

Activity 2.1.3: Feedback

Introduction

So far in this lesson, you have studied the connection between insulin and glucose and how the interaction of the two is related to diabetes. But how does your body monitor and control the level of sugar in your blood? The human body maintains *homeostasis*, a steady state, by monitoring changes in the internal and external environment and feeding this information back to the body so that it can make necessary change. The control of body temperature, heart rate, and the concentration of sugar in the blood are all regulated by these *feedback mechanisms* or *feedback loops*. There are actually two types of feedback mechanisms: negative feedback and positive feedback. In this instance, the terms positive and negative do not infer good or bad. Instead, the terms refer to the effect the input of information (feedback) has on the output (action) of the system. Positive feedback causes a reinforcement of the original action, so the input causes the reaction to increase. Negative feedback causes the system to stop doing the original action and to either take no action or to perform an opposite action.

While our nervous system communicates using electrical signals, the body’s *endocrine system* uses chemical signals, called hormones, to regulate body functioning. Hormones are proteins involved in maintaining the body’s homeostasis. These chemical messengers carry signals from one cell to another and regulate many of the body’s functions, including growth and development, metabolism, and reproduction. Hormones are secreted by tissues in the body referred to as *glands*. Each hormone has a specific list of target tissues, and in many cases these include other endocrine glands. Hormones are a vital component of the body’s feedback system. Insulin is one of the key hormones that helps maintain a healthy blood sugar level.

In this activity you will investigate feedback and feedback loops. Using knowledge of the insulin/glucose connection, diagram the specific steps in the body that function to keep blood sugar in balance.

Equipment

* Computer with Internet access and Inspiration® software
* Markers
* Laboratory journal or notebook

Procedure

1. Watch the Penn Medicine video – Negative Feedback and Insulin Production to learn more about feedback in the body <http://www.pennmedicine.org/health_info/diabetes2/000272.html>
2. Define *feedback* or *feedback mechanism* in your laboratory journal. This definition should include an example that shows you understand the concept.
3. Research how the body regulates body temperature. Think about the organs, tissues, or functions involved in warming and cooling the body. Use the Internet or other resources to find information. Take notes in your laboratory journal or notebook.
4. Open Inspiration® software.
5. Construct a feedback diagram depicting the regulation of body temperature. A basic template of a loop is shown below. You can use this basic template or design another visual using the software. Add or delete bubbles or boxes as needed. Fill in the steps to show how the body restores normal temperature. Indicate whether the feedback loop you have drawn represents a positive or a negative feedback mechanism.



1. Have your teacher check your loop for accuracy and completeness.
2. Think about the insulin/glucose connection. Insulin is a key hormone that communicates with the body to control the level of sugar in your blood.
3. Imagine you just ate a candy bar. Research your body’s hormonal response to this influx of sugar (glucose). In your laboratory journal, take notes on the steps your body goes through to control this increase. Make sure to mention the glands involved, the hormones released, and the response of target organs. Refer to the video you watched in Step 1 if needed.
4. Imagine your candy bar has long since worn off and your blood sugar is beginning to drop. Research the role of the hormone *glucagon* in getting your blood sugar back to normal. Make sure to mention the glands involved, the hormones released, and the response of target organs. Take notes in your laboratory journal.
5. Use your findings to create a feedback loop diagram that describes how your body maintains the proper level of sugar in the blood. Combine your findings about how insulin and glucagon work and think about the sequence of events that occurs to restore balance in the body. Complete this loop using Inspiration® software. A sample diagram is shown below:



1. Depending on how you set up your loop, consider adding additional boxes or deleting unnecessary ones. Be specific, detailing glands and organs as necessary, and make sure your progression makes sense.
2. Add additional information to your completed diagram to show what happens to this loop in the case of diabetes. Be sure to address both Type 1 and Type 2 diabetes.
3. Compare your feedback loop with another group. Discuss any discrepancies you may find and modify your information if needed.
4. Place a copy of your completed feedback loop in your laboratory journal.
5. Update the classroom evidence board with information from Lesson 2.1.
6. Answer the Conclusion questions.

Conclusion

1. Is blood sugar regulated by negative or positive feedback? Explain your answer.
2. Explain how a problem with insulin receptors would affect the ability to achieve homeostasis.
3. Explain how it is possible that a problem with hormones and feedback led to Anna Garcia’s untimely death.