

Hands-on Activity: Endocrine Excitement!

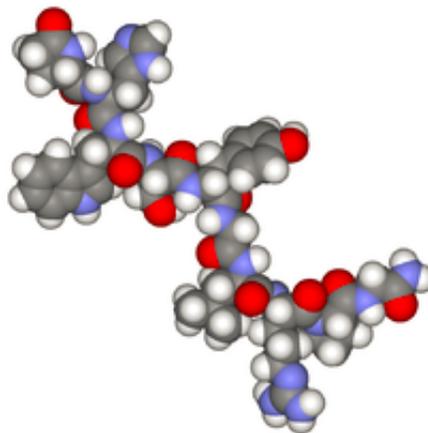
Contributed by: Integrated Teaching and Learning Program, College of Engineering, University of Colorado Boulder

Quick Look

Grade Level:	5 (3-5)
Time Required:	30 minutes
Expendable Cost/Grp ⓘ:	US\$ 0
Group Size:	2
Activity Dependency ⓘ:	None

Related Curriculum ⓘ

Subject Areas:	Biology
Curricular Units:	Engineering and the Human Body
Lessons:	Unlocking the Endocrine System



An example hormone in the human body
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Summary

In this activity, students are divided into a group of hormones and a group of receptors. The hormones have to find their matching receptors, and the pair, once matched, perform a given action. This activity helps students learn about the specificity of hormone-receptor interactions within the endocrine system.

Engineering Connection

One important aspect of engineering is communication. Engineers need to be able to explain their ideas and designs so that other people can understand their work. Biomedical engineers work to produce growth hormone and insulin for people who have challenges growing, or have diabetes. Engineers also design the technologies that make communication in space and on earth possible, including cell phones, digital video equipment and satellites.

Educational Standards

- Colorado: Science ▶
- International Technology and Engineering Educators Association: Technology ▶
- Next Generation Science Standards: Science ▶

Learning Objectives

After this activity, students should be able to:

- Explain that hormones help tell our body what to do
- Describe how hormones and receptors work together
- Relate how engineers are involved in communication

Materials List

To share with the entire class:

- Labeled puzzle pieces – one per student

Introduction/Motivation

Communication is important for everyone! It's a great skill for you, astronauts and engineers alike to have. Why do you think communication is important? Well, communication helps engineers, astronauts and anyone to get ideas across to each other. Astronauts need to be able to communicate with ground control on Earth while they are exploring space. If we could not communicate, then we could not let others know what we are thinking, or when we are sad or happy. Engineers would not be able to let you know what cool new technologies they have designed to help people out. In fact, engineers are the ones who design all the cool new technologies that help us communicate with friends far away, like cell phones, emails and text messaging. In our activity today, we are going to see one way that the body actually communicates with itself – through hormones.

Hormones help our body know what to do. They are part of our body's communication system – called the endocrine system. The endocrine system helps messages travel throughout our body so that our body can do all the different things it needs to do. There are four main parts to this endocrine system, glands, hormones, bloodstream and receptors. Glands make and send hormones through the bloodstream to specific receptor sites. These hormone messages tell our body to do things like make more blood cells, digest food, absorb vitamins or even grow. There has to be one specific receptor site for each hormone message, otherwise your glands might tell your stomach to produce more blood cells or your bones to digest food. That would not work! When a hormone matches up with its specific receptor, then the body knows what it is supposed to do next. It is kind of like receiving a letter in the mail.

One of the most fascinating things about hormones is how incredibly specific they are! In fact, hormones act like real puzzle pieces, or like a lock and key. Sometimes, when you are putting together a puzzle, you can force a puzzle piece in next to another piece when it is not really meant to fit there. But, hormones and receptors are not quite like that: they have to match up perfectly, or they will not send a message. Today, we are going to do an activity that will help us learn more about how the hormones and receptor sites fit together like puzzle pieces. You are going to be either a hormone or a receptor. If you are a receptor, you will stand still and wait for your hormone to come and find you. If you are a hormone, you will search around the classroom until you find the receptor that is a perfect match for you. Are you ready? Let's get started!

Vocabulary/Definitions

Endocrine Gland: A gland in the body which secretes hormones into the bloodstream.

Hormone: A chemical secreted by endocrine glands which carries instructions to the body.

Receptor: A specific site on a cell designed to recognize and accept a specific hormone.

Procedure

Before the Activity

- Create puzzle pieces by cutting shapes out of cardboard and cut them in half, or use pieces from a jigsaw puzzle and label the back (plain) side of them.
- Each pair of puzzle pieces should be labeled: with an H on one half for hormone, and with an R for receptor on the other half (see Figure 1). Note: Write an action across both pieces, so that it can only be fully read when they are joined together. Possible actions include: jump up and down, jump on one foot, put your hand on your head, act like a monkey, turn in a circle, clap your hands, etc.

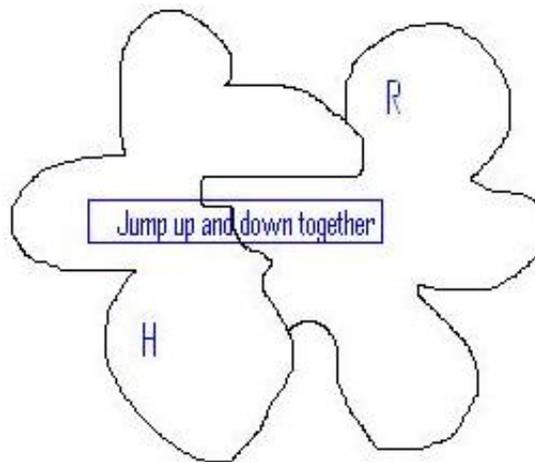


Figure 1. Example of a hand-made puzzle piece pair.
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With the Students

1. Explain the procedure and discuss the specificity of the hormone-receptor interaction.
2. Pass out puzzle pieces, one per student, but tell the students not to look at the label on their piece.
3. Have students scatter throughout the entire classroom and then freeze.
4. Tell students to look at their pieces: students who are "receptors" must remain frozen in place; the "hormone" students may now move throughout the classroom. "Hormone" students must try to match their piece with each receptor piece until they successfully find a match.
5. Once all students have found their match, have each pair act out together the action written on their puzzle pieces.
6. You can repeat the activity if time permits.

Safety Issues

Remind students to be careful not to bump into each other when moving around the classroom.

Troubleshooting Tips

If there are an uneven number of students in the class, the teacher may need to participate.

Assessment

Pre-Activity Assessment

Discussion Topic: Talk with students what it means to have a specific receptor site. Compare it to the child's toy where you fit the shapes into the different holes. Can they think of examples of specificity in their own lives? (One clear example is a lock and key, but encourage them to come up with other ideas.)

Activity Embedded Assessment

Formation: As a way to actively engage all students and assess their knowledge, have them all participate in the activity of matching hormones to receptor sites. Closely observe students as they interact with each other in this activity and notice if they seem to be grasping the concepts of specificity and hormone-receptor interactions.

Post-Activity Assessment

Telephone Game: Play the game "telephone" with the students. Have all the students stand in a circle. Whisper, "Engineers need good communication to talk about new technologies" in the first student's ear. Have that student turn to the person next to her/him and whisper the message to them. Continue whispering the message around the circle until it is relayed to the last person. The message can only be given once to each student. Have the last student say the message they heard aloud to the whole class. See how much the message has changed.

Discuss with the students how communication can be a problem when it goes through many receptor sites. This is why the endocrine system makes hormones that can only relay a message to one receptor site. When engineers design new technologies for communication, they need to understand how signals and messages can get changed if there are too many middle receptor sites as well. Ask the students if they can think of any times in their own lives when a message has been messed up because of bad communication.

Review Discussion: Review with the students what they learned. Discuss again how communication is so important for astronauts, engineers and for them. Discuss why it is such a good thing that the hormones in our bodies only match up with specific receptors. (This is good because it ensures that the hormones tell the "right" cells what to do.) Ask students the following questions:

- Of which body system are hormones a part? (*Answer: Hormones are part of the endocrine system.*)
- What are some examples of body functions that are triggered by hormones? (*Answer: Hunger, digestion, muscle growth, "fight or flight" reflex, among others.*)

Activity Extensions

A related activity might be to have the students act out the "mail delivery" system of the endocrine system. One student could be the mail carrier, and several students could be the endocrine glands and write out "hormone" instructions for the "receptor" students to read. Once the mail carrier delivers the mail to the correct students, the "receptor" students could read the "mail" and then tell other "body" students what to act out.

Activity Scaling

For upper grades, you may design a more complicated system of interactions. For example, have one hormone-receptor pair interact with another pair, or create a chain-reaction of interactions.

For lower grades, you may use matching shapes, or matching colors instead of puzzle pieces.

References

U.S. Department of Health and Human Services, National Institutes of Health, National Institute of Child Health and Human Development, "Study of Growth Hormone Treatment and Creutzfeldt-Jacob Disease Underscores Need for Prevention of Adrenal Crises," http://www.nichd.nih.gov/new/releases/growth_hormone.cfm

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Supporting Program

Integrated Teaching and Learning Program, College of Engineering, University of Colorado Boulder

Acknowledgements

The contents of this digital library curriculum were developed under a grant from the Fund for the Improvement of Postsecondary Education (FIPSE), U.S. Department of Education and National Science Foundation GK-12 grant no. 0338326. However, these contents do not necessarily represent the policies of the Department of Education or National Science Foundation, and you should not assume endorsement by the federal government.

Last modified: February 18, 2016