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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 block 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 use a design process to 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
* Evaluating Websites Guide
* Project 2.1.2 Response Sheet
* Design Process Resource Sheet
* Design Process – Insulin Glucose Example worksheet
* Laboratory journal
* PBS Course File
* 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: Evaluating Credible Sources

The Internet provides a fast, easy-to-access portal of information on almost any topic. But how do you know that what you read is accurate? What are some strategies you can use to assess the credibility of websites and to determine which information is reliable and can be used to help you complete your Biomedical Sciences projects?

1. Brainstorm ways that you can determine whether a website is credible. Record your ideas in your laboratory journal and discuss these features with a partner.
2. In your laboratory journal, list two pros and two cons of using the Internet to research current science topics.
3. Download the Evaluating Websites guide available from Phoenix College at <http://www.pc.maricopa.edu/departments/library/guides/EvaluateWeb08.pdf> Print a copy of the document. Alternatively, obtain a copy from your teacher.
4. Read this document and review guidelines that you can use to assess the author, purpose, and content of a website. Highlight important tips.
5. Obtain a Project 2.1.2 Student Response Sheet from your teacher. Use this document to compile your research on the relationship between insulin and glucose.
6. Use the tips presented on the Evaluating Websites guide to locate information about how insulin signals a cell to take in glucose from the blood. Choose three good sources of information that include diagrams, pictures, and/ or interactive elements that help you explain the relationship between these two molecules.
7. On the Response Sheet (#1), properly document each of these three sources. Under each documented source, write an explanation of why it is a legitimate and reliable source of information about insulin and its effects on cells.
8. Take notes on the Response Sheet (#2) about the relationship between insulin and glucose. Draw sketches or diagrams if necessary.
9. Discuss the information you researched with your partner and ask your teacher any clarification questions.
10. Work with your partner and create a summary, either in paragraph form or in a series of steps or bullets, explaining how insulin binds to cells and the mechanism involved in triggering the cells to take in glucose. Write the summary on the Response Sheet (#3).
11. Show your summary to your teacher and get approval before moving to Part 2.
12. File the Evaluating Websites Guide in the appropriate tab of your course file. Use the PBS Course File – Table of Contents as a guide. This will be a valuable resource in all of your Biomedical Sciences coursework.

Part 2: The Design Process

The design process in science and engineering is a plan or process for answering questions or for solving problems. The design process is an organized, systematic process that allows for continual evaluation and revision. In the sciences, the design process could include experimental design or the design of scientific models. Models are a very important tool for explaining complex processes in science, technology, and engineering.

Similar to the experimental design or the scientific method, the design process is a series of steps that outline a logical way to answer a question or solve a problem. This process helps to produce consistency, quality of work, and repeatable procedures for people to share. For this project you will be using a six step 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. At the completion of your presentation, the audience should understand the connection between insulin and glucose. 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. Make sure that the model accurately depicts the role of the following terms in blood sugar regulation:

* + Glucose transport proteins
  + Cell membrane
  + Glucose
  + Blood
  + Cell
  + Insulin
  + Insulin receptors

To complete this task, follow the steps below.

1. Obtain a Design Process Resource Sheet. Read through each step. Note that many projects will not require strict adherence to each and every step. Use the design process as a guideline to help define and justify the need of your project, as well as generate appropriate solutions to your problem.
2. Add notes to your resource sheet as your teacher presents the Design Process presentation.
3. Obtain a Design Process – Insulin Glucose Example worksheet. Note that you will use this sheet to describe your work as you design and build your insulin glucose model.
4. Note that an abbreviated Step 1 of the design process has been completed for you; however, you may add information if needed.
5. Work through steps 2 and 3 of the design process to generate ideas for your model, identify and list materials, and sketch potential designs/solutions. Write notes and sketch on the appropriate sections of the Design Process Example worksheet.
6. Share the list of materials with your teacher. If your teacher approves, complete steps 3-5 to build and test your model. Record relevant notes on the appropriate sections of Design Process Example worksheet.
7. To complete Step 6 of the design process, plan a 2 to 3 minute oral presentation, using the model, to teach an audience about the role of insulin in glucose uptake by cells as well as use the model to demonstrate 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. Add any presentation notes to the Design Process Example Worksheet.
8. With your partner, make your presentation to your teacher. Your teacher will pick the two most creative models and have those groups present to the class.
9. File the Design Process Resource Sheet and the Design Process Example Worksheet in the appropriate tab of your course file. Use the PBS Course File – Table of Contents as a guide If desired, take pictures (or video) of your completed model and store these files along with your Design Process Example handout.
10. Answer the Conclusion questions.

Conclusion

1. Describe one benefit and one drawback of using models to represent scientific processes.

1. Give two possible reasons why both engineers and scientists use a design process for their work.

1. Describe how you would use/alter your model to demonstrate the basic difference between Type I and Type II diabetes. (Extra credit if you demonstrate it!)