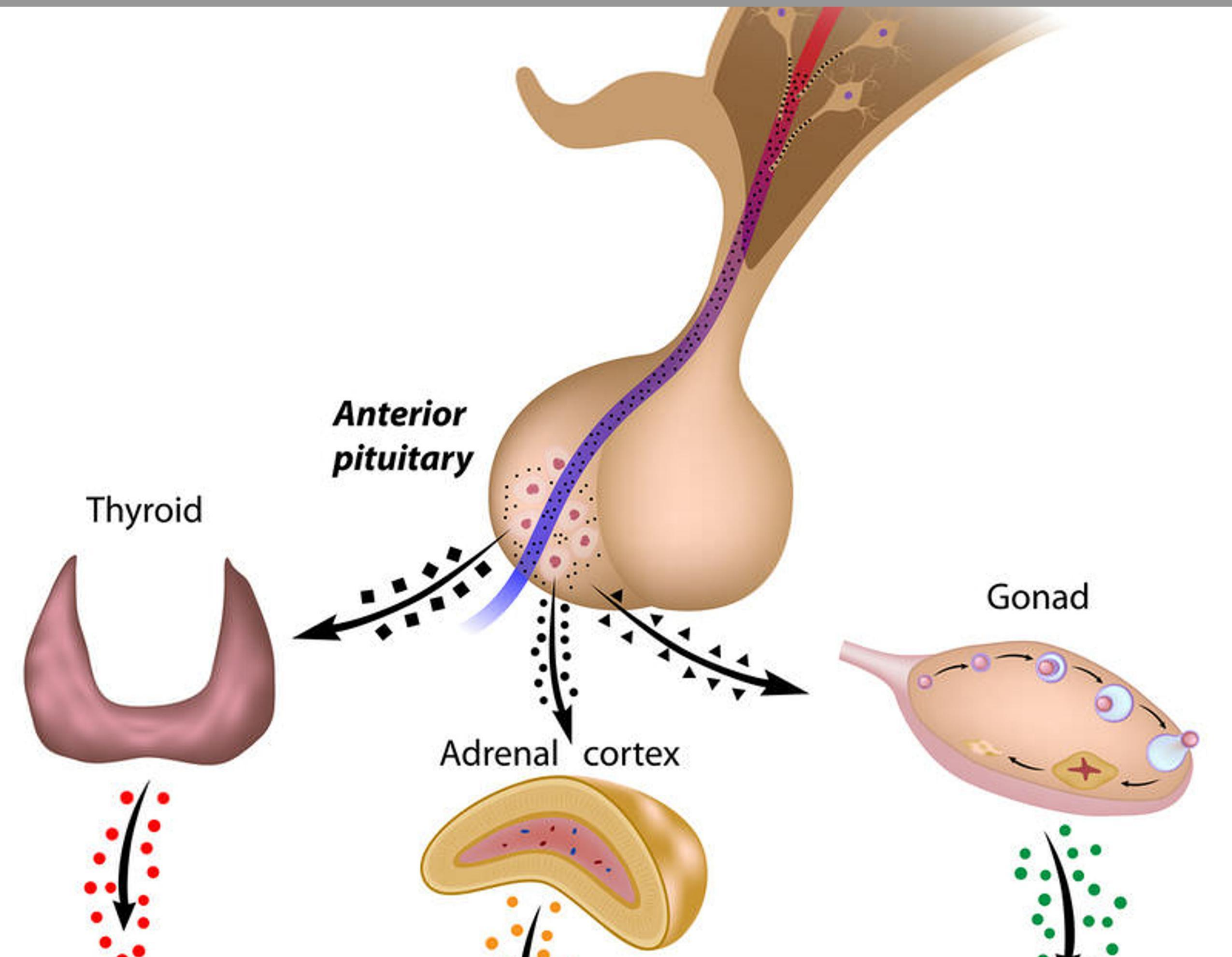
Human Physiology 110 Endocrine and Reproductive Systems



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Peter MacDonald
Douglas Wilkin, Ph.D.
Jean Brainard, Ph.D.
Niamh Gray-Wilson

AUTHORS
Peter MacDonald
Douglas Wilkin, Ph.D.
Jean Brainard, Ph.D.
Niamh Gray-Wilson

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CONCEPT 1 Glands of the Endocrine System

What's a hormone?

This messenger pigeon is delivering a letter, making sure it gets to where it needs to go. It could be said that hormones are biological messengers, and they originate from the endocrine system. The nervous system isn't the only message-relaying system of the human body. The endocrine system also carries messages. The endocrine system is a system of glands that release chemical messenger molecules into the bloodstream. The messenger molecules are hormones. Hormones act slowly compared with the rapid transmission of electrical messages by the nervous system. They must travel through the bloodstream to the cells they affect, and this takes time. On the other hand, because endocrine hormones are released into the bloodstream, they travel throughout the body. As a result, endocrine hormones can affect many cells and have body-wide effects.

Glands of the Endocrine System

The major glands of the **endocrine system** are shown in **Figure** 1.1. You can access a similar, animated endocrine system chart at the link below.

Hypothalamus

The **hypothalamus** is actually part of the brain (see **Figure** 1.2), but it also secretes **hormones**. Some of its hormones "tell" the pituitary gland either to secrete or to stop secreting its hormones. In this way, the hypothalamus provides a link between the nervous and endocrine systems. The hypothalamus also produces hormones that directly regulate body processes. These hormones travel to the pituitary gland, which stores them until they are needed. The hormones include antidiuretic hormone and oxytocin.

- **Antidiuretic hormone** stimulates the kidneys to conserve water by producing more concentrated urine.
- **Oxytocin** stimulates the contractions of childbirth, among other functions.

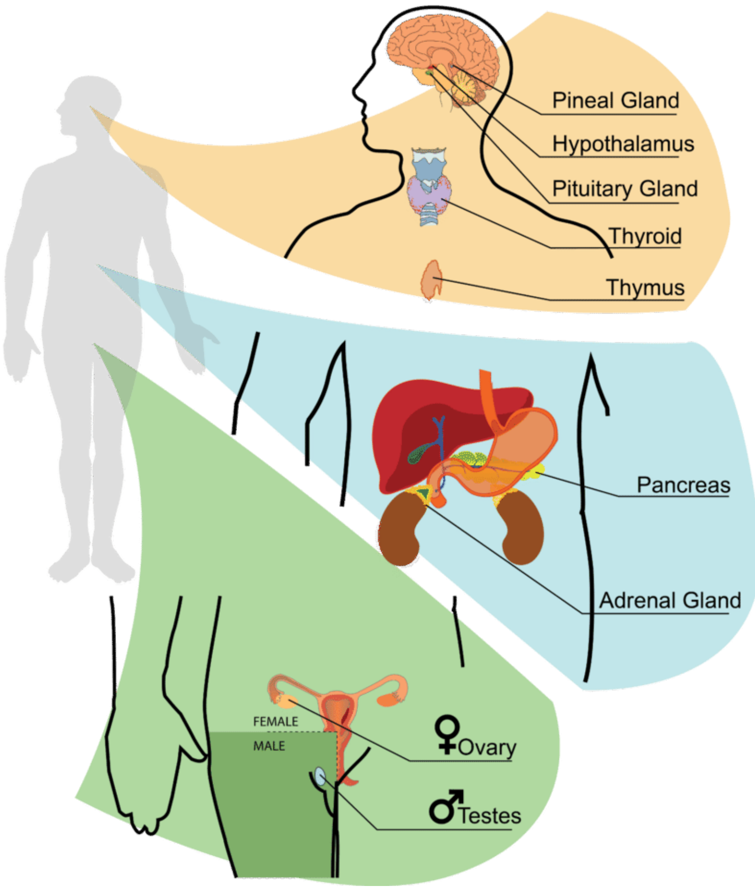


FIGURE 1.1
The glands of the endocrine system are the same in males and females except for the testes, which are found only in males, and ovaries, which are found only in females.

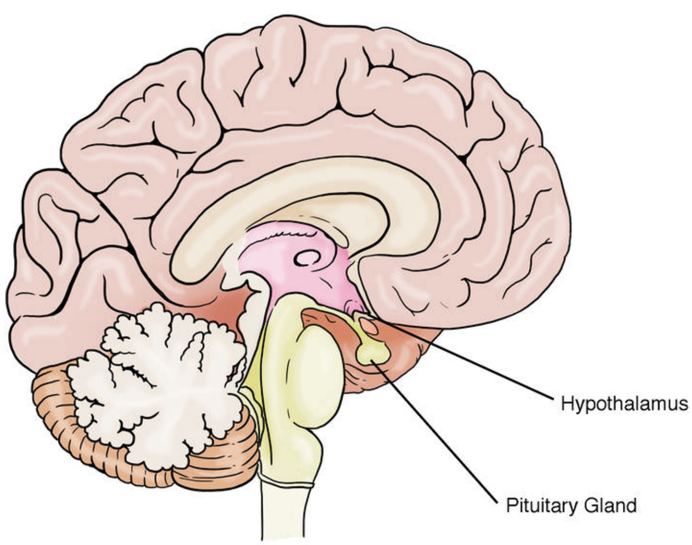


FIGURE 1.2
The hypothalamus and pituitary gland are located close together at the base of the brain.

Pituitary Gland

The pea-sized **pituitary gland** is attached to the hypothalamus by a thin stalk (see **Figure** 1.2). It consists of two bulb-like lobes. The posterior (back) lobe stores hormones from the hypothalamus. The anterior (front) lobe secretes pituitary hormones. Several pituitary hormones and their effects are listed in **Table** 1.1. Most pituitary hormones control other endocrine glands. That's why the pituitary is often called the "master gland" of the endocrine system.

TABLE 1.1: Pituitary Hormones

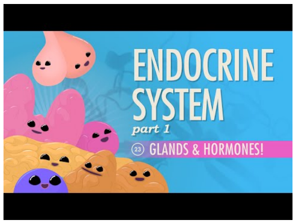
Hormone	Target	Effect(s)
Adrenocorticotropic hormone (ACTH)	Adrenal glands	Stimulates the cortex of each adrenal gland to secrete its hormones.
Thyroid-stimulating hormone (TSH)	Thyroid gland	Stimulates the thyroid gland to secrete thyroid hormone.
Growth hormone (GH)	Body cells	Stimulates body cells to synthesize proteins and grow.
Follicle-stimulating hormone (FSH)	Ovaries, testes	Stimulates the ovaries to develop mature eggs; stimulates the testes to produce sperm.
Luteinizing hormone (LH)	Ovaries, testes	Stimulates the ovaries and testes to secrete sex hormones; stimulates the ovaries to release eggs.
Prolactin (PRL)	Mammary glands	Stimulates the mammary glands to produce milk.

Other Endocrine Glands

Other glands of the endocrine system are described below. You can refer to **Figure** 1.1 to see where they are located.

- The **thyroid gland** is a large gland in the neck. Thyroid hormones increase the rate of metabolism in cells throughout the body. They control how quickly cells use energy and make proteins.
- The two **parathyroid glands** are located behind the thyroid gland. Parathyroid hormone helps keep the level of calcium in the blood within a narrow range. It stimulates bone cells to dissolve calcium in bone matrix and release it into the blood.
- The **pineal gland** is a tiny gland located at the base of the brain. It secretes the hormone **melatonin**. This hormone controls sleep-wake cycles and several other processes.
- The **pancreas** is located near the stomach. Its hormones include insulin and glucagon. These two hormones work together to control the level of glucose in the blood. **Insulin** causes excess blood glucose to be taken up by the liver, which stores the glucose as glycogen. **Glucagon** stimulates the liver to break down glycogen into glucose and release it back into the blood. The pancreas also secretes digestive enzymes into the digestive tract.
- The two **adrenal glands** are located above the kidneys. Each gland has an inner and outer part. The outer part, called the cortex, secretes hormones such as cortisol, which helps the body deal with stress, and aldosterone, which helps regulate the balance of minerals in the body. The inner part of each adrenal gland, called the medulla, secretes fight-or-flight hormones such as adrenaline, which prepare the body to respond to emergencies. For example, adrenaline increases the amount of oxygen and glucose going to the muscles.

- The **gonads** secrete sex hormones. The male gonads are called **testes**. They secrete the male sex hormone testosterone. The female gonads are called **ovaries**. They secrete the female sex hormone estrogen. Sex hormones are involved in the changes of puberty. They also control the production of gametes by the gonads.



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Summary

- The endocrine system consists of glands that secrete hormones into the bloodstream.
- The endocrine system is regulated by a part of the brain called the hypothalamus, which also secretes hormones.
- The hypothalamus controls the pituitary gland, which is called the "master gland" of the endocrine system because its hormones regulate other endocrine glands.
- Other endocrine glands include the thyroid gland and pancreas.

Review

1. Explain how the nervous system is linked with the endocrine system.
2. List five of the major glands of the endocrine system.
3. Name three pituitary hormones, and state how they affect their targets.

References

1. Mariana Ruiz Villarreal (LadyofHats) for CK-12 Foundation. Endocrine system components . CC BY-NC 3.0
2. Laura Guerin. Hypothalamus and pituitary gland . CC BY-NC 3.0

CONCEPT 2 Hormones

- Explain how hormones work.
- Distinguish between steroid hormone and non-steroid hormones.
- Explain the action of a second messenger.

Steroid hormones. How do they work?

As hormones, they are the messengers of the endocrine system. Obviously they must change something in the cell.

How Hormones Work

Hormones are the messenger molecules of the endocrine system. Endocrine hormones travel throughout the body in the blood. However, each hormone affects only certain cells, called target cells. A **target cell** is the type of cell on which a hormone has an effect. A target cell is affected by a particular hormone because it has **receptor proteins** that are specific to that hormone. A hormone travels through the bloodstream until it finds a target cell with a matching receptor it can bind to. When the hormone binds to a receptor, it causes a change within the cell. Exactly how this works depends on whether the hormone is a **steroid hormone** or a **non-steroid hormone**.

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Steroid Hormones

Steroid hormones are made of lipids, such as phospholipids and cholesterol. They are fat soluble, so they can diffuse across the plasma membrane of target cells and bind with receptors in the cytoplasm of the cell (see **Figure** 2.1). The steroid hormone and receptor form a complex that moves into the nucleus and influences the expression of genes, essentially acting as a transcription factor. Examples of steroid hormones include cortisol and sex hormones.

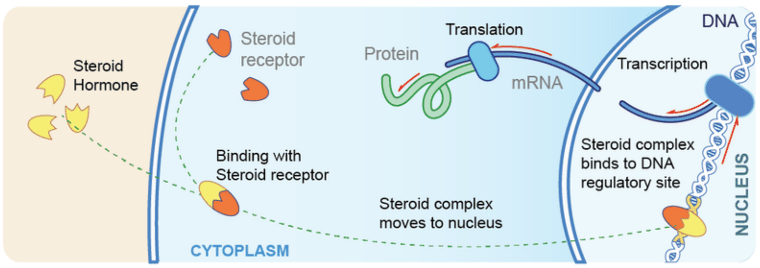


FIGURE 2.1
A steroid hormone crosses the plasma membrane of a target cell and binds with a receptor inside the cell.

Non-Steroid Hormones

Non-steroid hormones are made of amino acids. They are not fat soluble, so they cannot diffuse across the plasma membrane of target cells. Instead, a non-steroid hormone binds to a receptor on the cell membrane (see **Figure** 2.2). The binding of the hormone triggers an enzyme inside the cell membrane. The enzyme activates another molecule, called the **second messenger**, which influences processes inside the cell. Most endocrine hormones are non-steroid hormones, including insulin and thyroid hormones.

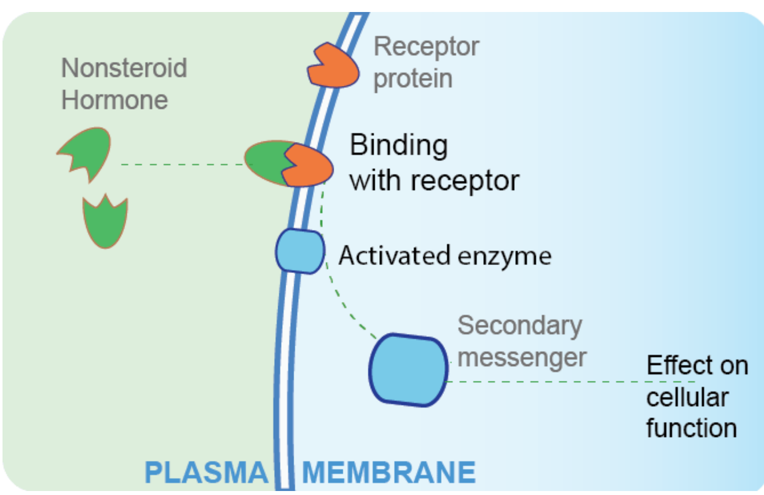


FIGURE 2.2
A non-steroid hormone binds with a receptor on the plasma membrane of a target cell. Then, a secondary messenger affects cell processes.

Summary

- Hormones work by binding to protein receptors either inside target cells or on their plasma membranes.
- The binding of a steroid hormone forms a hormone-receptor complex that affects gene expression in the nucleus of the target cell.
- The binding of a non-steroid hormone activates a second messenger that affects processes within the target cell.

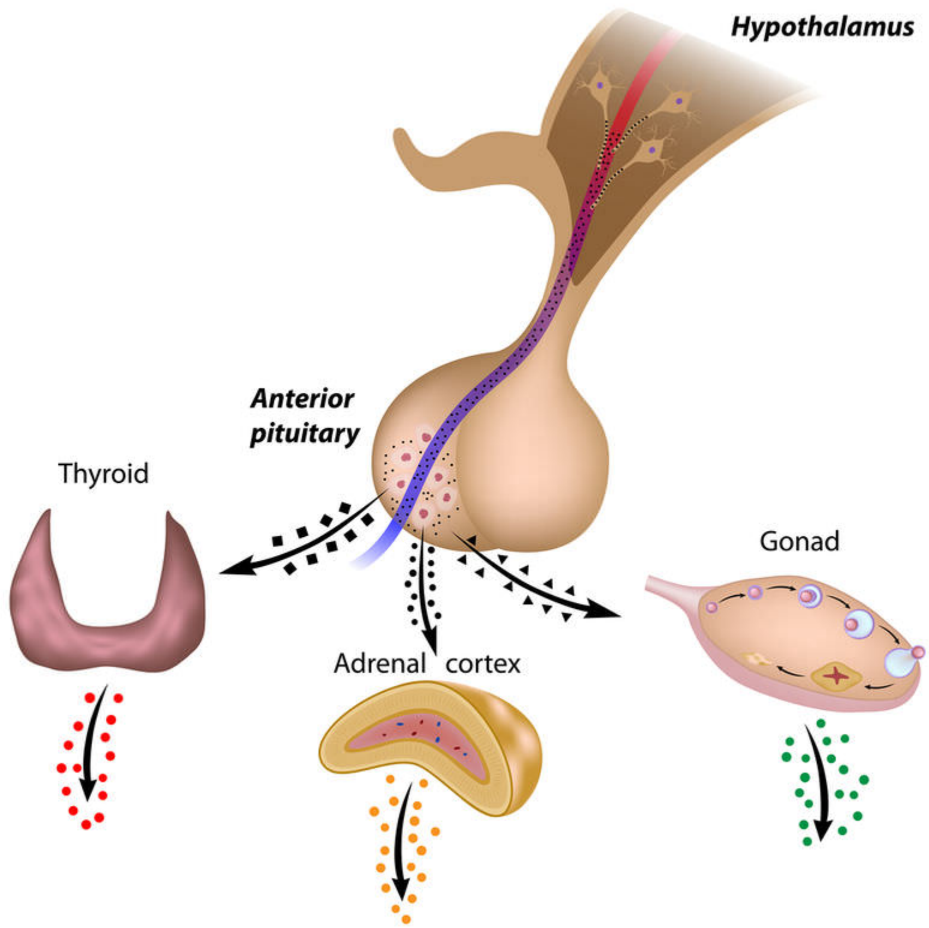
Review

1. Define hormone.
2. Compare and contrast how steroid and non-steroid hormones affect target cells.

References

1. LadyofHats. CK-12 Foundation . CC-BY-NC-SA 3.0
2. LadyofHats. CK-12 Foundation . CC-BY-NC-SA 3.0

CONCEPT 3 The Hypothalamus and Pituitary Gland



There must be a signal that tells hormones when to be released. Right?

Of course, and this signal starts with the hypothalamus in the brain and is sent to the pituitary gland where many hormones are made. The pituitary gland then sends the hormones on their way to various other places.

The Hypothalamus and Pituitary Gland

The **hypothalamus** links the nervous system to the endocrine system via the pituitary gland. The hypothalamus is located below the thalamus, just above the brain stem, and is found in all mammalian brains including those of humans. The human hypothalamus is about the size of an almond; its position in the brain is shown in **Figure** 3.1.

The hypothalamus is a very complex area of the brain, and even small numbers of nerve cells within it are involved in many different functions. The hypothalamus coordinates many seasonal and circadian rhythms, complex homeostatic mechanisms, and the autonomic nervous system (ANS). A **circadian rhythm** is a roughly-24-hour cycle in the biological processes carried out within organisms including plants, animals, fungi, and certain bacteria. The ANS controls activities such as body temperature, hunger, and thirst. The hypothalamus must therefore respond to

FIGURE 3.1
The red arrow shows the position of the hypothalamus in the brain.

many different signals, some of which are from outside and some from inside the body. Thus, the hypothalamus is connected to many parts of the CNS including the brainstem, the olfactory bulbs, and the cerebral cortex.

The hypothalamus produces hormones that are stored in the pituitary gland. For example, oxytocin and antidiuretic hormone (ADH) are made by nerve cells in the hypothalamus and are stored in the pituitary prior to their release into the blood. In addition to influencing maternal behavior, oxytocin is involved in controlling aspects of circadian homeostasis such as a person's body temperature, activity level, and wakefulness at different times of the day. Antidiuretic hormone (ADH) is released when the body is low on water; it causes the kidneys to conserve water by concentrating the urine and reducing urine volume. It also raises blood pressure by causing blood vessels to constrict.

Pituitary Gland

The **pituitary gland** is about the size of a pea and is attached to the hypothalamus by a thin stalk at the base of the brain, as shown in **Figure** 3.2. The pituitary gland secretes hormones that regulate homeostasis. It also secretes hormones, called **tropic hormones,** that stimulate other endocrine glands.

The **anterior pituitary,** or front lobe, makes many important hormones, which are listed in **Table** 3.1. The **posterior pituitary,** or rear lobe, releases two hormones, oxytocin and antidiuretic hormone (ADH), that are made by nerve cells in the hypothalamus. These hormones are transported down the nerve cells' axons to the posterior pituitary where they are stored until needed.

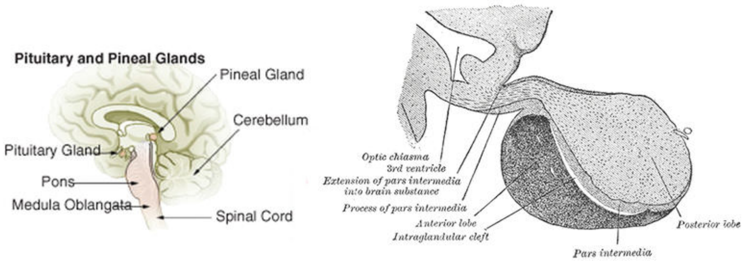


FIGURE 3.2

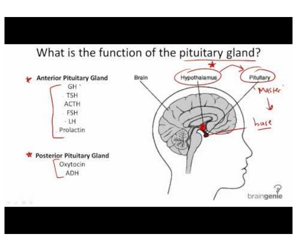
The position of the pituitary in the brain. A close-up of the anterior and posterior pituitary glands can be seen on the right. The orange vessels make up the capillary system that comes from the hypothalamus and carries hormones to the anterior pituitary (red) for storage. The blue vessels on the posterior pituitary come from the neurosecretory cells in the hypothalamus.

TABLE 3.1: Pituitary Hormones

Location	Hormone	Target	Function
Anterior Pituitary	Adrenocorticotropic hormone (ACTH) Thyroid-stimulating hormone (TSH) Growth hormone (GH) Follicle stimulating hormone (FSH) Leutinizing hormone (LH) Prolactin (PRL)	Adrenal gland Thyroid gland Body cells Ovaries and testes (gonads) Ovaries and testes Ovaries and mammary glands	Stimulates the adrenal cortex. Stimulates the thyroid. Stimulates growth. Stimulates production of ovarian follicles in females and sperm production in males. Causes ovulation in females. Causes milk secretion.
Posterior Pituitary	Antidiuretic hormone (vasopressin) Oxytocin	Kidneys or arterioles Uterus and mammary glands	Promotes water reabsorption in the kidneys and raises blood pressure. Causes the uterus to contract in childbirth and stimulates milk flow.

Most of these hormones are released from the anterior pituitary under the influence of hormones from the hypothalamus. The hypothalamus hormones travel to the anterior lobe down a special capillary system that surrounds the pituitary.

Oxytocin is the only pituitary hormone to create a positive feedback loop. For example, during the labor and delivery process, when the cervix dilates, the uterus contracts. Uterine contractions stimulate the release of oxytocin from the posterior pituitary, which, in turn, increases uterine contractions. This positive feedback loop continues until the baby is born.



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2. What makes oxytocin different from other hormones?

References

1. . http://commons.wikimedia.org/wiki/Image:Hypothalamus.jpg . Public Domain
2. Gray's Anatomy. http://training.seer.cancer.gov/anatomy/endocrine/glands/pituitary.html Pituitary gland: http://commons.wikimedia.org/wiki/File:Gray1181.png . Public Domain

CONCEPT 4 Hormone Regulation

- Describe feedback mechanisms that regulate hormone secretion.
- Explain a negative feedback loop.
- Distinguish between a negative feedback loop and a positive feedback loop.

On or off?

Hormones alter conditions inside the cell, usually in response to a stimulus. That means they are activated at specific times. So they must be turned on and then turned back off. What turns these hormones and their responses on or off?

Hormone Regulation: Feedback Mechanisms

Hormones control many cell activities, so they are very important for homeostasis. But what controls the hormones themselves? Most hormones are regulated by feedback mechanisms. A **feedback mechanism** is a loop in which a product feeds back to control its own production. Most hormone feedback mechanisms involve **negative feedback loops**. Negative feedback keeps the concentration of a hormone within a narrow range.

Negative Feedback

Negative feedback occurs when a product feeds back to decrease its own production. This type of feedback brings things back to normal whenever they start to become too extreme. The thyroid gland is a good example of this type of regulation. It is controlled by the negative feedback loop shown in **Figure** 4.1.

Here's how thyroid regulation works. The hypothalamus secretes thyrotropin-releasing hormone, or TRH. TRH stimulates the pituitary gland to produce thyroid-stimulating hormone, or TSH. TSH, in turn, stimulates the thyroid

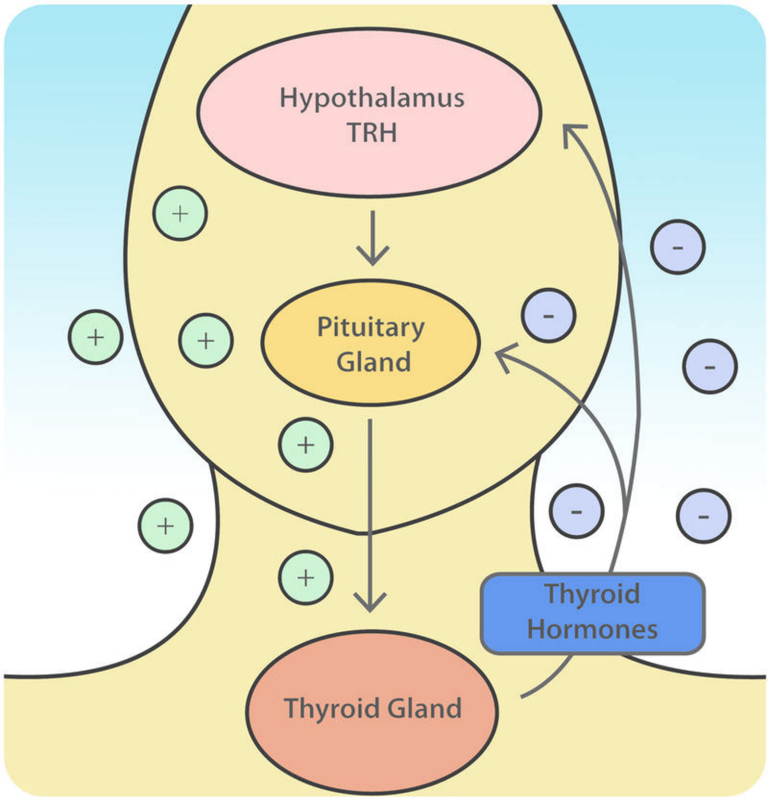
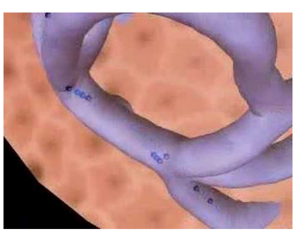


FIGURE 4.1
The thyroid gland is regulated by a negative feedback loop. The loop includes the hypothalamus and pituitary gland in addition to the thyroid.

gland to secrete its hormones. When the level of thyroid hormones is high enough, the hormones feedback to stop the hypothalamus from secreting TRH and the pituitary from secreting TSH. Without the stimulation of TSH, the thyroid gland stops secreting its hormones. Soon, the level of thyroid hormone starts to fall too low. What do you think happens next?



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Negative feedback also controls insulin secretion by the pancreas.

Positive feedback

Positive feedback occurs when a product feeds back to increase its own production. This causes conditions to become increasingly extreme. An example of positive feedback is milk production by a mother for her baby. As the baby suckles, nerve messages from the nipple cause the pituitary gland to secrete prolactin. Prolactin, in turn, stimulates the mammary glands to produce milk, so the baby suckles more. This causes more prolactin to be secreted and more milk to be produced. This example is one of the few positive feedback mechanisms in the human body. What do you think would happen if milk production by the mammary glands was controlled by negative feedback instead?

Summary

- Most hormones are controlled by negative feedback, in which the hormone feeds back to decrease its own production. This type of feedback brings things back to normal whenever they start to become too extreme.
- Positive feedback is much less common because it causes conditions to become increasingly extreme.

Review

1. What is negative feedback?
2. Why are negative feedback mechanisms more common than positive feedback mechanisms in the human body?
3. What might happen if an endocrine hormone such as thyroid hormone was controlled by positive instead of negative feedback?
4. Tasha had a thyroid test. Her doctor gave her an injection of TSH and 15 minutes later measured the level of thyroid hormone in her blood. What is TSH? Why do you think Tasha's doctor gave her an injection of TSH? How would this affect the level of thyroid hormones in her blood if her thyroid is normal?

References

1. Rupali Raju. Regulation of the thyroid gland . CC BY-NC 3.0

CONCEPT 5 Endocrine System Disorders

- Identify general problems and diseases associated with the endocrine system.
- Compare hypersecretion to hyposecretion.
- Explain hormone resistance.

How tall can a person become?

This may be an exaggeration, but the world's tallest person, Robert Pershing Wadlow, stood almost nine feet tall when he died at the age of 22. Is growing that tall due to a problem with the endocrine system?

Endocrine System Disorders

Diseases of the endocrine system are relatively common. An endocrine disease usually involves the secretion of too much or not enough hormone. When too much hormone is secreted, it is called **hypersecretion**. When not enough hormone is secreted, it is called **hyposecretion**.

Hypersecretion

Hypersecretion by an endocrine gland is often caused by a tumor. For example, a tumor of the pituitary gland can cause hypersecretion of growth hormone. If this occurs in childhood, it results in very long arms and legs and abnormally tall stature by adulthood. The condition is commonly known as **gigantism** (see **Figure** 5.1).

FIGURE 5.1
Hypersecretion of growth hormone leads to abnormal growth, often called gigantism.

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Hyposecretion

Destruction of hormone-secreting cells of a gland may result in not enough of a hormone being secreted. This occurs in **type 1 diabetes**. In this case, the body's own immune system attacks and destroys cells of the pancreas that secrete insulin, making type 1 diabetes an autoimmune disease. A person with type 1 diabetes must frequently monitor the level of glucose in the blood (see **Figure** 5.2). If the level of blood glucose is too high, insulin is injected to bring it under control. If it is too low, a small amount of sugar is consumed.

Hormone Resistance

In some cases, an endocrine gland secretes a normal amount of hormone, but target cells do not respond to the hormone. Often, this is because target cells have become resistant to the hormone. **Type 2 diabetes** is an example of this type of endocrine disorder. In type 2 diabetes, body cells do not respond to normal amounts of insulin. As a result, cells do not take up glucose and the amount of glucose in the blood becomes too high. This type of diabetes is usually treated with medication and diet. The addition of extra insulin to the treatment can help some patients.

Summary

- Endocrine system disorders usually involve the secretion of too much or not enough hormone. For example, a tumor of the adrenal gland may lead to excessive secretion of growth hormone, which causes gigantism.
- In Type 1 diabetes, the pancreas does not secrete enough insulin, which causes high levels of glucose in the blood.

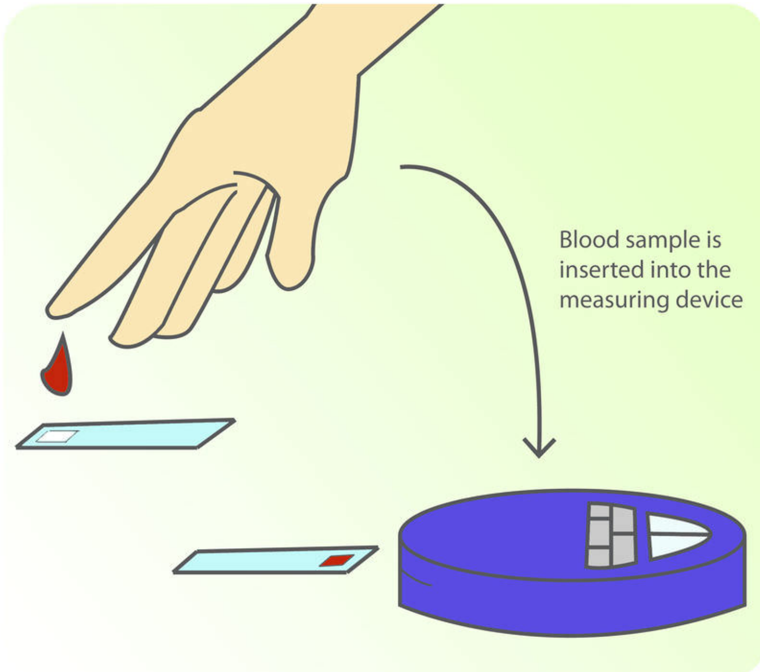


FIGURE 5.2
To measure the level of glucose in the blood, a drop of blood is placed on a test strip, which is read by a meter.

Review

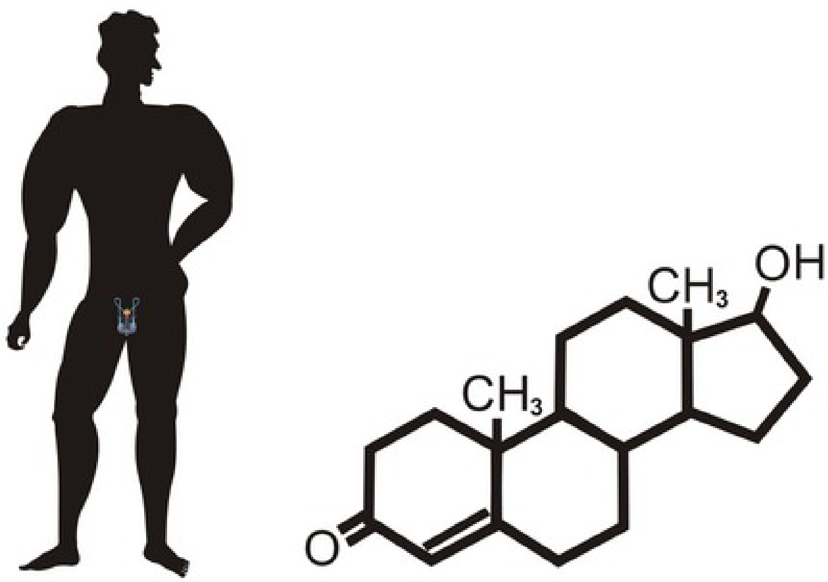
1. Define hypersecretion. Give an example of an endocrine disorder that involves hypersecretion.
2. Explain why a person with type 2 diabetes is not affected by normal amounts of insulin. Will providing extra insulin help this person?

References

1. . Extremely tall individual . Public Domain
2. Rupali Raju. Measuring blood glucose level . CC BY-NC 3.0

CONCEPT 6 Male Reproductive Structures

- Identify male reproductive structures and their functions.
- Describe the role of the testes, the epididymis, and the vas deferens.



Would you believe the male reproductive structures are over 100 feet long?

The male reproductive system has two goals: to produce and deliver sperm and to secrete testosterone. Might seem simple. But there are a number of complicated processes and structures - including over 100 feet of tubules - that go into these simple goals.

The male reproductive system has two main functions: (1) to produce sperm, the male gamete, and (2) to release the male sex hormone, testosterone, into the body.

Male Reproductive Structures

The reproductive system in both males and females consists of structures that produce reproductive cells, or gametes, and secrete sex hormones. A gamete is a haploid cell that combines with another haploid gamete during fertilization. Recall that haploid cells have one complete set of chromosomes; in humans that would be 22 autosomes and one sex chromosome.

Sex hormones are chemical messengers that control sexual development and reproduction. The male reproductive system consists of structures that produce male gametes called sperm and secrete the male sex hormone testosterone.

The main structures of the male **reproductive system** are shown in **Figure** 6.1. Locate them in the figure as you read about them below.

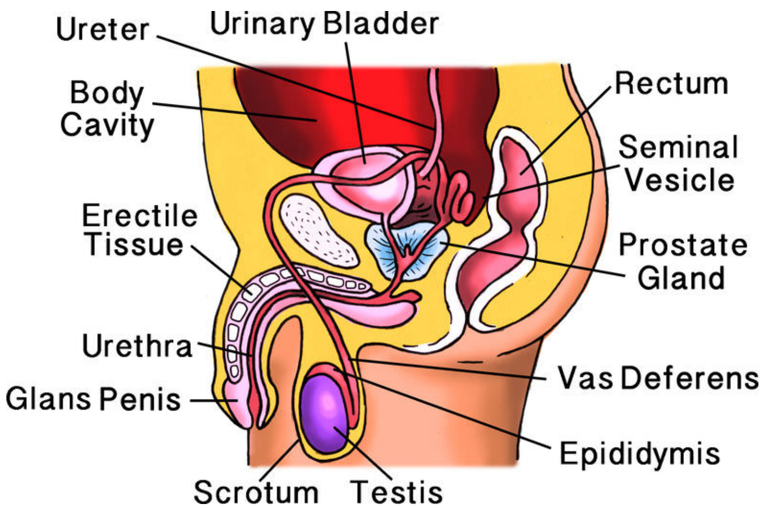


FIGURE 6.1
Male Reproductive Structures. Organs of the male reproductive system include the penis, testes, and epididymis. Several ducts and glands are also part of the system. Do you know the reproductive functions of any of these structures?

Penis

The **penis** is an external genital organ with a long shaft and enlarged tip called the glans penis. The shaft of the penis contains erectile tissues that can fill with blood and cause an erection. When this occurs, the penis gets bigger and stiffer. The **urethra** passes through the penis. **Sperm** pass out of the body through the urethra. (During urination, the urethra carries urine from the bladder.)

Testes

The two **testes** (singular, testis) are located below the penis. They hang between the thighs in a sac of skin called the **scrotum**. Each testis contains more than 30 meters (over 90 feet) of tiny, tightly packed tubules called **seminiferous tubules**. These tubules are the functional units of the testes. They produce sperm and secrete **testosterone**.

Epididymis

The seminiferous tubules within each testis join to form the epididymis. The **epididymis** (plural, epididymis) is a coiled tube about 6 meters (20 feet) long lying atop the testis inside the scrotum. The functions of the epididymis are to mature and store sperm until they leave the body.

Ducts and Glands

In addition to these organs, the male reproductive system consists of a series of ducts and glands. Ducts include the **vas deferens** and ejaculatory ducts. They transport sperm from the epididymis to the urethra in the penis. Glands include the **seminal vesicles** and **prostate gland**. They secrete substances that become part of semen.

Semen

Semen is the fluid that carries sperm through the urethra and out of the body. In addition to sperm, it contains secretions from the glands. The secretions control pH and provide sperm with nutrients for energy.

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Summary

- The male reproductive system consists of structures that produce sperm and secrete testosterone.
- Male reproductive structures include the penis, testes, and epididymis.

Review

1. What is a gamete?
2. What are sex hormones?
3. What are the two major roles of the male reproductive system?
4. Name two male reproductive organs and identify their functions.

References

1. Laura Guerin. Structures of the male reproductive system. . CC BY-NC 3.0

CONCEPT 7 Male Reproductive Development

- Explain how the male reproductive system develops.
- Summarize the roles of testosterone and luteinizing hormone.
- Define the adolescent growth spurt.

What changes happen during puberty?

A lot changes during this time. A boy has to start shaving, his voice deepens, he gets taller, as well as a few other changes.

Sexual Development in Males

The only obvious difference between boys and girls at birth is their reproductive organs. However, even the reproductive organs start out the same in both sexes.

Development Before Birth

In the first several weeks after fertilization, males and females are essentially the same except for their chromosomes. Females have two **X chromosomes** (XX), and males have an X and a **Y chromosome** (XY). Then, during the second month after fertilization, genes on the Y chromosome of males cause the secretion of testosterone. **Testosterone** stimulates the reproductive organs to develop into male organs. (Without testosterone, the reproductive organs always develop into female organs.) Although boys have male reproductive organs at birth, the organs are immature and not yet able to produce sperm or secrete testosterone.

Puberty and Its Changes

The reproductive organs grow very slowly during childhood and do not mature until puberty. **Puberty** is the period during which humans become sexually mature. In the U.S., boys generally begin puberty at about age 12 and complete it at about age 18.

What causes puberty to begin? The hypothalamus in the brain "tells" the pituitary gland to secrete hormones that target the testes. The main pituitary hormone involved is **luteinizing hormone (LH)**. It stimulates the testes to secrete testosterone. Testosterone, in turn, promotes protein synthesis and growth. It brings about most of the physical changes of puberty, some of which are shown in **Figure** 7.1. In addition to the changes shown below, during puberty male facial hair begins to grow, the shoulders broaden, and the male voice deepens.

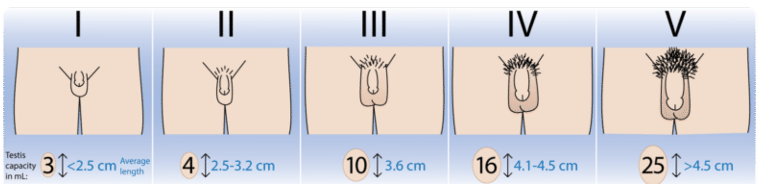
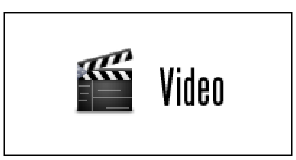


FIGURE 7.1

Some of the changes that occur in boys during puberty are shown in this figure. Pubic hair grows, and the penis and testes both become larger.

Adolescent Growth Spurt

Another obvious change that occurs during puberty is rapid growth. This is called the **adolescent growth spurt**. In boys, it is controlled by testosterone. The rate of growth usually starts to increase relatively early in puberty. At its peak rate, growth in height is about 10 centimeters (almost 4 inches) per year in the average male. Growth generally remains rapid for several years. Growth and development of muscles occur toward the end of the growth spurt in height. Muscles may continue to develop and gain strength after growth in height is finished.



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Summary

- The male reproductive system forms before birth but does not become capable of reproduction until it matures during puberty.
- Puberty lasts from about ages 12 to 18 years and is controlled by hormones.

Review

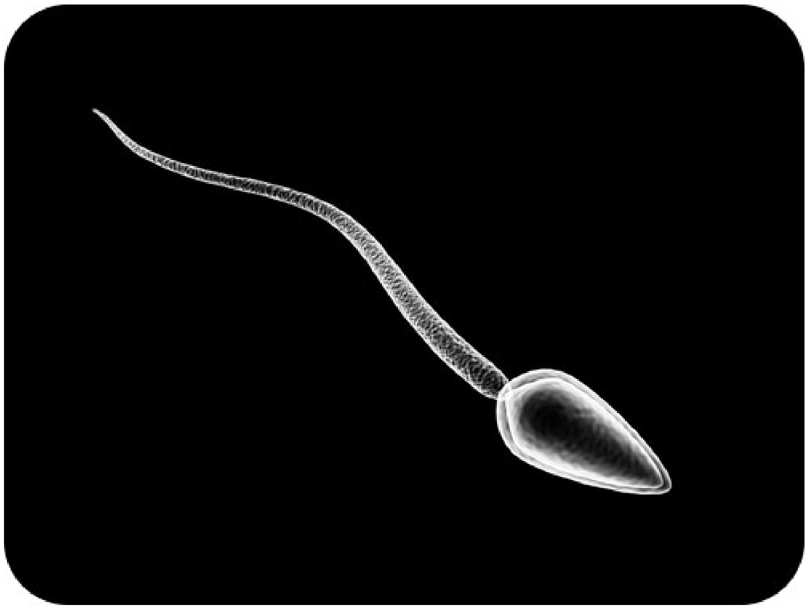
1. What happens to a developing baby that lacks testosterone?
2. List three physical changes that occur in males during puberty.
3. Explain how and why boys change so much during puberty.

References

1. Zachary Wilson. Male changes during puberty . CC BY-NC 3.0

CONCEPT 8 Human Sperm

- Describe how sperm are produced.
- Explain the role of the seminiferous tubules.
- Distinguish between spermatogonia, primary spermatocytes, secondary spermatocytes, and spermatids.
- Summarize the structures of a mature sperm cell.



How many sperm does it take to fertilize an egg?

85 million sperm per day are produced...per testicle. That's 170,000,000 every day. This means that a single male may produce more than a quadrillion (1,000,000,000,000) sperm cells in his lifetime! But it only takes one to fertilize an egg.

Production and Delivery of Sperm

A sexually mature male produces an astounding number of **sperm**—typically, hundreds of millions each day! Sperm production usually continues uninterrupted until death, although the number and quality of sperm decline during later adulthood.

Spermatogenesis

The process of producing mature sperm is called **spermatogenesis**. Sperm are produced in the **seminiferous tubules** of the testes and become mature in the **epididymis**. The entire process takes about 9 to 10 weeks.

If you look inside the seminiferous tubule shown in **Figure** 8.1, you can see cells in various stages of spermatogenesis. The tubule is lined with **spermatogonia**, which are diploid, sperm-producing cells. Surrounding the spermatogonia are other cells. Some of these other cells secrete substances to nourish sperm, and some secrete testosterone, which is needed for sperm production.

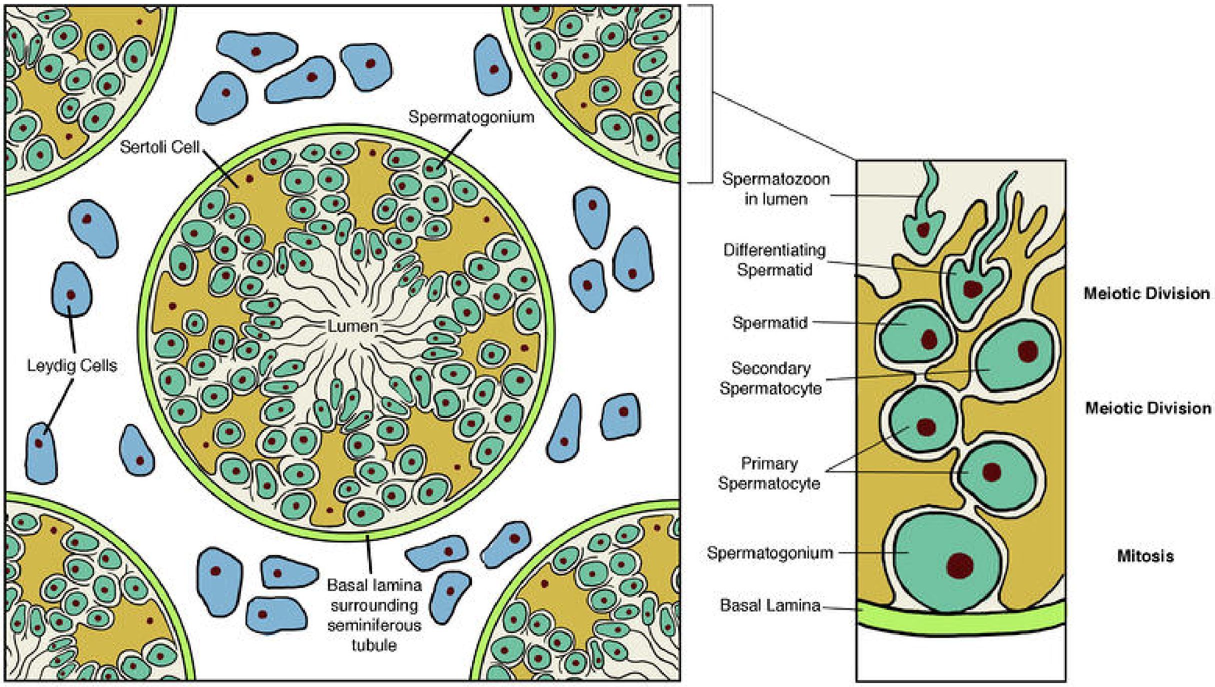


FIGURE 8.1
Seminiferous Tubule. Cross section of a testis and seminiferous tubules.

Spermatogonia lining the seminiferous tubule undergo mitosis to form **primary spermatocytes**, which are also diploid. The primary spermatocytes undergo the first meiotic division to form **secondary spermatocytes**, which are haploid. Spermatocytes make up the next layer of cells inside the seminiferous tubule. Finally, the secondary spermatocytes complete meiosis to form **spermatids**. Spermatids make up a third layer of cells in the tubule.

Sperm Maturation

After spermatids form, they move into the epididymis to mature into sperm, like the one shown in **Figure** 8.2. The spermatids grow a tail and lose excess cytoplasm from the head. When a sperm is mature, the tail can rotate like a propeller, so the sperm can propel itself forward. Mitochondria in the connecting piece produce the energy (ATP) needed for movement. The head of the mature sperm consists mainly of the nucleus, which carries copies of the father's chromosomes. The part of the head called the **acrosome** produces enzymes that help the sperm head penetrate an egg.

Ejaculation

Sperm are released from the body during **ejaculation**. Ejaculation occurs when muscle contractions propel sperm from the epididymis. The sperm are forced through the ducts and out of the body through the urethra. As sperm travel through the ducts, they mix with fluids from the glands to form semen. Hundreds of millions of sperm are released with each ejaculation.

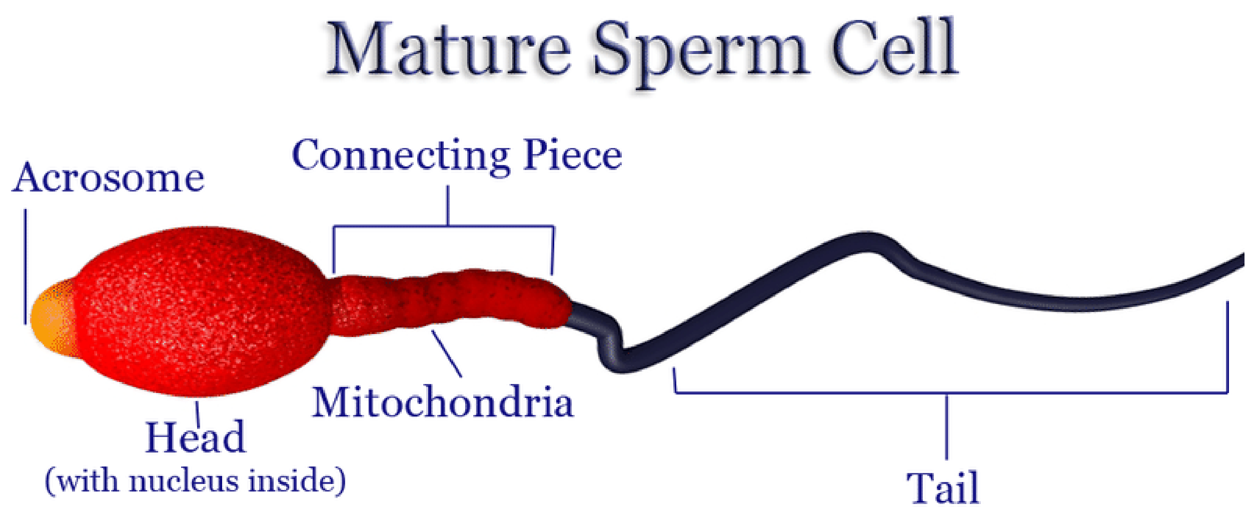
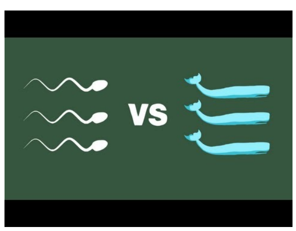


FIGURE 8.2

Mature Sperm Cell. A mature sperm cell has several structures that help it reach and penetrate an egg. These structures include the tail, mitochondria, and acrosome. How does each structure contribute to the sperm's function?



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Summary

- Sperm are produced in the testes in the process of spermatogenesis.
- Sperm mature in the epididymis before being ejaculated from the body through the penis.

Review

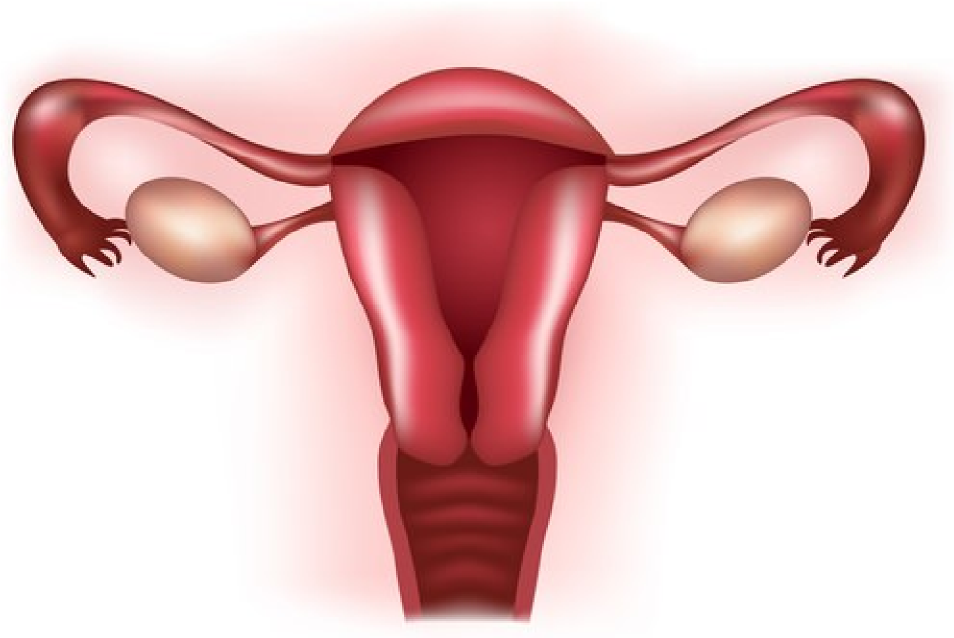
1. Outline the process of spermatogenesis. Name the cells involved in the process?
2. Where do sperm mature and how do they leave the body?
3. If a man did not have functioning epididymis, predict how his sperm would be affected. How would this influence his ability to reproduce?
4. How does each mature sperm structure contribute to the sperm's function?

References

1. Laura Guerin. Cross section of a testis and seminiferous tubules . CC BY-NC 3.0
2. Image copyright Scivit, 2014. Parts of a mature sperm cell, including the tail, head, mitochondria, acrosome . Used under license from Shutterstock.com

Concept 9 Female Reproductive Structures

- Identify female reproductive structures.
- Explain the roles of the female reproductive system.
- Summarize the importance of the uterus, endometrium, ovary, follicle, and fallopian tube.



Think producing millions of sperm each day is complicated?

If producing millions of sperm each day, as in the male reproductive system, is complicated, that is nothing compared to what must occur in the female reproductive system. This system is controlled by an intricate dance of hormones, cycles, and events.

Female Reproductive Structures

The female reproductive system consists of structures that produce female gametes called eggs and secrete the female sex hormone **estrogen**. The female reproductive system has several other functions as well:

1. It receives sperm during sexual intercourse.
2. It supports the development of a fetus.
3. It delivers a baby during birth.
4. It breast feeds a baby after birth.

The main structures of the female reproductive system are shown in **Figure** 9.1. Most of the structures are inside the pelvic region of the body. Locate the structures in the figure as you read about them below.

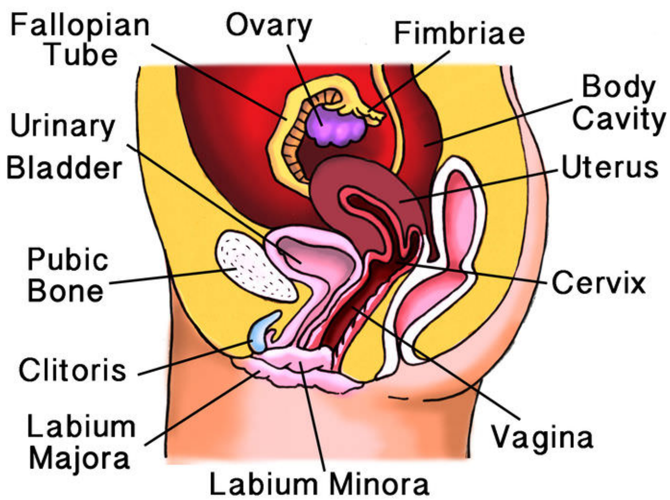


FIGURE 9.1
Female Reproductive Structures. Organs of the female reproductive system include the vagina, uterus, ovaries, and fallopian tubes.

External Structures

The external female reproductive structures are referred to collectively as the **vulva**. They include the **labia** (singular, **labium**), which are the "lips" of the vulva. The labia protect the vagina and urethra, both of which have openings in the vulva.

Vagina

The **vagina** is a tube-like structure about 9 centimeters (3.5 inches) long. It begins at the vulva and extends upward to the uterus. It has muscular walls lined with mucous membranes. The vagina has two major reproductive functions. It receives sperm during sexual intercourse, and it provides a passageway for a baby to leave the mother's body during birth.

Uterus

The **uterus** is a muscular organ shaped like an upside-down pear. It has a thick lining of tissues called the **endometrium**. The lower, narrower end of the uterus is known as the **cervix**. The uterus is where a fetus grows and develops until birth. During pregnancy, the uterus can expand greatly to make room for the baby as it grows. During birth, contractions of the muscular walls of the uterus push the baby through the cervix and out of the body.

Ovaries

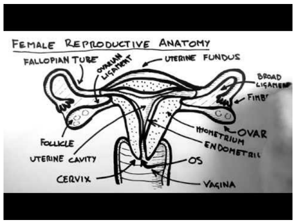
The two **ovaries** are small, egg-shaped organs that lie on either side of the uterus. They produce eggs and secrete estrogen. Each egg is located inside a structure called a **follicle**. Cells in the follicle protect the egg and help it mature.

Fallopian Tubes

Extending from the upper corners of the uterus are the two **fallopian tubes**. Each tube reaches (but is not attached to) one of the ovaries. The ovary end of the tube has a fringelike structure that moves in waves. The motion sweeps eggs from the ovary into the tube.

Breasts

The **breasts** are not directly involved in reproduction, but they nourish a baby after birth. Each breast contains **mammary glands**, which secrete milk. The milk drains into ducts leading to the nipple. A suckling baby squeezes the milk out of the ducts and through the nipple.



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Summary

- The female reproductive system consists of structures that produce eggs and secrete female sex hormones. They also provide a site for fertilization and enable the development and birth of a fetus.
- Female reproductive structures include the vagina, uterus, ovaries, and fallopian tubes.

Review

1. List three general functions of the female reproductive system.
2. Describe the uterus, and state its role in reproduction.
3. What are the roles of the ovaries and the follicles?
4. What are the fallopian tubes?

References

1. Laura Guerin. Structures of the female reproductive system . CC BY-NC 3.0

CONCEPT 10 Female Reproductive Development

- Explain how the female reproductive system develops.
- Outline the roles of luteinizing hormone and follicle-stimulating hormone.
- Define menarche and menstruation.

What changes happen during puberty?

A lot changes during this time. Girls may become interested in many new things, including the art of makeup.

Sexual Development in Females

Female reproductive organs form before birth. However, as in males, the organs do not mature until puberty.

Development Before Birth

Unlike males, females are not influenced by the male sex hormone testosterone during embryonic development. This is because they lack a Y chromosome. As a result, females do not develop male reproductive organs. By the third month of fetal development, most of the internal female organs have formed. Immature eggs also form in the ovary before birth. Whereas a mature male produces sperm throughout his life, a female produces all the eggs she will ever make before birth.

Changes of Puberty

Like baby boys, baby girls are born with all their reproductive organs present but immature and unable to function. Female reproductive organs also grow very little until puberty. Girls begin puberty a year or two earlier than boys, at an average age of 10 years. Girls also complete puberty sooner than boys, in about 4 years instead of 6.

Puberty in girls starts when the hypothalamus "tells" the pituitary gland to secrete hormones that target the ovaries. Two pituitary hormones are involved: **luteinizing hormone (LH)** and **follicle-stimulating hormone (FSH)**. These hormones stimulate the ovary to produce **estrogen**. Estrogen, in turn, promotes growth and other physical changes of puberty. It stimulates growth and development of the internal reproductive organs, breasts, and pubic hair (see **Figure** 10.1).

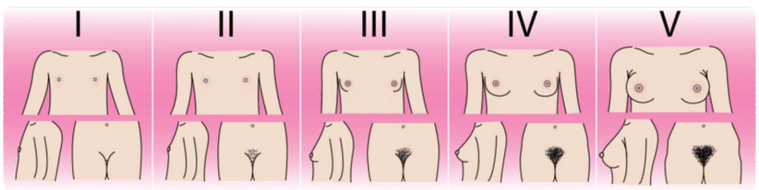


FIGURE 10.1

Changes in Females During Puberty. Two obvious changes of puberty in girls are growth and development of the breasts and pubic hair. The stages begin around age 10 and are completed by about age 14.

Adolescent Growth Spurt

Like boys, girls also go through an **adolescent growth spurt**. However, girls typically start their growth spurt a year or two earlier than boys (and therefore a couple of centimeters shorter, on average). Girls also have a shorter growth spurt. For example, they typically reach their adult height by about age 15. In addition, girls generally do not grow as fast as boys do during the growth spurt, even at their peak rate of growth. As a result, females are about 10 centimeters (about 4 inches) shorter, on average, than males by the time they reach their final height.

Menarche

One of the most significant changes in females during puberty is menarche. **Menarche** is the beginning of **menstruation**, or monthly periods as the ovaries begin the cyclic release of an egg. In U.S. girls, the average age of menarche is 12.5 years, although there is a lot of variation in this age. The variation may be due to a combination of genetic factors and environmental factors, such as diet.

Summary

- Female reproductive organs form before birth. However, they do not mature until puberty.

Review

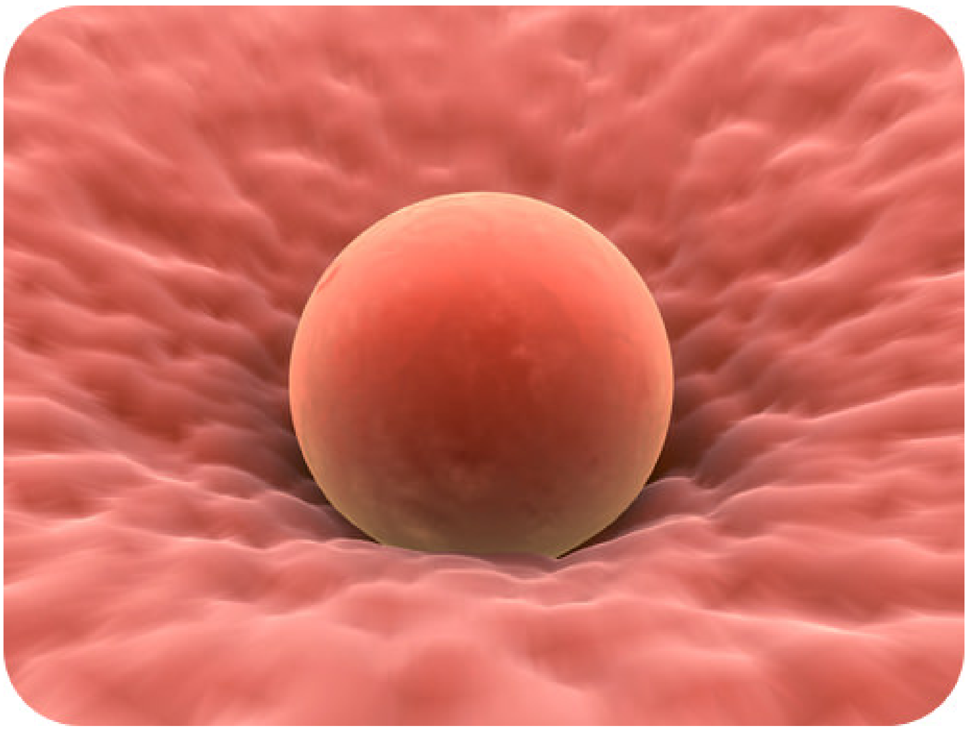
1. State two ways that puberty differs in girls and boys.
2. Define menstruation. What is the first menstrual period called?
3. Males and females are quite similar in height when they begin the adolescent growth spurt. Why are females about 10 centimeters shorter than males by adulthood?

References

1. Zachary Wilson. Changes in females during puberty . CC BY-NC 3.0

CONCEPT 11 Human Egg Cells

- Describe oogenesis.
- Distinguish between an oogonium, a primary oocyte, a secondary oocyte, and a polar body.
- Define ovulation.
- Explain the importance of the corpus luteum.



What's amazing about these cells?

Many things. A human egg cell. Just add sperm and you have the necessary ingredients for a new baby. What's amazing about these cells is that they are all produced before the girl is even born. Before the girl is even born, plans for the next generation have begun. And that is the start of an amazing process.

Egg Production

At birth, a female's ovaries contain all the eggs she will ever produce. However, the eggs do not start to mature until she enters puberty. After menarche, one egg typically matures each month until a woman reaches middle adulthood.

Oogenesis

The process of producing eggs in the ovary is called **oogenesis**. Eggs, like sperm, are haploid cells, and their production occurs in several steps that involve different types of cells, as shown in **Figure** 11.1. You can follow the process of oogenesis in the figure as you read about it below.

Oogenesis begins long before birth when an **oogonium** with the diploid number of chromosomes undergoes mitosis. It produces a diploid daughter cell called a **primary oocyte**. The primary oocyte, in turn, starts to go through the

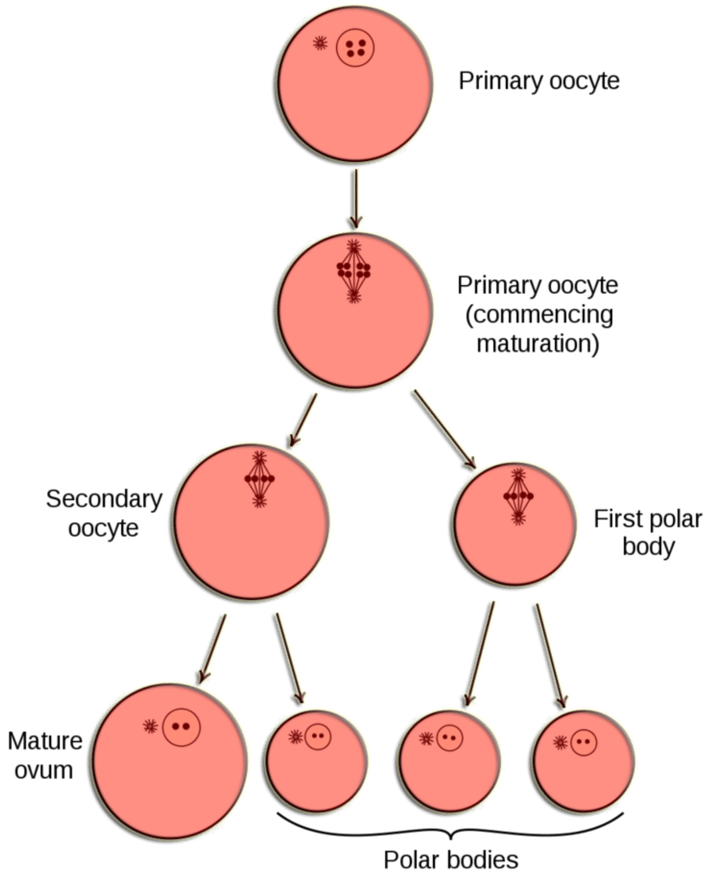


FIGURE 11.1
Oogenesis. Oogenesis begins before birth but is not finished until after puberty. A mature egg forms only if a secondary oocyte is fertilized by a sperm.

first cell division of meiosis (meiosis I). However, it does not complete meiosis until much later. The primary oocyte remains in a resting state, nestled in a tiny, immature **follicle** until puberty.

Maturation of a Follicle

Beginning in puberty, each month one of the follicles and its primary oocyte starts to mature (also see **Figure** 11.2). The primary oocyte resumes meiosis and divides to form a **secondary oocyte** and a smaller cell, called a **polar body**. Both the secondary oocyte and polar body are haploid cells. The secondary oocyte has most of the cytoplasm from the original cell and is much larger than the polar body.

Ovulation and Fertilization

After 12-14 days, when the follicle is mature, it bursts open, releasing the secondary oocyte from the ovary. This event is called **ovulation** (see **Figure** 11.2). The follicle, now called a **corpus luteum**, starts to degenerate, or break down. After the secondary oocyte leaves the ovary, it is swept into the nearby fallopian tube by the waving, fringelike end (see **Figure** 11.3).

If the secondary oocyte is fertilized by a sperm as it is passing through the fallopian tube, it completes meiosis and forms a mature egg and another polar body. (The polar bodies break down and disappear.) If the secondary oocyte is not fertilized, it passes into the uterus as an immature egg and soon disintegrates.

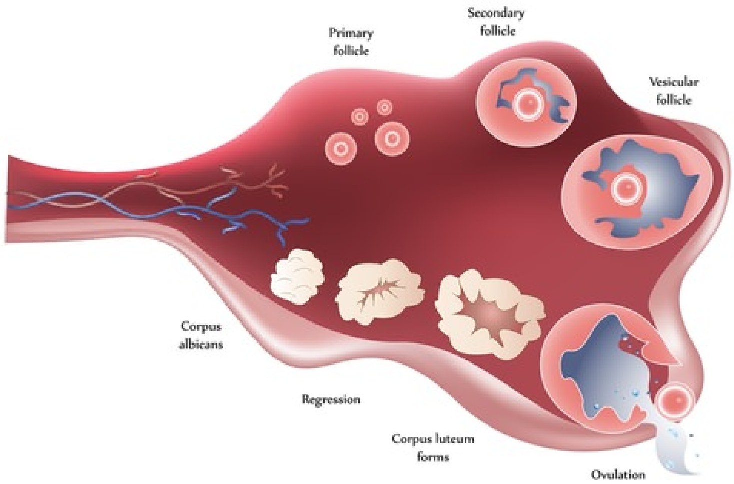


FIGURE 11.2
Maturation of a Follicle and Ovulation. A follicle matures and its primary oocyte (follicle) resumes meiosis to form a secondary oocyte in the secondary follicle. The follicle ruptures and the oocyte leaves the ovary during ovulation. What happens to the ruptured follicle then?

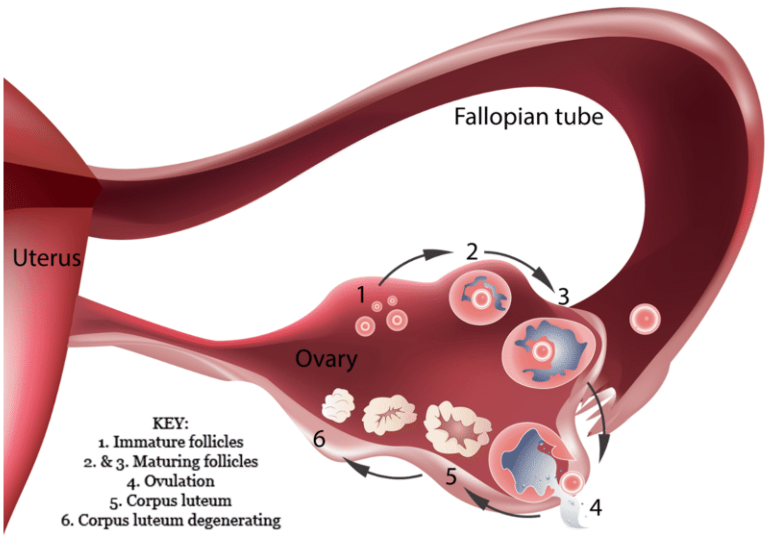
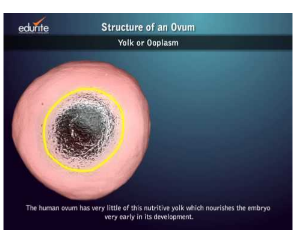


FIGURE 11.3
Egg Entering Fallopian Tube. After ovulation, the fringelike end of the fallopian tube sweeps the oocyte inside of the tube, where it begins its journey to the uterus.



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Summary

- Immature eggs form in the ovaries before birth.
- Each month, starting in puberty, one egg matures and is released from the ovary.

- Release of an egg is called ovulation.

Review

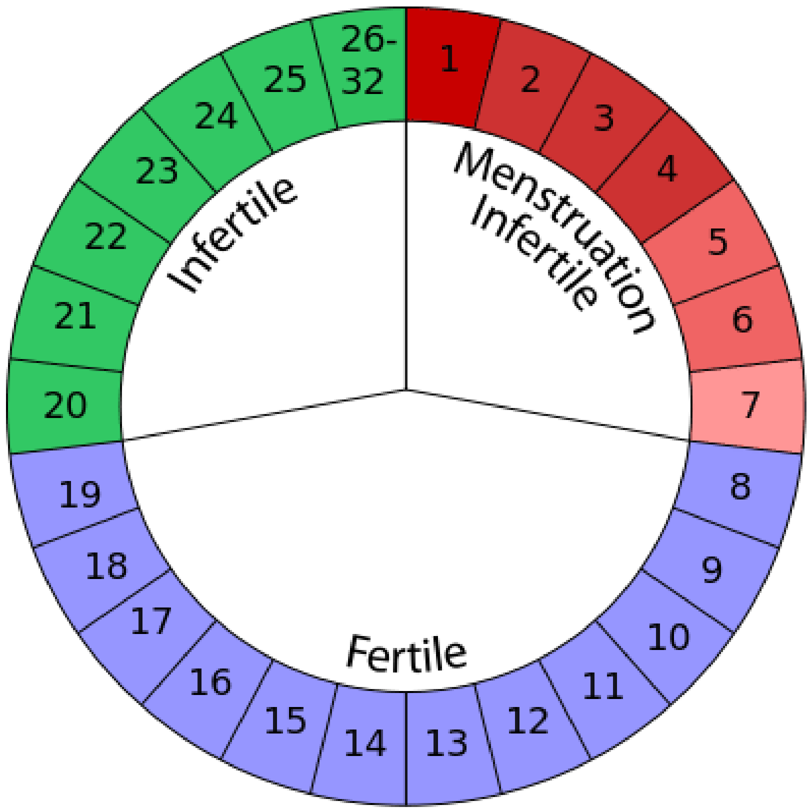
1. When does a female begin to produce her eggs?
2. What is a polar body?
3. Describe ovulation.
4. Predict how blockage of both fallopian tubes would affect a woman's ability to reproduce naturally. Explain your answer.
5. Create a flow chart showing the steps in which an oogonium develops into a mature egg.

References

1. User:Mysid/Wikimedia Commons. Oogenesis diagram . Public Domain
2. Image copyright GRei, 2014. Maturation of follicle and ovulation . Used under license from Shutterstock.com
3. Image copyright GRei, 2014, modified by CK-12 Foundation - Zachary Wilson. Egg entering fallopian tube. . Used under license from Shutterstock.com

CONCEPT 12 Menstrual Cycle

- Describe the phases of the menstrual cycle.
- Summarize changes to the endometrium during the menstrual cycle.
- Explain changes to a follicle during the monthly cycle.
- Summarize the importance of FSH, LH, estrogen, and progesterone in controlling the cycle.



What's the most important part of the female menstrual cycle?

A menstrual cycle calendar. A lot of things to keep track of. And for a few very important reasons, it is important to know when a woman is ovulating. But what's the *most* important part of the female menstrual cycle? That depends on who you ask.

Menstrual Cycle

Ovulation, the release of an egg from an ovary, is part of the **menstrual cycle**, which typically occurs each month in a sexually mature female unless she is pregnant. Another part of the cycle is the monthly period, or menstruation. **Menstruation** is the process in which the **endometrium** of the uterus is shed from the body. The menstrual cycle is controlled by hormones from the hypothalamus, pituitary gland, and ovaries.

Phases of the Menstrual Cycle

As shown in **Figure** 12.1, the menstrual cycle occurs in several phases. The cycle begins with menstruation. During menstruation, arteries that supply the endometrium of the uterus constrict. As a result, the endometrium breaks down and detaches from the uterus. It passes out of the body through the vagina over a period of several days.

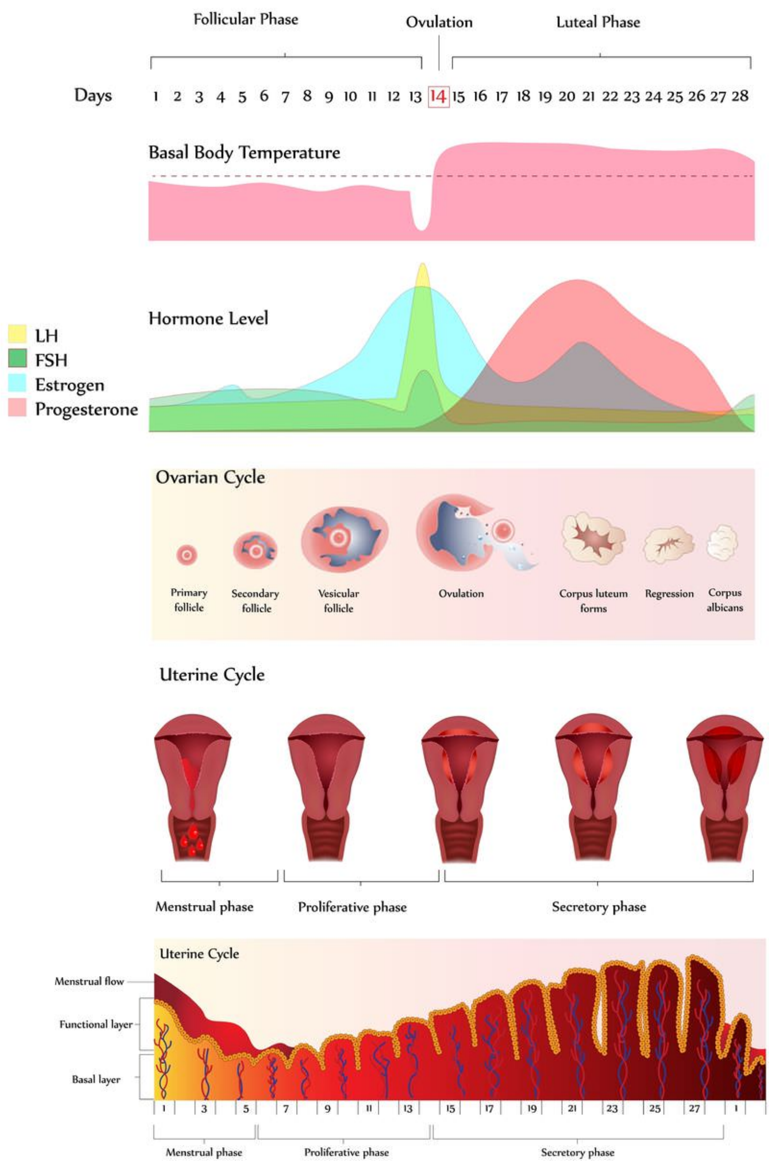


FIGURE 12.1

Phases of the Menstrual Cycle. The menstrual cycle occurs in the phases shown here.

After menstruation, the endometrium begins to build up again. At the same time, a **follicle** starts maturing in an ovary. Ovulation occurs around day 14 of the cycle. After it occurs, the endometrium continues to build up in preparation for a fertilized egg. What happens next depends on whether the egg is fertilized.

If the egg is fertilized, the endometrium will be maintained and help nourish the egg. The ruptured follicle, now called the **corpus luteum**, will secrete the hormone **progesterone**. This hormone keeps the endometrium from breaking down. If the egg is not fertilized, the corpus luteum will break down and disappear. Without progesterone, the endometrium will also break down and be shed. A new menstrual cycle thus begins.

Menopause

For most women, menstrual cycles continue until their mid- or late- forties. Then women go through **menopause**, a period during which their menstrual cycles slow down and eventually stop, generally by their early fifties. After menopause, women can no longer reproduce naturally because their ovaries no longer produce eggs.

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Summary

- The menstrual cycle includes events that take place in the ovary, such as ovulation.
- The menstrual cycle also includes changes in the uterus, including menstruation.
- Menopause occurs when menstruation stops occurring, usually in middle adulthood.

Review

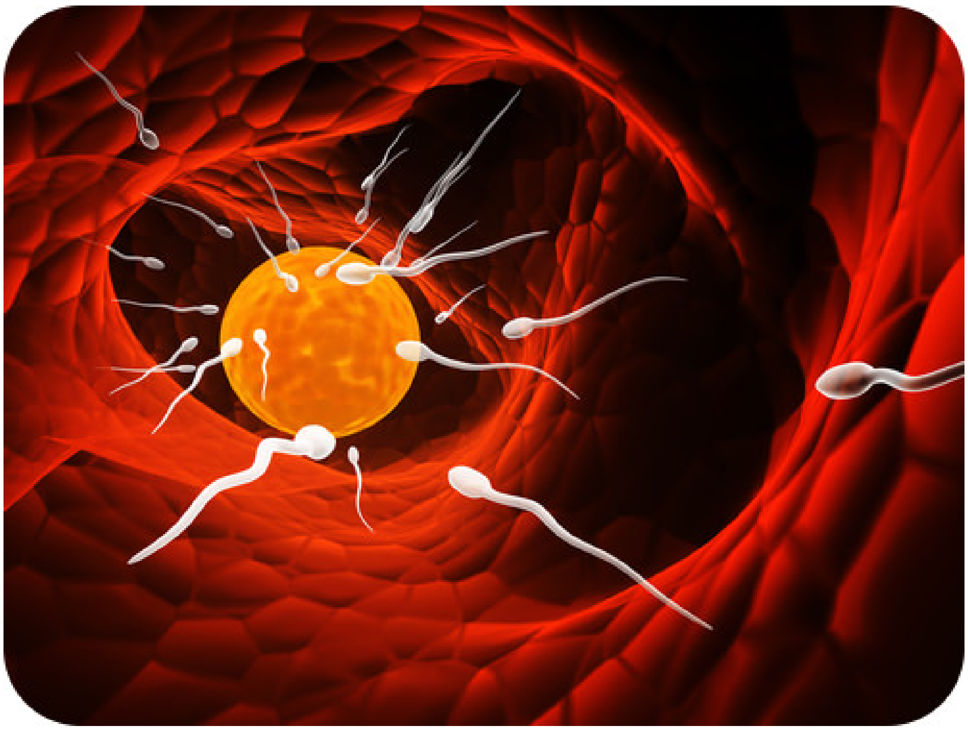
1. Define menstruation.
2. What is menopause? When does it occur?
3. What is the corpus luteum?
4. Compare and contrast what happens in the menstrual cycle when the egg is fertilized with what happens when the egg is not fertilized.
5. Make a cycle diagram to represent the main events of the menstrual cycle in both the ovaries and the uterus, including the days when they occur.

References

1. Image copyright GRei, 2014. Detailed linear menstrual cycle diagram . Used under license from Shutterstock.com

CONCEPT 13 Fertilization

- Describe the process of fertilization.
- Outline the events that occur between fertilization and the embryonic stage.
- Distinguish a morula from a blastocyst.
- Define implantation.



How far does a sperm have to swim?

Sperm swimming to an egg. If fertilization occurs, the egg will have all the "instructions" to grow into a new organism. That one cell will become two, then four, then eight, then sixteen, and on and on and on. And after about 9 months, that one cell will have become a new baby. But it all starts with the sperm swimming to the egg. A sperm cell is about two thousandths of an inch long. And although they are small, they can swim roughly 8 inches in an hour. To reach an egg, they will ultimately they have to swim around 192,000 times their own length.

Cleavage and Implantation

A day or two after an ovary releases an egg, the egg may unite with a sperm. Sperm are deposited in the vagina during sexual intercourse. They propel themselves through the **uterus** and enter a **fallopian tube**. This is where **fertilization** usually takes place.

When a sperm penetrates the egg, it triggers the egg to complete meiosis. The sperm also undergoes changes. Its tail falls off, and its nucleus fuses with the nucleus of the egg. The resulting cell, called a **zygote**, contains all the chromosomes needed for a new human organism. Half the chromosomes come from the egg and half from the sperm.

Morula and Blastocyst Stages

The zygote spends the next few days traveling down the fallopian tube toward the uterus, where it will take up residence. As it travels, it divides by mitosis several times to form a ball of cells called a **morula**. The cell divisions are called **cleavage**. They increase the number of cells but not the overall size of the new organism. As more cell divisions occur, a fluid-filled cavity forms inside the ball of cells. At this stage, the ball of cells is called a **blastocyst**.

The cells of the blastocyst form an inner cell mass and an outer cell layer, as shown in **Figure** 13.1. The inner cell mass is called the **embryoblast**. These cells will soon develop into an embryo. The outer cell layer is called the **trophoblast**. These cells will develop into other structures needed to support and nourish the embryo.

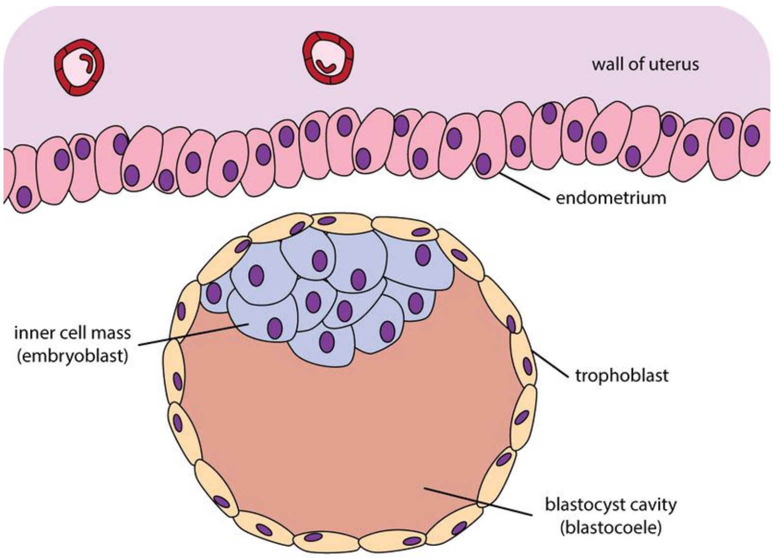


FIGURE 13.1
Blastocyst. The blastocyst consists of an outer layer of cells called the trophoblast and an inner cell mass called the embryoblast. The blastocyst fluid-filled cavity is also known as the blastocoel or blastocoele.

Implantation

The blastocyst continues down the fallopian tube and reaches the uterus about 4 or 5 days after fertilization. When the outer cells of the blastocyst contact cells of the endometrium lining the uterus, the blastocyst embeds in the endometrium. The process of embedding is called **implantation**. It generally occurs about a week after fertilization.

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Summary

- Fertilization is the union of a sperm and egg, resulting in the formation of a zygote.

- The zygote undergoes many cell divisions before it implants in the lining of the uterus.

Review

1. What happens during fertilization? Where does it usually take place?
2. What is implantation? When does it occur?
3. Describe a morula and blastocyst.

References

1. Zachary Wilson. Blastocyst diagram . CC BY-NC 3.0

CONCEPT 14 Sexually Transmitted Infections

- Explain what causes STIs.
- Describe how STIs spread and how they can be prevented.

What does "safe sex" truly mean?

"Safe Sex." The thought of a sexually transmitted infection should be enough to make you think about and believe in this saying.

Understanding Sexually Transmitted Infections

A shocking statistic made headlines in 2008. A recent study had found that one in four teen girls in the U.S. had a sexually transmitted infection. A **sexually transmitted infection (STI)** (also known as a **sexually transmitted disease**, or STD) is an infection caused by a pathogen that spreads mainly through sexual contact. Worldwide, a million people a day become infected with STIs. The majority of them are under the age of 25.

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To be considered an STI, an infection must have only a small chance of spreading naturally in ways other than sexual contact. Some infections that can spread through sexual contact, such as the common cold, spread more commonly by other means. These infections are not considered STIs.

Pathogens that Cause STIs

STIs may be caused by several different types of pathogens, including protozoa, insects, bacteria, and viruses. For example:

- Protozoa cause an STI called **trichomoniasis**. The pathogen infects the vagina in females and the urethra in males, causing symptoms such as burning and itching. Trichomoniasis is common in young people.
- **Pubic lice**, like the one in **Figure** 14.1, are insect parasites that are transmitted sexually. They suck the blood of their host and irritate the skin in the pubic area.

FIGURE 14.1

Pubic lice like this one are only about as big as the head of a pin.

Most STIs are caused by bacteria or viruses. Bacterial STIs can be cured with antibiotics. Viral STIs cannot be cured. Once you are infected with a viral STI, you are likely to be infected for life.

How STIs Spread

Most of the pathogens that cause STIs enter the body through **mucous membranes** of the reproductive organs. All sexual behaviors that involve contact between mucous membranes put a person at risk for infection. This includes vaginal, anal, and oral sexual behaviors. Many STIs can also be transmitted through body fluids such as blood, semen, and breast milk. Therefore, behaviors such as sharing injection or tattoo needles is another way these STIs can spread.

Why are STIs common in young people? One reason is that young people often take risks. They may think, "It can't happen to me." They also may not know how STIs are spread, so they don't know how to protect themselves. In addition, young people may have multiple sexual partners.

Preventing STIs

The only completely effective way to prevent infection with STIs is to avoid sexual contact and other risky behaviors. Using condoms can lower the risk of becoming infected with STIs during some types of sexual activity. However, condoms are not foolproof. Pathogens may be present on areas of the body not covered by condoms. Condoms can also break or be used incorrectly.

Summary

- STIs are diseases caused by pathogens that spread through sexual contact.
- Abstinence from sexual activity and other risk behaviors is the only completely effective way to prevent the spread of STIs.

Review

1. Describe how STIs spread.
2. What causes most STIs?
3. Can bacterial STIs be cured? If so, how? What about viral STIs?
4. What is the only completely effective way to prevent a sexually transmitted infection?
5. Assume you are preparing a public service announcement (PSA) to explain to teens how and why to avoid STIs. List three facts you think it would be important to include for an informative and persuasive PSA.

Explore More

Use this resource to answer the questions that follow.

MEDIA
Click image to the left or use the URL below.
URL: https://www.ck12.org/flx/render/embeddedobject/177265

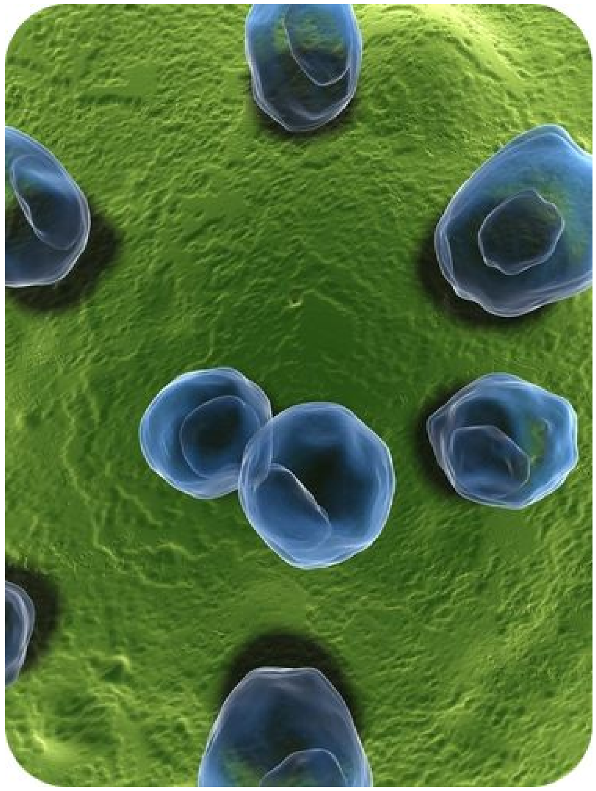
1. List five facts about STDs.
2. List five myths about STDs.

References

1. Courtesy of Centers for Disease Control and Prevention. Pubic Lice .

CONCEPT 15 Bacterial Sexually Transmitted Infections

- Identify and describe common bacterial STIs.



Single-celled organisms. Can they be dangerous?

These are chlamydia. Innocent-looking single-celled organisms. But these bacteria can lead to painful and devastating consequences.

Bacterial STIs

Many STIs are caused by bacteria. Some of the most common bacterial STIs are chlamydia, gonorrhea, and syphilis. Bacterial STIs can be cured with antibiotics.

Chlamydia

Chlamydia is the most common STI in the United States. As shown in the graph in **Figure** 15.1, females are much more likely than males to develop chlamydia. Like most STIs, rates of chlamydia are highest in teens and young adults.

Symptoms of chlamydia may include a burning sensation during urination and a discharge from the vagina or penis. Chlamydia can be cured with **antibiotics**, but often there are no symptoms, so people do not seek treatment.

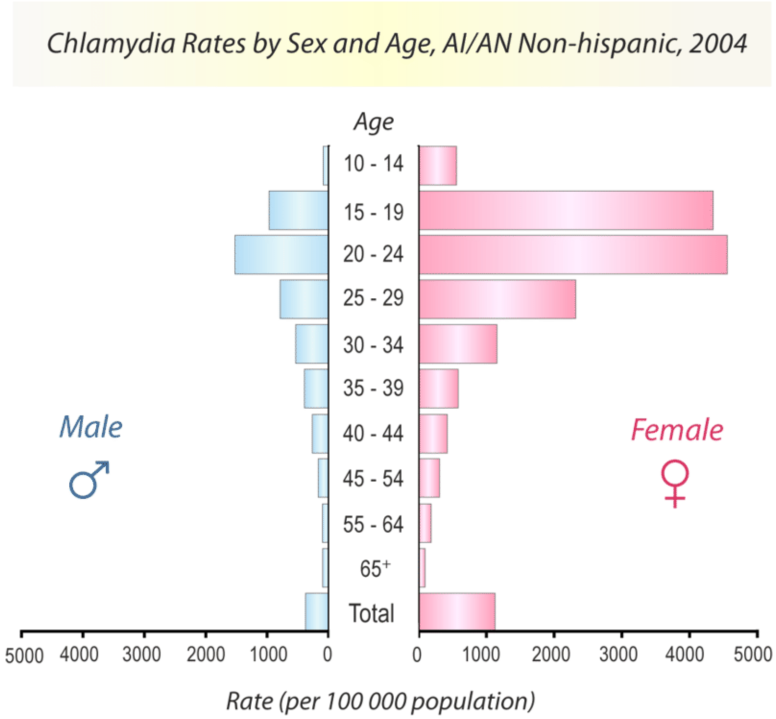


FIGURE 15.1

This graph shows the number of cases of chlamydia per 100,000 people in the U.S. in 2004. Which age group had the highest rates? How much higher were the rates for females aged 15-19 than for males in the same age group?

Untreated chlamydia can lead to more serious problems, such as **pelvic inflammatory disease (PID)**. This is an infection of the uterus, fallopian tubes, and/or ovaries. It can scar a woman's reproductive organs and make it difficult for her to become pregnant.

MEDIA

Click image to the left or use the URL below.
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Gonorrhea

Gonorrhea is another common STI. Symptoms of gonorrhea may include painful urination and discharge from the vagina or penis. Gonorrhea usually can be cured with antibiotics, although the bacteria have developed resistance to many of the drugs. Gonorrhea infections may not cause symptoms, especially in females, so they often go untreated. Untreated gonorrhea can lead to PID in females. It can lead to inflammation of the reproductive organs in males as well.

Syphilis

Syphilis is less common than chlamydia or gonorrhea but more serious if untreated. Early symptoms of syphilis infection include a small sore on or near the genitals. The sore is painless and heals on its own, so it may go unnoticed. If treated early, most cases of syphilis can be cured with antibiotics. Untreated syphilis can cause serious damage to the heart, brain, and other organs. It may eventually lead to death.

Summary

- Bacterial STIs include chlamydia, gonorrhea, and syphilis.
- Bacterial STIs usually can be cured with antibiotics.

Review

1. Identify three common STIs that are caused by bacteria.
2. Often, STIs do not cause symptoms. Why is it important to detect and treat STIs even when they do not cause symptoms? Give an example of the consequences of an untreated STI.
3. Which age group had the highest rates of chlamydia? How much higher were the rates for females aged 15-19 than for males in the same age group?
4. Explain how a lack of symptoms might contribute to the spread of STIs.

References

1. Hana Zavadska, based on data from Centers for Disease Control and Prevention. Chlamydia incidence rates by age and gender . CC BY-NC 3.0

CONCEPT 16 Viral Sexually Transmitted Infections

- Identify and describe common viral STIs.
- Explain the importance of a Pap test.

How long does a viral STI last?

This is the Human Papilloma Virus, which causes a viral STI. Viral STIs can be especially dangerous, as they cannot be cured. Once you get one, it's yours for life. And also, it's the person's you give it to.

Viral STIs

STIs caused by viruses include genital herpes, hepatitis B, genital warts, and **HIV/AIDS**. Whereas bacterial STIs can usually be cured with antibiotics, viral STIs cannot be cured.

Genital Herpes

Genital herpes is an STI caused by a herpes virus. In the United States, as many as one in four people are infected with the virus. Symptoms of genital herpes include painful blisters on the genitals (see **Figure** 16.1). The blisters usually go away on their own, but the virus remains in the body, causing periodic outbreaks of blisters throughout life. Outbreaks may be triggered by stress, illness, or other factors. A person with genital herpes is most likely to transmit the virus during an outbreak.

MEDIA

Click image to the left or use the URL below.

URL: https://www.ck12.org/flx/render/embeddedobject/1706

FIGURE 16.1

Blisters like these on the genitals are a sign of genital herpes.

Hepatitis B

Hepatitis B is inflammation of the liver caused by infection with the hepatitis B virus. In many people, the immune system quickly eliminates the virus from the body. However, in a small percentage of people, the virus remains in the body and continues to cause illness. It may eventually damage the liver and increase the risk of liver cancer, which is usually fatal.

Genital Warts and Cervical Cancer

Infections with the **human papillomavirus (HPV)** are very common. HPV may cause **genital warts**, which are small, rough growths on the genitals. It may also cause cancer of the cervix in females. A simple test, called a **Pap test**, can detect **cervical cancer**. If the cancer is detected early, it usually can be cured with surgery. There is also a vaccine , GARDASIL, to prevent infection with HPV. The vaccine is recommended for females aged 11 to 26 years.

Summary

- Viral STIs include genital herpes, hepatitis B, genital warts, and cervical cancer.
- Viral STIs cannot be cured, but some of them can be prevented with vaccines.

Review

1. Name and describe an STI caused by a virus.
2. Discuss treatment for the human papillomavirus.
3. Compare and contrast bacterial and viral STIs with regard to their treatment, cure, and prevention.

References

1. . Genital Herpes blister . Public Domain