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DSE-1BT: Developmental aspects of embryo

General concepts of reproductive system

❖ Introduction to the Reproductive System

The major function of the reproductive system is to ensure survival of the species. Other systems in the body, such as the endocrine and urinary systems, work continuously to maintain homeostasis for survival of the individual. An individual may live a long, healthy, and happy life without producing offspring, but if the species is to continue, at least some individuals must produce offspring.

To producing offspring, the reproductive system has four functions:

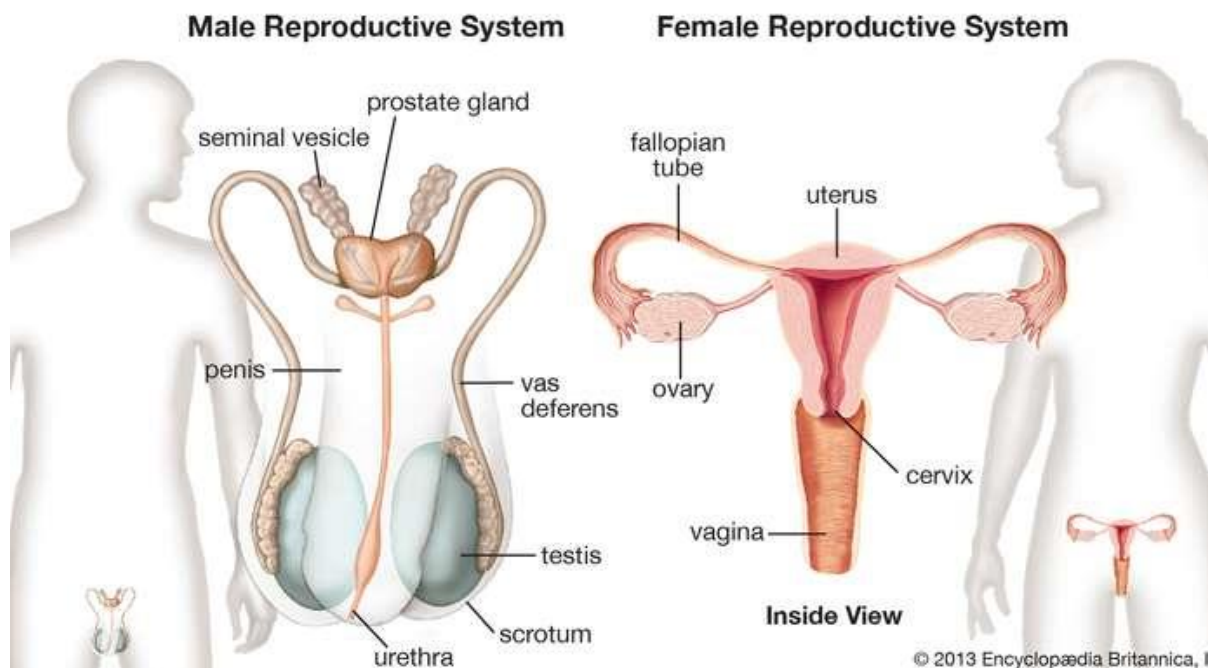
- To produce egg and sperm cells
- To transport and sustain these cells
- To nurture the developing offspring
- To produce hormones

These functions are divided between the primary and secondary, or accessory, reproductive organs. The primary reproductive organs, or gonads, consist of the ovaries and testes. These organs are responsible for producing the egg and sperm cells (gametes), and hormones. These hormones function in the maturation of the reproductive system, the development of sexual characteristics, and regulation of the normal physiology of the reproductive system. All other organs, ducts, and glands in the reproductive system are considered secondary, or accessory, reproductive organs. These structures transport and sustain the gametes and nurture the developing offspring.

❖ Definition of the reproductive system

The reproductive system is the human organ system responsible for the production and fertilization of gametes (sperm or eggs) and carrying of a fetus.

Both sexes' gonads produce gametes. A gamete is a Haploid cell that combines with another haploid gamete during fertilization, forming a single diploid cell called a zygote. Besides producing gametes, the gonads also produce sex hormones. Sex hormones are endocrine hormones that control the development of sex organs before birth, sexual maturation at puberty, and reproduction once sexual maturation has occurred. Other reproductive system organs have various functions, such as maturing gametes, delivering gametes to the site of fertilization, and providing an environment for the development and growth of an offspring.



❖ Reproductive hormones in women:

The menstrual cycle is regulated by the complex interactions of hormones produced in the hypothalamus, pituitary and ovary. FSH released from the pituitary stimulates the ovarian follicles to begin maturation and growth. Follicles are sac-like structures in the ovary containing eggs. As the follicle and egg develops, cells within the follicle produce estrogen. Follicle cells produce



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another hormone called inhibin that circulates back to the hypothalamus and pituitary to decrease the release of FSH.

The production of estrogen continues to rise under the influence of FSH as the follicle matures and increases in size. When the follicle is mature, maximum production of estrogen occurs and this signals a rapid rise in LH from the pituitary gland.

LH, along with the estrogen produced by the ovaries, helps in the maturation process of the egg. LH also triggers ovulation – the release of a mature egg from one of the follicles in the ovary. After ovulation, the follicle turns into a different structure, the corpus luteum, which produces progesterone.

Progesterone acts on the uterine lining (endometrium) causing it to thicken in preparation for implantation. Progesterone is essential for implantation and pregnancy. If implantation does not occur, the thickened endometrium will break down and be lost with menstrual bleeding.

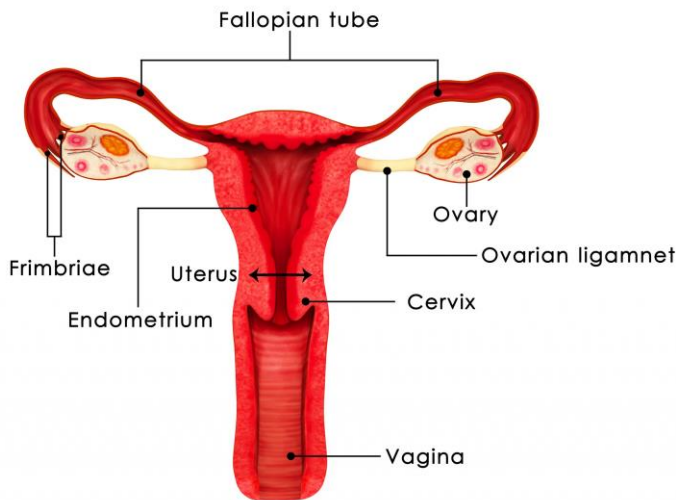
❖ Reproductive hormones in men:

In men, FSH from the pituitary gland stimulates the testes to produce sperm by a process known as spermatogenesis. LH from the pituitary gland signals the testes to produce testosterone, which enhances sperm maturation. Testosterone is the primary male sex hormone.

❖ Functions & parts of the female reproductive system:

The female reproductive system is designed to:

- Produce the eggs necessary for reproduction, called the ova (*ovum* is singular for one egg) or oocytes
- Incubate and nourish a fertilized egg until it is fully developed
- Produce female sex hormones that maintain the reproductive cycle



The female reproductive organs include:

- ◆ **Ovaries** — The ovaries are two small, oval-shaped glands located on either side of the uterus. They are home to the female sex cells, called eggs, and they also produce estrogen, the female sex hormone.
- ◆ **Fallopian tubes** — The fallopian tubes are narrow tunnels for a fertilized egg to make its way down to the uterus. Damage or blockage to the fallopian tubes — called tubal disease — can sometimes cause fertility problems. Learn more about common fertility problems.
- ◆ **Uterus** — The uterus is a hollow, pear-shaped organ located in a woman's lower abdomen, between the bladder and the rectum. It is also called the “womb” and holds the fetus during pregnancy. Each month, the uterus develops a lining (the endometrium) that is rich in nutrients. The reproductive purpose of this lining is to provide nourishment for a developing fetus. Uterine abnormalities, such as fibroids or endometriosis, may cause infertility by interfering with egg fertilization or embryo implantation and development.
- ◆ **Cervix** — The cervix is the lower, narrow part of the uterus, located between the bladder and rectum. It forms a canal that opens to the vagina. Often called the neck or entrance to the womb, the cervix lets menstrual blood out and

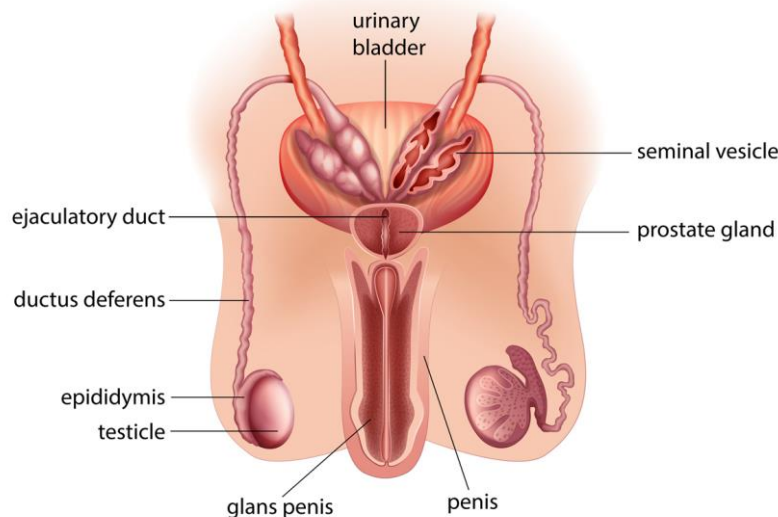
semen into the uterus. Growths in the cervix called polyps can sometimes affect the fertilization or embryo growth process.

- ◆ **Vagina** — The vagina, also known as the birth canal, joins the cervix (the lower part of uterus) to the outside of the body.
- ◆ **Vulva** — This is the external portion of the female genital organs.

❖ **Functions & parts of the male reproductive system:**

The male reproductive system performs the following functions:

- Produces, maintains and transports sperm (the male reproductive cells) and protective fluid (semen)
- Discharges sperm within the female reproductive tract during sex
- Produces and secretes male sex hormones responsible for maintaining the male reproductive system



Unlike in the female reproductive system, most **male reproductive organs** are not located internally. They include:

- ◆ **Penis** — The penis is made up of two parts, the shaft and the head. The urethral opening at the tip of the penis delivers sperm into the vagina during sexual intercourse.



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- ◆ **Scrotum** — The scrotum is the sac-like organ hanging behind and below the penis. It contains the testicles (also called testes), as well as many nerves and blood vessels.
- ◆ **Testicles (testes)** — The testes (oval organs that lie in the scrotum) are the primary male reproductive organ and are responsible for testosterone and sperm production.
- ◆ **Epididymis** — The epididymis is a C-shaped tube that rests on the backside of each testicle. It transports and stores sperm cells that are produced in the testes. The epididymis also brings the sperm to maturity, since the sperm emerging from the testes are immature and incapable of fertilization. During sexual arousal, contractions force the sperm into the vas deferens.
- ◆ **Ductus (vas) deferens** — The vas deferens is a long, muscular tube that travels from the epididymis into the pelvic cavity, to just behind the bladder. The vas deferens transports mature sperm to the urethra, the tube that carries urine or sperm outside of the body, in preparation for ejaculation.
- ◆ **Ejaculatory ducts** — These are formed by the fusion of the vas deferens and the seminal vesicles. The ejaculatory ducts empty into the urethra.
- ◆ **Urethra** — The urethra is the tube that carries urine from the bladder to outside of the body. In males, it has the additional function of ejaculating semen when the man reaches sexual climax. When the penis is erect during sex, the flow of urine is blocked from the urethra, allowing only semen to be ejaculated at climax.
- ◆ **Other glands** — Several glands produce semen or fluid in support of the reproductive process. The *seminal vesicle* produces fructose that provides energy to the sperm as they seek an egg. The *prostate gland* also produces a fluid that helps the sperm move more quickly through the female reproductive system. Another set of glands called *bulbourethral*,



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or sometimes *Cowper's glands*, makes a fluid for protecting the sperm on its way through the urethra.

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