

# Definitions

<b>adrenocorticotrophic hormone (ACTH)</b>	hormone which acts on the adrenal cortex gland to produce the hormones cortisol and aldosterone
<b>anterior lobe</b>	one of two lobes within the pituitary gland; produces thyroid-stimulating hormone and adrenocorticotrophic hormone
<b>antidiurectic hormone (ADH)</b>	hormone which targets the kidney cells to balance the volume of fluids within the body
<b>eggs</b>	female reproductive cells
<b>growth hormone (GH)</b>	hormone which acts on many different tissues within the body to stimulate their growth
<b>hemorrhage</b>	the loss of a large amount of blood
<b>hormones</b>	chemical messengers which travel throughout the body and help to maintain homeostasis
<b>lactation</b>	process by which women produce milk from their mammary glands
<b>luteinizing hormone (LH)</b>	hormone which targets ovaries and testes; stimulates the production of hormones utilized by the reproductive system
<b>mammary glands</b>	glands which produce and secrete milk in females
<b>ovaries</b>	female reproductive organs
<b>oxytocin</b>	hormone which stimulates the smooth muscles of the uterus to contract during childbirth
<b>pituitary glands</b>	two glands located within the skull; responsible for the majority of hormone production
<b>posterior lobe</b>	one of two lobes within the pituitary gland; receives and transports antidiurectic hormone and oxytocin which are produced by the hypothalamus
<b>prolactin (PRL)</b>	hormone which helps women to produce milk from their mammary glands
<b>sperm</b>	male reproductive cells

<b>target cells</b>	cells identified for specific chemical reactions by individual hormones
<b>testes</b>	male reproductive organs
<b>thyroid-stimulating hormone (TSH)</b>	hormone which targets the thyroid gland to control the production of thyroxine ( $T_4$ ) and triiodothyronine ( $T_3$ )
<b>uterus</b>	organ where offspring are grown during pregnancy

## Sample questions to ask your child after completing the weekly reading.

**How are hormone levels typically balanced within the body?**

*The nervous system can control the level of hormones within the body; however, a more general answer to this question would be that negative feedback mechanisms typically balance the level of hormones within the body.*

**What causes the difference in response time between the nervous and endocrine systems?**

*Hormones travel through the blood to its intended target. This is a much slower vehicle than a nerve impulse which is utilized by the nervous system.*

**Which lobe of the pituitary gland is responsible for producing its own hormones? Where are the hormones produced for its other lobe?**

*The anterior lobe of the pituitary gland produces its own hormones. The posterior lobe stores the hormones produced by the hypothalamus.*

**Which hormone has a general effect on nearly every cell in the human body?**

*Growth hormone*

# Day Two:

Your child should check their work on the practice worksheets today with the answer key on the next page.

In addition, your child should read the lab activity and start collecting all of the necessary materials!

# Answer Key for Practice Problems

## Vocabulary Review

- 1) target cells
- 2) hormones
- 3) eggs
- 4) ovaries
- 5) mammary glands
- 6) growth hormone (GH)
- 7) adrenocorticotrophic hormone (ACTH)
- 8) prolactin (PRL)
- 9) oxytocin
- 10) luteinizing hormone (LH)
- 11) antidiurectic hormone (ADH)
- 12) thyroid-stimulating hormone (TSH)
- 13) sperm
- 14) testes
- 15) anterior lobe
- 16) posterior lobe
- 17) uterus
- 18) lactation
- 19) hemorrhage
- 20) pituitary glands

## Multiple Choice

- 1) E
- 2) B
- 3) C
- 4) C
- 5) C
- 6) D

## Application Questions

Because the amount of water from the body lost in the form of sweat can be quite large in a hot environment, the blood will contain an increased concentration of dissolved solutes. This increased concentration of solutes triggers an increase in ADH secretion. Therefore, increased ADH secretion in a hot environment reduces the amount of water lost in the form of urine, thereby conserving water loss from the body.

# Day Three: Lab Activity

Your child should have already read through this lab and has been reviewing all of this week's vocabulary words.

Collect your supplies for the lab:

- 2 sticks (225g) unsalted butter, cut into pieces
- Small saucepan
- Glass measuring cup (Pyrex)
- Plastic wrap
- Spoon

# Clarifying Proteins or...

*What's going on inside my butter?*

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The isolation of the protein casein will be performed through the act of clarifying butter.

## Materials:

2 sticks (225g) unsalted butter, cut into pieces

Small saucepan

Glass measuring cup (Pyrex)

Plastic wrap

Spoon

## Procedure:

Place the pieces of butter into a saucepan over low heat. Allow the butter to completely melt. Foam should appear at the surface.

Pour the liquefied butter into a container and allow it to rest for five minutes before covering it with plastic wrap and setting it in the refrigerator overnight.

\*Be careful placing the plastic wrap on the container as it will likely be very hot!

In the morning, observe the three layers of butter within the measuring cup.

The top layer of hardened foam can be scraped off and used for topping popcorn or flavoring vegetables.

The middle layer contains the clarified butter and can be lifted away from the lower, watery layer. You should have approximately  $\frac{3}{4}$  cup (169g) of clarified butter to be stored. This butter should be kept refrigerated and can be used exactly as regular butter in your recipes.

**But why go to all this trouble for butter? Keep reading...**

**Explanation:**

First of all, clarified butter has three very important properties that make it different from regular butter:

1. It has a higher smoke point than regular butter. This means that it can be used to fry or sear foods with a buttery flavor without the fear of it burning the meat.
2. The flavor of clarified butter has a nuttier flavor which gives some dishes a little more character than usual. Try it with scrambled eggs and you will find out what I mean!
3. The separation of the butter into three layers removes the solid portions of the milk including the milk sugar known as lactose into the bottom, watery layer. This is the main reason why you can use this butter at higher temperatures; otherwise, its sugar will easily scorch the pan. Another added bonus with this separation is that individuals who are lactose intolerant can still cook with clarified butter without any worry.

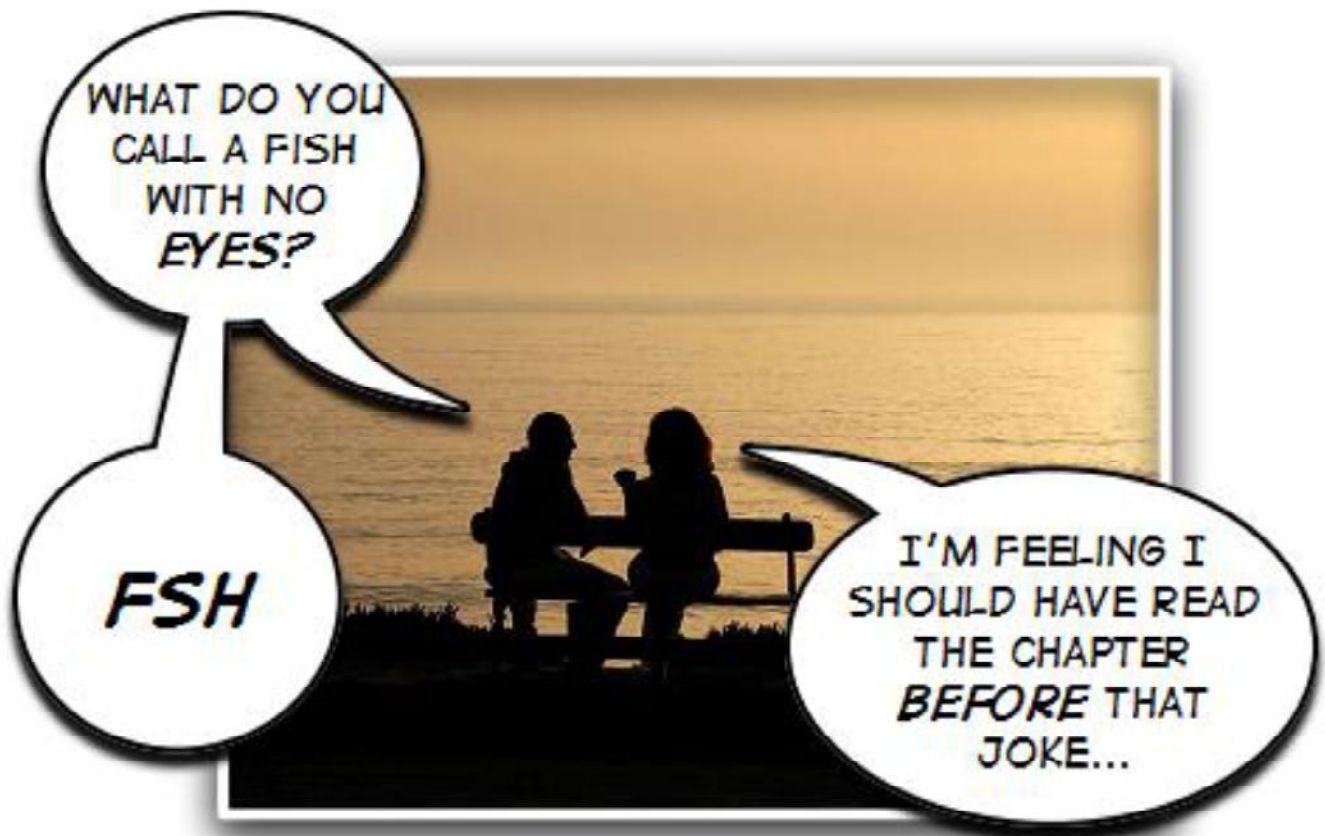
Simply put, the clarification of butter evaporates its water, removes its sugar, and separates the protein **casein** from its mixture. Casein makes up a large portion of the proteins found in the milk of mammals. Nearly 80% of protein in cow milk and 20%-45% of proteins in human milk are made up of casein. Although casein is not technically a hormone, it does maintain several hormone-like processes within the human body. For example, casein assists in the reduction of breathing and heart rates, the release of insulin into the blood, and the triggering of the immune system to remove harmful pathogens from the body.

**The casein can be found within the foam that you skimmed off the top of your clarified butter!**



# Chapter 13

## Endocrine System - Part II



# Day One:

Today, your child should complete their reading and practice problems for the week.

Below are the supplies for this week's lab:

Oral thermometer (a digital thermometer will likely work best that can provide information to at least 0.1 degree accuracy)

Computer with Internet access

Paper and pencil

## National Science Education Standards covered this week:

12CLS5.2 The energy for life primarily derives from the sun. Plants capture energy by absorbing light and using it to form strong (covalent) chemical bonds between the atoms of carbon-containing (organic) molecules. These molecules can be used to assemble larger molecules with biological activity (including proteins, DNA, sugars, and fats).

# Definitions

<b>adrenal cortex</b>	comprises ~90% of the adrenal gland; secretes 2+ dozen corticosteroid hormones
<b>adrenal glands</b>	two glands which sit on top of each kidney and separated into two sections known as the medulla and the cortex
<b>adrenal medulla</b>	small section of the adrenal gland responsible for producing the hormones epinephrine (also known as adrenaline) and norepinephrine
<b>aldosterone</b>	a mineralocorticoid hormone secreted by the adrenal cortex; responsible for increasing the amount of sodium (and water) into the blood and to remove potassium from the blood into the urine
<b>calcitonin</b>	hormone produced by the thyroid gland which stimulates bone growth and helps to regulate the amount of calcium found in the blood
<b>circadian rhythm</b>	sleep-wake cycle of humans; controlled by the hormone melatonin secreted by the pineal gland
<b>corticosteroid</b>	one of 2+ dozen hormones secreted by the adrenal cortex
<b>cortisol</b>	a glucocorticoid hormone secreted by the adrenal cortex responsible for increasing the level of sugar within the blood
<b>epinephrine (adrenaline)</b>	hormone secreted by the adrenal medulla; works with norepinephrine to regulate the fight or flight response in humans during times of stress
<b>estrogen</b>	hormone secreted by the ovaries which works along with progesterone to prepare and maintain women before and during pregnancy
<b>fight or flight response</b>	hormonal response to emergency situations; regulated by epinephrine which elevates the heart rate which increases blood and oxygen flow throughout the body

<b>glucagon</b>	hormone secreted by the pancreas which stimulates the liver to produce an increased amount of glucose to be released into the bloodstream
<b>glucocorticoids</b>	one class of corticosteroid secreted by the adrenal cortex; the primary hormone being cortisol
<b>glucose</b>	a simple sugar created from glycogen within the liver; used as fuel for most cellular functions within the body
<b>glycogen</b>	a complex sugar stored by the liver for use when blood sugar levels increase or decrease
<b>inhibin</b>	hormone responsible for lowering the amount of follicle stimulating hormone within the blood stream
<b>insulin</b>	hormone secreted by the pancreas which helps cells to absorb sugar from the bloodstream
<b>melatonin</b>	hormone secreted by the pineal gland; regulates the circadian rhythm of humans
<b>mineralocorticoid</b>	one class of corticosteroid secreted by the adrenal cortex; the primary hormone being aldosterone
<b>norepinephrine</b>	hormone secreted by the adrenal medulla; works with epinephrine to regulate the fight or flight response in humans during times of stress
<b>pancreas</b>	an elongated organ 6in (15+cm) found between the stomach and small intestine; responsible for producing several hormones, the most important being insulin and glucagon
<b>parathyroid glands</b>	four glands found on each side of the back (posterior) surface of the thyroid gland ; responsible for producing the hormone parathyroid hormone (PTH)
<b>parathyroid hormone (PTH)</b>	hormone released from the parathyroid glands; responsible for increasing the levels of calcium (for bones) and phosphorus (for cell membranes) found within the blood
<b>pineal gland</b>	gland found near the center of the brain; secretes melatonin; regulates the sleep-wake cycle of humans

<b>progesterone</b>	hormone secreted by the ovaries which works along with estrogen to prepare and maintain women before and during pregnancy
<b>puberty</b>	a series of physical changes in which a child's body matures into an adult body
<b>T cells</b>	immune cells which attack foreign substances as they enter our body
<b>testosterone</b>	hormone which stimulates the growth of male reproductive tissues, bones, muscles, body hair, and the deepening of one's voice
<b>thymosins</b>	hormones produced by the thymus gland
<b>thymus gland</b>	gland found directly between the lungs; secretes thymosin hormones which help the immune system produce T cells
<b>thyroid gland</b>	a gland which is located in the neck and is in front of (anterior) to the trachea ; secretes the hormones thyroxine, triiodothyronine, and calcitonin
<b>thyroxine (T<sub>4</sub>)</b>	hormone secreted by the thyroid gland which contains three atoms of iodine and regulates the rate in which cells use oxygen and food to produce energy
<b>triiodothyronine (T<sub>3</sub>)</b>	hormone secreted by the thyroid gland which contains four atoms of iodine and regulates the rate in which cells use oxygen and food to produce energy