

Activity 2.3.1: The Hormone Connection

Introduction

While the 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. Endocrine glands secrete hormones directly into the bloodstream while exocrine glands secrete hormones into ducts, or passageways, before they reach their target. Each hormone has a specific list of target tissues, and in many cases these include other endocrine glands. This system of chemical communication, the endocrine system, works with the nervous system to regulate and control all the actions of the human machine.

In this activity, you will investigate the way in which hormones interact with their target cells and create a concept map that describes the interworkings of the endocrine system. You will review the concept of feedback and feedback loops and using knowledge of the insulin/glucose connection, diagram the specific actions that occur to keep blood sugar in balance. As you move through the Human Body Systems course, you will encounter many more examples of key hormones. Use your graphic organizer to visually display the many structures and functions of the body’s amazing endocrine system.

Equipment

* Computer with Internet access and Inspiration software
* Laboratory journal
* Body system graphic organizer handout
* Markers or colored pencils
* Concept Map Rubric handout
* Reference textbook (optional)

Procedure

1. Read about the endocrine system and the mechanisms of hormone action at the following websites or in the reference textbook:

* Overview of Endocrinology- Colorado State University <http://www.vivo.colostate.edu/hbooks/pathphys/endocrine/basics/overview.html>
* Hormones, Receptors and Target Cells- Colorado State University <http://www.vivo.colostate.edu/hbooks/pathphys/endocrine/basics/hormones.html>
* Mechanisms of Hormone Action- Colorado State University <http://www.vivo.colostate.edu/hbooks/pathphys/endocrine/moaction/index.html>
* The Endocrine System- Estrella Mountain Community College <http://www.estrellamountain.edu/faculty/farabee/biobk/BioBookENDOCR.html>

1. Obtain a Concept Map Rubric from your teacher and review requirements for a successful concept map.
2. Use Inspiration software to create a concept map for Chemical Communication describing the basic mechanism of hormone action in the human body. Your map should include (but is not limited to) the following terms:

* hormone
* endocrine system
* gland
* target cells
* receptor
* endocrine gland
* exocrine gland

1. Use additional terms and linking phrases as needed to paint a picture of chemical communication in the human body. Make sure to include at least one specific example for terms such as *hormone*, *endocrine gland*, and *exocrine gland*. Use additional websites to help you complete your map.
2. Using your completed map, answer conclusion questions 1-3.
3. Think back to your discussion of the insulin/glucose connection in PBS. Insulin is a key hormone that communicates with the body to control the level of sugar in your blood.
4. If you completed a feedback loop of the insulin/glucose connection in PBS, take our your completed loop and skip to step 13. NOTE: Your teacher may ask that you complete the loop as review or review the loop on the board. If you have not previously completed the loop, continue with Step 8.
5. 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. Think back to what you learned last year.
6. 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.
7. 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 or draw your loop in your notebook. A sample diagram is shown below:



1. Depending on how you set up your loop, consider the need to add additional boxes or to delete unnecessary ones. However, be complete and make sure your progression makes sense.
2. Compare your feedback loop with another group. Discuss any discrepancies you may find and modify your information if needed.
3. Obtain a body system graphic organizer handout from your teacher and label it “Endocrine System.”
4. Use markers or colored pencils to draw in the gland(s) that is (are) responsible for maintaining blood sugar.
5. Draw an arrow from the releasing gland to the target organs, tissues or cells. Draw a representation of these targets on your organizer.
6. Write the name of the hormone being released on the edge of the arrow and make sure to label any endocrine glands or other structures you draw on your organizer. Provide a brief statement about function of the hormone.

* For example, a hormone called ADH is released from the pituitary gland in the brain and this hormone helps the kidneys maintain a water balance. In this case, you could draw the pituitary gland in the area of the brain, a kidney in the abdominal region and an arrow connecting the two with ADH written on the side. Both the pituitary gland and the kidney should be labeled. Next to ADH, write “maintains water balance.” NOTE: You do not have to draw this sequence on your organizer just yet.

1. Continue to add endocrine glands, hormones and target organs as you encounter them throughout the Human Body Systems course. By the end of the year, you will see the important role hormones play in controlling the function of the human machine.
2. Answer the remaining Conclusion questions.

Conclusion

1. Describe two ways in which communication in the endocrine system and in the nervous system are different and one way in which they are similar.
2. How do you think the endocrine system and the nervous system work together to control communication in the body?
3. What is the main difference between an endocrine gland and an exocrine gland? Provide an example of each type of gland and discuss what this gland secretes.
4. Think about how your body responds when you ingest a huge amount of sugar. Is your body’s response an example of positive or negative feedback? Explain your reasoning.
5. Describe two problems in the loop you have created that can produce an imbalance of sugar in the blood and lead to diabetes.
6. We have already talked about another class of chemicals that help send signals in the body – neurotransmitters. How are neurotransmitters and hormones similar and how are they different?