

*The Endocrine System*  
*from*  
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## **THE ENDOCRINE SYSTEM**

**Grade Levels: 6 - 9**

**(Review for Grades 10 - 12)**

**Viewing Time: 17 minutes with video quiz**

### **INTRODUCTION**

This video is designed for use in grades 6 - 9 as an introduction to the major ideas and concepts associated with the human endocrine system, and for use in grades 10 - 12 as review.

### **PROGRAM OBJECTIVES**

After viewing the video and participating in the accompanying activities, the students will be able to achieve the following objectives:

- Describe the function and workings of the endocrine system.
- Identify the main parts of the endocrine system.
- Identify the way the endocrine and nervous systems work together to regulate various body activities.
- Define key vocabulary terms associated with the endocrine system.

### **SUMMARY OF THE VIDEO**

This video describes the functions of the endocrine system. The nervous and endocrine systems work together to regulate various body activities. The endocrine system is made up of eight glands located throughout the body. These glands make and release hormones, which are chemical messengers. These hormones move into the circulatory

system which carries them throughout the body. Each chemical is designed to affect or react with certain body tissues or organs and stimulate changes. Probably the most famous hormone is adrenaline which, when released from the adrenal glands, causes the body to prepare for a “fight or flight” condition. The heart beats faster, the lungs work harder, the muscles tense for action, and the blood pressure rises. This hormone is released when the nervous system senses danger or fear. So the two systems actually work together to prepare the body for an emergency situation. Some hormones trigger changes in the physical appearance of the body.

### INSTRUCTIONAL NOTES

Before presenting this lesson to your students, we suggest that you preview the video and review this guide and the accompanying blackline master activities in order to familiarize yourself with their content.

Duplicate any blackline masters you wish to distribute. If you choose to use the Video Quiz, which immediately follows the video presentation, you may wish to distribute **Blackline Master 1, Video Quiz** before showing the video. Also, plan to pause the tape between questions if students require more time.

As you review the materials presented in this guide, you may find it necessary to make some changes, additions, or deletions to meet the specific needs of your class. We encourage you to do so, for only by tailoring this program to your class will they obtain the maximum instructional benefits afforded by the materials.

It is also suggested that the video presentation take place before the entire group under your supervision. The lesson activities grow out of the context of the video; therefore, the presentation should be a common experience for all students.

## INTRODUCING THE VIDEO

Ask students to share experiences they have had when their bodies have suddenly been surprised or scared. This might be a close call in a car or a terrifying experience. Tell the students that the video they will be watching today will describe how the nervous and endocrine systems work together to signal changes in the body.

**Present the video.** The viewing time is 12 minutes for the program and about 5 minutes for the Video Quiz.

### BLACKLINE MASTER DESCRIPTIONS

Most of the follow-up activities for this program are designed for middle school grades. If you use this program with an older audience, you will need to adapt the materials appropriately.

**Blackline Master 1, Video Quiz,** is to be used at the end of the video program. At the completion of the video, there is a short quiz. The narrator will read the questions which are displayed on the screen. Students can use this sheet to record their answers. Answers to the questions are provided in the Answer Key on page 5.

**Blackline Master 2, Vocabulary,** is a collection of important vocabulary words from the video. You may want to distribute this sheet before viewing the video so students can listen for definitions.

**Blackline Master 3, The Location of the Endocrine Glands,** contains a diagram of the endocrine system. At the bottom of the page there is a box containing the names of the endocrine glands. Students are to place the names next to the appropriate lines on the diagram of the human endocrine system.

**Blackline Master 4, Match**, asks students to match the glands in column A with the functions listed in column B.

**Blackline Master 5**, is the formal test for this unit of study.

### INTERNET ACTIVITIES

1. Visit the **The Center for the Study of Environmental Endocrine Effects** at

**<http://www.endocrine.org>**

for information on the latest and most significant scientific research and governmental policy developments on issues concerning adverse or beneficial effects that various environmental agents, both synthetic and natural, may have on the endocrine functions of humans, wildlife, and ecology.

2. The **MedWeb's** endocrinology page at

**<http://www.gen.emory.edu/medweb/medweb.endocrinology.html>**

includes myriad sources for information on diabetes, endocrine diseases, environmental issues, discussion groups, publications, and information resources.

### DISCUSSION QUESTIONS

1. Discuss the relationship between the nervous and endocrine systems.
2. Discuss how the negative-feedback mechanism helps to maintain proper balances of hormones in the blood.
3. Discuss how hormones can travel through the blood stream and reach their target tissues or organs.

## ANSWER KEY

### Blackline Master 1, Video Quiz

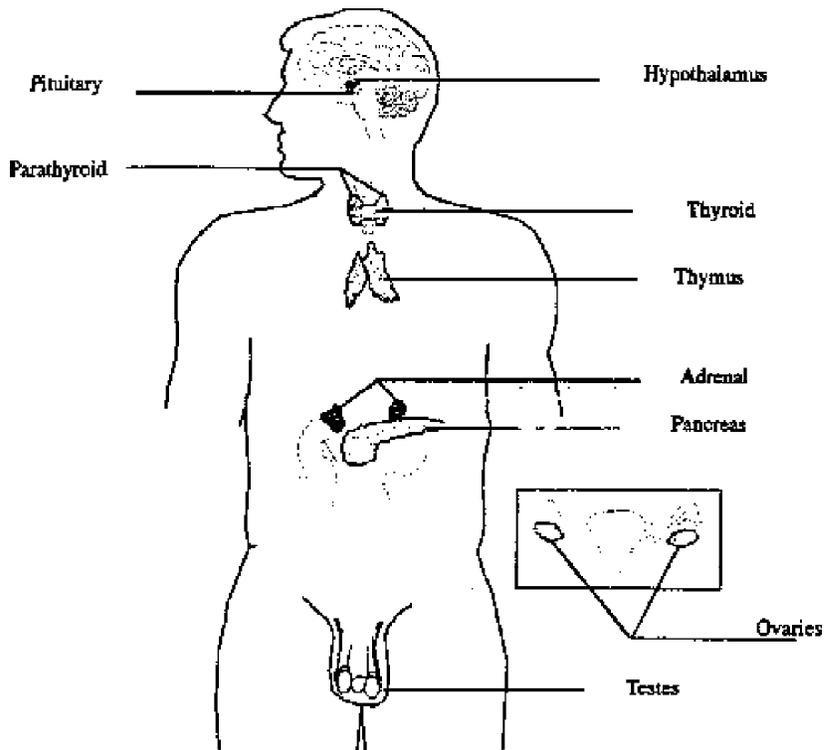
1. Hormones are chemical messengers produced in the endocrine glands and released to the circulatory system.
2. They are released to the circulatory system, which carries them throughout the body. When they make contact with target tissues or organs, they are absorbed by the cells of those tissues or organs.
3. hypothalamus, pituitary, thyroid, thymus, adrenal, pancreas, parathyroids, gonads (ovaries or testes)
4. The negative-feedback mechanism is the endocrine system's method for regulating itself. Certain glands monitor the level of hormones in the blood. If a certain hormone level is too low or too high, then these glands release chemicals that stimulate or shut-off production of the hormone in question.
5. The hypothalamus regulates activities of the other endocrine glands.

### Blackline Master 2, Vocabulary

1. endocrine system - a system of eight glands that produce chemicals which regulate certain body activities
2. exocrine glands - glands which are responsible for things like tears, sweat, or digestive juices. These glands are usually located near the organs that they affect
3. hormones - chemical messengers produced by glands of the endocrine system
4. hypothalamus - considered the central control gland of the endocrine system
5. pituitary - gland located at the base of the brain which stimulates skeletal growth and the development of male and female sex organs
6. thymus - gland which regulates development and function of the immune system
7. thyroid - gland which increases metabolism and maintains the level of calcium in the blood

8. parathyroid - gland which regulates the level of calcium and phosphorus in the body
9. adrenal - gland which increases heart rate, blood pressure, and breathing rate
10. islets of Langerhans - produces insulin and glucagon, which regulate the level of sugar in the blood
11. ovary - gland which produces female secondary sex organs
12. testes - glands which produce male secondary sex organs
13. negative-feedback mechanism - method used by endocrine system to regulate itself; certain glands detect the level of hormones in the blood and release other hormones to either start or stop the production of the hormone being monitored

### Blackline Master 3, The Location of the Endocrine Glands



### **Blackline Master 4, Match**

Hypothalamus	11
Pituitary	10, 12
Thyroid	7, 8
Thymus	9
Adrenals	3
Pancreas	2, 5
Ovaries	4
Testes	1
Parathyroids	6

### **Blackline Master 5, Quiz**

1. The endocrine system produces and releases hormones which are chemical messengers that affect various tissues and organs of the body.
2. hypothalamus, pituitary, thyroid, thymus, parathyroids, pancreas, gonads, adrenals
3. A hormone is a chemical messenger that regulates activities of tissues and organs in the body.
4. Negative-feedback is the method used by the endocrine system to regulate the level of hormones in the blood. Certain glands can detect how much of a given hormone is present in the blood. Based on this information, either the signal to create more or stop releasing that hormone is given.
5. Adrenaline is a hormone that has very dramatic effects on the body. It causes an increase in heart rate, breathing rate, and blood pressure. It is the “flight or fight” hormone. It prepares the body for an emergency.
6. The nervous system gathers information about what is happening around us and sends that information to the brain. The hypothalamus is an endocrine gland that is located in the brain. Much of the information sent by the nervous system goes through the hypothalamus. Based on that information, various other endocrine glands might be stimulated to produce hormones.

7. The “flight or fight” response is set into motion when the nervous system senses danger or an emergency. The adrenal glands respond by releasing adrenaline into the circulatory system. This chemical causes dramatic changes that include an increase of heart rate, breathing rate, and blood pressure levels. These changes occur so that if the human must run or fight, their bodies are ready for extreme measures.

8. The hormones travel throughout the body by way of the circulatory system. Each hormone has certain target cells located in various tissues or organs of the body. When a target cell detects the hormone in the blood, the cell absorbs the hormone.

9. Insulin is a chemical that helps cells convert sugar into energy. It decreases the sugar level in the blood. Glucagon does the opposite of insulin. It increases the blood sugar level by stimulating the conversion of stored sugar.

10. Some people can't produce enough insulin. The insulin helps the cells to convert sugar into energy. If there isn't enough insulin in the blood, then the blood sugar level goes too high.

### **SCRIPT OF VIDEO NARRATION THE ENDOCRINE SYSTEM**

Have you ever been driving along when suddenly ...  
...WATCH OUT! You almost hit that car!

That was a close call. You might remember that your heart was racing and your muscles felt all tensed up. In fact, you might have even been trembling. You might have wondered why your body felt so strange. This is one way the body reacts to danger or surprise.

The nervous system and the endocrine system have worked together to prepare your body for an emergency situation. In this case, the nervous system sent a visual image from your eyes of a possible collision with another car. The brain

interpreted this information and sent messages to the glands of the endocrine system. These glands produced hormones that rushed to certain parts of the body to stimulate changes. For instance, a hormone rushed to the heart and caused it to beat faster, while other hormones signaled the lungs to work harder, and still other hormones caused the muscles to stiffen and prepare for action. In a case like the one described above, the hormones were sent to prepare the body for a flight or fight condition. This is a situation where the body is prepared to defend itself by either quickly running away or fighting. Once the danger was over, the body began to calm down because the brain stopped sending signals to the endocrine glands and the production of these flight or fight hormones stopped.

Not everything the endocrine system does is in response to danger. In fact, the job of the system is to regulate or control various body functions and activities. The endocrine system is made up of a series of glands that produce hormones, which are chemical messengers. These hormones are responsible for speeding up or slowing down the activities of tissues and organs found throughout the body. The purpose of this program is to show how this system performs its job of helping to maintain a healthy body.

There is another set of glands in the body called the exocrine glands. These glands don't produce hormones but rather they are responsible for things like tears, sweat, or digestive juices. These glands are usually located near the organs that they affect. For instance, the pancreas releases digestive juices into the small intestine through small tubes that connect the two organs.

The chemicals produced by glands in the endocrine system travel through the blood stream to reach their destinations. Therefore, these glands don't need to be located near the

organs they will affect. There are eight endocrine glands found in the human body, each producing different hormones. The tissues of the body are able to identify which chemicals are meant for them and which to reject. Hormones that are not accepted continue to move through the circulatory system until they reach the tissue or organ they were designed to control.

Hormones are chemical messengers that are very powerful. Hormones are responsible for three kinds of control. Some hormones speed up body processes. Some hormones are designed to slow down or stop certain processes. Still other hormones change body structure by stimulating growth. Only a small amount of a hormone is required to control various body activities. For instance, the growth of the skeleton is controlled by the pituitary gland. If too much hormone is manufactured, a giant would result. If too little of the hormone is released, then a dwarf can result.

If an endocrine gland isn't producing enough of a particular hormone, then medication can be used to supplement or supply the missing amount of chemicals. For instance, many people with diabetes must take insulin on a regular basis to maintain proper blood sugar levels.

Insulin is a hormone produced in the pancreas. Actually the pancreas is more of an exocrine gland that produces digestive enzymes but there are special cells within the pancreas called the islets of Langerhans that produce the hormones insulin and glucagon, and therefore, are considered members of the endocrine system. Insulin is a hormone that lowers the sugar level in blood. It stimulates and helps body cells to take in sugar and use it as energy. It also helps excess sugar to be changed into glycogen in the liver so it can be stored for use later. The islets also produce glucagon, which stimulates the breakdown of glycogen to sugar when more energy is needed by cells.

So the insulin and glucagon work together to keep the level of sugar in the blood at a proper amount for normal body functions. When the sugar level is low, glucagon is released to change stored glycogen back into sugar. If the sugar level is too high, then insulin is released to encourage body cells to absorb and use the excess sugar. If insulin isn't present, the body cells can't absorb and use the sugar in the blood. The cells begin using their own proteins and fat for energy. If this happens, the level of sugar in the blood increases to abnormally high levels. This condition is called diabetes mellitus and can lead to heart disease, kidney failure, or blindness. In fact, this condition is the third major cause of death in the United States.

#### THE HYPOTHALAMUS

The hypothalamus is an endocrine gland located in the brain. It is considered the main control for the endocrine system because it affects the other seven glands in the system. It is the major link between the nervous system and the endocrine system. Messages sent to the brain by the nervous system go through the hypothalamus. So this gland receives information from all parts of the body. It uses this information to regulate the level of hormones in the circulatory system, the amount of nutrients in the body, and the temperature of the body.

#### THE PITUITARY

The pituitary gland is located just below the hypothalamus at the base of the brain. This gland controls blood pressure, the overall chemical and physical activities of the body, growth, sexual development and reproduction. Because this gland is responsible for so much and it also controls many other glands, it was once referred to as the "master gland." But this label is no longer used because it has been discovered that the hypothalamus actually controls the pituitary through nerve impulses. Though the pituitary is only the size of a pea, it is responsible for so much that goes on in our bodies.

### THE THYROID

The thyroid gland is located on the trachea. The hormone made by this gland helps to control metabolism in the body and the production of protein. It is very important to the proper development of the nervous system and it affects the growth rate in children.

### THE PARATHYROIDS

Located on the back of the thyroid are four small parathyroid glands. These glands secrete a hormone that regulates the amount of calcium in the blood. Calcium is important to the proper functioning of muscles and nerves in the body.

### THE THYMUS

The thymus is located behind the breastbone and below the thyroid. It starts out large but shrinks to the size of a thumb by the time a person is an adult. The thymus is involved in the development of the immune system. The immune system is responsible for defending the body against germs and bacteria. The thymus produces white blood cells during infancy, but as the human gets older, other organs in the body take over the production of white blood cells.

### ADRENALS

On top of each of the two kidneys is an adrenal gland. This gland produces the hormone adrenaline. This hormone raises the heart rate, increases breathing, and raises the blood sugar level. This is the “flight or fight” hormone that was discussed at the beginning of this tape. It is a part of the emergency response system of our bodies. There have been some very unusual cases where people have managed incredible feats of strength during an emergency or stressful situation.

For example, there was an account of two elderly women who carried their piano out of their burning home. When the fire was over, it took five fireman to carry the piano back inside. Another incident happened when a jack slipped and the car a man was working on fell on him. He had been working on the brakes, so the tire was gone and the axle was now lying on his chest. His wife lifted the side of the car and with her foot moved him from danger.

### GONADS

The gonads are the reproductive glands of humans. The ovaries are the female gonads and the testes are the male gonads. The ovaries secrete estrogens that cause wider hips, enlarged breasts, and body hair. The testes secrete androgens, the most important of which is testosterone that deepens the voice, stimulates the growth of body hair, and enlarges muscles and bones. These hormones are released during puberty, which is a period during which boys and girls mature physically and sexually.

### NEGATIVE-FEEDBACK MECHANISM

The endocrine system uses negative-feedback to regulate or control itself. How much hormone is present in the blood determines whether more or less of the hormone is produced. Think of a thermostat system as used in many cars of today. You set the thermostat to the desired temperature. Then the equipment reads the temperature inside the car and adjusts itself appropriately. If the car temperature is below the desired temperature on the thermostat, then the heater is turned on until that temperature is reached. If the temperature was higher than the setting, the air conditioner would kick on until the desired temperature is reached. This is similar to the way hormone level is controlled in the blood. For instance, the pituitary gland monitors the level of thyroxine in the blood. Thyroxine is manufactured in the thyroid. If the level of the hormone thyroxine is detected to be too low, the

pituitary releases one of its hormones called TSH. This stands for thyroid-stimulating hormone. It travels to the thyroid by way of the circulatory system and stimulates the thyroid to produce more thyroxine. When the level of thyroxine in the blood returns to normal, the pituitary stops releasing the TSH and the thyroid stops making thyroxine. So the negative-feedback system keeps the body's internal environment operating smoothly.

#### **SUMMARY**

The endocrine and nervous systems work closely together to maintain a proper internal environment for humans. The endocrine system is made up of eight glands that work as a team to release various hormones throughout the body.

The hormones are chemical messengers that travel through the circulatory system to specific tissues and organs of the body. The hormones stimulate changes that speed up or slow down various activities of the tissues and organs. The hypothalamus gland, located in the brain, receives information from the nervous system concerning everything that is happening to the body. It even gets information about fear and anger. Based on this stimulation, the hypothalamus sends hormones throughout the endocrine system to help keep the body balanced.

The endocrine system is an important contributor to the health and maintenance of a very complicated living organism...you.

## VIDEO QUIZ

Students may write the answers to the following questions on a separate piece of paper or on the duplicating master titled **Video Quiz (Blackline Master 1)**.

1. What are hormones?
2. How do hormones move throughout the body?
3. Name the eight glands of the endocrine system.
4. What is the negative-feedback mechanism of the body?
5. Why is the hypothalamus considered the control center of the endocrine system?

## THE ENDOCRINE SYSTEM

### Video Quiz

**Directions:** At the end of the video production is a short quiz. Choose the correct answer or answers from the list below. Write your answers in the space provided. Not all options from the list will be used.

1. What are hormones?
  
2. How do hormones move throughout the body?
  
3. Name the eight glands of the endocrine system.
  
4. What is the negative-feedback mechanism of the body?
  
5. Why is the hypothalamus considered the control center of the endocrine system?

**Options:**

- hypothalamus
- endocrine
- gonads
- parathyroids
- nervous system
- chemical messengers produced in the endocrine glands
- causes an increase in heart rate, breathing rate, and blood pressure
- regulates activities of other endocrine glands
- released to the circulatory system which carries them through the body
- endocrine system's method for regulating itself
- exocrine
- thymus
- insulin
- adrenal
- islets of Langerhans
- thyroid
- pancreas
- adrenaline
- flight-or-fight
- pituitary

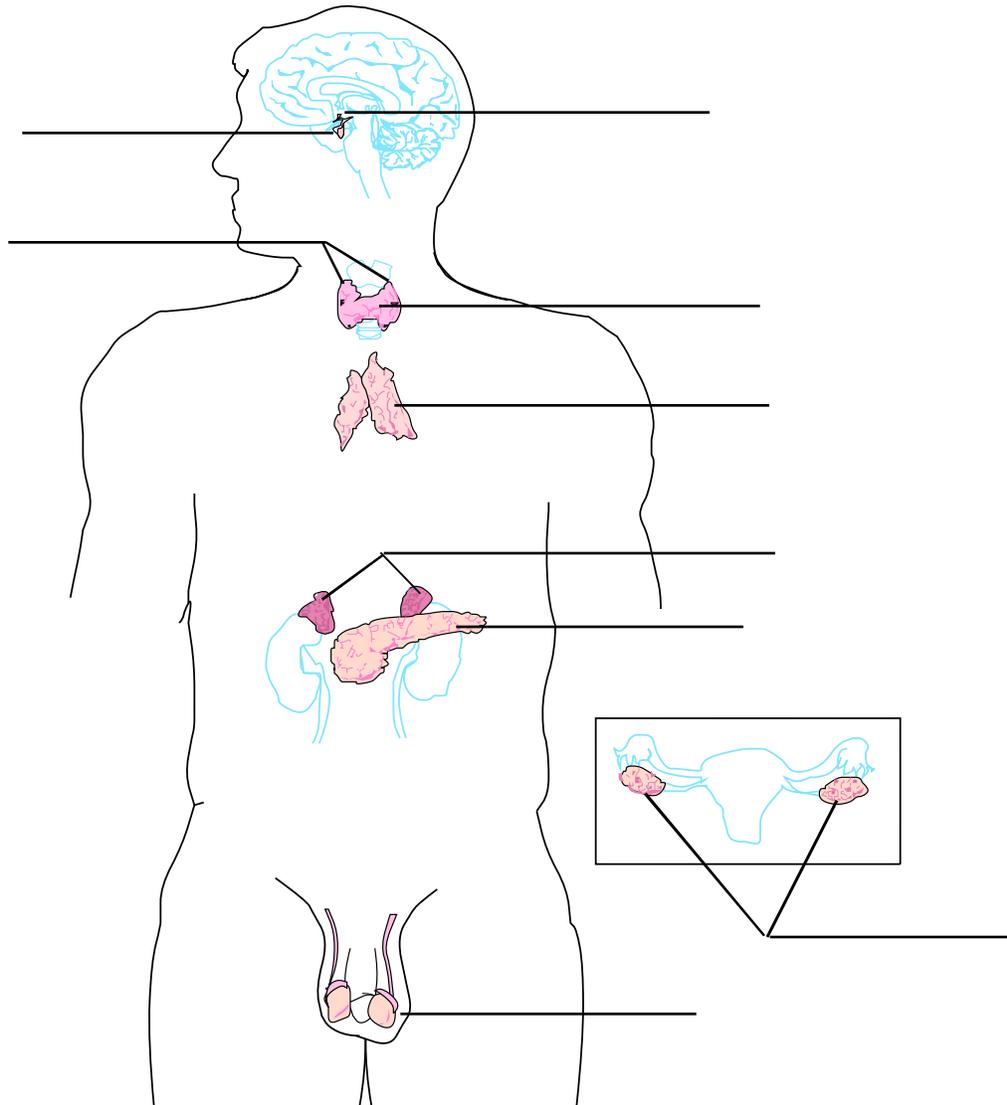
**THE ENDOCRINE SYSTEM****Vocabulary**

**Directions: Write a definition for each of the terms listed below.**

1. endocrine system
2. exocrine glands
3. hormones
4. hypothalamus
5. pituitary
6. thymus
7. thyroid
8. parathyroid
9. adrenal
10. islets of Langerhans
11. ovary
12. testes
13. negative-feedback mechanism

**THE ENDOCRINE SYSTEM**  
**The Location of the Endocrine Glands**

**Directions: Place the words from the box at the bottom of the page next to the appropriate lines on the diagram.**



Pancreas	Hypothalamus	Pituitary	Parathyroid	Ovaries
Adrenal	Thyroid	Thymus	Testes	

## THE ENDOCRINE SYSTEM

### Match

**Directions:** Match the functions described in column B with the endocrine gland listed in column A.

<u>Column A</u>	<u>Column B</u>
Hypothalamus _____	1. produces male sex characteristics
	2. decreases blood sugar level
Pituitary _____ _____	3. increases heart and breathing rate, raises blood pressure
	4. produces female sex characteristics
	5. increases blood sugar level
Thyroid _____ _____	6. regulates the level of calcium and phosphorus
	7. increases rate of metabolism
Thymus _____	8. maintains the level of calcium and phosphorus in the blood
	9. development of immune system
Adrenals _____	10. stimulates skeletal growth
	11. regulates the activities of other glands
Pancreas _____ _____	12. stimulates development of male and female sex organs
Ovaries _____	
Testes _____	
Parathyroids _____	

## THE ENDOCRINE SYSTEM

### Quiz

**Directions:** Use the space provided to answer the following questions. Use the back of this sheet if necessary.

1. What is the function of the endocrine system?
2. Name the eight endocrine glands of the human body.
3. What is a hormone?
4. How does the negative-feedback mechanism work?
5. What are some of the effects of adrenaline?
6. How do the nervous and endocrine systems work together?
7. What is meant by the "flight or fight" response?
8. How do the hormones released by the endocrine glands get around the body?
9. Two of the hormones secreted by the pancreas are insulin and glucagon. These hormones work together to maintain a balanced blood sugar level. How do they do that?
10. Why must some people take insulin as a medication on a regular basis?