

## ANATOMY OF THE HUMAN REPRODUCTIVE SYSTEM

## I. MALE REPRODUCTIVE SYSTEM

## A. Anatomy

1. Male reproductive organs include paired testes, which produce sperm, a system of ducts (epididymis, vas deferens, ejaculatory ducts and the urethra, (which carries sperm out of the body and is both excretory and reproductive in function in the male) and the penis (the male copulatory organ); associated with the sperm ducts are accessory structures (seminal vesicles, prostate gland, and bulbourethral gland or Cowper's gland) that contribute secretions, which together with sperm constitute a thick fluid called semen.
2. Testes are suspended in saclike structures called scrotum; each testis is an oval, white body about 1 1/2 inches in length and covered with visceral peritoneum.
  - a. Internally, the testes is divided into compartments separated by septa.
  - b. Each compartment is filled with small coiled tubules called seminiferous tubules, which produce sperm (spermatozoa) and have total length of about one half mile; also, male androgen production
    1. Ducts that drain seminiferous tubules are the straight tubules, rete testes, efferent ducts to the epididymis.
    2. A mass of highly coiled ducts that collect sperm from the efferent ductules located somewhat like a cap on each testis is the epididymis; and leading toward urethra is the vas deferens.
  - c. Interstitial cells of the testes produce androgenic hormone and are influenced by the pituitary hormones.
  - d. The testes are formed in the male fetus within the abdominal cavity near the level of the kidneys; as the fetus matures, the testes migrate downward and move through opening at base of abdominal cavity (inguinal canal) into scrotal sac; this occurs shortly before birth; if testes does not descend, the condition is called cryptorchidism.
3. From the vas deferens union with the duct from the seminal vesicle on the same side, the ejaculatory duct is formed; the two ejaculatory ducts then enter the posterior surface of the prostate gland and continues through the substance of this gland for less than an inch before they end in the prostate portion of the urethra.
4. Accessory structures: those that secrete substances into the urethra (comprises semen)
  - a. Seminal vesicles: located posterior to the urinary bladder and empty secretions into the ejaculatory duct (this duct, during sexual excitement, ejects semen into urethra); secretions (60% of semen volume) produced by the vesicles contain simple sugars (primarily fructose) amino acids and mucus, and is alkaline; increases motility by reducing acidity in their environment; spermatozoa do not enter the seminal vesicle.
  - b. Prostate gland - lies surrounding upper portion of urethra at base of the urinary bladder; this structure secretes more fluids (slightly alkaline, thereby aiding motility), which combine with sperm as they are emptied into urethra; the smooth muscle of this gland provides part of the force needed for ejaculation.
  - c. Bulbourethral glands - (Cowper's glands) are two glands, yellow in color and about the size of peas, located further along the urethra distal to the prostate gland; these glands secrete an alkaline, mucus like substance that coats the lining of the urethra prior to ejaculation and lubricates end of penis in preparation for coitus.
  - d. Penis - male organ for copulation, serves to introduce sperm into female vagina and also serves as part of the male urinary system; the unstimulated penis is small and flaccid; upon erotic stimulation, it becomes firm, enlarged, and lengthened.
    1. It is composed of three cylindrical bodies which are located side by side in the dorsal half of the penis; the cylinder lying beneath and between the upper two encloses the urethra; these cylinders are made up internally of spongy tissue surrounded by tough fibrous tissue and are highly vascularized.
    2. During sexual excitement, blood rapidly enters the corpora cavernosa and corpus spongiosum, filling the spongy spaces leading to penis erection; the flow of blood into the spaces creates a pressure upon the veins that drains the penis, reducing or shutting off the outward flow of blood; the penis remains erect until stimulation ceases causing arteries to constrict; less blood then enters the cylinders, and therefore less pressure is exerted on the veins, allowing blood to leave the penis, and permitting it to regain its unstimulated, flaccid condition.
    3. At the distal of the penis the outer skin forms a fold or a cuff around the glans called the foreskin; surgical removal of the foreskin is called circumcision.
    4. Semen: spermatozoa, plus secretions of the seminal vesicles, prostate gland, and the bulbourethral glands; it is thick, grayish-white with average pH of 7.5; in average male, each milliliter of semen contains about 100 million spermatozoa, an average amount of ejaculate varies between 2.5 and 6mL; semen is ejected by means of contraction of smooth muscle of prostate gland and contraction of the bulbocavernosus muscle which compresses the cavernous portion of the urethra; sperm remain viable in the female tract from 48 to 72 hours; ova viable for only 24 hours.

5. Spermatogenesis: Meiosis in the seminiferous tubules: each diploid mother cell results in 4 haploid gametes or spermatids that then undergo metamorphosis into spermatozoa with a distinct head, body and tail(flagellum); begins in puberty and continues until death; acceptable range for normal fertility: 50 to 100 million with 60% motile; males with less than 20 million are considered infertile: spermatozoa are produced and matured at the rate of about 300 million/day; location of the testes in the scrotum outside the abdominal cavity relates to the lower temperature requirement for sperm maturation.
  - a. Spermiogenesis: maturation of spermatids into spermatozoa (metamorphosis) in the seminiferous tubules; they then pass to the epididymis where in 18 hours to 10 days maturity is reached (acquires motility and the ability to fertilize an ovum); sperm is stored in the vas deferens where they can retain viability up to several weeks.

## II. FEMALE REPRODUCTIVE SYSTEM

### A. Anatomy

1. Female reproductive organs include paired ovaries, paired uterine tubes (Fallopian), uterus, vagina, external genitalia, and the mammary glands.
2. The ovaries are small, almond shaped bodies about 1-1/2 inches in length that are located on either side of the uterus, below the fallopian tubes; weigh 6 grams approximately.
  - a. Their major activities, which occur simultaneously, include the development and release of ova (oogenesis), and the production and release of female hormones, progesterone and estrogen; pituitary hormones also affect the ovaries.
  - b. They are attached medially to the uterus by the ovarian ligament; lateral end is in intimate contact with free end of fallopian tube.
  - c. Structurally, ovary consists of outer cortex and inner medulla; free surface of cortex covered by single layer of cuboidal cells; immediately below this is the connective tissue stroma of the cortex where the ovarian follicles are formed (at time of birth each ovary contains about 250,000 primary follicles of which each follicle is a mass of epithelial cells surrounding an immature ovum); medulla is vascular loose connective tissue in which no follicles are found.
  - d. Until puberty all ova are immature; as oogenesis begins to resume with the menstrual cycle, hormonal influence will single out a single follicle of a single ovary to fully mature, although several follicles are stimulated from both ovaries per cycle; leads to the release of a single ovum (ovulation) approximately every 14th day of a female's 28 day menstrual cycle.
3. The uterus is a hollow, thick-walled, muscular organ about 7.5 cm (3") long and 5 cm (2") wide at its widest point and tapering down to about 2.5cm.
  - a. It communicates (cavity of uterus) with fallopian tubes above and with vagina below.
  - b. It is flattened from front to back with the cavity slit-like.
  - c. Upper portion is the body with the lower constricted portion being called the cervix.
  - d. Upper portion is free and movable and rests on the upper surface of the urinary bladder (position of uterus changes with size of the bladder).
  - e. Blood is supplied to uterus by way of branches of the internal iliac and ovarian arteries
  - f. The inner lining is composed of special epithelial cells called the endometrium
    - 1) It is composed of two chief layers; a thick, superficial, or functional layer; and a thin deep, or basilar, layer
    - 2) Since the female is not in a state of continual reproductive readiness, the functional layer changes greatly during the menstrual cycle and is lost almost completely during menstruation; under hormonal influence
    - 3) Basilar layer is not lost and remains to regenerate a new functional layer when menstruation ceases
  - g. Initial functions are to retain and sustain the new individual during the first 40 weeks of growth (gestation) and development the final function is to expel the fetus and the placenta (afterbirth) at the end of pregnancy
4. The uterine tubes or fallopian tubes or oviducts and hollow extensions of the uterine cavity (4 1/2 inches long) and functions to receive the ovulated secondary oocyte released from the ovary and by muscular contractions and the ciliated epithelium carry the ova in the direction of the uterus; fertilization in distal third
  - a. Distally, the free end has many fringelike projections or fimbriae that are in intimate contact with the ovary
  - b. The lining of the tubes is mucous membrane containing some ciliated cells and some secretory; middle coat is composed of circular and longitudinal layers of smooth muscle that provide peristaltic contractions
    - 1) The mucosa of the tube is continuous with that of the uterus and the vagina making possible the spread of harmful bacteria leading to infection

5. The vagina or birth canal is a collapsible, musculomembranous tube, about 3 1/2" long extending downward and frontward from the uterus to the external opening in the vestibule between the external genitalia (specifically btw. urethral orifice and the anus).
  - a. Upper end of vagina is attached to the cervix a short distance above the projecting cervical lips
  - b. At lower end of vagina there is a thin fold of mucous membrane called hymen; usually, it forms a circular border around the external vaginal orifice.
  - c. It serves as a receptacle into which sperm is deposited by the male during sexual intercourse and gives passage to the fetus during birth.
  - d. The urethra opens above the vaginal opening and is excretory in function only.
6. The external genitalia are structures located externally to the vaginal opening and include the labia major, labia minor, prepuce and the clitoris.
  - a. The clitoris is a small mass of erectile tissue containing numerous sensory nerve endings; physical stimulation of the clitoris during sexual intercourse plays an important part in sexual arousal of the woman; synonymous with penis of the male.
7. The mammary glands, or breasts, are functionally related to the reproductive system since they secrete milk for the nourishment and immediate temporary immunity of the newborn.
  - a. Each breast is composed of 15 to 20 lobes, or compartments, separated by adipose tissue (amount of adipose tissue determines the breast size and not with the amount of milk produced). In each lobe are several smaller compartments (lobules) containing connective tissue, in which milk secreting cells (alveoli) are embedded. A series of ducts culminating with lactiferous ducts terminate in the nipple.
  - b. On ventral surface of each breast, is a cylindrical nipple; in its rounded tip are 15 to 20 perforations, which represent openings of the lactiferous ducts.
    - 1) The nipple is surrounded by a pigmented area (areola), which becomes darker during pregnancy.
  - c. During pregnancy, estrogens produce growth of the duct system of the mammary glands, and progesterone stimulates development of the secretory tissue; prolactin stimulates production of milk in mammary glands that have been prepared by estrogen and progesterone; this process is called lactation; oxytocin required for its release.