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| **Project 2.1.2: The Insulin Glucose Connection** |

Introduction

In the last activity, you learned that both glucose and the hormone insulin play a role in the regulation of blood sugar and the development of diabetes. But how specifically do these substances interact?

Cells are the fundamental building blocks of life. These tiny units make up our tissues and organs, house the DNA that provides our unique identity, and control body functions at the most basic level. The communication that exists in cells is an amazing process that depends on molecules that travel from one cell to the other. This chemical communication is highly specific and often involves molecules called proteins. A specific protein will be released by one cell and travel to a second cell. The protein binds to the second cell because that cell has a *receptor* for it. When the protein binds to the receptor, a cascade of events in the second cell are initiated. The specific protein molecules are referred to as *signal molecules* because they carry the signal from one cell to another. Once a signal molecule binds to a receptor, multiple events occur within the cell to transfer the message to other parts of the cell and to induce the cell to act on the message.

In this project you will investigate how insulin and glucose are involved in cell communication. Imagine that you are a healthcare professional who has the task of explaining the connection between insulin and glucose to a group of adults who are either at risk for diabetes or have just been diagnosed. In this project you will create a 3-D working model demonstrating how insulin works to move glucose into cells. You will use your model to explain this process to your target audience.

Equipment

* Computer with Internet access
* Supplies to build a model – possible supplies include, but are not limited to:
* Styrofoam, balls, or sheets
* Knife or scissors
* Pipe cleaners
* Colored construction paper
* Glue
* Tape
* Clay or play dough
* Markers

Procedure

Part 1: Research

1. Research and take notes below on how insulin signals a cell to take in glucose from the blood. Use the following resources to find the information, and please read/watch them in the order provided. As you research, keep in mind that your ULTIMATE goal is to be able to explain/understand how insulin signals a cell to take in glucose using ONLY the following terms:

* Insulin
* Glucose
* Beta cells of pancreas
* Glucose transporters (glut 4 transporters)
* Insulin receptor
* Blood
* Lymph
* Cell membrane

The explanations will get complicated, but always focus on the eight terms as you read/watch because the above is the BIG picture that I want you to understand.

Resources (in the order of research):

1. First read the article at <http://www.livestrong.com/article/27924-insulin-signal-cell-glucose-blood/>
2. Now watch the two videos on you tube. These are titled “How Does Insulin Work in the Body? https://www.youtube.com/watch?v=CuQMpN7rM-4 and “Insulin and Regulation of Glucose in the Blood” https://www.youtube.com/watch?v=OlHez8gwMgw
3. Next read the article <http://www.vivo.colostate.edu/hbooks/pathphys/endocrine/pancreas/insulin_phys.html>

Read the entire article, paying particular attention to the section titled *Insulin and Carbohydrate Metabolism.*

4. Finally watch <http://vcell.ndsu.edu/animations/insulinsignaling/movie-flash.htm>

1. Take notes in your notebook:

How insulin signals a cell to take in glucose from the blood:

1. Once you have your research, write a summary in paragraph form explaining how insulin binds to cells and the mechanism involved in triggering the cells to take in glucose. Make sure that your summary includes the eight bulleted terms/phrases in step 1. Write the summary in your notebook.

Summary explaining the cell mechanism, triggered by insulin, which allows a cell to take in glucose:

1. Show your summary to your teacher and get approval before moving to Part 2.

Part 2: The Design Process

Imagine you and your partner are health care professionals who are giving a presentation to a group of adults who are either at risk for or who have just been diagnosed with diabetes. Your task is to teach them about the role of insulin in the body. For this presentation you will design and build a 3-D working model that demonstrates the role of insulin in getting glucose into a cell as well as shows the difference between Type 1 and Type 2 diabetes. Remember that your presentation should be tailored to an audience that does not have an advanced science background and that might also be sensitive to a new diagnosis. At the completion of your presentation, the audience should understand the connection between insulin and glucose. Make sure that the model accurately depicts the role of the following terms in blood sugar regulation:

* Insulin
* Glucose
* Beta cells of pancreas
* Glucose transporters (glut 4 transporters)
* Insulin receptor
* Blood
* Cell membrane

To complete this task, follow the guidelines below.

* The model must be a 3-D visual model that demonstrates the function of insulin in the body and needs to be designed, built and presented to a group of adults who know very little about the topic.
* The model must be constructed of materials easily accessible at home or school.
* The model must have moveable parts.
* The model should be labeled clearly.
* The model must accurately show the role of insulin as it relates to glucose in the body.

Review the rubric on the next page.

**PLTW: PBS—Glucose/Insulin Model Presentations**

Name:

Block:

Date:

Requirements:

* Your presentation/model must cover the role that insulin plays in the body concerning the uptake of glucose in to cells. Your presentation must include the following terms:
  + Insulin
  + Glucose
  + Beta cells of pancreas
  + Glucose transporters (glut 4 transporters)
  + Insulin receptor
  + Blood
  + Lymph
  + Cell membrane
* Your presentation must include all people in your group with an equal speaking time.

3=Mastery

2=Average

1=Needs Improvement

0=Lacking

**Individual Grade**

1. Eye Contact 3 2 1 0

2. Volume 3 2 1 0

3. Speed 3 2 1 0

* not too fast, not too slow

4. Speech Clarity 3 2 1 0

* clear pronounciation and

delivery of words, no

mumbling

5. Flow/Transitions 3 2 1 0

6. Word Usage 3 2 1 0

* stays away from slang

words such as “sucks” and

“yea”

7. Thoroughness of Presentation 3 2 1 0

* covers all necessary support to explain

point/requirements

8. Demonstrates Understanding 3 2 1 0

* can tell that speaker

is familiar with, understands,

and knows information in

presentation, is

conversational with

audience, teaches

**Group Grades**

9. Minimum requirements are fulfilled 3 2 1 0

* see requirements above

10. Accuracy 3 2 1 0

* information is correct

11. Model(s) 3 2 1 0

* ready to use and included smoothly

into the presentation, creative and

powerful

Total Points \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_/33