Lesson: Unlocking the Endocrine System

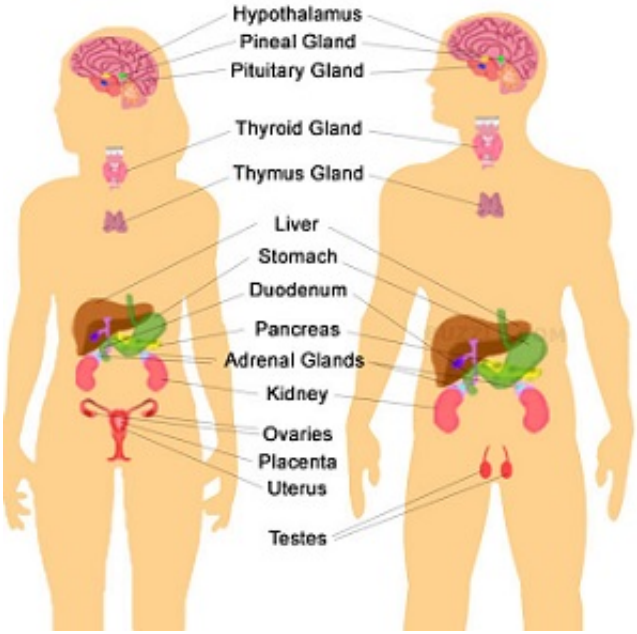
Contributed by: Integrated Teaching and Learning Program, College of Engineering, University of Colorado Boulder

Quick Look

Grade Level:	5 (3-5)
Lessons in this Unit:	1 2 3 4 5 6 **7** 8 9 10
Time Required:	20 minutes
Lesson Dependency:	None

Related Curriculum

Subject Areas:	Biology
Curricular Units:	Engineering and the Human Body
Activities:	Endocrine Excitement!



The Endocrine System
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Summary

Students learn how the endocrine system works and compare it to the mail delivery system. Students discuss the importance of communication in human body systems and relate that to engineering and astronauts.

Engineering Connection

The endocrine system helps us learn the importance of communication in the body. Good communication skills are also an important part of engineering. Astronauts have to communicate well with each other both on Earth and in outer space. 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 lesson, students should be able to:

- List several parts of the endocrine system.
- Compare the endocrine system to a mail delivery system.
- Explain why communication is important for engineers and astronauts.

Introduction/Motivation

Today we are going to talk about communication. Who can give me a definition of what communication is? (Possible answers: Communication involves talking to other people, conveying information between people, etc.). Great job! Thank you for thinking hard about that. Now, we have been talking a lot about astronauts and outer space, so let's think together about why communication would be important for astronauts. Does anyone have any ideas? (Possible answers: Astronauts need to be able to talk with each other, even when they are in their space suits, and the astronauts in the space shuttle need to be able to talk back and forth with mission control on Earth). Great answers! Now let's talk about one more group of people that need to be really good at communicating: engineers! Why do you think it is so important for engineers to be good communicators? Engineers must be able to explain their ideas so that other people can understand them.

How does this relate to the human body? Well, today we are going to learn about a body system that is all about communication! This system is called the endocrine system (write the word endocrine on the board). The endocrine system helps carry messages throughout your body, to tell your body what to do. You can think of it as a giant mail system.

Here is how it works: your body has many endocrine glands, which secrete hormones into your blood. The bloodstream carries the hormones to a specific place (an organ or a receptor) that is designed to receive them. Once the hormone gets to that specific place, it gives your body some special instructions. Some of these instructions tell your body to make more red blood cells, to make more white blood cells, to secrete acid to digest food, to absorb calcium, or even to make you not feel hungry any more. Hormones can also tell the cells in your body when to divide and grow.

So, if we compare this whole endocrine system to how mail gets delivered, the endocrine gland would be like someone who puts a letter in the mailbox, then the bloodstream (which would be like the mail carrier) carries the letter to exactly where it is supposed to go (to just the right new mailbox, which would be like an organ, or receptor). Then, when the person who receives the mail reads their letter, it is similar to your body receiving the hormone (at the organ or receptor) and then doing what the hormone (letter) suggests to do. Pretty neat, isn't it!

In a microgravity environment such as space, astronauts cannot easily send letters back to Earth to see how everything is going. However, astronauts need to be able to communicate with ground control on Earth to see if their body systems are being monitored correctly and even if the timing is right for their return to Earth. Engineers need to understand how to best communicate in return with the astronauts as well, and they work to design the technologies, including cameras, video equipment, satellite phones and monitoring equipment, to be able to

communicate with the astronauts while they are so far from home.

Lesson Background and Concepts for Teachers

The endocrine system is all about communication. There are two main communication pathways in your body: the *nervous system* and the *endocrine system*. In the nervous system, signals travel very fast, and lead to almost instantaneous responses. In the endocrine system, chemicals travel through your body more slowly, and the response to these chemicals can be slow and/or long lasting.

Hormones

What is a *hormone*? It is a chemical that has a high level of specificity, which means that it will only react with a specific receptor site in your body. The lock and key analogy is often used to explain this specificity, and it is a great way to think about how hormones work. Hormones convey important information to the body, including such instructions as cell division and growth, appetite suppression, acid secretion, calcium absorption, and red and white blood cell production.

Hormones are secreted by endocrine glands. There are eight major endocrine glands. Those glands, along with their main functions, are listed below:

Pituitary gland – regulates other endocrine glands; secretes growth hormone.

Thyroid – regulates metabolic rate.

Thymus – assists in development of immune system.

Adrenal gland – regulates fluid and sodium balance; emergency warning system under stress.

Ovary – controls development of secondary sex characteristics and functioning of sex organs.

Testis - controls development of secondary sex characteristics and functioning of sex organs.

Pancreatic islets – helps regulate blood sugar.

Pineal gland - believed to regulate biorhythms and moods and stimulate the onset of puberty.

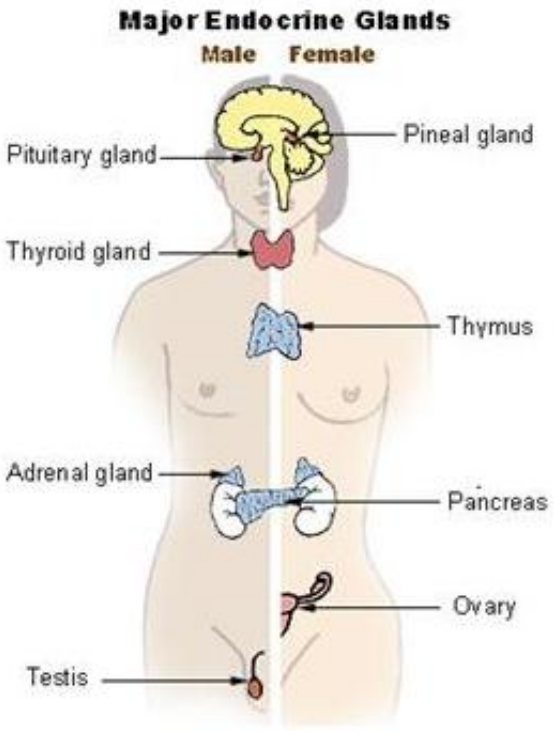

Figure 1. Major endocrine glands.
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Two hormones that engineers are involved in producing are growth hormone and insulin. Growth hormone can be used for children (or some adults) whose bodies do not produce enough on their own, and insulin is needed for people who have diabetes.

Vocabulary/Definitions

Adrenal Gland: Regulates fluid and sodium balance; emergency warning system under stress.
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.
Ovary: Controls development of secondary sex characteristics and functioning of sex organs.
Pancreatic islets: Helps regulate blood sugar.
Pineal gland: Believed to regulate biorhythms and moods and stimulate the onset of puberty.
Pituitary Gland: Regulates other endocrine glands; secretes growth hormone.
Receptor: A specific site on a cell designed to recognize and accept a specific hormone.
Testis: Controls development of secondary sex characteristics and functioning of sex organs.
Thymus: Assists in development of the immune system.
Thyroid: Regulates metabolic rate.

Associated Activities

- Endocrine Excitement! - Students create hormone-receptor pairs by matching puzzle pieces and then follow the instructions written on the pieces.

Lesson Closure

Today we learned about the endocrine system and how it helps the body communicate signals like when to grow or digest food. Who can tell me the four main parts of the endocrine system? (Answer: endocrine glands,

hormones, receptor sites, bloodstream) How is the endocrine system like the mail system? Well, the endocrine gland sends a hormone message, like a letter, and the bloodstream mail carrier carries it to the receptor site, like a new mailbox. Lastly, the body reacts to the hormone message, as somebody might if they read the letter. It's all about communication!

Who remembers why communication is important to astronauts and engineers? That's right, astronauts and engineers have to communicate well with each other both on Earth and in outer space. Engineers also design the technologies that make communication in space and on Earth possible, including cell phones, digital video equipment and satellites.

Assessment

Pre-Lesson Assessment

Discussion Topic: Talk with students about the importance of good communication. Discuss what happens when we have problems communicating in the classroom, or with our friends. Talk about why communication is important for us, for astronauts, and for engineers!

Post-Introduction Assessment

Voting: Ask a true/false question and have students vote by holding thumbs up for true and thumbs down for false. Count the votes and write the totals on the board. Be sure to tell students the right answer after they vote.

- True or False: Engineers do not need to be good communicators. (Answer: False, communication is a very important part of being an engineer.)
- True or False: The endocrine system in our bodies is like the mail system, and hormones are like letters that get delivered by our bloodstream. (Answer: True)
- True or False: Hormones go to a specific place in our body and tell our body what to do. (Answer: True)

Lesson Summary Assessment

Matching: Create a list of parts of the endocrine system, and parts of the mail system. Randomly write the endocrine system parts on the left side of the board and the mail system parts on the right side of the board. As a class, have the students match the correct sides together. For example:

Bloodstream *Mail carrier, who carries the message or letter to the right spot*

Hormone *The message or letter, which has specific instructions in it*

Organ or Receptor *The mailbox, where the message needs to go in exactly the right box!*

Endocrine gland *The person who wrote the letter or is mailing out the instructions*

(Note: these pairs are sorted correctly, but should be randomly mixed for the students).

Lesson Extension Activities

Have students research the production of insulin or human growth hormone.

Help students research and give a presentation on endocrine disruptors.

For older students, teachers may want to discuss the role of illegal steroids in sports.

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Supporting Program

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