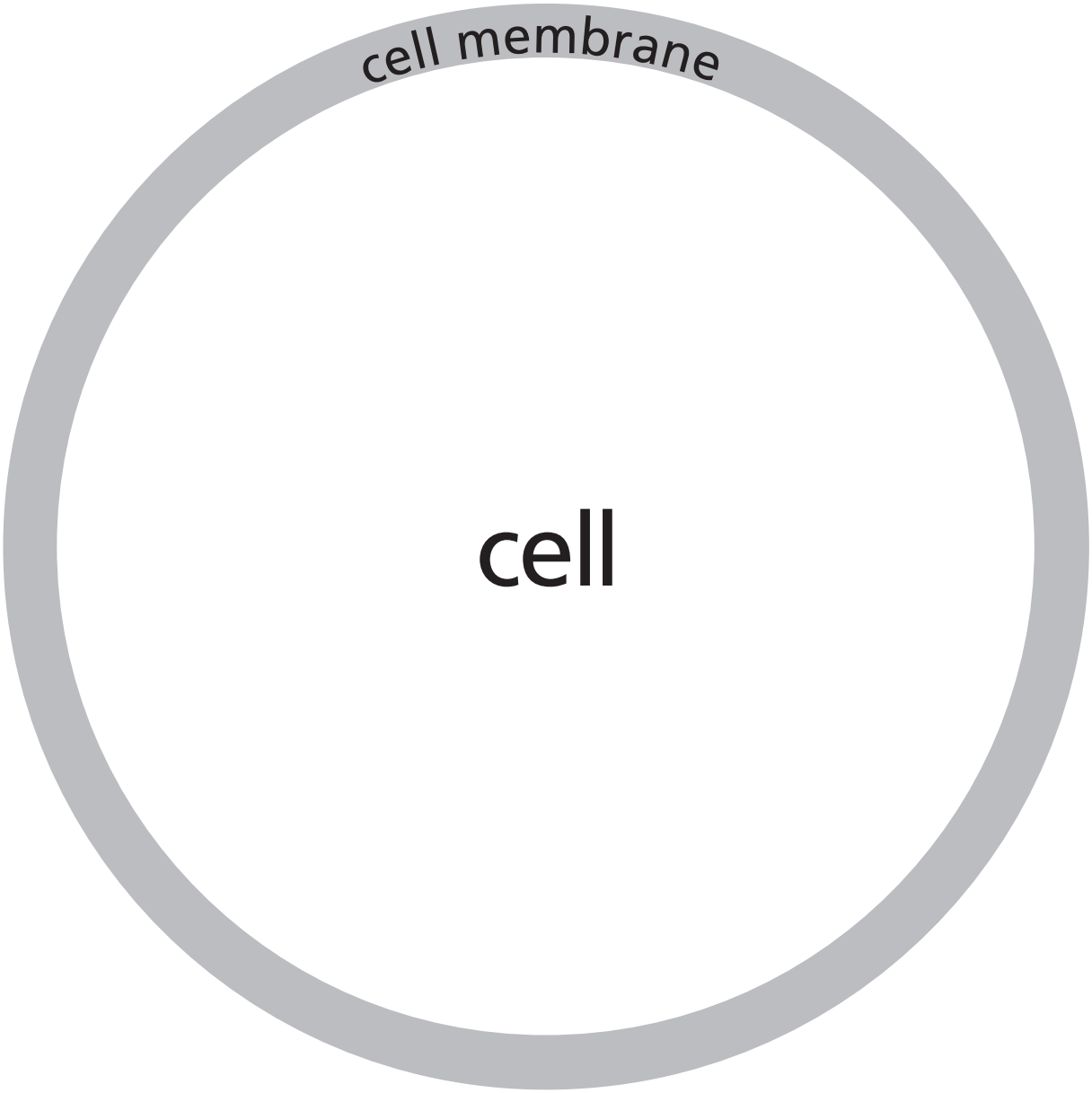
pancreas

pancreas

blood glucose concentration homeostasis

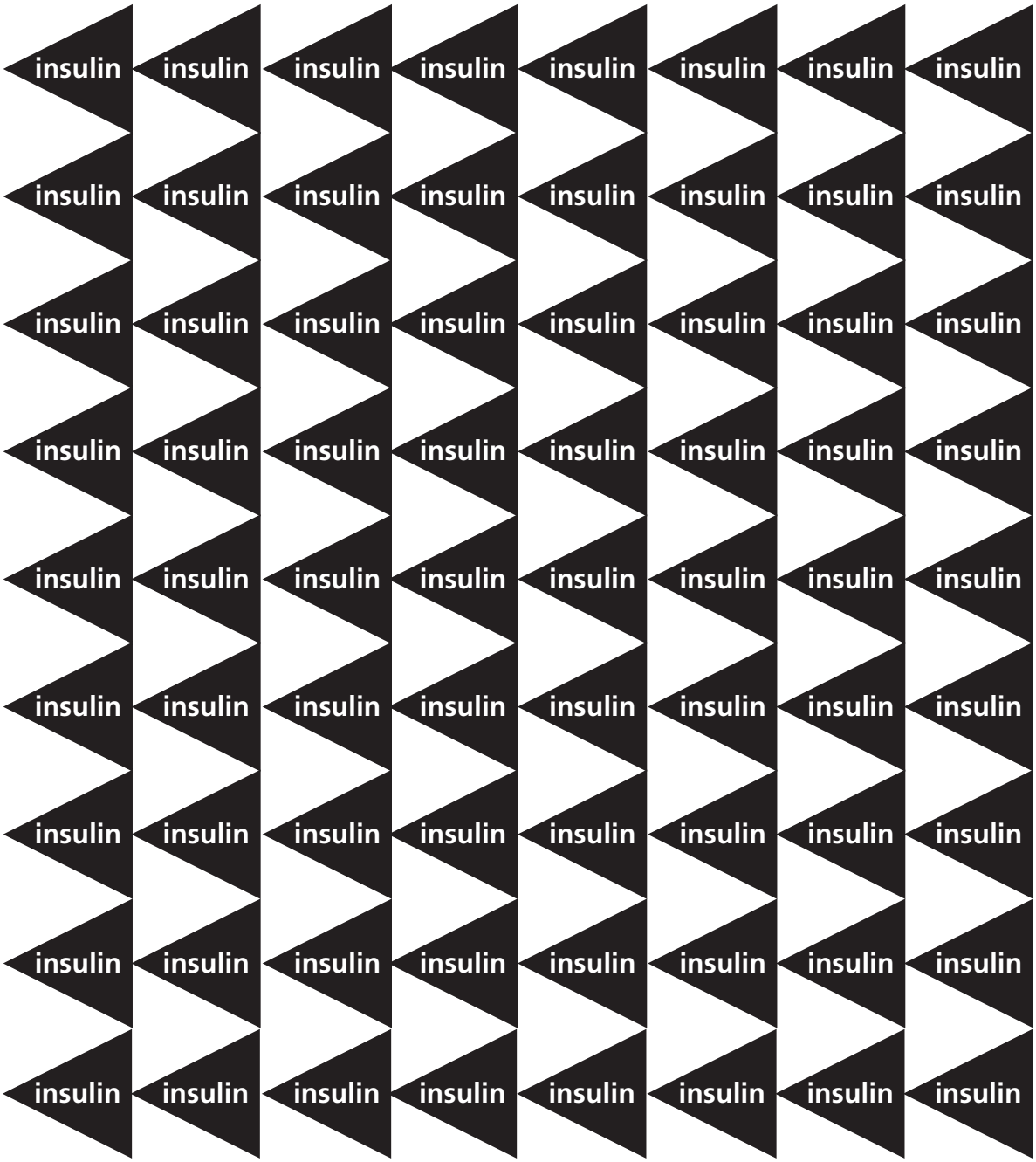
4.1

Modeling Insulin Action—the Cell



4.2

Modeling Insulin Action—Insulin



4.3

Modeling Insulin Action—Insulin Receptors

insulin receptor	insulin receptor	insulin receptor	insulin receptor
insulin receptor	insulin receptor	insulin receptor	insulin receptor
insulin receptor	insulin receptor	insulin receptor	insulin receptor
insulin receptor	insulin receptor	insulin receptor	insulin receptor
insulin receptor	insulin receptor	insulin receptor	insulin receptor
insulin receptor	insulin receptor	insulin receptor	insulin receptor
insulin receptor	insulin receptor	insulin receptor	insulin receptor
insulin receptor	insulin receptor	insulin receptor	insulin receptor

4.4

Moving Insulin Action—Transporters

transporter	transporter	transporter	transporter
transporter	transporter	transporter	transporter
transporter	transporter	transporter	transporter
transporter	transporter	transporter	transporter
transporter	transporter	transporter	transporter
transporter	transporter	transporter	transporter
transporter	transporter	transporter	transporter
transporter	transporter	transporter	transporter

4.4

Modeling Insulin Action—Glucose

glucose glucose glucose glucose glucose glucose glucose
glucose glucose glucose glucose glucose glucose glucose
glucose glucose glucose glucose glucose glucose glucose
glucose glucose glucose glucose glucose glucose glucose
glucose glucose glucose glucose glucose glucose glucose
glucose glucose glucose glucose glucose glucose glucose
glucose glucose glucose glucose glucose glucose glucose
glucose glucose glucose glucose glucose glucose glucose

4.6

How Insulin Works

Part 1

The pancreas is always releasing a very small amount of insulin into the blood. When the concentration of glucose in the blood goes up, the pancreas releases more insulin into the blood. Insulin in the blood attaches or binds to a special protein on the membrane of a cell called the insulin receptor. Many cells in the body have insulin receptors. The insulin receptor can only bind to insulin, not any other type of hormone or protein. When insulin binds to the insulin receptor, things inside the cell change. A different protein inside the cell called glucose transporter (or just transporter) moves from inside the cell, where it is stored, to the cell membrane. When it reaches the cell membrane, it embeds in the membrane. Once it is in the membrane, the transporter carries glucose inside the cell. This is how glucose gets from the blood into the cell where it can be used to make energy in the form of ATP.

Part 2

All the cells in the body need glucose to function and work properly. They all need glucose so they can make ATP for energy. Some types of cells in the body can store glucose for use later. Cells in the liver take up glucose using the process described in Part 1. After the glucose is in the liver cells, however, it is changed to glycogen. Glycogen is many glucose molecules linked together. Muscle cells need a lot of glucose to function. But they also can change some of the glucose to glycogen. Liver cells change excess glucose into fat, which is then stored in fat cells in the body. Glycogen and fat are ways that the body can store glucose for later use. Glycogen and fat can be converted back to glucose if a person doesn't take in more glucose by eating.

4.7

Changing the System

Change to Part of System	Effect on Blood Glucose (Including Reason)	Is This Something That Really Happens?

4.8

Type 2 Diabetes and Glucose

- For people who have type 2 diabetes, do their cells still need glucose to function properly?
- If the cells need glucose, and the movement of glucose into cells doesn't work normally, how does glucose get into the cells?

4.9

Cells, Glucose, and Type 2 Diabetes

Directions: As you learned in the last part of this lesson, in type 2 diabetes, the movement of glucose from the blood into the body's cells doesn't happen normally. However, the body's cells still need to take in glucose from the blood. How can this happen in type 2 diabetes?

Use the pieces of the model that you used before. Select one of your team members to read the information in Steps 1–5 aloud to the team while other team members move the pieces of the model into the correct places.

1. The glucose, insulin, insulin receptors, and transport proteins start in the same places they did before. The receptors are in the cell membrane. The transport proteins are inside the cell. Glucose and insulin are in the blood outside the cell. Put pieces for each of these parts in the appropriate place.

2. Normally, when an insulin molecule binds to the insulin receptor, it triggers the movement of the transporter protein from inside the cell to the cell membrane. The transporter then carries a glucose molecule into the cell. Move the pieces to show this process.

3. In type 2 diabetes, insulin doesn't work as well. Insulin binds to its receptor, but there is something different about this interaction. It doesn't work normally. In type 2 diabetes, it isn't that insulin can't result in the entry of glucose into cells; it just doesn't work as well.

4. Instead of insulin binding to its receptor and causing glucose uptake into cells, it takes more insulin binding to more receptors. For example, it may take two insulin molecules binding to two insulin receptors to activate one transporter protein to carry one glucose molecule into the cell. Move the pieces of the model to show this situation.

5. There is a limit to what the body can do. You might ask if it might take three times as much insulin binding to insulin receptors to get one molecule of glucose into the cell. Move the pieces in your model to show this possibility.

6. ***Work with your team members to answer the following questions. Write your answers in the space below.***

a. The body can only make a certain amount of insulin. At some point, the body can't make enough. In Step 5, you modeled taking three times as much insulin binding to insulin receptors to get one molecule of glucose into the cell. What would happen if the body can only make two times as much insulin?

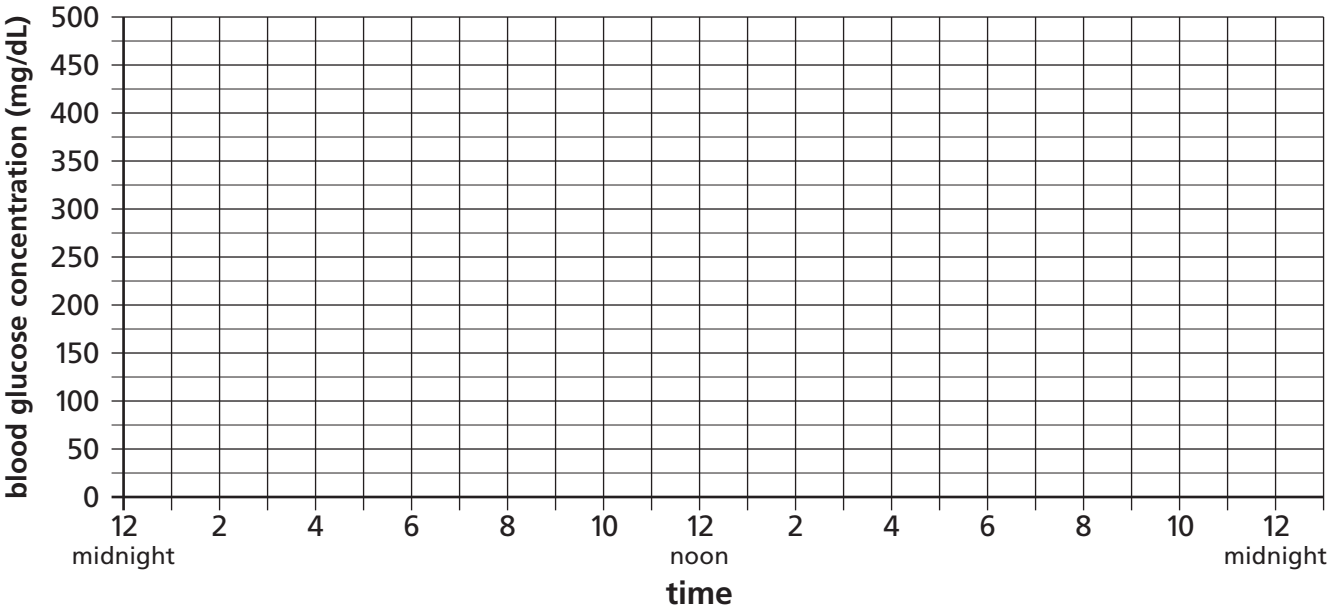
b. Write a few sentences summarizing how glucose gets into cells when someone has type 2 diabetes. Also explain how that differs from how it works in people who do not have type 2 diabetes.

5.1

Blood Glucose and Diabetes

1. Look at your graph of blood glucose concentration that you drew in Lesson 2. That graph showed how blood glucose concentration changes in someone who does not have diabetes. What part of the graph would be different in someone who has type 2 diabetes?

2. Use what you have learned about type 2 diabetes to draw a graph of blood glucose concentration in someone who does have type 2 diabetes.



3. Explain why you think this graph represents the blood glucose concentration in someone who has type 2 diabetes.

5.2

Complications from High Blood Glucose Concentration

Short-Term Signs of Having a High Blood Glucose Concentration and Being Out of Balance (Diabetes)

- Tired
- Thirsty
- Going to the bathroom a lot
- Weight loss
- Irritability
- Feeling sick
- Blurred vision
- Headaches

Long-Term Consequences of Having a High Blood Glucose Concentration (Uncontrolled Diabetes)

- Damage to nerves (especially of the eyes, leading to blindness)
- Damage to blood vessels (resulting in poor circulation that can lead to heart attack, stroke, or amputation of limbs)
- Damage to body organs, including kidneys and heart
- Wounds that won't heal or heal very slowly

5.2

Type 2 Diabetes: Can You Lower Your Risk?

A scientific study, called the Diabetes Prevention Program, or DPP for short, asked the question, "Do positive changes in lifestyle reduce the chance that a person will get type 2 diabetes?"

The people who volunteered to be part of this scientific study did not have type 2 diabetes when the study began. Even though they didn't have type 2 diabetes when the study began, all the volunteers had a high risk for getting it. The study lasted for almost three years. At the end of the three years, scientists recorded the number of people in each group who got type 2 diabetes. People were randomly put into one of two groups for the study.

Group Name	What They Did in the Study
Positive change in lifestyle	Individuals in this group ate a diet lower in fat and calories, lost at least 7 percent of their initial body weight, and moderately exercised for 30 minutes per day, five days per week.
Control	Individuals in this group received only their usual health care. They also received information about healthy living.

Directions: The results of the DPP are summarized in the following tables. Work with your team members to analyze the data and answer the questions that follow.

Results for All Participants of All Ethnic Groups

Group	Number in Group	Number Who Developed Type 2 Diabetes	Percent of People with Type 2 Diabetes at End of Study
Lifestyle	1,079	142	13%
Control	1,082	336	31%

Results for American Indian Participants

Group	Number in Group	Number Who Developed Type 2 Diabetes	Percent of People with Type 2 Diabetes at End of Study
Lifestyle	60	7	12%
Control	59	20	34%

5.3

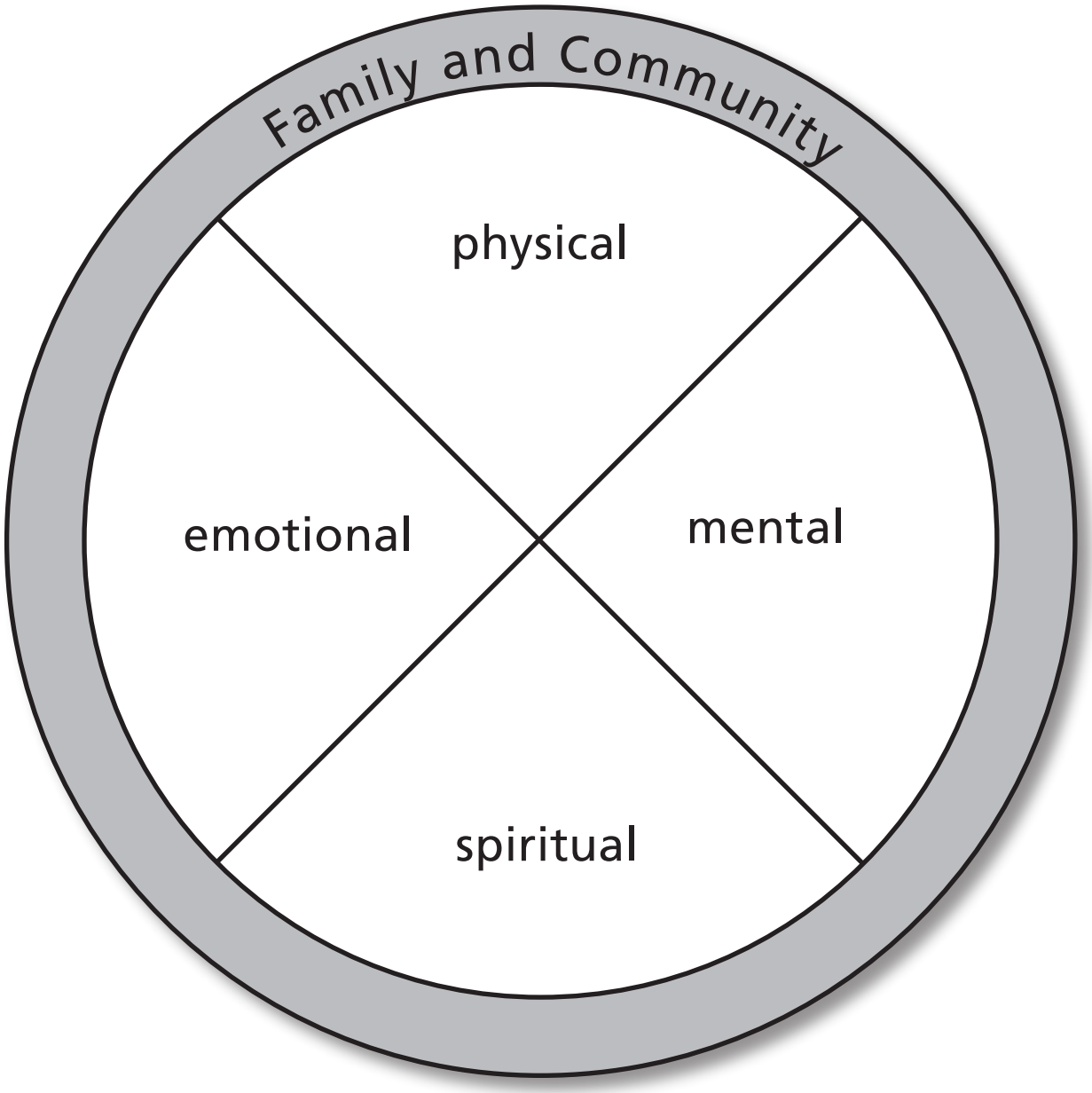
1. Write at least three conclusions you can make from the information in the tables.

2. Based on the data, can people who do not currently have type 2 diabetes lower their chance of getting it if they lose weight and become more active?

3. Use your knowledge of the biology of type 2 diabetes to explain why changes in lifestyle may change a person's chance of getting type 2 diabetes.

5.4

Revisiting the Circle of Balance



5.5

Updates from Nick and Kim

Nick's Story

In the many years of living with type 1 diabetes, I've learned to listen and soak in different types of motivation to keep myself healthy.

I talk with my grandpa who is 69 years old and living with type 2 diabetes. He is constantly exercising every day, and I keep in touch with him to discuss diet plans and exercise routines. Doing this helps me keep my head on my shoulders—knowing that if my grandpa can stay healthy, eat right, and still exercise every day, then I am capable of doing it, too.

Another way I get motivation is from one of my friends. He is always asking me how my diabetes is doing. He constantly questions me if my blood sugar is at the right level. The thing that I like best about the questioning is just the fact that people are concerned about my health, and it makes me feel positive inside. I know now that you need to have someone close to you that you can talk to because diabetes can drag you down at times, and when you are down that close person will always tend to have positive thoughts to bring you back up.

My spirituality is the reason that, I believe, I am here today. Growing up with diabetes was very hard, especially at such a young age. When I first got diabetes, I thought I wasn't going to be the same person. I wanted to give up. My parents and I are religious and we always went to church every Sunday morning. When I was diagnosed with diabetes, I almost died. My blood sugar was 600* or more. My Mom prayed for me, but she said she stopped because she felt God was not helping her. I didn't know what to think. I was going through this hard time. I prayed and prayed. Then, when I was able to drive, I started to go to church again by myself, and still do to this day. The feeling of being in church made me think straight and kept my thoughts positive. Just having something to believe in, I think, pushed me to keep on trying and to realize that there is too much to live for.

Having type 1 diabetes for over six years has put a lot of stress on my body, and fighting the disease can be tough, but with all my friends and family pushing me and keeping me on track, it gives me a lot of motivation. Now that I am on a good diet and good exercise plan, I can give back to my friends and family by setting examples of exercising and eating healthy. I seem to help my friends out a lot by telling them how I count my carbohydrates with every meal and how I stay in shape by exercising in the Lummi gym. Having family members on both sides of my family with type 2 diabetes is tough for me because I don't like seeing others with the problem I have. It is working out, though, as a kind of advantage, because I have others who know what I am going through and also I can always talk to them and give them advice on what I am doing to make myself better and healthier. I give back to my friends and family by showing, not only those who have diabetes but also the ones who do not, how to prevent diabetes by great eating habits and lots of exercise.

**600 milligrams / deciliter (mg/dL)*

5.5

Kim's Story

Because I was pregnant, I now had an extra good reason to straighten up and take care of myself and my baby. It was not only about me anymore but my baby, too. I took my insulin, checked my sugar, exercised, and ate right. I prayed that nothing would happen to my baby and that she would be healthy and normal.

On November 15, 2005, my baby girl was born. She was 10 pounds and 11 ounces. I was not shocked that I had a huge baby because I was told during my first prenatal visit that women with diabetes usually had large babies due to the insulin. She required insulin at first and had to be weaned off the insulin. I felt bad about that. I named her Derikah Marion Starr Whiteshield; she is my pride and joy. I never realized how giving birth can change a person's outlook on life.

I went back to school second semester and had to get caught up and it was hard trying to go to school and taking care of a baby. My health suffered and it got the best of me, and I ended up in the hospital. I got back on track taking care of myself, and in May 2006, I graduated from Warwick High School. Along with my parents and family, I was so proud of myself. My dad is on the school board and he was the person giving the diplomas at this graduation, so I received my diploma from my father.

I look to the future now, and want to make a better life for myself and daughter. I take care of myself; I don't want my daughter pushing me around in a wheelchair due to me losing my eyesight or because my feet are amputated.

Today, I am a full-time student at the Candeska Cikana Community College. I want to continue on and go into the medical field. I have learned that I am a strong person who can overcome problems and learn from them.

I would like to encourage others to eat healthy and exercise, and don't take your health for granted—especially the children, because when you are young it's that much harder to accept diabetes. I blamed so many people and was angry for a long time for having diabetes.

Life is not fair sometimes, but it is a gift from God, and I plan on living it to the fullest.

6.1

You Are a Diabetes Educator

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A diabetes educator is someone who has learned a great deal about diabetes and who works with people to help them learn to live with diabetes, both for the individual and the family. A diabetes educator is someone who has a college degree in nursing, nutrition, health education, exercise science, or another field related to health. A person who wants to be a diabetes educator then gets special training about diabetes. A diabetes educator can help someone who has type 2 diabetes learn about healthy eating behaviors, ways to be more active, how to use a meter to check his or her blood glucose concentration, and many other things. Mainly, a diabetes educator helps people understand their disease and practice diabetes self-care behaviors.

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6.2

Marilyn's Story

Marilyn packed her shawl and moccasins. She and her parents and her little brother were going to her tribe's annual summer powwow.

At last, they all arrived at the powwow grounds. She waited anxiously for her cousins and other members to get ready in time for Grand Entry. As usual, Marilyn's family found seats in the woodland bowl to watch the Grand Entry. This powwow was a big intertribal event. Tribes from Canada to Mexico were there.

After the Grand Entry, Marilyn liked to stroll among the vendors. The jewelry at some of the booths was colorful and sparkling. Other booths were selling a lot of different kinds of beads, feathers, and shells for use on regalia. The booths selling food were her favorites. The smell of fry bread and hamburgers made everyone hungry. Of course, she could not come to the powwow without buying a fry bread with honey and soda! The taste of fry bread brought back memories of the first time she helped her grandmother make it. She remembered all the times she would watch her grandmother making fry bread and listen to her grandmother's stories about growing up on the reservation. From the stories, Marilyn knew her life was very different from her grandmother's.

After Marilyn walked around all the booths, she headed back to the entrance of the powwow grounds. Her older sister, Peggy, was sitting at the Health Department's diabetes screening booth. Peggy was a nurse at the Tribal Clinic. Peggy called for Marilyn to come over and get tested. Marilyn laughed and said, "I don't need to get tested. I'm just 18—I'm too young to get diabetes!"

Peggy kept saying that Marilyn should be tested, and Marilyn finally gave in. Marilyn said that she didn't think that the finger stick test for blood glucose would work because she just ate fry bread with honey and a soda.

Peggy kept pushing Marilyn to do the test. She said, "Let's give it a whirl anyway." Marilyn agreed to the test. The two sisters chatted while they waited for the machine to give the results. The results finally started to print. Marilyn asked, "Well, what does it say?" Peggy told Marilyn that her blood glucose level was much higher than normal. Marilyn's blood glucose level was 200 milligrams per deciliter (mg/dL), and normal is between 70 and 100 milligrams per deciliter of blood.

Peggy told Marilyn that the food and soda could have raised her blood glucose to go that high, but that it could also mean that Marilyn had a problem. Peggy told Marilyn that she should go to the Tribal Clinic the next day for another test. Only this time, Marilyn should not eat anything for breakfast before the test.

Marilyn was sure that she did not have diabetes. After all, she was only 18. As far as she knew, only old people got diabetes. And none of her sisters or brothers had diabetes. Neither did her parents. But she told her sister that she would come to the clinic for another test. This time, she followed her sister's instructions and didn't eat before the test. At the clinic, they repeated the test, and the results showed Marilyn's blood glucose was 164. Marilyn knew that was high. Peggy

Photo provided by: Carolee Dodge Francis, author
Oneida Nation of Wisconsin

told Marilyn that she didn't need to worry. Before the doctor could say whether Marilyn had diabetes, they would need to repeat the test one more time—again without eating for eight hours before the test.

Marilyn didn't want to make the appointment. But she did make one for the next week. Marilyn knew that type 2 diabetes was serious—her best friend's mother had it and Marilyn had seen how it had caused problems in her life. Marilyn was worried about the second test. She didn't want to be told that she had type 2 diabetes. She even worked out really hard and tried to avoid French fries and candy during the week before the next test. When it came time to go to the clinic again, Marilyn almost didn't go. But she did. When the doctor came in with the results, she had a serious look on her face. Marilyn knew she had diabetes.

Marilyn felt sad and overwhelmed. She knew that type 2 diabetes had something to do with insulin and that she needed to lower her blood sugar, but she didn't really understand what was going on in her body. She needed to know more.

7.1

Science and Health Career Information

You will have a chance to find out about how to enter a science or health care profession. You need to select a career to explore and complete the chart below with information you find on the Web about the qualifications for, and responsibilities of, that career.

Careers in science and health that you may wish to explore include scientist researching diabetes and its treatment, physician, nurse, pharmacist, physical therapist, mental health counselor, exercise physiologist, dietitian, and nutritionist. You should look for the education or degree required, the duties and responsibilities for that career, the type of business or organization where a person in that occupation works, what happens during a typical work day, and how a person in that profession can help individuals, communities, or both learn about or manage diabetes.

Science or health career to investigate:

_____

Web sites used for research (at least three):

_____

_____

_____

Question	Information about Career Choice	Your Own Questions or Additional Information
Why is this career a good choice for you? Explain.		
What are some duties and responsibilities of people in this career?		
How can this career help Native American communities?		
What education is required? (What degree and skills are needed?)		

7.2

Web Sites for Career Information

The following Web sites contain information about some careers related to science and health.

http://www2.sacnas.org/biography/listsethnicity.asp
This site will give you a chance to read about Native American/ Alaska Native/ Hawaii Native professionals working in science and medical careers.

http://science.education.nih.gov/LifeWorks
At this general site, you can find all of the sites listed below.

http://science.education.nih.gov/women/careers/index.html
This site gives information about women in cancer research, heart research, and neuroscience research.

http://science.education.nih.gov/LifeWorks.nsf/Interviews/Frank+GrayShield
This site is about a health educator.

http://science.education.nih.gov/LifeWorks.nsf/Alphabetical+List/Health+Educator
This site is about being a health educator.

http://science.education.nih.gov/LifeWorks.nsf/Interviews/Antoinette+Colbert
This site is about a dietetic technician.

http://science.education.nih.gov/LifeWorks.nsf/Alphabetical+List/Dietetic+Technician,+Registered
This is about being a dietetic technician.

http://science.education.nih.gov/LifeWorks.nsf/Interviews/Egda+M.+Morales-Ramos
This site is about a high school biology teacher.

http://science.education.nih.gov/LifeWorks.nsf/Alphabetical+List/Biology+Teacher,+Secondary
This is about being a biology teacher.

http://science.education.nih.gov/LifeWorks.nsf/Interviews/Barbara+Biesecker
This site is about a genetic counselor.

http://science.education.nih.gov/LifeWorks.nsf/Alphabetical+List/Genetic+Counselor
This is about being a genetic counselor.

http://science.education.nih.gov/LifeWorks.nsf/Interviews/Angi+M.+Christensen
This site is about a forensic scientist.

http://science.education.nih.gov/LifeWorks.nsf/Alphabetical+List/Forensic+Science+Technician
This is about being a forensic scientist.

http://science.education.nih.gov/LifeWorks.nsf/Interviews/Darryl+Lowery
This site is about a paramedic and emergency medical technician.

7.2

http://science.education.nih.gov/LifeWorks.nsf/Alphabetical+List/Emergency+Medical+Technician+and+Paramedic
This is about being an emergency medical technician and paramedic.

http://science.education.nih.gov/LifeWorks.nsf/Interviews/Lynne+Haverkos
This site is about a pediatrician, a doctor working with kids.

http://science.education.nih.gov/LifeWorks.nsf/Alphabetical+List/Pediatrician
This site is about being a pediatrician.

http://science.education.nih.gov/LifeWorks.nsf/Interviews/Karoline+Harvey
This site is about an occupational therapist.

http://science.education.nih.gov/LifeWorks.nsf/Alphabetical+List/Occupational+Therapist
This site is about being an occupational therapist.

http://science.education.nih.gov/LifeWorks.nsf/Interviews/Patricia+Diaz
This site is about a microbiologist.

http://science.education.nih.gov/LifeWorks.nsf/Alphabetical+List/Microbiologist
This site is about being a microbiologist.

http://science.education.nih.gov/LifeWorks.nsf/Interviews/Matthew+Scherer
This site is about a physical therapist.

http://science.education.nih.gov/LifeWorks.nsf/Alphabetical+List/Physical+Therapist
This site is about being a physical therapist.

http://science.education.nih.gov/LifeWorks.nsf/Interviews/Keisha+Potter
This site is about a nurse.

http://science.education.nih.gov/LifeWorks.nsf/Alphabetical+List/Nurse,+Registered
This site is about being a nurse.

http://science.education.nih.gov/LifeWorks.nsf/Interviews/Leslie+Adams
This site is about a pharmacist.

http://science.education.nih.gov/LifeWorks.nsf/Alphabetical+List/Pharmacist
This site is about being a pharmacist.

http://science.education.nih.gov/LifeWorks.nsf/Interviews/Gloria+Stables
This site is about a dietitian and nutritionist.

http://science.education.nih.gov/LifeWorks.nsf/Alphabetical+List/Dietitian+and+Nutritionist
This site is about being a dietitian and nutritionist.

http://science.education.nih.gov/LifeWorks.nsf/Interviews/Chris+King
This site is about a medical and clinical laboratory technologist.

7.2

http://science.education.nih.gov/LifeWorks.nsf/Alphabetical+List/Medical+and+Clinical+Laboratory+Technologist
This site is about being a medical and clinical laboratory technologist.

http://science.education.nih.gov/LifeWorks.nsf/Interviews/Barry+Weidner
This site is about a fitness trainer and aerobics instructor.

http://science.education.nih.gov/LifeWorks.nsf/Alphabetical+List/Fitness+Trainer+and+Aerobics+Instructor
This site is about being a fitness trainer and aerobics instructor.

http://science.education.nih.gov/LifeWorks.nsf/Interviews/Byron+Ford
This site is about a medical scientist.

http://science.education.nih.gov/LifeWorks.nsf/Alphabetical+List/Medical+Scientist
This site is about being a medical scientist.

http://science.education.nih.gov/LifeWorks.nsf/Interviews/Jason+Sacks
This site is about a biological technician.

http://science.education.nih.gov/LifeWorks.nsf/Alphabetical+List/Biological+Technician
This site is about being a biological technician.

http://science.education.nih.gov/LifeWorks.nsf/Interviews/Julie+Hoehl
This site is about a recreational therapist.

http://science.education.nih.gov/LifeWorks.nsf/Alphabetical+List/Recreational+Therapist
This site is about being a recreational therapist.

http://science.education.nih.gov/LifeWorks.nsf/Interviews/Victoria+Cargill
This site is about an epidemiologist.

http://science.education.nih.gov/LifeWorks.nsf/Alphabetical+List/Epidemiologist
This site is about being an epidemiologist.

http://science.education.nih.gov/LifeWorks.nsf/Alphabetical+List/Family+and+General+Physician
This site is about being a general doctor or physician.

http://science.education.nih.gov/LifeWorks.nsf/Alphabetical+List/Biologist
This site is about being a biologist.

http://science.education.nih.gov/LifeWorks.nsf/Alphabetical+List/Internist
This site is about being an internist (special doctor).

http://science.education.nih.gov/LifeWorks.nsf/education.htm
This site gives information about education required.

7.3

Essay for a Diabetes-Related Career

This essay will help us become acquainted with you and your educational goals. This information is different from what we learn about you from grades, test scores, and other objective data. It will demonstrate your ability to organize your thoughts and express yourself. Please write an essay at least 250 words long about the diabetes-related science or health career that you have selected. Include information related to *one or two* of the following areas:

- Explain why you became interested in this career.
- Discuss why you think this career can be important either to your community or to an individual.
- Provide reasons why you think you would be good at this career.
- Explain why diabetes is an important issue for Native Americans, and all people, to know about.
- Discuss specific facts about diabetes and how a person in this career would use those facts.

Directions: Follow these suggestions for writing this essay.

- Organize your thoughts and write an outline with categories you want to make sure to include in your essay. Arrange your categories in a logical order.
  - The opening paragraph might include your own goal for a job and the career you are exploring.
  - The second paragraph might explain what a person who is in the career of your choice does during a workday. You might give a description of what working in this job is like, what you might like, and what might be hard to do.
  - The third paragraph might present information about the education required and why you think this professional job would be interesting to you. What might you like about working in this job? You could also write how this person could work in your own community.
  - Think about how you can include what you know about diabetes.
  - In the ending paragraph, you might say why this career is of value to your community and how you could help other people. You can also say why you would be good at this kind of job.
- Review your outline and talk about it with a classmate.
- Write a draft of your essay. Check to see how long it is. Avoid using unnecessary words just to meet the length requirements. Be concise. (One page is about 250 words. This is the minimum.)
- Use a strong and informative topic sentence (the first sentence) for each paragraph so the reader knows what you plan to discuss in the paragraph.
- Writing large or using a large font size to make your essay look longer, or using a small font to give you more space on the page, should not be done. The font size should be 11 or 12.
- If you write your essay using a computer word processing program, use the software's tool to check spelling and grammar.
- When you finish your draft, exchange papers with one or two other people. Read each others' drafts and offer suggestions to each other to help make each essay the very best it can be. It is OK to help each other during the draft stage.
- Check your work against the rubric. (This is the tool that will be used to grade your essay.) Make sure you have met the requirements stated in the rubric.

7.3

Rubric for Grading the Essay

The chart lists the categories that will be used to evaluate your essay. When the reviewer scores your essay, he or she will circle the number of points to assess each of the criteria. This information will help you know which areas may need additional work.

Criteria for Evaluation	Score				
The essay includes accurate information about type 2 diabetes.	5	4	3	2	1
The essay includes sufficient information about type 2 diabetes, including ways to prevent or manage the disease to stay healthy.	5	4	3	2	1
The essay explains the connection between the chosen career, type 2 diabetes, and community needs.	5	4	3	2	1
The essay discusses the writer's reasons for interest in this career choice.	5	4	3	2	1
The essay is clearly written, with correct spelling, grammar, and sentence structure.	5	4	3	2	1
Other	5	4	3	2	1

Score	Definition
5	Exceeds minimum requirements, is accurate and well written
3	Meets requirements
1	Does not meet requirements