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Human Hormones and Reproduction

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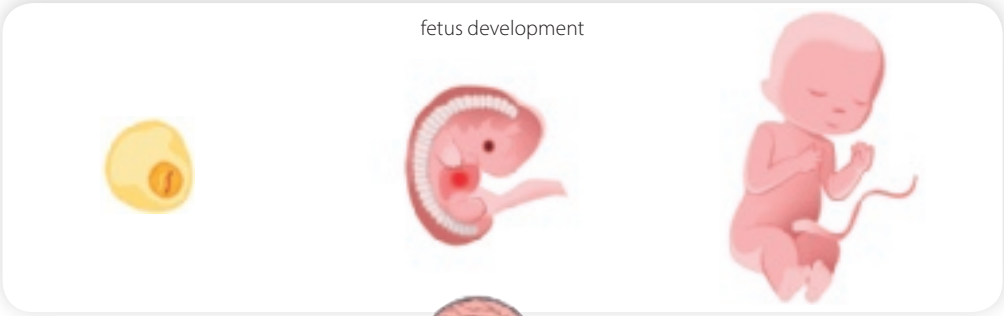
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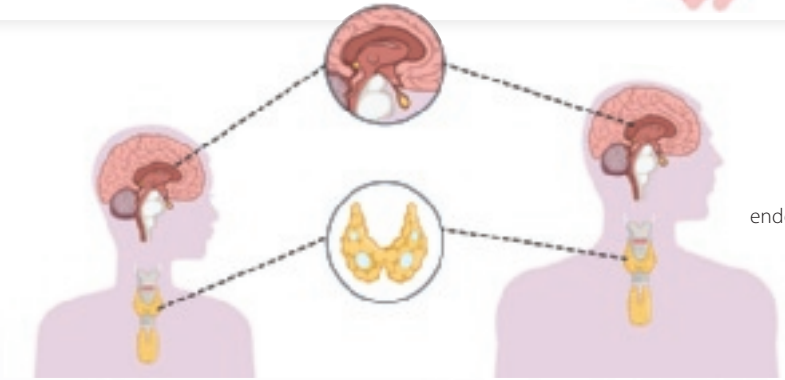
endocrine system


stages of maturity

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Human Hormones and Reproduction

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Human Hormones and Reproduction

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Growth and Change

Chapter 1

Everyone starts out as a baby. A baby's bones and muscles grow. Babies start out crawling but after a while they can stand up and walk. Soon after that, the child can run and move in all sorts of directions. As the years go by, **growth** continues until the body is **mature**.

Humans go through a predictable sequence of development from infancy, through childhood and adolescence, and into adulthood. As the human body matures, it develops different functions related to the different stages of life. The body has structures called **glands** that produce substances that control the processes of bodily change.

Big Question

How do humans change as they mature?

Vocabulary

growth, n. the life process of becoming bigger and stronger

mature, adj. fully developed (v. to develop and become full-grown)

gland, n. a body organ that makes substances used by the body

Glands produce chemical substances called **hormones**. Hormones signal tissues and organs in the body to perform functions or to change.

The effects of hormones can vary. Hormones can trigger sudden change in the body or sustained gradual change. For example, one hormone can suddenly make a heart beat faster when a person is surprised. Other hormones very gradually make a person grow and mature.

Vocabulary

hormone, n. a substance made in the body that produces effects in other cells or tissues in the body

Glands and Hormones

Chapter 2

To function well and stay alive, the human body tries to maintain a condition called **homeostasis**. Think of homeostasis as internal balance. The body has many systems, all performing complicated functions at the same time. The body has a system that maintains balance by subjecting all of its processes to the chemical commands by hormones. Hormones, the structures that make them, and the pathways they travel make up the **endocrine system**.

Big Question

What is the endocrine system?

Vocabulary

homeostasis, n. the balanced functional state of the body's systems to maintain life

endocrine system, n. the glands and body structures that create and control the metabolic activity of a body

The human body functions best when its systems are stable—all parts are getting enough of what they need but not too much. When a function becomes unstable, the body responds and starts a change process. For example, when a person needs energy from food, a part of the endocrine system releases a hormone. This hormone travels to the brain and signals "I am hungry." Once the person has had enough to eat, another hormone is released that tells the body "I am full."

The Endocrine System

The endocrine system produces hormones. It also controls when the hormones are released into the bloodstream.

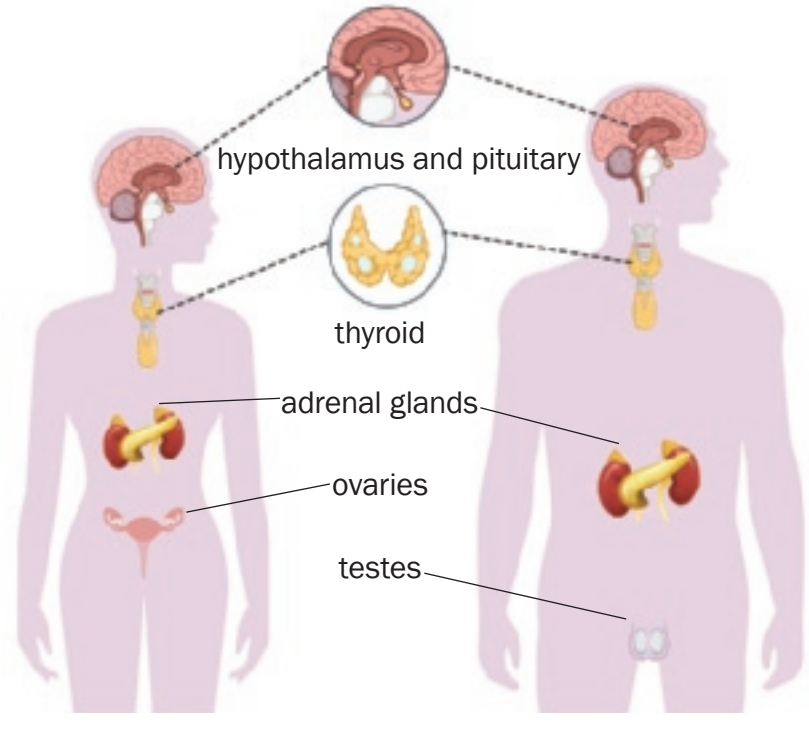
Some of the body processes that hormones control include the following:

- digestion
- maintaining the body's internal balance
- growth of the body
- repair to damages
- reproduction

Words to Know

Processes are ongoing biological activities carried out for particular purposes. *Control* and *regulation* refer to determining the way that a process or event happens.

The endocrine system routinely has to start and stop processes, such as hunger, sleep, and growth. Males and females have some differences in their endocrine systems.



Some Hormones and Their Effects

When a condition in the body triggers a need, glands secrete hormones. The hormones circulate in the bloodstream to different organs and structures throughout the body. When hormones reach their targeted cells, the cells' activities are affected and change.

Vocabulary

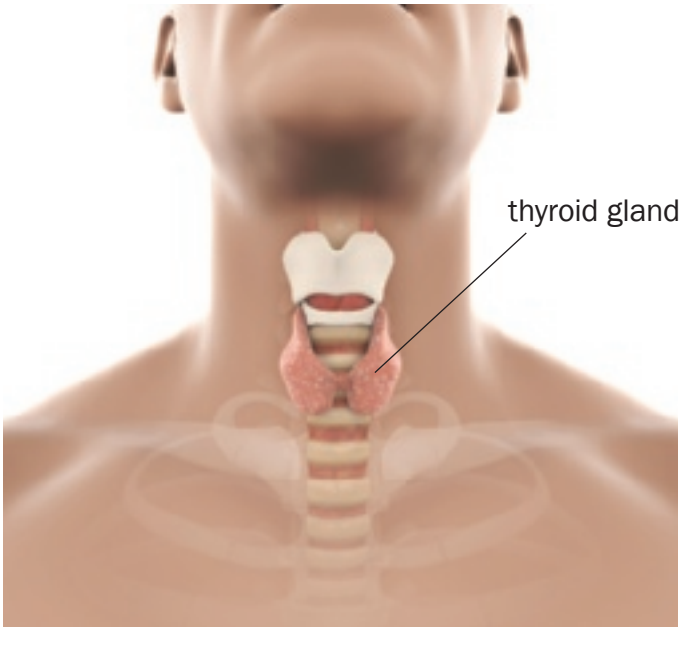
metabolism, n. the combined chemical and energy processes that occur continuously in a living body

Word to Know

Secrete means to gradually release a substance.

The most immediate and important role of hormones is to control the body's **metabolism**. In the body, metabolism is the ongoing buildup and breakdown of the body's important chemicals and processes.

Thyroid hormone, secreted by the thyroid gland, controls some aspects of metabolism. If the gland secretes too little thyroid hormone, metabolism slows down. This can cause the heart to slow down and the body to gain excess weight. If the gland secretes too much thyroid hormone, metabolism speeds up. This can cause the heart to beat rapidly or irregularly and the body to have trouble gaining weight.



The pancreas produces enzymes that break down food in the stomach. The pancreas also releases hormones that help control the amount of sugar in the blood and cells.

The pineal gland secretes a hormone that gets the body ready for sleep. Sleep is a necessary body function.

The thymus makes white blood cells. In children, this defense against infection is necessary for survival as their immune system develops. After adolescence, the thymus starts to shrink.

The adrenal gland secretes adrenaline. Though adrenaline affects many different organs and systems in the body, it is primarily known for producing the “fight or flight” reaction. When something scares a person, adrenaline instantly causes an increase in blood flow from the heart to the muscles. Adrenaline prepares the body to either fight the danger or flee from it.

Hormones and Growth

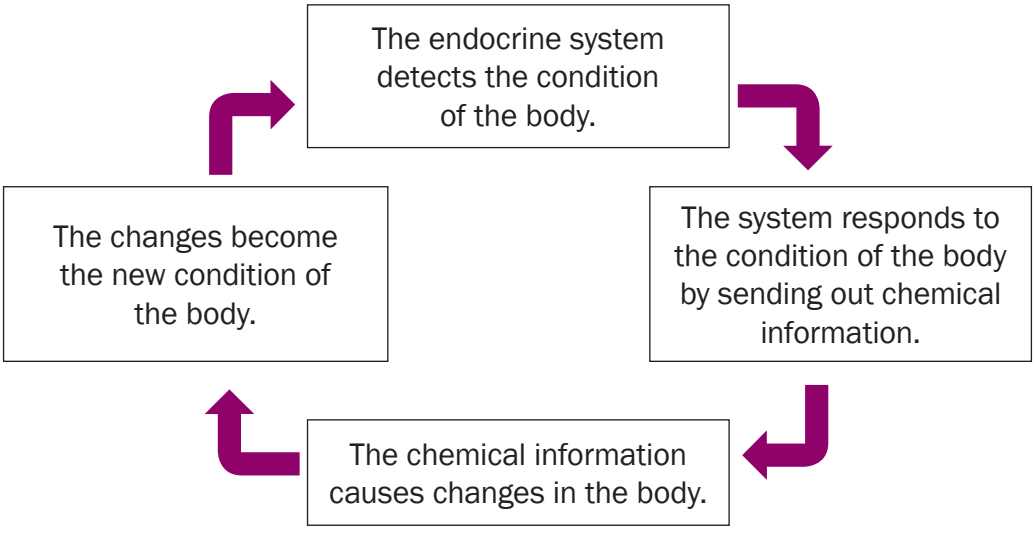
Hormones also regulate a body's growth. The pituitary gland secretes many different hormones, including growth hormone and a hormone that controls the sex hormones. Early in life, when growth must occur for survival, the body secretes more growth hormone. The amount of growth hormone secreted by the pituitary gland decreases with age.

The parathyroid gland controls the levels of calcium and phosphorous in the body. Both minerals are required for bone growth. Too little of this hormone can result in bones that are weak. And too much of this hormone can result in too much calcium and phosphorous in the body, which can be harmful.

Finally, the endocrine system produces gender-specific hormones known as the sex hormones. Sex hormones play little role in humans until adolescence. Sex hormones control the significant body changes that occur during adolescence. Sex hormones are released by ovaries in females and by testes in males.

Feedback and Balance in the Endocrine System

The endocrine system performs based on feedback from the body. Feedback is information about an outcome returned to the source that produced the outcome. In the endocrine system, it works like this:



A change in one area of the endocrine system affects other areas. For example, being hungry affects hormone levels. Eating in response to hunger affects other hormones. Diet, sleep, and activity level are all things that change hormone levels, and these are factors that people affect through behavior.

The Hypothalamus, Pituitary, and Adrenal Glands

Chapter 3

The hypothalamus is the part of the endocrine system that connects the nervous system to the glandular responses from the body.

For example, the body has two responses when someone has not eaten in a while. One response travels through the nervous system. The stomach shrinks and sends a signal to the brain. The brain then signals the hypothalamus, and then hormones prompt the body to eat.

Big Question

What do the hypothalamus, pituitary, and adrenal glands do?

Vocabulary

hypothalamus, n. region of the brain that produces and releases hormones that regulate many body functions

The other response occurs when blood sugar gets low. A hormone in the bloodstream signals low blood sugar. Cells in the hypothalamus receive the chemical signal and secrete hormones that prompt the body to eat.

The same hormone that triggers hunger also signals the pituitary gland to release insulin, which controls blood sugar levels.

The Pituitary Gland

Vocabulary

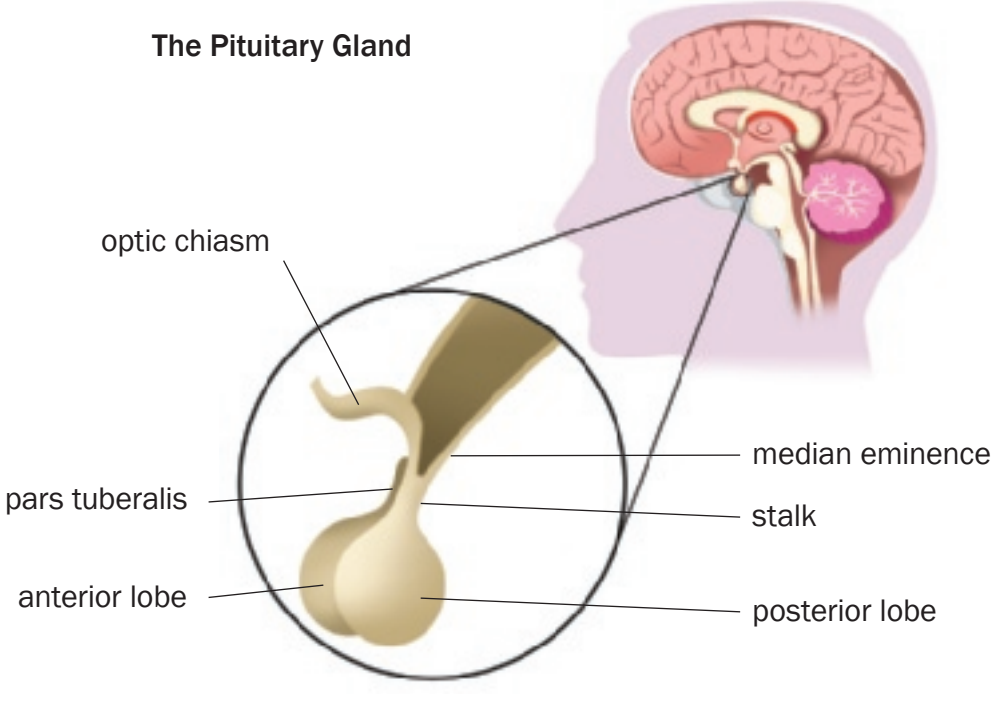
pituitary gland, n. the master gland that produces hormones that control other glands

The **pituitary gland** is considered the master gland because it controls other glands. It is a small, almond-sized gland located below the brain, directly below the hypothalamus.

When a signal from the nervous or endocrine system reaches the hypothalamus, the brain processes the signal. The hypothalamus then secretes related hormones into the pituitary gland. These hormones from the hypothalamus direct the pituitary gland to release still other specific hormones as the response to the signal. The pituitary gland sends hormones into the bloodstream.

Hormones in the blood command glands throughout the body to perform their jobs. They secrete their specific hormones to affect certain organs and tissues.

The Pituitary Gland



Hormones Secreted by the Pituitary Gland

The pituitary gland releases hormones needed for both immediate body functions and long-term development.

Throughout a person's life, the pituitary gland releases hormones to do the following:

- regulate blood pressure
- regulate the function of the thyroid gland
- convert food into energy usable by cells
- regulate the movement of water throughout the body
- regulate temperature
- relieve pain

In infancy, childhood, adolescence, or adulthood, the pituitary gland releases hormones necessary for that stage of life. Pituitary hormones also prepare the body for the next stage of life, such as prompting bone growth in infants or the development of reproductive organs in adolescents.

As children turn into adolescents and adolescents into adults, the pituitary gland releases hormones related to the following:

- gender-specific changes during puberty
- pregnancy and childbirth
- milk production in mothers after they give birth

The Adrenal Glands

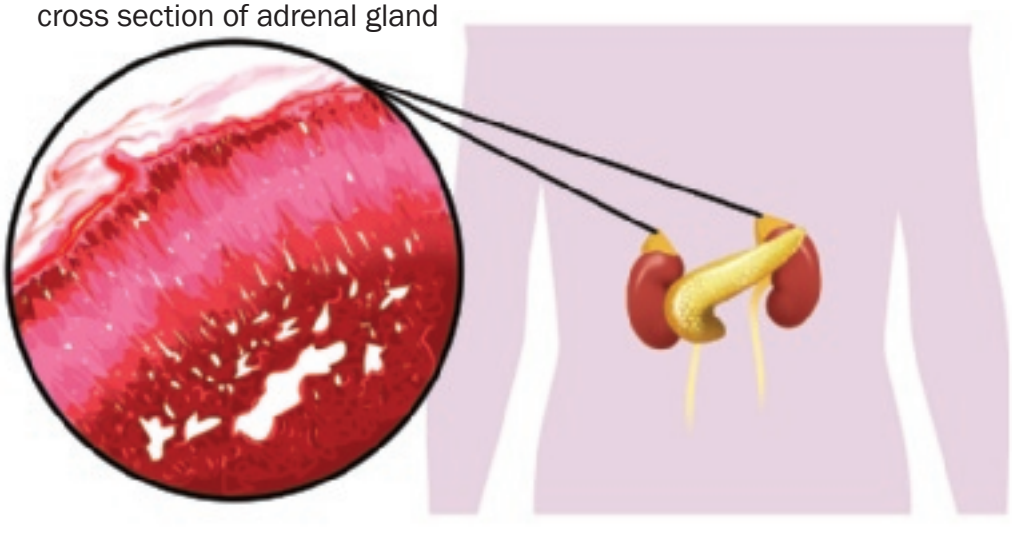
Vocabulary

adrenal gland, n. the gland that produces adrenaline and other hormones related to heart rate, blood pressure, and metabolism

Adrenal glands are located above each kidney. Being located so close to the kidneys, where blood is cleansed, means that hormones secreted by the adrenal glands get to the bloodstream quickly. Adrenal glands produce adrenaline, the hormone that stimulates the "fight or flight" reaction that you read about previously.

But the function of the adrenal glands involves more than producing hormones to help you respond to lions. Many of the hormones secreted by the adrenal glands work to regulate metabolism and a healthy body.

cross section of adrenal gland



Hormones Secreted by the Adrenal Glands

The adrenal gland has three zones inside, each of which produces different hormones that perform different functions.

The outermost zone produces a hormone that helps with the long-term regulation of blood pressure.

The middle zone is the largest of the three zones and is where adrenaline is produced. Other hormones produced in this zone perform the following functions:

- regulate blood volume and mineral balance
- regulate the rate at which the body processes fats, proteins, and sugars
- help reduce inflammation

The innermost zone produces hormones related to male characteristics.

Words to Know

A *reaction* is a response to something.

Adrenaline is a hormone released by the adrenal glands.

Think About Metabolism and Hormones

Hormones control metabolism. Every person has their own metabolism. Two people can eat the same diet, yet one person may weigh more and the other may weigh less. Many factors affect their bodies' hormone release and, therefore, metabolism.

Adrenal Gland and Pituitary Disorders

Because the adrenal glands release so many different hormones, diseases of the adrenal glands can have a large number of different symptoms.

Because the pituitary gland controls the release of hormones by the other glands, any disorder that affects the pituitary gland can greatly affect the body.

The result of a pituitary disorder is the release of too much or not enough hormones. The most common causes of pituitary disorders are tumors on the gland. But other causes include head injuries and some medical treatments.

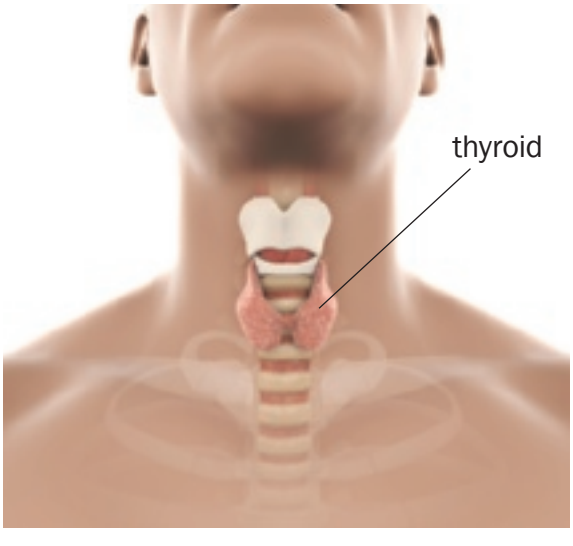
A condition called acromegaly occurs when the pituitary gland releases a much greater than average amount of growth hormone. With this condition, the hands, feet, jaw, and brow can grow larger than normal.

The Thyroid and the Pancreas

Chapter 4

The **thyroid** gland sits at the base of the neck under the Adam's apple. The thyroid produces two hormones that contain the chemical iodine, which humans need to have as part of their diet. Iodine can be found in seafood and dairy products. Iodine is also an added ingredient in iodized salt.

The thyroid stores the two hormones that it makes until it is directed by the hypothalamus to release them. When the hypothalamus receives signals to release these hormones, it sends a hormone to the pituitary, which secretes another hormone to tell the thyroid to release its hormones.



Big Question

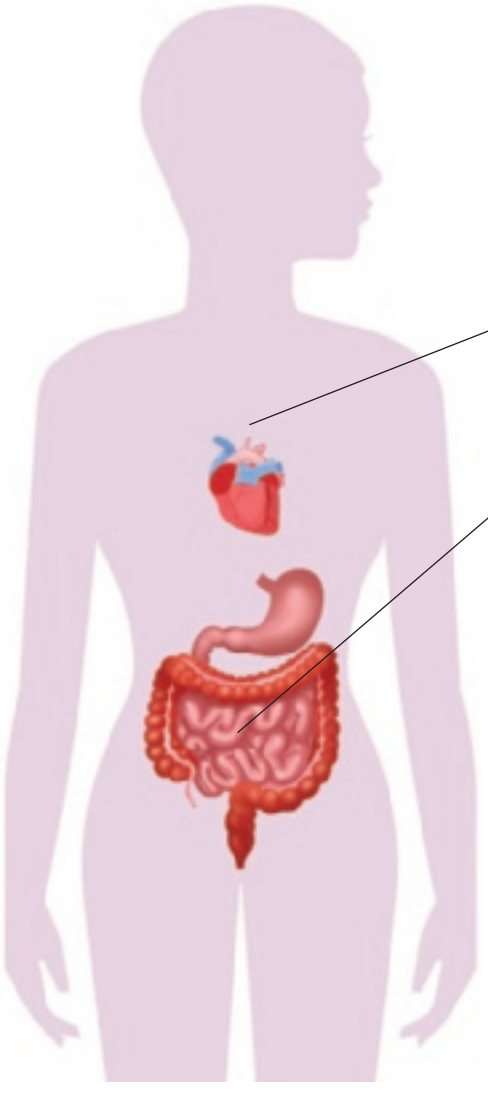
What do the thyroid and pancreas do?

Vocabulary

thyroid, n. a gland located in the front of the neck that produces hormones to control growth and metabolism

As with most substances in the body, the hypothalamus and pituitary gland work together to try to maintain balance of thyroid hormones in the body. When levels of the two thyroid hormones in the blood are too low, the pituitary directs the thyroid to release more of them. When levels of the two thyroid hormones in the blood are too high, the pituitary directs the thyroid to release less of them.

Hormones released by the thyroid affect all cells and organs and the body. These hormones do the following:

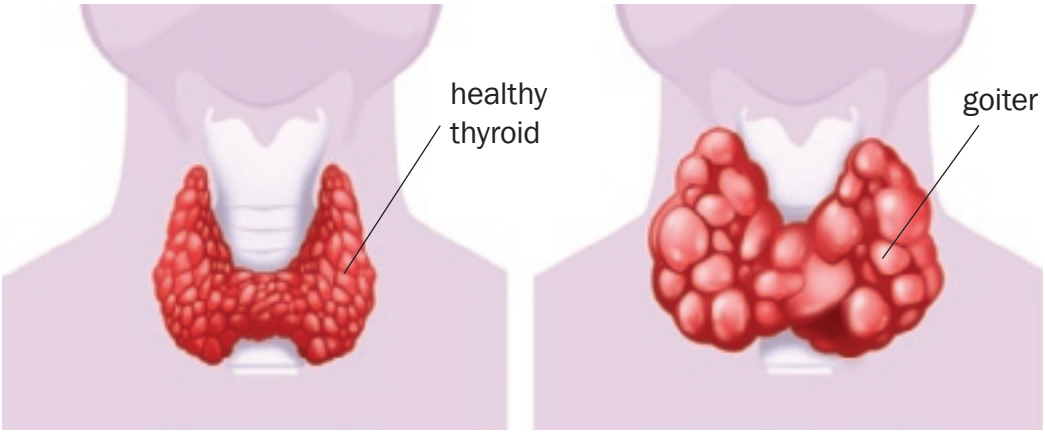


- control how fast or slow calories are burned, which affects body weight
- slow down or speed up heart rate
- affect the rate at which the intestines process food
- raise or lower body temperature
- control how muscles contract
- control the rate at which dying cells are replaced

Disorders of the Thyroid Gland

The thyroid gland can produce too much or too little of the thyroid hormones, each of which results in different symptoms.

A person who has hyperthyroidism has a thyroid that produces too much of the thyroid hormones. Symptoms of this condition can include irritability, trouble sleeping, weight loss, irregular heartbeat, and enlargement of the thyroid. An enlargement of the thyroid is called a goiter.



A person who has hypothyroidism has a thyroid that produces too little of the thyroid hormones. Symptoms of this condition can include fatigue, depression, weight gain, slow heart rate, and enlargement of the thyroid.

The conditions that underly both disorders can be treated with medicines, radiation, and surgery.

Words to Know

The prefix *hyper-* means high or above normal. The prefix *hypo-* means low or below normal.

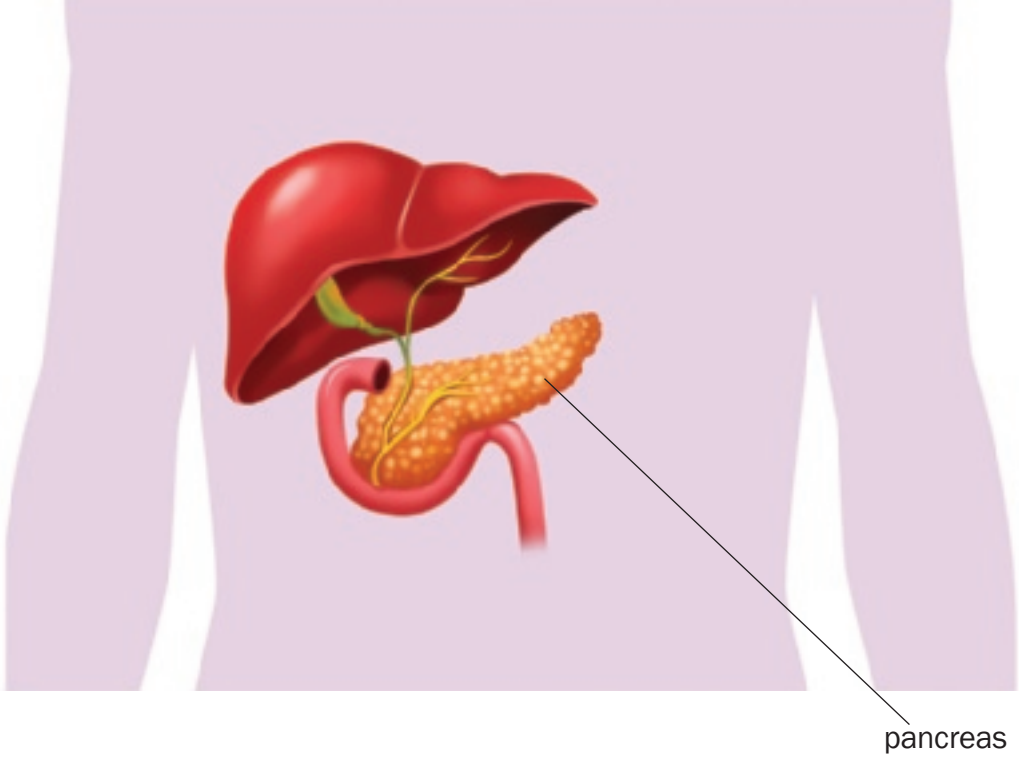
The Pancreas

The **pancreas** is located in the abdomen behind the stomach and below the liver. It is part of both the endocrine and digestive systems. As a digestive organ, the pancreas produces enzymes that break down carbohydrates, fats, and proteins during digestion.

Vocabulary

pancreas, n. organ that produces insulin and other hormones and fluids related to metabolism and digestion

As a gland, the pancreas secretes hormones directly into the bloodstream. The two main hormones produced by the pancreas are insulin and glucagon. Insulin acts to regulate the metabolism of cells by lowering blood sugar levels. Glucagon acts to regulate the metabolism of cells by raising blood sugar levels and fatty acid levels.



Insulin and Glucagon

Sugar from food is broken down and released to the bloodstream, which transports the sugar to the body's cells for use for energy. Blood sugar rises sharply after meals. Sugar in the blood signals the pancreas to release insulin, which directs cells to allow the blood sugar to enter. Insulin thus controls the absorption of blood sugar into fat, liver, and bone cells.

When sugar in the bloodstream gets low, the pancreas releases glucagon to raise it again. Along with some other hormones, glucagon breaks food molecules down, making the energy and chemical building blocks from food usable by cells.

As a result of glucagon release, levels of sugar and useful fatty acids in the blood increase. The blood sugar is used immediately for energy to support body functions. The fatty acids can be used for energy as well or can be used as building blocks for making cells.

While glucagon acts to break down molecules for use in the body, insulin acts to build up the body. The two hormones produce a feedback loop.

Normal Blood Sugar Levels	
Blood sugar level is measured in milligrams per deciliter (mg/dL).	
Before meals	80 to 130 mg/dL
Two hours after meals	less than 180 mg/dL
Age and personal health affect the ideal blood sugar levels for individuals.	

Disorders of the Pancreas

Some people's bodies do not produce the right amount of insulin. This is a condition called diabetes. There are two main types of diabetes.

Word to Know

Diabetes is a condition in which the body does not make enough insulin or the body cannot use the insulin it does make.

Type 1 diabetes occurs when the body doesn't make insulin. Type 1 diabetes is also sometimes called juvenile diabetes, because it can occur in children. It is the rarer type, affecting only 5–10 percent of people with diabetes. Without insulin to release blood sugar to cells, the body cannot survive. So people with type 1 diabetes must have insulin injections to live. People with type 1 diabetes and some people with type 2 diabetes can wear small pumps that measure and inject insulin into their bloodstream.

Type 2 diabetes occurs when the body has trouble using insulin and cannot keep blood sugar at normal levels. It is the more common condition, affecting 90–95 percent of people with diabetes. People with type 2 diabetes need to test their blood sugar levels to make sure they are normal. Type 2 diabetes tends to develop over time, so more adults are diagnosed with it. Eating healthy foods and being active can prevent or delay the onset of type 2 diabetes.

Human Adolescence

Chapter 5

Every human goes through a developmental stage between being a child and becoming an adult. This stage, called **puberty**, usually starts one to three years before age thirteen. A girl or boy undergoing these changes is an **adolescent**.

Changes during puberty prepare the body to reproduce. To reproduce, male and female bodies need to undergo changes. This development starts when the pituitary gland initiates the release of sex hormones. In females, the main sex hormones are estrogen and progesterone. In males, the main sex hormone is testosterone.

In addition to causing maturation of the reproductive organs, the sex hormones also produce secondary sex characteristics, such as body hair and a more adult body shape. One side effect of sex hormones that adolescents might experience is mood swings. The release of sex hormones can vary a lot, which can lead to adolescents experiencing new emotions.

Big Question

What are puberty and adolescence?

Vocabulary

puberty, n. the onset of changes to the human body that result in the ability to reproduce

adolescent, n. a young person in the development stage between childhood and adulthood

Word to Know

Adolescence is the period between childhood and adulthood.

Puberty in Females

Girls commonly start to experience puberty around the age of eleven. Rarely, early signs of puberty in girls can appear around the age of eight. Most, but not all, girls have started to experience puberty by the age of thirteen. Puberty lasts about two to five years depending on the girl. On the way to adulthood, each girl experiences different changes at different times and for different amounts of time.

Early Signs of Female Puberty

The breasts start to develop. After about four years, the breasts will stop growing. The function of the breasts is to produce milk once a baby is born.

Hair starts to grow in more places on the body, especially the arms, legs, and pubic area. During puberty, hair often grows thicker, too.

The body goes through growth spurts as it begins to grow taller and put on more weight. Some of the weight is additional muscle mass, and some is more body fat. As with growth of breasts, additional body fat is a body function in support of reproduction.

pre-puberty female

Later Signs of Female Puberty

As the adolescent body creates more hair, generates more heat as part of growth, and goes through more emotions, it sweats more to cool off. With more sweat and more hair, the body tends to release more oils.

Skin changes can lead to acne. Acne is a skin condition caused by pores becoming plugged. The best treatment for acne is to keep the skin clean. But changing skin conditions can lead to blemishes even with good cleanliness.

post-puberty female

At the End of Puberty

Breasts will be closer in size to their adult size.

The genitals and other reproductive organs will be fully developed and ready for reproduction.

The body stops growing taller, though young women can grow another inch or two in early adulthood.

The hips grow wider and the waist narrower. This body shape supports the ability of a baby to be born through the birth canal.

Puberty in Males

Boys typically start to experience puberty around age ten. Early signs of puberty in boys can occasionally appear around age nine. Most boys, but not all, have started to experience puberty by age fourteen. Puberty lasts about two to five years depending on the boy. On the way to adulthood, each boy experiences different changes at different times and for different amounts of time.

Early Signs of Male Puberty

Cells inside the testes start to develop into sperm, and the testes get larger to store the sperm. Males produce sperm from puberty to death.

Hair starts to grow in more places on the body, especially the arms, legs, and pubic area. During puberty, hair often grows thicker, too.

The body goes through growth spurts, becoming taller and putting on weight. Much of the weight is additional muscle mass. Boys' bodies start to develop leaner muscle.

pre-puberty male

Later Signs of Male Puberty

Boys' voices deepen, but as this development occurs, their voices can sound deeper one minute and higher the next.

Boys' breasts can swell slightly as their bodies start to develop chest muscles.

As the adolescent boy's body creates more hair, generates more heat, and goes through more emotions, it sweats more to cool off. With more sweat and more hair, the body tends to release more oils. Adolescent boys need to bathe more frequently to manage body odor.

Skin changes can lead to acne, a skin condition caused by pores becoming plugged. The best treatment for acne is to keep the skin clean. Changing skin conditions can lead to blemishes in spite of good cleanliness.

post-puberty male

At the End of Puberty

Boys develop facial hair.

The genitals and other reproductive organs will be fully developed and ready for reproduction.

The body stops growing taller, though young men can grow another few inches over the first years of adulthood.

Things to Remember About Puberty

Adolescence, that time between being a child and becoming an adult, is when your body and life will go through some distinct changes. Some unpleasant parts of being a teenager, like acne, will pass with time. Physically, you will be different than you were when you were a child, but you will still be you.

Not every part of your body will grow at the same rate, so you might notice some new things about your body for a while. For example, one foot might grow faster than the other, making one shoe feel looser and the other feel tighter. Over the period of adolescence, body parts changing at different rates will catch up with each other.

Biologically speaking, puberty is the life phase where the body develops so humans can produce more humans. Puberty is also the point when you will start feeling more emotions, and it's not uncommon for it to feel like your emotions are out of control. Talking with people you trust can help you sort out your feelings.

The Reproductive System

Chapter 6

After adolescence, you are an **adult** biologically. Socially, however, there's more to learn and experience before you are emotionally mature. Some of the things that adults do, like living independently and caring for others, are still a distance in the future.

However, the end of puberty results in the fully developed **reproductive system**. Reproduction is the process by which organisms make new young of their type. Once a human body has been through puberty, it is capable of contributing to the reproduction of another human being.

Big Question

What are the parts of the human reproductive system, and how do they function?

Vocabulary

adult, n. a fully developed and mature human

reproductive system, n. the organs and structures that function to produce offspring

Female Reproductive System

A woman's reproductive system produces sex cells, eggs, for fertilization. And once an egg is fertilized, her body provides the place, called the uterus or womb, where a baby can develop.

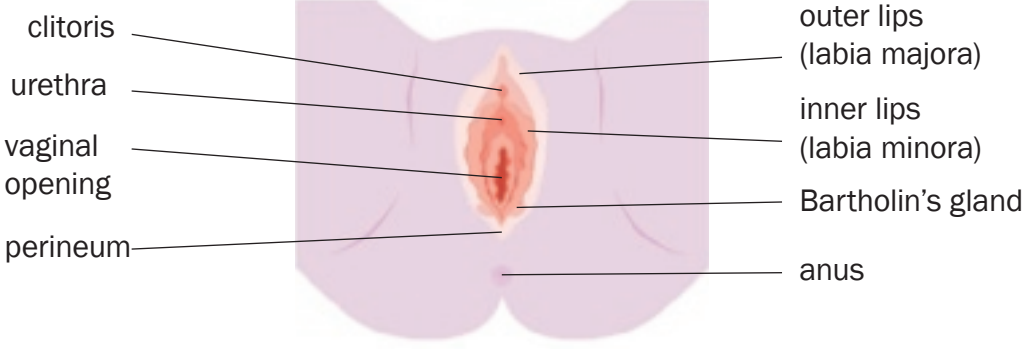
Vocabulary

female, n. the sex that produces eggs and bears young

Most of the physical structure of the female reproductive system is located inside the body. The part of the female reproductive system located outside the body is the vulva. The vulva is the area between the legs towards the front of the body.

Some of the parts of the vulva are the following:

- Inner and outer labia (lips) help cover the opening to the vagina. Inner and outer labia can be all different sizes and shapes.
- The clitoris is a small structure where the inner labia meet. This is the portion of the clitoris outside of the body. Inside the body, it is about one inch long. It is made up of a lot of nerves and can be sensitive.
- The urethra is the opening where urine leaves the body. The labia cover the urethra.
- The opening of the vagina leads to the cervix and then to internal structures of the female reproductive system.



The ovaries are glands that only females have. Depending on the time of life, ovaries do the following:

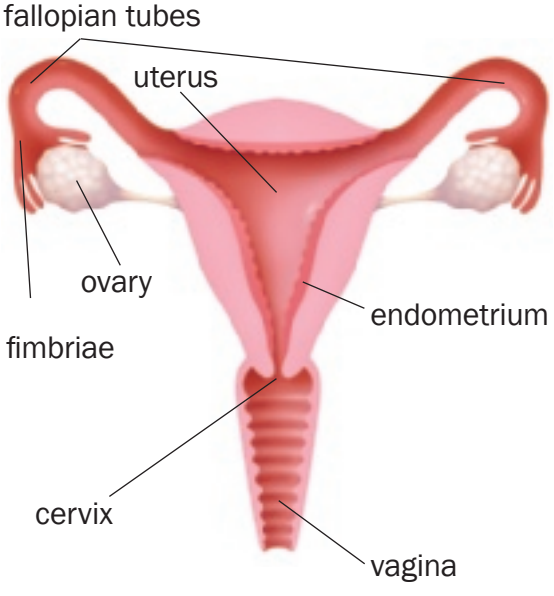
- release hormones that trigger development of secondary sex characteristics
- regulate hormones that play a role in pregnancy and fertilization
- release sex cells (eggs) once a month

The fallopian tubes connect the ovaries to the uterus. The tubes are lined with tiny hairs capable of back and forth movement. Once an ovary releases an egg, the egg is moved along by these hairs to the uterus.

Once an egg is released and fertilized, it attaches to the wall of the uterus. As the fertilized egg develops into a baby, substances needed for growth, such as oxygen and nutrients, pass through the wall to the developing baby. The uterus opens to the vagina through the cervix.

The vagina is a canal that connects the uterus to the outside of the body. The vagina serves as the path for the following:

- the introduction of male sex cells into the uterus
- the baby to leave the body during childbirth
- unfertilized eggs and material to leave the body during menstruation



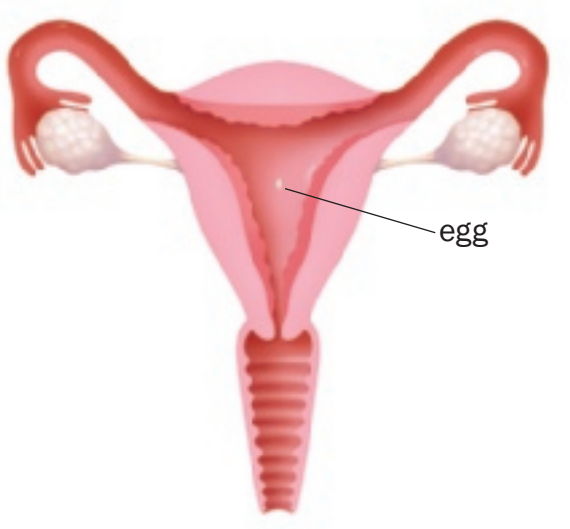
Menstruation

Menstruation is a cycle the female reproductive system goes through about every twenty-eight days. Females start to experience menstruation around the age of twelve, and the cycles stop by fifty-five, when some hormone levels drop.

The cycle begins when female hormones released by the ovaries cause the uterus to develop a thick lining. The lining thickens in preparation for the attachment of a fertilized egg. Hormones also trigger the development of new eggs. This phase takes about five days.

After about two weeks, a new egg is released. This is called ovulation. The egg travels through the fallopian tubes to the uterus. During this stage, a woman can become pregnant. This phase lasts about eight days.

More hormones make the lining of the uterus thicken. After about ten days, if a fertilized egg has not implanted into the wall of the uterus, the lining starts to break down.



Menstruation is the process of the uterus shedding its unused lining of blood and tissue if no pregnancy occurs. This body function is called "having a period." The uterus contracts to help push the lining out. This can cause a cramping feeling in the abdomen. Menstrual fluid, containing blood and mucus, flows out of the body through the vagina. This phase lasts about five days. After this, the body starts the cycle again.

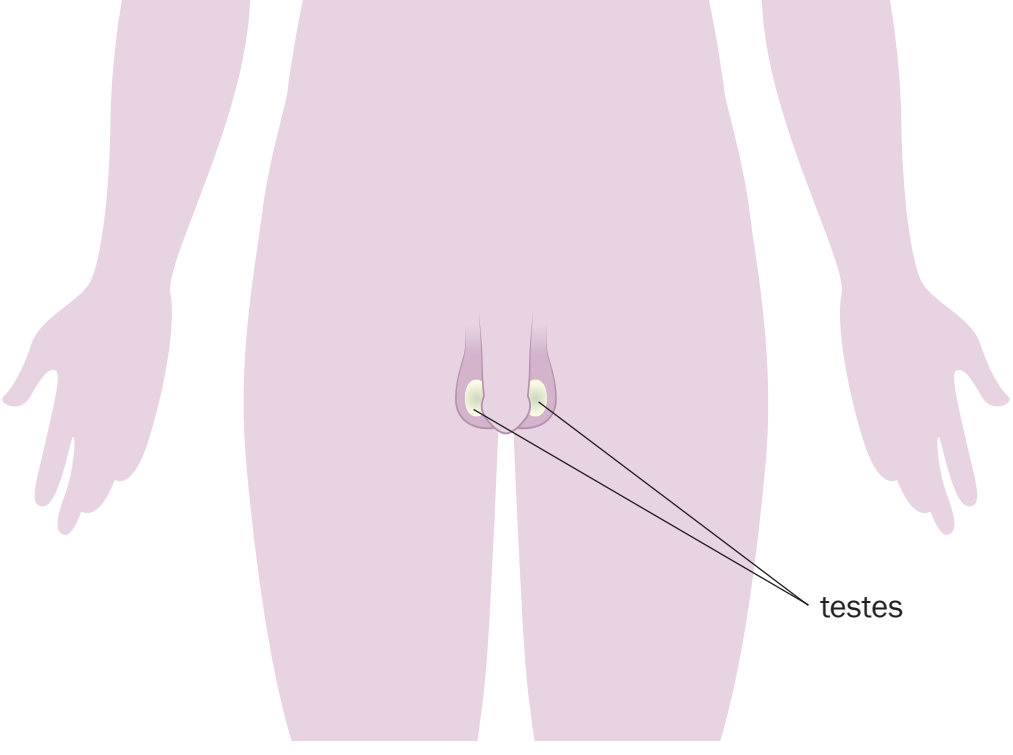
Male Reproductive System

A man's reproductive system produces sex cells for fertilization.

Physical structures of the male reproductive system are located both inside and outside the body. The penis and testes, or testicles, are external organs.

Vocabulary

male, n. the sex that has the capacity to produce sperm to fertilize female egg cells



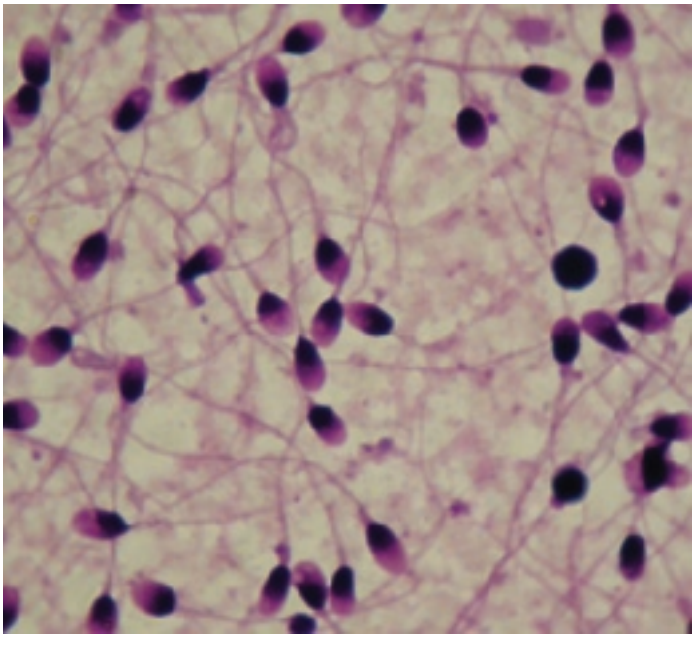
Only males have testes. Once puberty has started in a male, the testes do the following:

- release testosterone, a hormone that triggers development of secondary sex characteristics, such as a deep voice, facial hair, and bigger muscles
- produce sex cells called sperm

At around forty years of age, the body starts to produce less testosterone, though the testes will continue to produce sperm until around age seventy.

The scrotum is the pouch of skin that contains the testes. The scrotum helps regulate the temperature of the testes by raising them closer to or lowering them away from the body.

The penis has two functions, providing a pathway for removal of urine from the body and also providing a pathway for the delivery of sex cells for fertilization. Penises can be all different sizes and shapes, but they all function the same way.



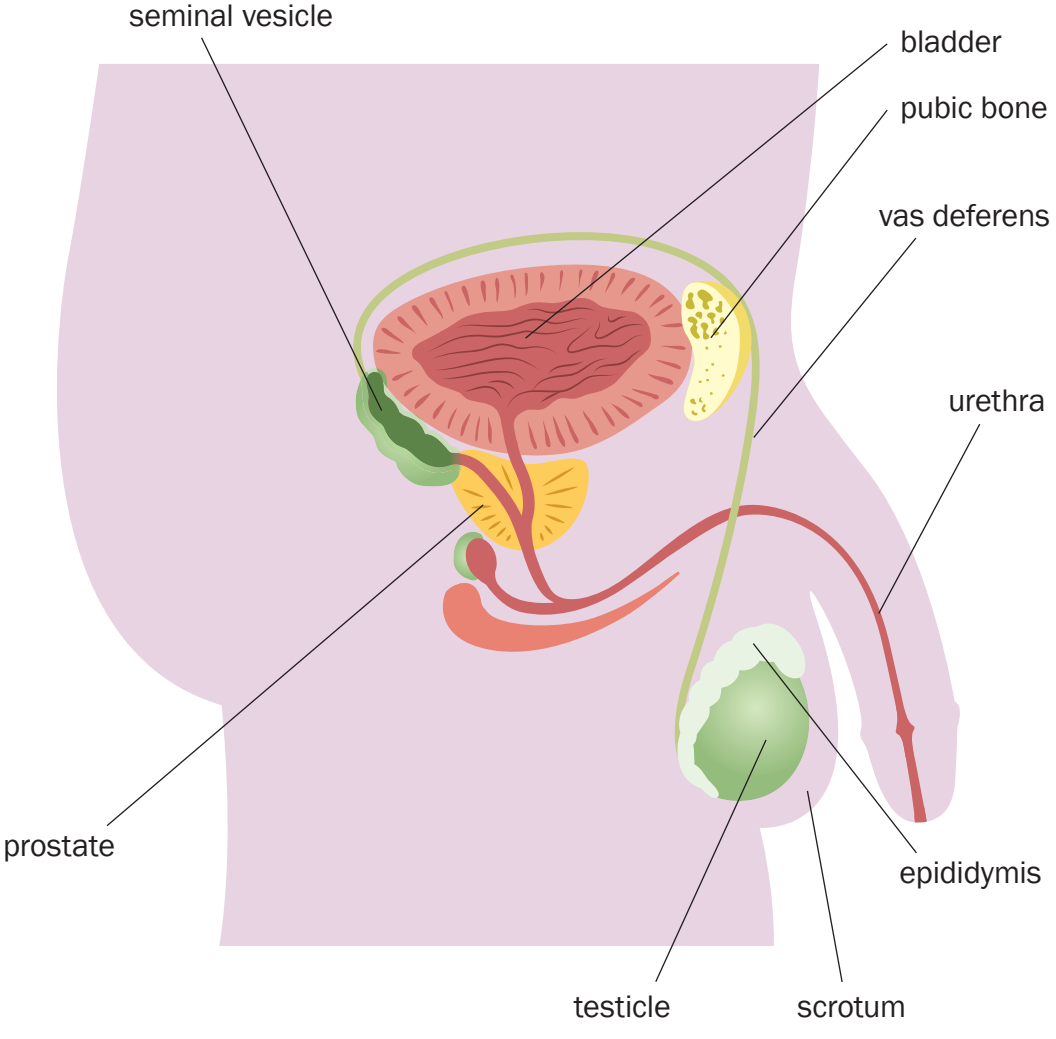
Sperm are very small. The sperm in this photo have been magnified 1000x.

Human sperm has a tail for movement which allows it so swim to the female egg.

The urethra is the passageway through the penis. When the penis is soft, urine can pass from the bladder through the urethra and out. When the penis is hard, urine flow is shut off, and only semen can flow out through the urethra.

Semen is a milky white fluid produced in the male reproductive system. Semen is made up of seminal fluid and sex cells. The function of semen is to safely transport the sex cells from the testes, through the penis, to the vagina.

The prostate is a gland that only males have. The prostate produces seminal fluid.



Sexual Reproduction

Chapter 7

Sexual reproduction is the combining of sex cells from individuals of two different sexes. For **fertilization** to occur, a female reproductive cell, an egg, must contact a male reproductive cell, a sperm. In nature, a single egg is exposed to millions of sperm at the same time. Once a single sperm has entered the egg, the two cells combine and form a zygote. The rest of the sperm die off.

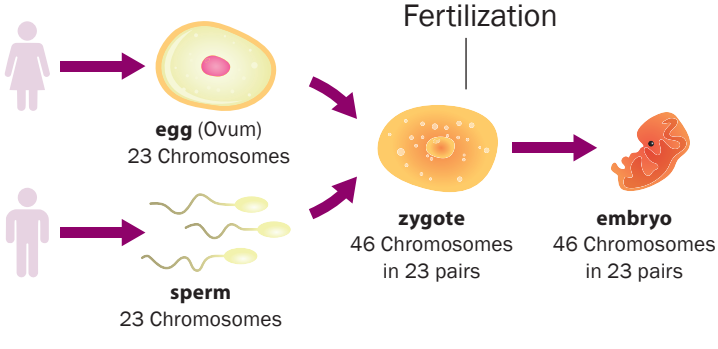
Big Question

What is sexual reproduction?

Vocabulary

fertilization, n. the process in which sex cells from a female and a male member of a species combine to produce a cell called a zygote

In humans, fertilization occurs when sperm, deposited by the penis into the vagina during intercourse, combines with the egg in the uterus. After puberty, human bodies are ready to reproduce, and intercourse can result in pregnancy. Birth control methods can be used to prevent pregnancy.



The proportions in this picture are not true to life. A human egg is about as thick as a human hair. A human sperm is about 10,000 times smaller than the egg.

Internal Fertilization

In most mammals, including humans, the new individual develops inside the body of the female.

Vocabulary

embryo, n. an organism in the earliest stages of growth and development before birth

Not all animals reproduce in this way. Most birds, fish, and reptiles reproduce by laying eggs. Some dinosaurs also reproduced this way. This method includes internal fertilization, but the female lays eggs. The **embryo** inside the shell and membranes of the egg continues to develop but outside the mother's body. In many cases, eggs with developing embryos need to be kept warm. Once it reaches a certain size, the young animal inside will break out of the shell.

A mother hen cleans her chicks as they emerge from their shells. Hatching from the shell is hard work for new chicks.

External Fertilization

Not all animals rely on internal fertilization to reproduce. Many fish and amphibians lay eggs before the eggs have been fertilized. This process is known as external fertilization.

In external fertilization, the eggs are usually released in water or moist areas. The female of a species will release a large number of eggs. Depending on the species, this can be hundreds or even thousands of eggs in one spot. After the female has laid the eggs, the male releases sperm over the eggs. The water carries the sperm all around the eggs.

The female clownfish lays a clutch of eggs on the rock. The male will then release sperm over the eggs. Both parents will keep the eggs clean and guard them as the eggs develop.

From Egg and Sperm into Baby

When an egg and a sperm combine to form a zygote, the zygote contains the information within the cells to develop another member of the same species. Although the zygotes of many animals look similar, as the zygote divides into more cells, those cells will start to produce the characteristics of their own species.

Vocabulary

pregnancy, n. the period during which a zygote develops into an embryo and then into a fetus

	Zygote	Embryo	Fetus
Chicken			
Human			
Dog			

Human Pregnancy

First Trimester

From fertilization to birth, human offspring take about nine months to develop in the mother's womb. The first three months are referred to as the first trimester.

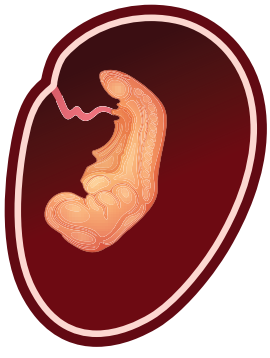
After about a day, the zygote starts dividing into many cells. After about three days, the zygote descends to the uterus and implants into the lining of the uterus wall. This causes mucus in the uterus to plug the opening from the uterus into the vagina, enclosing a safe environment for the baby to develop.

The zygote continues dividing into more cells, and by three weeks it becomes an embryo. As the embryo develops, an organ called the placenta develops. The placenta transfers nutrients to the developing baby and waste products to the mother.

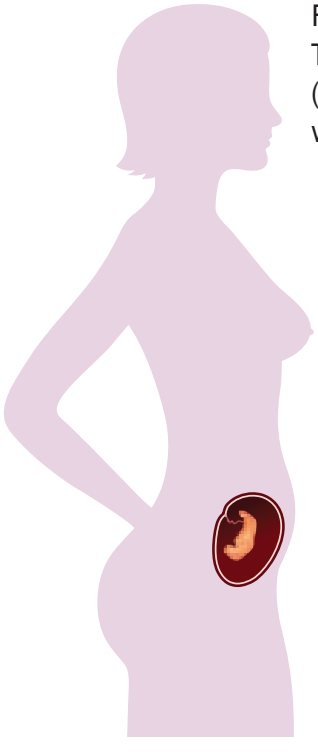
After about nine weeks, the embryo has developed all its organs, though not all of them function yet. At this stage, the developing baby is considered a **fetus**.

Vocabulary

fetus, n. a developing organism that has reached its basic structural form



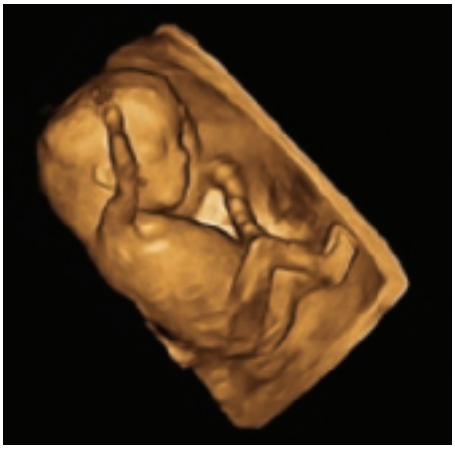
human embryo at five weeks



First Trimester (0 to 12 weeks)

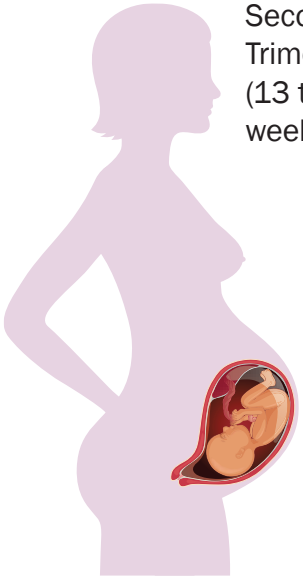
Second Trimester

The middle three months of pregnancy are the second trimester. Once the developing baby has formed all its organs, the body continues to grow and develop. During this trimester, the fetus is developed enough that the baby can be observed using ultrasound.



Doctors can use ultrasound technology to view the baby and even identify its sex.

In the first half of the second trimester, the following happen:



Second Trimester (13 to 28 weeks)

- The heartbeat of the fetus can be heard.
- The nervous system starts to work, and the fetus can interact with its environment, such as sucking a thumb.
- The features of the face are formed.
- The fetus is developing more muscles and can be felt moving around.
- Hair starts to grow on the head.
- The fetus is about ten inches long and weighs between a half and a full pound.

In the second half of the second trimester, the following is true:

- The fetus can respond to sound and light as its nervous system continues to develop.
- The fetus develops body fat.
- The fetus is about fourteen inches long and weighs between two and four pounds.

Third Trimester

The third and final trimester ends with the **birth** of a baby.

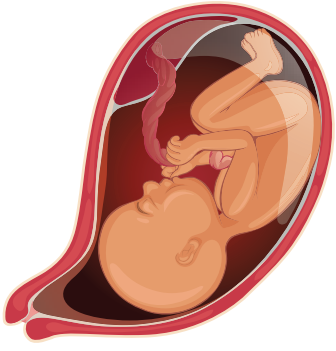
Vocabulary

birth, n. the emergence of a fetus from its mother

In the first half of the third trimester, the following is true:

- The fetus continues to grow and develop reserves of body fat.
- The fetus will kick more.
- The fetus has a set of well-developed systems, except for the lungs.

Third Trimester
(29 to 40 weeks)



In the second half of the third trimester, the following is true:

- The fetus continues to grow.
- The fetus completes the development of the lungs.
- The fetus moves less (because space is too tight in the womb).
- The fetus moves around into a position be born.

By the end of the of the third trimester, the fetus is about nineteen inches long and weighs around seven pounds. The mother can go into labor, the active process leading up to birth, anytime. Once labor starts—and it can take many hours—the baby starts to descend from the womb and through the birth canal, the vagina. Once the fetus leaves the mother's body, it is a **newborn,** a baby human.

Vocabulary

newborn, n. a recently birthed baby

Development After Birth

The period during which a baby develops before birth is called gestation. Different animals gestate for different periods of time. For example, an Indian elephant takes about twenty-two months to develop from a fertilized egg to a newborn, but a human baby takes about nine months.

A newborn human has a lot of needs and can't survive on its own. Babies need to be fed, cleaned, kept warm, and nurtured. Children need to be cared for continually by adults for many years.

A human baby can learn to crawl in a few months, but it can take well over a year for some to learn to walk. In contrast, the baby elephant will be ready to walk shortly after birth. Young of each species are born needing different amounts of continuing care from their parents. When humans reproduce, they need to care for their children for a long time.

Glossary

A

adolescent, n. a young person in the development stage between childhood and adulthood

adrenal gland, n. the gland that produces adrenaline and other hormones related to heart rate, blood pressure, and metabolism

adult, n. a fully developed and mature human

B

birth, n. the emergence of a fetus from its mother

E

embryo, n. an organism in the earliest stages of growth and development before birth

endocrine system, n. the glands and body structures that create and control the metabolic activity of a body

F

female, n. the sex that produces eggs and bears young

fertilization, n. the process in which sex cells from a female and a male member of a species combine to produce a cell called a zygote

fetus, n. a developing organism that has reached its basic structural form

G

gland, n. a body organ that makes substances used by the body

growth, n. the life process of becoming bigger and stronger

H

homeostasis, n. the balanced functional state of the body's systems to maintain life

hormone, n. a substance made in the body that produces effects in other cells or tissues in the body

hypothalamus, n. region of the brain that produces and releases hormones that regulate many body functions

M

male, n. the sex that has the capacity to produce sperm to fertilize female egg cells

mature, adj. fully developed (v. to develop and become full-grown)

metabolism, n. the combined chemical and energy processes that occur continuously in a living body

N

newborn, n. a recently birthed baby

P

pancreas, n. organ that produces insulin and other hormones and fluids related to metabolism and digestion

pituitary gland, n. the master gland that produces hormones that control other glands

pregnancy, n. the period during which a zygote develops into an embryo and then into a fetus

puberty, n. the onset of changes to the human body that result in the ability to reproduce

R

reproductive system, n. the organs and structures that function to produce offspring

T

thyroid, n. a gland located in the front of the neck that produces hormones to control growth and metabolism

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