

# The Reproductive System

The human reproductive system is a system by which humans reproduce and bear live **offspring**. Provided all organs are present, normally constructed, and functioning properly, the essential features of human reproduction are (1) **liberation** of an **ovum**, or egg, at a specific time in the reproductive cycle, (2) **internal fertilization** of the ovum by **spermatozoa**, or sperm cells, (3) transport of the fertilized ovum to the **uterus**, or **womb**, (4) implantation of the **blastocyst**, the early **embryo** developed from the **fertilized egg**, in the wall of the uterus, (5) formation of a **placenta** and maintenance of the unborn child during the entire period of **gestation**, or **pregnancy** (6) birth of the child and **expulsion** of the placenta, and (7) **suckling (breast-feeding)** and care of the child, with an eventual return of the maternal organs to their original state.

For this biological process to be carried out, certain organs and structures are required in both the male and the female. The source of the ova (the female germ cells) is the **female ovary**; that of spermatozoa (the male germ cells) is the **testis**. In females, the two ovaries are situated in the pelvic cavity; in males, the two testes are enveloped in a sack of skin, the **scrotum**, lying below and outside the abdomen. Besides producing the **germ cells**, or **gametes**, the ovaries and testes are the source of hormones that cause full development of secondary sexual characteristics and also the proper functioning of the reproductive tracts. These tracts comprise the **fallopian tubes**, the uterus, the **vagina**, and associated structures in females and the **penis**, the **sperm channels** (epididymis, ductus deferens, and ejaculatory ducts), and other related structures and glands in males. The function of the fallopian tube is to convey an ovum, which is fertilized in the tube, to the uterus, where gestation (development before birth) takes place. The function of the male ducts is to convey spermatozoa from the testis, to store them, and, when ejaculation occurs, to eject them with secretions from the male glands through the penis.

At copulation, or sexual **intercourse**, the erect penis is inserted into the vagina, and spermatozoa contained in the seminal fluid (semen) are ejaculated into the female genital tract. Spermatozoa then pass from the vagina through the uterus to the fallopian tube to fertilize the ovum in the outer part of the tube. Females exhibit a periodicity in the activity of their ovaries and uterus, which starts at puberty and ends at the menopause. The periodicity is manifested by menstruation at intervals of about 28 days; important changes occur in the ovaries and uterus during each reproductive, or menstrual, cycle. Periodicity, and subsequently menstruation, is suppressed during pregnancy and **lactation**.

## Development of the reproductive organs

The sex of a child is determined at the time of fertilization of the ovum by the spermatozoon. The differences between a male and a female are genetically determined by the chromosomes that each possesses in the nuclei of the cells. Once the genetic sex has been determined, there normally follows a succession of changes that will result, finally, in the development of an adult male or female. There is, however, no external indication of the sex of an embryo during the first eight weeks of its life within the uterus. This is a neutral or **indifferent stage** during which the sex of an embryo can be ascertained only by examination of the chromosomes in its cells.

The next phase, one of differentiation, begins first in **gonads** that are to become testes and a week or so later in those destined to be ovaries. Embryos of the two sexes are initially alike in possessing similar duct systems linking the undifferentiated gonads with the exterior and in having similar external genitalia, represented by three simple **protuberances**. The embryos each have four ducts, the subsequent fate of which is of great significance in the eventual anatomical differences between men and women. Two ducts closely related to the developing urinary system are called **mesonephric**, or **wolffian ducts**. In males each mesonephric duct becomes differentiated into four related structures: a **duct of the epididymis**, a **ductus deferens**, an **ejaculatory duct**, and a **seminal vesicle**. In females the mesonephric ducts are largely suppressed. The other two ducts, called the **paramesonephric or müllerian ducts**, persist, in females, to develop into the fallopian tubes, the uterus, and part of the vagina; in males they are largely suppressed. Differentiation also occurs in the primitive external genitalia, which in males become the penis and scrotum and in females the **vulva** (the clitoris, labia, and vestibule of the vagina).

At birth the organs appropriate to each sex have developed and are in their adult positions but are not functioning. Various abnormalities can occur during development of sex organs in embryos, leading to hermaphroditism, pseudohermaphroditism, and other chromosomally induced conditions. During childhood until puberty there is steady growth in all reproductive organs and a gradual development of activity. Puberty marks the onset of increased activity in the sex glands and the steady development of **secondary sexual characteristics**.

In males at puberty the testes enlarge and become active, the external genitalia enlarge, and the capacity to ejaculate develops. Marked changes in height and weight occur as hormonal secretion from the testes increases. The larynx, or voice box, enlarges, with resultant deepening of the voice. Certain features in the skeleton, as seen in the pelvic bones and skull, become accentuated. The hair in the **armpits** and the **pubic hair** become abundant and thicker. Facial hair (**beard**) develops, as well as hair on the chest, abdomen, and **limbs**. Hair at the **temples** recedes. Skin glands become more active, especially **apocrine glands** (a type of sweat gland that is found in the armpits and groin and around the anus).

In females at puberty, the external genitalia enlarge and the uterus commences its periodic activity with menstruation. There is a deposition of body fat in accordance with the usual contours of the mature female. Growth of axillary (armpit) and pubic hair is more abundant, and the hair becomes thicker.

## Disorders

Many disorders can affect the male and female reproductive systems, preventing them from functioning properly. These conditions can range from mild to moderate to severe. Some are life-threatening.

**Benign prostatic hyperplasia (BPH)** is a condition in men that affects the prostate gland, which is part of the male reproductive system. The prostate is located at the bottom of the bladder and surrounds the urethra. BPH is an enlargement of the prostate gland that can interfere with urinary function in older men. It causes blockage by squeezing the urethra, which can make it difficult to urinate. Men with BPH frequently have other bladder symptoms including an increase in frequency of bladder emptying both during the day and at night. Most men over age 60 have some BPH, but not all have problems with blockage. There are many different treatment options for BPH.

**Sexually transmitted diseases** (also called STDs or **venereal diseases**) are infections transmitted through various forms of sexual activity. More than twenty-five STDs exist, caused by many different organisms. STDs can cause birth defects, blindness, brain damage, cancer, heart disease, infertility, mental retardation, and death.

Symptoms of STDs vary according to the virus or bacteria causing the disease and the body system affected. In general, a woman who has an STD may bleed when she is not menstruating. She may also have an abnormal vaginal discharge. In addition, vaginal burning, itching, and odor are common. A man afflicted with an STD may have a discharge from the tip of his penis. Urinating may also cause a painful or burning sensation. Both women and men may develop skin rashes, sores, bumps, or blisters near the mouth, genitals, or anal area.

**AIDS (acquired immune deficiency syndrome)** is perhaps the most deadly and frightening STD. It is caused by the human immunodeficiency virus or HIV. The virus is transmitted between humans in blood, semen, and vaginal secretions. The two main ways to contract the virus are by sharing a needle with a drug user who is HIV-positive (infected with the virus) or by having unprotected sexual relations with a person who is HIV-positive.

Other common and potentially serious STDs include the following:

**Chlamydia** is caused by a microscopic organism that lives as a parasite in human cells. It is transmitted through vaginal intercourse. A common symptom for both men and women is frequent and painful urination. The disease can be successfully treated with antibiotics.

**Genital herpes** is an incurable infection caused by a virus that is similar to the one responsible for cold sores. The infection is marked by the formation of fluid-filled, painful blisters in the genital area. The virus stays in the body for

life. It can be transmitted by oral and vaginal intercourse. Drugs are available to lessen symptoms and reduce outbreaks of the disease.

**Genital warts**, also called venereal warts, are caused by a virus that produces growths (warts) on the skin. In women, the growths occur on the genitals and on the walls of the vagina and cervix. In men, they develop in the urethra and on the shaft of the penis. The disease is transmitted by sexual contact. In addition to the visible warts, bleeding, pain, and odor are common symptoms. No treatment for genital warts is completely effective because it is necessary to destroy the skin infected by the virus.

**Gonorrhea**, commonly referred to as "the clap," is a highly contagious STD caused by bacteria. It is transmitted through vaginal and anal intercourse. In men, the disease begins as an infection of the urethra. In women, it will most likely infect the cervix. If left untreated, the disease can travel through the reproductive tract (causing sterility) and spread to the bloodstream, infecting the brains, heart valves, and joints. Symptoms of the disease in women include bleeding between menstrual periods, painful urination, abdominal pain, and a cloudy and yellow vaginal discharge. Symptoms in men include painful and frequent urination and a thick, cloudy discharge from the penis. Gonorrhea is usually treated with a variety of antibiotics, but the bacteria that cause it are developing an increased resistance to routine medications.

**Syphilis** is an infectious disease caused by a coil-shaped bacterium. Spread by vaginal and anal intercourse, syphilis has been a public health problem since the sixteenth century. It currently affects an estimated 50 million people worldwide. The earliest symptom in both women and men is a chancre sore in the mouth or on the genitals. The fluid in the sore is very infectious. Lymph nodes near the chancre swell in most people afflicted with the disease. As syphilis progresses, lymph nodes in the armpits, groin, and neck areas may also swell and skin lesions may erupt. If not treated, syphilis may cause damage years later to the heart and blood vessels, lungs, and central nervous system. The disease is usually treated with sufficiently large doses of antibiotics such as penicillin.

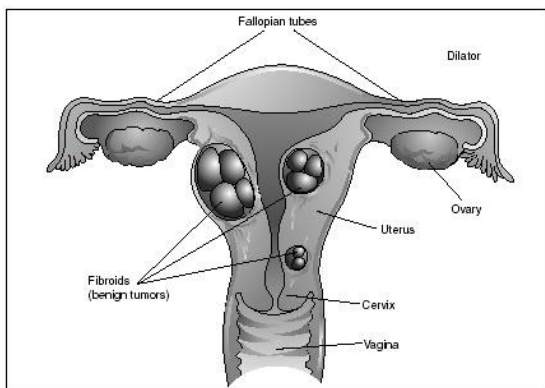
Other reproductive system disorders include the following:

**Vaginal yeast infections**, caused by a species of yeast found in virtually all normal people, are common infections in women. While not serious, they can be uncomfortable and irritating until treated.

**Impotence**, a condition in which a man is unable to maintain an erection, may be due to some physical or psychological problem. Again, this disorder does not threaten life, but it is a cause of concern to a man (and to his spouse or partner) as it prevents him from engaging in sexual intercourse.

**Uterine fibroids**, also called **myomas**, are benign (nonthreatening) growths of the muscle in the uterus. They are not cancerous, nor are they related to cancer. Uterine fibroids are extremely common. They usually develop in women between the ages of thirty and fifty. About 25 percent of the women in this age group have noticeable fibroids.

No one knows exactly what causes fibroids, which grow in three locations: in the uterine cavity, on the wall of the uterus, and on the outside of the uterus. Not all fibroids cause symptoms, but when they do, the symptoms include the following: heavy uterine bleeding, pelvic pressure and pain, and complications during pregnancy.



Even fibroids that do cause symptoms may not require treatment. When the fibroids grow large enough to cause serious problems, surgery may be necessary. The only real cure for fibroids is the surgical removal of the uterus, a procedure called a hysterectomy. If only the fibroids are removed and the uterus is repaired and left in place, the surgical procedure is called a myomectomy.

Uterine fibroids cannot be prevented. Luckily, many women who have fibroids have either no symptoms or only minor symptoms. Unfortunately, fibroids tend to grow over time, and many women ultimately decide to have some form of treatment.

The following are some of the most serious diseases and disorders that can afflict the reproductive system. The organs of the male and female reproductive systems are often sites where tumors or other growths develop.

### **Breast cancer**

Breast cancer develops when cells of the breast become abnormal and grow uncontrollably, forming tumors. The cancer cells can invade and destroy surrounding tissue, then spread throughout the body by way of the blood or lymph vessels. Every woman is at risk for breast cancer. Regardless of family history, a woman's risk for developing this type of cancer increases as she ages. In fact, 80 percent of all breast cancers are found in women over the age of fifty.

A woman's chance for developing breast cancer increases if her mother or sister have had breast cancer, if she has gone through menopause late in life, if she did not breastfeed her children, or if she did not have children or had them late in life. However, more than 70 percent of women who get breast cancer have none of these risk factors.

The following are all indications of possible breast cancer: a lump in the breast, changes in the nipple of the breast, dimpled or reddened skin over the breast, and change in size or shape of the breast.

Breast cancer is detected by mammography (a low-dose X-ray of the breast). It is recommended that women between the ages of forty-five and sixty-nine have a mammogram done once in two years. Treatment options for breast cancer include surgery, chemotherapy, and radiation. During surgery, surgeons may remove only a portion of a woman's breast, her entire breast and some underarm lymph nodes, or her entire breast along with all of the underarm lymph nodes and chest muscles. The extent of the surgery depends on the type of breast cancer, whether the disease has spread, and the woman's age and health. After the cancer has been removed, the physician may recommend the woman undergo chemotherapy (using a combination of drugs to kill any remaining cancer cells and shrink any tumors) or radiation therapy (using X-rays or other high-energy rays to kill any remaining cancer cells and shrink any tumors) or a combination of both.

Breast cancer cannot be prevented, but it can be treated successfully if diagnosed from a mammogram at an early stage.

### **Ovarian cancer**

Ninety percent of all ovarian cancers develop in the cells that line the surface of the ovaries. The death rate due to this cancer is higher than that of any other cancer among women. Ovarian cancer can develop at any age, but more than half the cases occur in women who are sixty-five or older. It is difficult to diagnose ovarian cancer early because often there are no warning symptoms. Also, the disease spreads relatively quickly.

The actual cause of ovarian cancer is not known. In the early stages of ovarian cancer, there may be no noticeable symptoms. Later, a woman may experience pain or swelling in the abdomen, constipation, vomiting, loss of appetite, fatigue, and unexplained weight gain.

If cancer is detected, surgery is the main treatment. The type of surgery depends on the extent of the disease. In most cases, the ovaries, uterus, and fallopian tubes are completely removed. In rare cases, only one ovary may be removed with the uterus and fallopian tubes left intact. After surgery, chemotherapy is usually administered.

### **Prostate cancer**

Prostate cancer is found mainly in men over the age of fifty-five. As men grow older, the chance of developing the disease increases. Although the cause of this type of cancer is unknown, evidence suggests that age, race, a high-fat diet, and increased blood levels of testosterone may play a part in the development of the disease.

Frequently, prostate cancer has no symptoms. When the tumor is enlarged or the cancer has spread, the following symptoms may appear: weak or interrupted urine flow, frequent urination (especially at night), difficulty starting urination, inability to urinate, pain or burning sensation when urinating, blood in the urine, persistent pain in the lower back, and painful ejaculation.

If prostate cancer is detected (either through a rectal examination or blood test), surgery to remove the prostate gland completely is the most common treatment. The seminal vesicles are also removed during the procedure. If the prostate cancer is detected at an early stage, radiation therapy may be used instead of surgery. Chemotherapy is sometimes used to treat prostate cancer that has recurred after initial treatments.

### **Testicular cancer**

Although testicular cancer is a rare type of cancer, it often grows very quickly. It is the most common type of cancer to occur in young males under the age of thirty. The cause of testicular cancer is unknown.

This type of cancer usually shows no early symptoms. A mass in the testes usually indicates testicular cancer, but this may not be true in every case. In advanced stages of the cancer, symptoms include lower back pain, difficulty in urinating, a cough, and breathing problems. Sometimes there is pain in the testes.

If testicular cancer is discovered, surgery to remove the mass is the first line of treatment. If the cancer has spread to other parts of the body, chemotherapy or radiation therapy or a combination of both may be used following surgery.