



## Grade 9 Sample Lesson Plan: Unit 1 – The Endocrine System

### SOLs

- 9.1. A Identify and describe the major structures and functions of the endocrine system.
- 9.2. A Identify health risks and other factors that affect the function of the endocrine system.
- 9.2. D Identify health-related decisions that contribute to heart disease, stroke, diabetes, and other chronic diseases and conditions.
- 9.2.L Describe the benefits of organ donation.

### Objectives/Goals

- Students will learn about the glands and functions of the endocrine system. Students will consider these functions in their own lives and will be able to identify the the connections to disease.

### Materials

- Handouts, Internet access for video clips and information.

### Procedure

- Introduce the endocrine system to students, e.g.,:  
*The endocrine system is network of glands that produce and release hormones. Hormones are chemical substances that help control many important body functions, including the body's ability to change calories into energy that powers cells and organs. The endocrine system influences how your heart beats, how your bones and tissues grow, even your ability to make a baby. It plays a vital role in whether or not you develop diabetes, thyroid disease, growth disorders, sexual dysfunction, and a host of other hormone-related disorders. (Source: WebMD <http://www.webmd.com/diabetes/endocrine-system-disorders#1> )*
- Additionally, ensure that students know that the endocrine system works in concert with the nervous system to regulate body activities.  
*The nervous system acts through electrical impulses and neurotransmitters to cause muscle contraction and glandular secretion).*

*There are two types of glands in the endocrine system, exocrine glands that take their secretions to the surface through ducts that exit the body (e.g., mammary, sebaceous, sweat, and glands that secrete digestive enzymes), and endocrine glands, the seven sets of gland secrete different hormones directly into the blood (they do not have ducts that carry their secretions to the surface and out of the body); the endocrine hormones are carried throughout the body where they influence cells that have receptor sites for that particular hormone (source: National Cancer Institute (NCI) SEER Training Modules <https://training.seer.cancer.gov/anatomy/endocrine/glands/> ).*

- Show students illustrations of the glands and where they are located in the body (e.g., using the following NCI illustration) or have them view illustrative videos readily available online (e.g., KidsHealth.org How the Endocrine System Works [https://www.youtube.com/watch?v=HXPCQBD\\_WGI&index=17&list=PLRmb5AxU-JXgajvrrcozhkhMeSWa0XI0Z](https://www.youtube.com/watch?v=HXPCQBD_WGI&index=17&list=PLRmb5AxU-JXgajvrrcozhkhMeSWa0XI0Z) or the Khan Academy's Introduction to the Endocrine System [https://www.youtube.com/watch?v=f\\_Z1zsR9IFM](https://www.youtube.com/watch?v=f_Z1zsR9IFM) )
- Review the functions of the endocrine glands (e.g., :
  - (1) *Pituitary gland – located at the bottom or base of the brain; master gland; secretes hormones that control all other glands, and hormones that regulate growth*
  - (2) *Thyroid gland – it is located below the voice box; it secretes a hormone that controls the rate at which the body burns energy and uses food (nutrients)*
  - (3) *Parathyroid – controls the growth of bones and the amount of calcium in your body*
  - (4) *Pancreas – it is both a duct and ductless gland; secretes a hormone called insulin that regulates how the body uses and stores sugars (glucose); when the pancreas does not produce enough insulin, a person may have a illness called diabetes (potential complications of diabetes include heart disease, stroke, kidney disease, and blindness). Diabetes can be controlled with medication, nutrition, and exercise.*
  - (5) *Adrenal glands – secrete three stress hormones: adrenaline – the fight or flight hormone-which, especially when a person is frightened or angry or nervous, causes rapid heartbeat and breathing and a surge in energy; norepinephrine – which also causes arousal and supports the body's response to stressful situations; and cortisol – commonly known as the stress hormone- which typically helps to maintain fluid balance and blood pressure but when chronically released can lead to serious health issues (e.g., suppresses immune system, increases blood pressure and sugar, contribute to obesity)(*

(6) Ovaries – female reproductive; controls maturation and reproduction in females including voice change, breast growth, menstruation, and hair (puberty)

(7) Testes – male reproductive; controls maturation and reproduction in males including voice change, hair, muscle development (puberty)

Sources: *The Endocrine System, Who is In Control Here; The Stress Hormones Explained*

- Review information on endocrine disorders so students can identify how these disorders contribute to chronic diseases (e.g., National Institute of Diabetes and Digestive and Kidney Diseases: <https://www.niddk.nih.gov/health-information/endocrine-diseases> ).
- Engage students in activities and scenarios so they can relate to the impact of the endocrine system on their daily lives.
  - (1) Have students engage in a 2-minute physical activity that makes them sweat. Have them report how they felt. Summarize that, similar to a ‘thermostat,’ the endocrine system senses the body is heating up and makes sweat to cool the body.
  - (2) The endocrine system also functions as a ‘smoke alarm’. Have students read the attached article, *Fight or Flight*, to better understand the fight or flight response that is triggered through the endocrine system (<http://psychcentral.com/lib/fight-or-flight/> ). Ask students to share other examples from their own fight-or-flight experiences. What individual and societal factors contribute to stress and how can these stressors be addressed?
  - (3) Have students engage in web research and write a report on the impact of society and behavior on the three stress hormones, and their role in the development of chronic disease. Identify articles to get students started (e.g., *Adrenaline, Cortisol, Norepinephrine/The Stress Hormones Explained* [http://www.huffingtonpost.com/2013/04/19/adrenaline-cortisol-stress-hormones\\_n\\_3112800.html](http://www.huffingtonpost.com/2013/04/19/adrenaline-cortisol-stress-hormones_n_3112800.html) and *Cortisol, Its Role in Stress, Inflammations, and Implications for Diet Therapy* <http://www.todaysdietitian.com/newarchives/111609p38.shtml> ).
- Refer students to <https://organdonor.gov/index.html> and ask them to work in groups to do a brief presentation on
  - Reasons to donate <https://organdonor.gov/statistics-stories/statistics.html#growing> ,
  - Who is eligible to donate <https://organdonor.gov/about/donors.html> , and
  - How to register to donate (e.g. signing up online or through a local department of motor vehicles <https://organdonor.gov/register.html> ).

- Knowledge quizzes can supplement the lesson. A sample knowledge quiz that illustrates the reach of endocrine hormones is included at the end of this unit plan. The NCI also provides a full online training and quiz on the endocrine at: <https://training.seer.cancer.gov/anatomy/endocrine/glands/>

### Assessment Idea

- Quality of student participation in discussion.
- Quality of student reports/presentations on stress hormones and organ donation
- Changes in pre/post performance on knowledge quizzes.

### References

- Department of Health and Human Services, Organ Donation Site <https://organdonor.gov/index.html>
- National Cancer Institute <https://training.seer.cancer.gov/anatomy/endocrine/>
- National Institute of Diabetes and Digestive and Kidney Diseases: <https://www.niddk.nih.gov/health-information/endocrine-diseases>
- Articles:
  - Adrenaline, Cortisol, Norepinephrine/The Stress Hormones Explained*  
[http://www.huffingtonpost.com/2013/04/19/adrenaline-cortisol-stress-hormones\\_n\\_3112800.html](http://www.huffingtonpost.com/2013/04/19/adrenaline-cortisol-stress-hormones_n_3112800.html)
  - Cortisol, Its Role in Stress, Inflammations, and Implications for Diet Therapy*  
<http://www.todaysdietitian.com/newarchives/111609p38.shtml> .
  - Fight or Flight* (<http://psychcentral.com/lib/fight-or-flight/>)
  - Web MD Endocrine Systems Disorders*  
<http://www.webmd.com/diabetes/endocrine-system-disorders#1>
- YouTube Videos:
  - KidsHealth.org *How the Endocrine System Works*  
[https://www.youtube.com/watch?v=HXPCQBD\\_WGI&index=17&list=PLRmb5AxU-JXgajvrrcozhkhMeSWa0XI0Z](https://www.youtube.com/watch?v=HXPCQBD_WGI&index=17&list=PLRmb5AxU-JXgajvrrcozhkhMeSWa0XI0Z)
  - Khan Academy's *Introduction to the Endocrine System*  
[https://www.youtube.com/watch?v=f\\_Z1zsR9IFM](https://www.youtube.com/watch?v=f_Z1zsR9IFM)

### Handout

The next page includes a handout for the lesson. The handout is designed for print use only.

## Fight or Flight

 [psychcentral.com/lib/fight-or-flight/](http://psychcentral.com/lib/fight-or-flight/)

May 17, 2016

Consider this stressful situation: At a meeting for which you have thoroughly prepared, the chair criticizes you and accuses you of failing to attend to tasks that were, in reality, someone else's responsibility. As all eyes turn on you, you feel your face getting hot, your jaw tightening, and your fist clenching. You would not shout or hit anyone—doing so would only make things worse. But you feel like shouting or striking out.

Now consider another stressful situation: You walk into class a few moments late, only to find everyone putting books and notes away—apparently preparing for a test you did not realize had been scheduled for today. Your heart seems to stop, your mouth is dry, your knees feel weak and you momentarily consider hurrying back out the door. Your life is not really in danger, and running away will not solve your problem—so why should you feel a physical urge to escape?

These two scenarios illustrate the two poles of the **fight-or-flight response**, a sequence of internal processes that prepares the aroused organism for struggle or escape. It is triggered when we interpret a situation as threatening. The resulting response depends on how the organism has *learned* to deal with threat, as well as on an *innate* fight-or-flight "program" built into the brain.

### The learned fight response

Evidence that the fight response can be learned is seen, for example, in studies showing that reactions to a perceived insult are strongly dependent on culture. In the United States the learned fight response has been nurtured in the "culture of honor" that developed in the South—which some experts believe may account for the southern states' much higher murder rate in comparison to the northern states.<sup>(1)</sup> Learning can also affect our internal responses to stress. For example, in a study of patients with high blood pressure (which can be a stress response), those who took placebos along with their medication for high blood pressure maintained a healthy blood pressure after the medication was removed, as long as they continued taking the placebo.<sup>(1)(2)</sup>

This suggests that their expectation that the placebos would control their blood pressure was enough to reduce the emergency response of the blood vessels.

While the fight or flight response clearly can be learned, it also involves an innate reaction that operates largely outside consciousness. This was first recognized in the 1920s by physiologist Walter Canon, whose research showed that a threat stimulates a sequence of activities in an organism's nerves and glands. We now know that the hypothalamus controls this response by initiating a cascade of events in the autonomic nervous system (ANS), in the endocrine system and in the immune system.<sup>(4)</sup>

As you will recall, the autonomic nervous system regulates the activities of our internal organs. When we perceive a situation as threatening, this judgment causes the hypothalamus to send an emergency message to the ANS, which sets in motion several bodily reactions to stress. This response is helpful when you need to escape a hungry bear or confront a hostile rival.

It served our ancestors well, but it has a cost. Staying physiologically on guard against a threat eventually wears down the body's natural defenses. In this way, suffering from frequent stress—or frequently *interpreting* experiences as stressful—can create a serious health risk: an essentially healthy stress response can become *distress*.

*Adapted from Psychology, Third Edition, by Philip G. Zimbardo, Ann L. Weber and Robert Lee Johnson.*

## References

1. Nisbett, R. E. (1993). "Violence and U.S. regional culture." *American Psychologist*, 48, 441 -449.
2. Ader, R., & Chohen, N. (1975). "Behaviorally conditioned immuno-supression." *Psychosomatic Medicine*, 37, 333 -340.
3. Suchman, A. L. and Ader, R. (1989). "Placebo response in humans can be shaped by prior pharmacologic experience." *Psychosomatic Medicine*, 51, 251.
4. Jansen, A. S. P., Nguyen, X. V., Karpitskiy, V., Mettenleiter, T. C., & Loewy, A. D. (1995, October 27). "Central command neurons of the sympathetic nervous system: Basis of the fight-or-flight response." *Science*, 270, 644 -646.

Name:

Date:

*I didn't know that!*

Please answer each question with true or false (not T or F). This is not a graded test. I just want to see what you already know!

- \_\_\_\_\_ 1. Hormones can make you grow to be nine feet tall.
- \_\_\_\_\_ 2. Hormones can affect your ability to taste salty foods.
- \_\_\_\_\_ 3. Hormones can make you very sensitive to high-pitched sounds.
- \_\_\_\_\_ 4. Hormones cause a young man to begin to grow facial hair.
- \_\_\_\_\_ 5. Hormones can help fight stress.
- \_\_\_\_\_ 6. Hormones determine what color eyes you have.
- \_\_\_\_\_ 7. Hormones can cause you to be allergic to milk.
- \_\_\_\_\_ 8. Hormones can make your heart beat faster when you are scared.
- \_\_\_\_\_ 9. Hormones can soothe you.
- \_\_\_\_\_ 10. Hormones can cause your hands to tremble when you are nervous.
- \_\_\_\_\_ 11. Hormones affect how much energy you have.
- \_\_\_\_\_ 12. Hormones affect how fast or slow you read.
- \_\_\_\_\_ 13. Hormones tell your body how fast it should grow.
- \_\_\_\_\_ 14. Hormones give you the strength and energy to fight or run when in a dangerous situation.
- \_\_\_\_\_ 15. Hormones cause your voice to change, especially in boys.
- \_\_\_\_\_ 16. Hormones can make twins become triplets before they are born.
- \_\_\_\_\_ 17. Hormones tell your body how to swallow.
- \_\_\_\_\_ 18. Hormones help control when you sleep and when you wake.

## ANSWER KEY TO PRE-QUIZ

<http://inside.mines.edu/~nstambac/Body%20Systems%20Lesson%20Plan.pdf>

Name:

Date:

*I didn't know that!*

Please answer each question with true or false (not T or F). This is not a graded test. I just want to see what you already know!

- True 1. Hormones can make you grow to be nine feet tall.
- False 2. Hormones can affect your ability to taste salty foods.
- False 3. Hormones can make you very sensitive to high-pitched sounds.
- True 4. Hormones cause a young man to begin to grow facial hair.
- True 5. Hormones can help fight stress.
- False 6. Hormones determine what color eyes you have.
- False 7. Hormones can cause you to be allergic to milk.
- True 8. Hormones can make your heart beat faster when you are scared.
- True 9. Hormones can soothe you.
- True 10. Hormones can cause your hands to tremble when you are nervous.
- True 11. Hormones affect how much energy you have.
- False 12. Hormones affect how fast or slow you read.
- True 13. Hormones tell your body how fast it should grow.
- True 14. Hormones give you the strength and energy to fight or run when in a dangerous situation.
- True 15. Hormones cause your voice to change, especially in boys.
- False 16. Hormones can make twins become triplets before they are born.
- False 17. Hormones tell your body how to swallow.
- True 18. Hormones help control when you sleep and when you wake.