



YOUNG VOICES:

Life With Diabetes

Lesson 4: The Biology of Diabetes

Inquiry Focus: Who can have diabetes?

Student Learning Objectives: By the end of the lesson, students will be able to do the following:

- Describe diabetes as a disorder of insulin production or response by the cells to insulin
- Explain the biological difference between Type 1 and Type 2 diabetes
- Explain what is understood about the causes of Type 1 and Type 2 diabetes
- Describe the effect of diabetes on blood glucose levels
- Describe how high and low blood glucose levels affect the body
- Explain what biological processes are replaced with blood glucose testing and insulin injections

Time Frame: 1 – 2 Class sessions

Materials:

- Simple pan balance and inexpensive sets of weights; variety of small objects that can be weighed using those weights (multiple balances and sets if activity is done by small groups)
- Body Atlas: Diabetes – interactive from web site
- Video clip: “Diabetes” from *Behind the News: Medical Marvels*
- Video clip: “Connection Between the Pancreas and Insulin” from *Biologix: The Pancreas*

Teacher Background Information:

- Glucose is the body’s preferred currency for energy. Insulin is released from the pancreas to signal cells to take up glucose when the blood glucose is high (hyperglycemia), which results in a lower blood glucose. Glucagon is another hormone released from the pancreas to cause the liver to free stored glucose in response to low blood glucose (hypoglycemia).
- Diabetes is a disorder where either not enough insulin is made or the body does not appropriately react to the insulin that is produced.
- This is what happens with Type 1 diabetes; in Type 1 diabetes the body does not make insulin. The cause of Type 1 diabetes is unknown, but in many people with the disease it appears that

the body's immune system attacks the insulin-producing cells in the pancreas. Type 1 diabetes may also be known as "juvenile diabetes" because it usually begins in children and young adults, though it can start at any age.

- The treatment for Type 1 diabetes is to replace the missing insulin with insulin injections, which has to be done for the person's lifetime. How does someone with Type 1 diabetes know how much insulin to take? One option is to find out the carbohydrate content in the food they are going to eat and estimate how much insulin they will need. In addition, they test their blood glucose and take insulin to reduce their blood glucose level to target.
- Type 2 diabetes is caused by not enough insulin being produced, the body not responding appropriately to the insulin that is produced, or both. This type is much more common than Type 1 diabetes. Many people with Type 2 diabetes will be able to control their blood glucose with diet and exercise, though some will need medications that might include insulin.
- Type 2 diabetes is also known as "adult-onset diabetes" or "non-insulin-dependent diabetes." It is not thought to have a single cause, though obesity and older age do increase the chance of acquiring it.
- Blood glucose levels have important health effects, which is why it is important for people with diabetes to control their blood glucose.
- Long-standing hyperglycemia is associated with heart disease and stroke, blindness, kidney disease, and skin problems, especially on the feet.
- Hyperglycemia can also cause an emergency situation known as "diabetic ketoacidosis," which involves dehydration from having so much glucose in the blood and acidic blood partly from the ketone bodies being produced from fat. This is more common with Type 1 and requires going to a hospital to get hydrated and receive insulin.
- Taking too much insulin could result in hypoglycemia, which could make a person lose consciousness. If the person is conscious, they can take some food with simple sugars to bring up their blood glucose quickly, like a fruit juice. If the patient is unconscious, they may need an injection of glucagon, the pancreatic hormone that causes the liver to release its stored glycogen as glucose.

For more information on Type 1 diabetes, visit the "Life with diabetes" section of the Juvenile Diabetes Research Foundation International (JDRF) web site at www.jdrf.org. JDRF also provides a downloadable Student Advisory Toolkit which helps to explain the difference between Type 1 and Type 2 diabetes.

Instructional Activities:

Discuss and review the action of glucose in the bloodstream and how it delivers energy to the cells of the body. Also review the "feedback" mechanism of the pancreas and how it regulates the body's glucose levels to within a narrow range.

Use a pan balance and a set of inexpensive weights (demonstration or have groups of students conduct this exercise) to demonstrate the difficulty of balancing a dynamic system. Explain to students that in a dynamic system, things are changing all the time. Have one person add an object

to the pan balance. Another person balances it with the appropriate combination of weights. Once the object is balanced, the first object is taken off and a different one added. Continue this, increasing the speed with which the objects are switched out to demonstrate a dynamic system and the challenge of balancing such a system.

From what we already know, what would happen if not enough insulin was made by the pancreas? How is the balance of glucose in the body similar to balancing masses on a pan balance?

Use the interactive, Body Atlas: Diabetes, to demonstrate to students where the pancreas is and explain what it does for the body. What happens if the balance of glucose in the blood is not maintained?

Explain that the pancreas must work to produce insulin to regulate glucose in the bloodstream. Have students view the video, "Diabetes" from the program, *Behind the News: Medical Marvels* and record the differences between Type 1 and Type 2 diabetes. A clear description of the two types is found in the video clip, "Description of the Two Types of Diabetes Mellitus." You may also wish to have students view the video, "Connection Between the Pancreas and Insulin" to discover the history of how the relationship between diabetes and insulin was discovered and a treatment found.

Lesson Assessment:

Have students complete the chart explaining what the causes and symptoms and cures are for Type 1 and Type 2 diabetes.

Vocabulary:

- Type 1 diabetes- a disorder where the body does not produce insulin
- Type 2 diabetes- a disorder where the body does not produce insulin, does not respond properly to insulin, or both

NSES Standards Addressed:

Scientific Inquiry: Formulate and revise scientific explanations and models using logic and evidence.

Life Science: The Cell: Most cell functions involve chemical reactions. Food molecules taken into cells react to provide the chemical constituents needed to synthesize other molecules. Both breakdown and synthesis are made possible by a large set of protein catalysts called enzymes.

Life Science: Matter, Energy, and organization in living systems: The chemical bonds of food molecules contain energy. Energy is released when the bonds of food molecules are broken and new compounds with lower energy bonds are formed.

Personal and Community Health: Personal choice concerning fitness and health involves multiple factors; selection of foods and eating patterns determine nutritional balance; many diseases can be prevented, controlled, or cured; Some diseases . . . result from specific body dysfunctions and cannot be transmitted.

Historical perspectives: Usually, changes in science occur as small modifications in extant knowledge; scientific knowledge evolves by changing over time, almost always building on earlier knowledge.

Lesson 4:Worksheet:

Name: _____ Date: _____

	Type 1 Diabetes	Type 2 Diabetes
Causes (include what happens in the body)		
Symptoms		
Treatment		





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