

The Reproductive System

The human reproductive system exhibits anatomical & physiological differences between the male & female. However, there are principal similarities between the two, including:

- Both systems function to produce a reproductive cell (the gamete), which is the sperm in the male & the ovum in the female. Gametes contain half the number of other cells chromosomes.
- Both systems consist basically of 2 gamete-producing organs (the gonads: the testes in the male & the ovaries in the female); & a duct system for the transportation of those gametes.
- Both systems have a secondary function, which is the production of hormones responsible for the secondary sexual characteristics of the male & the female (testosterone in the male & estrogen & progesterone in the female).

However, the female reproductive system has the following major differences from the male:

- The presence of a specific organ to accommodate pregnancy, which is the uterus.
- The development of milk-secreting glands (the mammary glands) to serve lactation.
- The monthly cyclic changes associated with ovulation (menstrual cycle).

On the other hand, the male reproductive system differs by the presence of specific glands (the seminal vesicles & the prostate).

MALE REPRODUCTIVE SYSTEM

This system consists of 2 testes, each testis has its duct system (intra-testicular & extra-testicular ducts), that empty into the urethra (prostatic part). In addition, the system includes the 2 seminal vesicles, the prostate gland, the bulbourethral glands, & the penis.

The Testis:

The testes are 2 small oval organs situated in a skin sac outside the pelvis called the scrotum. This position is necessary to create a temperature lower than the core body temperature, which is needed for normal sperm maturation. Each testis is surrounded by a double layer of serous membrane (the tunica vaginalis, derived from the abdominal peritoneum). In section, the testis is divided into many conical compartments called the "lobules", each lobule contains 2-3 highly tortuous tiny tubules called the "seminiferous tubules". Human sperms are synthesized by the epithelium of those seminiferous tubules, then they are transported to the intratesticular ducts (the rete testis).

Extra-testicular Ducts:

These include, in order:

- Efferent ductules: 15-20 small ducts that emerge from the testis. They receive sperms from the rete testis & transport them to:
- The epididymis: a single very tortuous & very long tube, present on the superior & posterior sides of the testis. In the epididymis, the sperms acquire their motility (ability to move). The epididymis receives sperms from the efferent ductules & transports them to:
- The vas deferens: a thick, long muscular tube that transports the sperms from the epididymis to the ejaculatory duct. The vas deferens exits the scrotum surrounded by muscular & fascial layers (forming the spermatic cord) to enter the abdominal cavity (at the groin) through a special passage called the "inguinal canal". In the abdomen, the vas deferens passes posteriorly then inferiorly to become dilated (the ampulla) & end behind the urinary bladder.

- The ejaculatory duct: a short, thin tube that is formed by the union of the vas deferens & the duct of the seminal vesicle. The ejaculatory duct penetrates the prostate & open into the prostatic urethra.

Seminal Vesicles:

A pair of long, highly tortuous tubes situated below the ampulla of vas deference on the posterior surface of the bladder. Seminal vesicles don't contain sperms, they secrete a yellowish viscid fluid that supplies sperms with fructose (necessary for energy production needed for movement) in addition to other sperm activating substances. Seminal vesicles secretion makes 70% of the human ejaculate. The duct of the seminal vesicle fuses with the ampulla of vas deferens forming the ejaculatory duct.

Prostate:

A single midline gland situated below the urinary bladder, surrounding the initial part of the urethra. The prostate secretion is added to the ejaculate through many tiny ducts emptying into the prostatic urethra also. Note: with advanced age, the prostate may enlarge compressing the prostatic urethra, causing obstructive urinary symptoms. This condition is called (BPH: benign prostatic hypertrophy).

Bulbourethral glands:

Two small glands that empty in the urethra below the prostate. Their mucous secretion lubricates the passage of the seminal fluid.

The Male Urethra:

A long, S-shaped tube that acts as a common passage for urine & seminal fluid.

The Penis:

An erectile organ through which the urethra passes to the exterior. Penile erection is mandatory for normal sexual intercourse. The penis is made mainly of erectile tissue that enlarges when filled with blood. Penile erection is mediated by parasympathetic innervation, while ejaculation is mediated by sympathetic innervation.

Blood Supply of the Male Reproductive System:

- Each testis is supplied by a long & thin testicular artery, a branch of the abdominal aorta.
- The prostate is supplied by prostatic branched from the inferior vesical arteries.
- The vas deferens is supplied by the artery of vas deferens.
- The penis & scrotum are supplied by the internal pudendal artery.

Nerve Supply of the Male Reproductive System:

- Parasympathetic innervation: from the pelvic nerve (S2, 3, 4), responsible for erection.
- Sympathetic innervation: from the hypogastric plexus in the pelvis, responsible for ejaculation.
- The pudendal nerve (sensory & motor).

FEMALE REPRODUCTIVE SYSTEM:

The female reproductive system consists of a single vagina, single uterus, 2 uterine tubes, & 2 ovaries. All of those structures are situated in the pelvic cavity.

The Ovaries:

Each ovary is a small whitish oval organ situated on the lateral wall of the female pelvic cavity. Internally, the ovary the ovary has a medulla & a cortex, where the different stages of ovarian follicles are seen. Externally, the ovary is close to the lateral open end of the uterine tube, & is fixed in position by ligaments.

The Uterine Tubes:

Each uterine tube is a curved muscular tube which is attached to the uterus medially, & closely related to the ovary laterally. The medial end of the tube is narrow, while its lateral part is wide & contains many finger-like processes (the fimbria) that help catching the ovum after ovulation.

The Uterus (non-pregnant):

A muscular organ with thick walls & small cavity, lined with a special mucosa (the endometrium) that undergoes monthly cyclic changes under hormonal effects. The uterus is divided into the body (upper 2/3, inverted triangular shape) & the cervix (the lower 1/3, cylindrical shape). The uterine body is attached to the uterine tubes at its 2 angles, where the lumen of each tube is connected to the triangular uterine cavity. The uterine cervix is a cylinder, with a narrow cavity (the cervical canal). Inferiorly, the cervix bulges into the upper part of the vagina, & opens into its cavity. During pregnancy, the cervical canal is closed by a thick mucous plug to protect the fetus from microorganisms. During childbirth, the cervix flattens & dilates to allow the delivery of the fetus. The uterus (& the upper part of vagina) is situated in the middle of the pelvic cavity between the bladder & the rectum.

The Vagina:

A short muscular tube that connects the uterus to the female external genitalia (the vulva). The vagina represents the last part of the birth canal, through which the fetus passes during delivery.

Blood Supply of the Female Reproductive System:

- The ovaries: ovarian arteries from the abdominal aorta (identical to the testicular arteries in the male). Also, each ovary receives an ovarian branch from the uterine artery.
- The Uterine tube: tubal branch of the uterine artery.
- The uterus: the uterine arteries (one on each side), branches from the internal iliac arteries.
- The vagina: the vaginal arteries (one on each side), branches from the internal iliac arteries.

Nerve Supply of the Female Reproductive System:

- Sympathetic innervation: from the hypogastric plexus in the pelvis.
- Parasympathetic innervation: from the pelvic nerve (S2, 3, 4).
- Sensory & motor innervation: from the pudendal nerve.

Female Pelvis & Vaginal Delivery:

Naturally, the female pelvis is adapted to enable childbirth through normal vaginal delivery. This requires that the upper & lower openings of the bony pelvic cavity (the pelvic inlet & pelvic outlet, respectively) are large enough to allow the passage of the fetal head. Sometimes, the female bony pelvis small or mis-shaped, so that the fetal head cannot pass smoothly. In this case, delivery through Caesarian section is needed.

Notes:

- The female genital tract (uterus, tubes, & ovaries) are connected to the lateral wall of the pelvis by a double-layer of peritoneum, called the "broad ligament".
- In the non-pregnant female, the uterus is totally in the pelvic cavity. During pregnancy, the uterine body grows up into the abdomen, until reaches just below the diaphragm anteriorly by the end of pregnancy.

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