SEXUAL REPRODUCTION- is the process by which organisms produce offspring by making germ cells called gametes

FERTILIZATION- an event where the male gamete (sperm cell) unites with the female gamete (secondary oocyte)

GONADS- testes in males and ovaries in females—produce gametes and secrete sex hormones

ACCESSORY SEX GLANDS- produce substances that protect the gametes and facilitate their movement

SUPPORTING STRUCTURES- (such as the penis in males and the uterus in females) assist the delivery of gametes and the uterus is also the site for the growth of the embryo and fetus during pregnancy.

GYNECOLOGY- is the specialized branch of medicine concerned with the diagnosis and treatment of diseases of the female reproductive system

UROLOGY- is the study of the urinary system. Urologists also diagnose and treat diseases and disorders of the male reproductive system.

ANDROLOGY- The branch of medicine that deals with male disorders, especially infertility and sexual dysfunction.

THE MALE REPRODUCTIVE SYSTEM

FUNCTIONS OF THE MALE REPRODUCTIVE SYSTEM

The male reproductive system performs the following functions:

1. Production of sperm cells.
2. Sustaining and transfer of the sperm cells to the female.
3. Production of male sex hormones.

The organs of the male reproductive system include the testes, a system of ducts (including the epididymis, ductus deferens, ejaculatory ducts, and urethra), accessory sex glands (seminal vesicles, prostate, and bulbourethral glands), and several supporting structures, including the scrotum and the penis.

- Organs of the reproductive system may be classified as:
  - Essential organs- for the production of gametes (sex cells)
  - Accessory organs- play some type of supportive role in the reproductive process.
    - include Genital ducts, Accessory ducts, and Supporting ducts

A. ACCESSORY ORGANS

- Genital ducts- convey sperm to the outside of the body
  - the ducts are a pair of epididymides, the paired vasa deferentia, a pair of ejaculatory ducts, and the urethra.

  - Epididymides/epididymis

Structure and location
- A comma-shaped organ about 4 cm (1.5 in) long that lies along the posterior border of each testis
- Each epididymis consists mostly of the tightly coiled ductus epididymis.

DIVIDED INTO:
- Head- connected to the testis by the efferent tubules
- A central BODY- is the narrow midportion of the epididymis.
- Tail- is the smaller, inferior portion
- sperm maturation -process by which sperm acquire motility and the ability to fertilize an ovum.

The tunica vaginalis covers the epididymis except at the posterior border. Vasculature and innervation of the epididymis is the same as for the testes.

Functions
It serves as one of the ducts through which sperm pass in their journey from the testis to the exterior.

It contributes to the maturation of sperm, which spend from 1 to 3 weeks in this segment of the duct system.

It secretes a small part of the seminal fluid.

**Vas Deferens (ductus deferens)**

**Structure and Location**
- The duct of the vas is an extension of the tail of the epididymis
- It is 30-45-cm long and conveys sperm to the ejaculatory ducts
- The convoluted portion of the ductus deferens becomes straighter (diameter, 2-3-mm) as it travels posterior to the testis and medial to the epididymis

**Muscular Layer of the Vas**
- The muscular layers of the vas help in propelling sperm through the duct system
- The ductus ascends on the posterior aspect of the spermatic cord until it reaches the deep inguinal ring, where it participates in the formation of the spermatic cord and loops over the inferior epigastric artery.

**Function**
- Serves as one of the male genital ducts connecting the epididymis with the ejaculatory duct.
- Sperm remain in the vas deferens for varying periods of time depending on the degree of sexual activity and frequency of ejaculation
- Storage time may exceed 1 month with no loss of fertility

**Ejaculatory Duct**
- The two ejaculatory ducts are short tubes about 1 cm long that pass through the prostate gland to terminate in the urethra.
- They are formed by the union of the vas deferens distal to the ampulla with the ducts from the seminal vesicles.

**Urethra**
- Urethra in males serves as a dual function, which involves both the reproductive system and the urinary system.
- Extends from the urinary bladder to the distal end of the penis.

**Seminal Vesicles**
- Secrete alkaline, viscous, creamy-yellow liquid that constitutes about 60% of semen volume.
- The alkalinity helps neutralize the acid pH environment of the terminal urethra and the vagina.
- Fructose found in this component of the semen serves as an energy source for sperm motility after ejaculation.

**Accessory glands**
- Produce secretions that serve to nourish, transport, and mature sperm.
- The glands are a pair of seminal vesicles, one prostate, and a pair of bulbourethral (Cowper's) glands.

**Function**
- Secrete alkaline, viscous, creamy-yellow liquid that constitutes about 60% of semen volume.
- The alkalinity helps neutralize the acid pH environment of the terminal urethra and the vagina.
- Fructose found in this component of the semen serves as an energy source for sperm motility after ejaculation.

**Other components** include prostaglandins, which are involved in cyclic AMP formation, and non-blood type coagulating enzyme called vesiculase.
The reproductive system

- **Prostate Gland**  
  **Structure and Location**
  - The **prostate** is a compound tubuloalveolar gland that lies just below the bladder and is shaped like a doughnut.
  - The fact that the urethra passes through a small hole in the center of the prostate is a matter of considerable clinical significance.
  - **Benign prostatic hypertrophy** - a non-cancerous enlargement of the prostate gland

**Function**
- Secretes a watery, milky-looking, and slightly acidic fluid that constitutes about 30% of the seminal fluid volume.
- Citrate, found in prostatic fluid, serves as a nutrient for sperm.
- Other constituents include enzymes such as hyaluronidase and prostate-specific antigen or PSA.
  
- Prostatic fluid play an important role in sperm activation, viability, and motility.

- **Bulbourethral Glands**  
  **Structure and Location**
  - The two bulbourethral, or Cowper’s glands resemble peas in size and shape.
  - A duct approximately 2.5 cm (1 inch) long connects with the penile portion of the urethra.

**Function**
- Like the seminal vesicles, the bulbourethral glands secrete an alkaline fluid that is important for counteracting the acid present in the male urethra and the female vagina.
- Mucus produced in these glands serves to lubricate the urethra and helps protect sperm from friction damage during ejaculation.

- **Scrotum**
  - The **scrotum** is a saclike structure containing the testes.
  - It is divided into right and left internal compartments by an incomplete connective tissue septum.
  - Externally the scrotum consists of skin beneath the skin is a layer of loose connective tissue and a layer of smooth muscle, called the dartos muscle.
  - The cremaster muscle causes significant elevation of the testes.

- **Penis (External)**
  - Composed of three cylindrical masses of erectile, or cavernous, tissue, enclosed in separate fibrous coverings and held together by a covering of skin
    - Corpora cavernosa - the two larger and uppermost of these cylinders
    - Corpus spongiosum - smaller, lower one, which contains the urethra
  - Glans penis - slightly bulging structure over which the skin is folded doubly to form a more or less loose-fitting, retractable casing known as the prepuce or foreskin.
  - **Circumcision** - surgical removal of the foreskin
  
  The opening of the urethra at the tip of the glans is called the **external urinary meatus**.

**Functions**
- The penis contains urethra, the terminal duct for both urinary and reproductive tracts.
- During sexual arousal, the erectile tissue of the penis fills with blood, causing the organ to become rigid and enlarge in both diameter and length. Erection permits the penis to serve as a penetrating copulatory organ during sexual intercourse.
  - The scrotum and the penis constitute the external genitals, or genitalia of the male.

- **Spermatic cords (Internal)**
  - The spermatic cords are cylindrical casings of white, fibrous tissue located in the...
inguinal canals between the scrotum and the abdominal cavity.
- They enclose the vasa deferentia, blood vessels, lymphatics, and nerves.

- **PERINEUM**
  - The perineum in male is a roughly diamond shaped area between the thighs.
  - Its most lateral boundary on either side is the ischial tuberosity.
  - A line drawn between the two ischial tuberosities divides the area into a larger **urogenital triangle**, which contains the external genitalia, and the **anal triangle**, which surrounds the anus.

**B. ESSENTIAL ORGANS**

- **TESTES**
  - **Structure and Location**
    - The **testes** (testˈes) are small, ovoid organs, each about 4–5 cm long, within the scrotum.
    - They are both exocrine and endocrine Glands.
    - Sperm cells form a major part of the exocrine secretions of the testes, and testosterone is the major endocrine
  - **tunica albuginea**- is connective tissue forming the outer capsule of each testis
    - encases each testis and then enters the gland, sending out partitions (septa) that radiate through its interior, dividing it into 200 or more cone-shaped lobules.
    - Each lobule of the testis contains specialized **interstitial cells** (of Leydig) and one to three tiny, coiled **sperminferous tubules**.
    - The tubules come together to form aplexus called the **rete testis**.
    - **Efferent ductules** are series of sperm ducts that drain the rete testis and pierce the tunica albuginea to enter the head of the epididymis.

**Meiosis**

- **Gametes** or sex cells, have half the number of chromosomes as other cells in the body.
- **Meiosis** is a kind of cell division that produces gametes.
  - It consists of two consecutive nuclear divisions without replication of the genetic material between the divisions.
  - It consists of two consecutive nuclear divisions without replication of the genetic material between the divisions.
  - Four daughter cells are produced, and each has half as many chromosomes as the parent cell.

**Chromosomes**

- Chromosomes contain most of the cell’s DNA, which has the genes determining the structural and functional features of every individual.
  - The normal chromosome number in human cells is 46.
  - This number is called a diploid, or a 2n, number of chromosomes.
  - The chromosomes consist of 23 pairs, each of which is called a homologous pair.
  - The homologous pairs consist of 22 autosomal pairs, which are all of the chromosomes except the sex chromosomes, and 1 pair of sex chromosomes.
  - The sex chromosomes are an X and a chromosome in males and two X chromosomes in females.
  - In sperm cells and oocytes, the number of chromosomes is 23. This number is called a haploid, or n, number of chromosomes.
  - Each gamete contains one chromosome from each of the homologous pairs.
- The sex is male if the sperm cell that fertilizes the oocyte carries a Y chromosome, female if the sperm cell carries an X chromosome.
THE REPRODUCTIVE SYSTEM

First Meiotic Division (Meiosis I)
- Centromere
- Chromosomes
- Nucleus
- Chromatids

Second Meiotic Division (Meiosis II)
- Each chromosome consists of two chromatids.

1. Prophase I
   - The duplicated chromosomes become visible chromosomes (shown separated for emphasis; they actually are not close together that they appear as a single strand).

2. Metaphase I
   - Homologous chromosomes align at the center of the cell.
   - Random assortment of homologous chromosomes occurs.

3. Anaphase I
   - Homologous chromosomes move apart to opposite sides of the cell.

4. Telophase I
   - New nuclei form, and the cell divides.

5. Prophase II (top of next column)

6. Metaphase II
   - Chromosomes align along the center of the cell.

7. Anaphase II
   - Chromatids separate, and each daughter cell receives a copy of each chromosome.

8. Telophase II
   - New nuclei form around the chromosomes. The cells divide to form four daughter cells, each with a haploid number of chromosomes.
Descent of the Testes

Spermatogenesis

- Spermatogenesis is the formation of sperm cells, a process that takes approximately 74 days.
- Spermatogonia are the cells that give rise to sperm cells. They are located in the periphery of the seminiferous tubules and divide by mitosis.
- Spermatids- two smaller cells
  - Much of the cytoplasm of the spermatids is eliminated, and each spermatid develops a head, midpiece, and flagellum (tail) to become a sperm cell, or spermatozoon
- The head contains the nucleus with its chromosomes.
- The leading end of the head has a cap, the acrosome, which contains enzymes that are released during the process of fertilization and are necessary for the sperm cell to penetrate the oocyte.

The flagellum is similar to a cilium, and movement of microtubules past one another within the tail causes the tail to move and propel the sperm cell forward.
- The midpiece has large numbers of mitochondria, which produce the ATP necessary for microtubule movement.

- Sustentacular cells, or Sertoli- are in the seminiferous tubules. Are also sometimes referred to as nurse cells.
  - are large cells that extend from the periphery to the lumen of the seminiferous tubule
  - they nourish the developing sperm cells and probably produce, together with the interstitial cells, a number of hormones, such as androgens, estrogen, and inhibin.
- Tight junctions between the sustentacular cells form a blood-testis barrier between spermatogonia and sperm cells.
  - It isolates the sperm cells from the immune system.
  - This barrier is necessary because developing sperm cells form surface antigens that could stimulate an immune response, resulting in their destruction

SPERM
- Each day about 300 million sperm complete the process of spermatogenesis.
- A sperm is about 60 _m long and contains several
structures that are highly adapted for reaching and penetrating a secondary oocyte.

MAJOR PARTS OF A SPERM:
- **Head**: The flattened, pointed head of the sperm is about 4–5 \( \mu \) m long.
  - It contains a **nucleus** with 23 highly condensed chromosomes.
  - Covering the anterior two-thirds of the nucleus is the **acrosome**, a caplike vesicle filled with enzymes that help a sperm to penetrate a secondary oocyte to bring about fertilization.
- **Tail**: The tail of a sperm is subdivided into four parts: neck, middle piece, principal piece, and end piece.
  - The **neck** is the constricted region just behind the head that contains centrioles.
  - The **middle piece** contains mitochondria arranged in a spiral, which provide the energy (ATP) for locomotion of sperm to the site of fertilization and for sperm metabolism.
  - The **principal piece** is the longest portion of the tail, and
  - the **end piece** is the terminal, tapering portion of the tail.

Hormonal Control of the Testes

- **gonadotropin-releasing hormone (GnRH)**: This hormone in turn stimulates gonadotrophs in the anterior pituitary to increase their secretion of the two gonadotropins, **luteinizing hormone (LH)**, and **follicle-stimulating hormone (FSH)**.
  - LH stimulates Leydig cells, which are located between seminiferous tubules, to secrete the hormone **testosterone**.
  - FSH and testosterone act synergistically on the Sertoli cells to stimulate secretion of **androgen-binding protein (ABP)** into the lumen of the seminiferous tubules and into the interstitial fluid around the spermatogenic cells.
  - Once the degree of spermatogenesis required for male reproductive functions has been achieved, Sertoli cells release **inhibin**, a protein hormone named for its role in inhibiting FSH secretion by the anterior pituitary.
  - Testosterone and dihydrotestosterone both bind to the same androgen receptors, which are found within the nuclei of target cells. The hormone receptor complex regulates gene expression, turning some genes on and others off. Because of these changes, the androgens produce several effects:
    - **Prenatal development**.
    - **Development of male sexual characteristics**.
    - **Development of sexual function**.
    - **Stimulation of anabolism**.

**STRUCTURE OF SPERMATOZOA**
- Elongated tail-bearing in the seminiferous tubules.
- They undergo a process of “ripening” or “maturation” as they pass through the genital ducts before ejaculation.
- **Capitation** occurs in sperm only after they have been introduced into the vagina of the female.

**Semen** is a mixture of sperm and **semenal fluid**, a liquid that consists of the secretions of the seminiferous tubules, seminal vesicles, prostate, and bulbourethral glands.

**COMPOSITION AND INTERCOURSE OF SEMINAL FLUID**:
- The following structures secrete the substance that, together, make up the seminal fluid or semen:
  - **Testes and epididymis**: Their secretions constitute less than 5% of the seminal fluid volume.
- Seminal vesicles- their secretions are reported to contribute about 60% of the seminal fluid volume
- Prostate gland- its secretions constitute about 30% of the seminal fluid volume
- Bulbourethral glands- their secretions are said to constitute less than 5% of the seminal fluid volume

PUBERTY
- Is the sequence of events by which a child is transformed into a young adult.

EFFECTS OF TESTOSTERONE
Testosterone- is the major male hormone secreted by the testes
- During puberty, testosterone causes the enlargement and differentiation of the male genitals and reproductive duct system.
- Secondary sexual characteristics- are those structural and behavioral changes, other than in reproductive organs, that develop at puberty and distinguish males from females.

DISORDERS OF THE MALE REPRODUCTIVE SYSTEM

Undescended Testes (also called cryptorchidism) and testicular atrophy are associated with testicular cancer. The link between undescended testes and testicular cancer is high. Other risk factors, such as maternal estrogen use, testicular trauma, or infection have not clearly demonstrated a correlative relationship.

Prostatitis is inflammation of the prostate gland. The prostate is a walnut-sized gland in men that surrounds the urethra. The prostate produces a fluid that is part of semen.

There are four types of prostatitis:
Category 1: acute bacterial (least common of the four types, but the most common in men under 35)
Category 2: chronic bacterial (not very common, but affects mostly men between 40-70)
Category 3: chronic nonbacterial/prostatodynia (most common type, chronic pelvic pain)
Note: Prostatodynia (also known as chronic pelvic pain syndrome) is a condition associated with similar symptoms as chronic nonbacterial prostatitis, but which has no evidence of prostatic inflammation.
Category 4: asymptomatic inflammatory prostatitis

Prostate Cancer is a disease in which cancer cells grow in the prostate. The prostate is a gland that surrounds the urethra, the tube that carries urine from the bladder to the end of the penis in men.
- the prostate enlarges in this benign manner, called Benign Prostatic Hyperplasia

DISORDERS OF THE MALE REPRODUCTIVE SYSTEM

1. Azoospermia- no production of sperm cells
2. Erectile dysfunction- also called impotence is the inability to attain or maintain an erection of the penis that is firm enough for penetration during sexual intercourse.
   Causes:
   a. Venous leak- Blood vessels are not compressed causing erection to be unattainable or not last long
   b. Neurovascular Function- Erection cannot be attained if nerve signals do not prompt blood vessels to do their job or if blood flow to the penis is reduced.
3. Epididymitis- is an inflammation of the epididymis
4. Gynecomastia- is due to abnormal enlargement of breasts in men
5. Hydrocele- fluid accumulates in and around the testes
6. Oligospermia- too few production of sperm cells
7. Priapism- refers to painful erection
8. Prostatitis- is inflammation of the prostate gland.
   a. Category 1: acute bacterial
   b. Category 2: chronic bacterial
   c. Category 3: chronic nonbacterial/prostatodynia
   d. Category 4: asymptomatic inflammatory prostatitis
9. Prostate Cancer- is a disease in which cancer cells grow in the prostate
Disorders of the Scrotum, Testicles, or Epididymis

Conditions affecting the scrotal contents may involve the testicles, epididymis, or the scrotum itself.

- **Testicular trauma.** Even a mild injury to the testicles can cause severe pain, bruising, or swelling. Most testicular injuries occur when the testicles are struck, hit, kicked, or crushed, usually during sports or due to other trauma. Testicular torsion, when one of the testicles twists around, cutting off its blood supply, is also a problem that some teen males experience, although it's not common. Surgery is needed to untwist the cord and save the testicle.

- **Varicocele.** This is a varicose vein (an abnormally swollen vein) in the network of veins that run from the testicles. Varicoceles commonly develop while a boy is going through puberty. A varicocele is usually not harmful, although it can damage the testicle or decrease sperm production. Take your son to see his doctor if he is concerned about changes in his testicles.

- **Testicular cancer.** This is one of the most common cancers in men younger than 40. It occurs when cells in the testicle divide abnormally and form a tumor. Testicular cancer can spread to other parts of the body, but if it's detected early, the cure rate is excellent. Teen boys should be encouraged to learn to perform testicular self-examinations.

- **Epididymitis** is inflammation of the epididymis, the coiled tubes that connect the testes with the vas deferens. It is usually caused by an infection, such as the sexually transmitted disease chlamydia, and results in pain and swelling next to one of the testicles.

- **Hydrocele.** A hydrocele occurs when fluid collects in the membranes surrounding the testes. Hydroceles may cause swelling in the scrotum around the testicle but are generally painless. In some cases, surgery may be needed to correct the condition.

- **Inguinal hernia.** When a portion of the intestines pushes through an abnormal opening or weakening of the abdominal wall and into the groin or scrotum, it is known as an inguinal hernia. The hernia may look like a bulge or swelling in the groin area. It can be corrected with surgery.

Disorders of the Penis

Disorders affecting the penis include:

- **Inflammation of the penis.** Symptoms of penile inflammation include redness, itching, swelling, and pain. Balanitis occurs when the glans (the head of the penis) becomes inflamed. Posthitis is foreskin inflammation, which is usually due to a yeast or bacterial infection.

- **Hypospadias.** This is a disorder in which the urethra opens on the underside of the penis, not at the tip.

- **Phimosis.** This is a tightness of the foreskin of the penis and is common in newborns and young children. It usually resolves itself without treatment. If it interferes with urination, circumcision (removal of the foreskin) may be recommended.

- **Paraphimosis.** This may develop when the foreskin of a boy's uncircumcised penis is retracted (pulled down to expose the glans) and becomes trapped so it can't be returned to the unretracted position. As a result, blood flow to the head of the penis may be impaired, and your son may experience pain and swelling. A doctor may use lubricant to make a small incision so the foreskin can be pulled forward. If that doesn't work, circumcision may be recommended.

- **Ambiguous genitalia.** This occurs when a child is born with genitals that aren't clearly male or female. In most boys born with this disorder, the penis may be very small or nonexistent, but testicular tissue is present. In a small number of cases, the child may have both testicular and ovarian tissue.

- **Micropenis.** This is a disorder in which the penis, although normally formed, is well below the average size, as determined by standard measurements.
THE FEMALE REPRODUCTIVE SYSTEM

FUNCTIONS
1. Production of female sex cells.
2. Reception of sperm cells from the male.
3. Nurturing the development of and providing nourishment for the new individual.
4. Production of female sex hormones.

The female reproductive system includes the ovaries, uterine tubes, uterus, vagina, external genitalia, and mammary glands.

Ovaries
1. The suspensory ligament, ovarian ligament, and broad ligament hold the ovary in place.
2. The visceral peritoneum covers the surface of the ovaries.
3. The ovary has an outer capsule (tunica albuginea) and is divided internally into a cortex (contains follicles) and a medulla (receives blood and lymphatic vessels and nerves).

4. Oocyte development and fertilization
   - Oogonia proliferate and become primary oocytes that are in prophase I of meiosis.
   - A primary oocyte continues meiosis and produces a secondary oocyte, which is in metaphase II of meiosis, and a polar body, which degenerates or divides to form two polar bodies.
   - Ovulation is the release of a secondary oocyte from an ovary.
   - Fertilization is the joining of a sperm cell and a secondary oocyte to form a zygote.

An embryo is the developing human between the time of fertilization and 8 weeks of development. A fetus is the developing human from 8 weeks to birth.

5. Follicle development
   - Primordial follicles are surrounded by a single layer of flat granulosa cells.
   - Primary follicles are primary oocytes surrounded by a zona pellucida and cuboidal granulosa cells.
   - The primary follicles become secondary follicles as granulosa cells increase in number and fluid begins to accumulate in the vesicles. The granulosa cells increase in number, and theca cells form around the secondary follicles.
   - Mature follicles have an antrum.

6. Ovulation occurs when the follicle swells and ruptures and the secondary oocyte is released from the ovary. The corona radiate surround the oocyte.

7. Fate of the follicle
   - The mature follicle becomes the corpus luteum.
   - If pregnancy occurs, the corpus luteum persists. If no pregnancy occurs, it becomes the corpus albicans.

Histology of the Ovary
- The germinal epithelium is a layer of simple epithelium (low cuboidal or squamous) that covers the surface of the ovary.
- The tunica albuginea is a whitish capsule of dense irregular connective tissue located immediately deep to the germinal epithelium.
The ovarian cortex is a region just deep to the tunica albuginea. It consists of ovarian follicles (described shortly) surrounded by dense irregular connective tissue that contains collagen fibers and fibroblast-like cells called stromal cells.

The ovarian medulla is deep to the ovarian cortex.

Ovarian follicles are in the cortex and consist of oocytes in various stages of development, plus the cells surrounding them. When the surrounding cells form a single layer, they are called follicular cells; later in development, when they form several layers, they are referred to as granulosa cells.

A mature (graafian) follicle is a large, fluid-filled follicle that is ready to rupture and expel its secondary oocyte, a process known as ovulation. A corpus luteum contains the remnants of a mature follicle after ovulation. The corpus luteum produces progesterone, estrogens, relaxin, and inhibin until it degenerates into fibrous scar tissue called the corpus albicans.

Uterine Tubes

1. The uterine tubes extend from the ovaries to the uterus.
   - The ovarian end of the uterine tube is expanded as the infundibulum. The opening of the infundibulum is surrounded by fimbriae.
   - The ampulla is the widest, longest part of the uterine tube.

2. The uterine tube consists of an outer serosa, a middle muscular layer, and an inner mucosa with simple ciliated columnar epithelium.

3. Muscular contractions and cilia move the oocyte through the uterine tube.

Uterus

1. The uterus consists of the fundus, body, and cervix. The uterine cavity and the cervical canal are the spaces formed by the uterus.

2. The uterus is held in place by the broad, round, and uterosacral ligaments.

3. The wall of the uterus consists of the perimetrium (visceral peritoneum), the myometrium (smooth muscle), and the endometrium (mucous membrane).

Hormonal Regulation of the Female Reproductive Cycle

There are five main hormones that control the reproductive cycle. Three are produced in the brain, while the other two are made in the ovaries.

- Gonadotrophin-releasing hormone (GnRH) is made by a part of the brain called the hypothalamus. GnRH travels to another part of the brain where it controls the release of follicle-stimulating hormone (FSH) and luteinising hormone (LH).
- Follicle-stimulating hormone (FSH) is released by a part of the brain called the anterior pituitary. FSH is carried by the bloodstream to the ovaries. Here it stimulates the immature ova to start growing.
- Luteinising hormone (LH) is also released by the anterior pituitary and travels to the ovaries. LH triggers ovulation and encourages the formation of a special group of cells called the corpus luteum.
- Oestrogen is produced by the growing ova and by the corpus luteum. In moderate amounts oestrogen helps to control the levels of GnRH, FSH and LH. This helps to prevent the development of too many ova. Oestrogen also helps to develop and maintain many of the female reproductive structures.
- Progesterone is mainly released by the corpus luteum. It works with oestrogen to prepare the lining of the uterus for the implantation of a fertilised ovum. It also helps to prepare the breasts for releasing milk. High levels of progesterone control the levels of GnRH, FSH and LH.

Vagina

1. The vagina is the female organ of copulation. It connects the uterus (cervix) to the vestibule.

2. The vagina consists of a layer of smooth muscle and an inner lining of moist stratified squamous epithelium.

3. The hymen covers the vaginal orifice.

- A recess called the fornix surrounds the vaginal attachment to the cervix.
- The mucosa of the vagina is continuous with that of the uterus. Histologically, it consists of nonkeratinized stratified squamous epithelium and areolar connective tissue that lies in a series of transverse folds called rugae.
- The muscularis is composed of an outer circular layer and an inner longitudinal layer of smooth muscle that can stretch...
considerably accommodate the penis during sexual intercourse and a child during birth.

- The adventitia, the superficial layer of the vagina, consists of areolar connective tissue. A thin fold of vascularized mucous membrane, called the hymen, forms a border around and partially closes the inferior end of the vaginal opening to the exterior, the vaginal orifice.

Vulva

The term vulva, or pudendum, refers to the external genitals of the female. The following components comprise the vulva:

- Anterior to the vaginal and urethral openings is the mons pubis.
  - From the mons pubis, two longitudinal folds of skin, the labia majora.
  - Medial to the labia majora are two smaller folds of skin called the labia minora.
  - The clitoris (KLI-to-ris) is a small cylindrical mass composed of two small erectile bodies, the corpora cavernosa, and numerous nerves and blood vessels.

  - A layer of skin called the prepuce of the clitoris is formed at the point where the labia minora unite and covers the body of the clitoris.
  - The exposed portion of the clitoris is the glans clitoris.
  - The region between the labia minora is the vestibule.
  - The vaginal orifice, the opening of the vagina to the exterior, occupies the greater portion of the vestibule and is bordered by the hymen.
  - Anterior to the vaginal orifice and posterior to the clitoris is the external urethral orifice, the opening of the urethra to the exterior.
  - On either side of the external urethral orifice are the openings of the ducts of the paraurethral (Skene’s) glands.
  - On either side of the vaginal orifice itself are the greater vestibular (Bartholin’s) glands, which open by ducts into a groove between the hymen and labia minora.

- The bulb of the vestibule (see Figure 28.21) consists of two elongated masses of erectile tissue just deep to the labia on either side of the vaginal orifice.

External Genitalia

1. The external female genitalia consist of the vestibule and its surrounding structures.

2. The vestibule is the space into which the vagina and the urethra open.

3. Erectile tissue is associated with the vestibule.
   - The two corpora cavernosa form the clitoris.
   - The corpora spongiosa form the bulbs of the vestibule.

4. The labia minora are folds that cover the vestibule and form the prepuce.

5. The greater and lesser vestibular glands produce a mucous fluid.

6. When closed, the labia majora cover the labia minora.
   - The mons pubis is an elevated deposit of adipose tissue superior to the labia.
   - The pudendal cleft is a space between the labia majora.

Perineum

The clinical perineum is the region between the vagina and the anus.

- is the diamond-shaped area medial to the thighs and buttocks of both males and females.
- A transverse line drawn between the ischial tuberosities divides the perineum into an anterior urogenital triangle that contains the external genitals and a posterior anal triangle that contains the anus.

Mammary Glands

Each breast is a hemispheric projection of variable size anterior to the pectoralis major and serratus anterior muscles and attached to them by a layer of fascia composed of dense irregular connective tissue.

The circular pigmented:
- area of skin surrounding the nipple is called the areola.
- Strands of connective tissue called the suspensory ligaments of the breast (Cooper’s ligaments) run between the skin and fascia and support the breast.
- Within each breast is a mammary gland, a modified sudoriferous (sweat) gland that produces milk.
- Lobules, composed of grapelike clusters of milk-secreting glands termed alveoli embedded in connective tissue

1. The mammary glands are modified sweat glands located in the breasts.
2. The areola surrounds the nipple.
   - The mammary glands consist of glandular lobes and adipose tissue.
   - The lobes consist of lobules that have milk-producing alveoli.
   - The lobes connect to the nipple through the lactiferous ducts.
3. Suspensory ligaments support the breasts.

**Functions:**
- The functions of the mammary glands are the synthesis, secretion, and ejection of milk; these functions, called lactation, are associated with pregnancy and childbirth.
- Milk production is stimulated largely by the hormone prolactin from the anterior pituitary, with contributions from progesterone and estrogens.
- The ejection of milk is stimulated by oxytocin, which is released from the posterior pituitary in response to the sucking of an infant on the mother’s nipple (suckling).

**Physiology of Female Reproduction**

**Puberty**
1. Puberty begins with the first menstrual bleeding (menarche).
2. Puberty begins when GnRH, FSH, LH, estrogen, and progesterone levels increase.
3. Increased estrogen and progesterone promote the development of the female primary and secondary sex characteristics.

**Menstrual Cycle**
1. The menstrual cycle consists of the periodic changes occurring in the ovaries and uterus of a sexually mature, nonpregnant female that result in the production of a secondary oocyte and prepare the uterus for implantation.
2. The menstrual phase is the time between the beginning and the end of menstruation (days 1–5).
   - Menstruation is the discharge of blood and part of the endometrium from the uterus.
   - Menstruation begins because of a decrease in progesterone and estrogen from the previous cycle.
3. The proliferation phase is the time between the end of menstruation and ovulation (days 6–14).
   - FSH and LH stimulate follicular growth and estrogen production.
   - Estrogen stimulates epithelial cells in the endometrium to multiply. The endometrium becomes thicker and spiral glands and arteries develop.
   - The LH surge stimulates completion of the first meiotic division by the primary oocyte, ovulation, and formation of the corpus luteum.
   - The FSH surge stimulates follicle development. Mature follicles inhibit the development of less mature follicles.
4. The secretory phase is the time between ovulation and the beginning of menstruation (days 14–28).
   - Estrogen stimulates cell division in the endometrium.
   - Progesterone stimulates the spiral glands to produce a secretion rich in glycogen and lipids and inhibits uterine contractions.
   - If fertilization does not occur, menses begins and the corpus luteum becomes the corpus albicans.
   - If fertilization occurs, hCG stimulates the corpus luteum to persist.

**What Happens During the Menstrual Cycle?**

Females of reproductive age experience cycles of hormonal activity that repeat at about one-month intervals. With every cycle, a woman’s body prepares for a potential pregnancy, whether or not that is the woman’s intention. The term menstruation refers to the periodic shedding of the uterine lining. (Menstru means “monthly”; hence the term menstrual cycle.)

The average menstrual cycle takes about 28 days and occurs in phases: the follicular phase, the ovulatory phase (ovulation), and the luteal phase.

There are four major hormones (chemicals that stimulate or regulate the activity of cells or organs) involved in the menstrual cycle: follicle-stimulating hormone, luteinizing hormone, estrogen, and progesterone.

**Follicular Phase of the Menstrual Cycle**

This phase starts on the first day of your period. During the follicular phase of the menstrual cycle, the following events occur:

- Two hormones, follicle stimulating hormone (FSH) and luteinizing hormone (LH) are released from the brain and travel in the blood to the ovaries.
The hormones stimulate the growth of about 15 to 20 eggs in the ovaries each in its own “shell,” called a follicle.

These hormones (FSH and LH) also trigger an increase in the production of the female hormone estrogen.

As estrogen levels rise, like a switch, it turns off the production of follicle-stimulating hormone. This careful balance of hormones allows the body to limit the number of follicles that mature.

As the follicular phase progresses, one follicle in one ovary becomes dominant and continues to mature. This dominant follicle suppresses all of the other follicles in the group. As a result, they stop growing and die. The dominant follicle continues to produce estrogen.

**Ovulation**

Ovulation, the rupture of the mature (graafian) follicle and the release of the secondary oocyte into the pelvic cavity, usually occurs on day 14 in a 28-day cycle. During ovulation, the secondary oocyte remains surrounded by its zona pellucida and corona radiata.

- The high levels of estrogens during the last part of the preovulatory phase exert a positive feedback effect on the cells that secrete LH and gonadotropin-releasing hormone (GnRH) and cause ovulation, as follows:
  - A high concentration of estrogens stimulates more frequent release of GnRH from the hypothalamus. It also directly stimulates gonadotrophs in the anterior pituitary to secrete LH.
  - GnRH promotes the release of FSH and additional LH by the anterior pituitary.
  - LH causes rupture of the mature (graafian) follicle and expulsion of a secondary oocyte about 9 hours after the peak of the LH surge. The ovulated oocyte and its corona radiate cells are usually swept into the uterine tube.

**Ovulatory Phase of the Menstrual Cycle**

The ovulatory phase, or ovulation, starts about 14 days after the follicular phase started. The ovulatory phase is the midpoint of the menstrual cycle, with the next menstrual period starting about two weeks later. During this phase, the following events occur:

- The rise in estrogen from the dominant follicle triggers a surge in the amount of luteinizing hormone that is produced by the brain.
- This causes the dominant follicle to release its egg from the ovary.
- As the egg is released (a process called ovulation) it is captured by finger-like projections on the end of the fallopian tubes (fimbriae). The fimbriae sweep the egg into the tube.
- Also during this phase, there is an increase in the amount and thickness of mucous produced by the cervix (lower part of the uterus). If a woman were to have intercourse during this time, the thick mucus captures the man’s sperm, nourishes it, and helps it to move towards the egg for fertilization.

**Luteal Phase of the Menstrual Cycle**

The luteal phase of the menstrual cycle begins right after ovulation and involves the following processes:

- Once it releases its egg, the empty follicle develops into a new structure called the corpus luteum.
- The corpus luteum secretes the hormone progesterone. Progesterone prepares the uterus for a fertilized egg to implant.
- If intercourse has taken place and a man’s sperm has fertilized the egg (a process called conception), the fertilized egg (embryo) will travel through the fallopian tube to implant in the uterus. The woman is now considered pregnant.
- If the egg is not fertilized, it passes through the uterus. Not needed to support a pregnancy, the lining of the uterus breaks down and sheds, and the next menstrual period begins.

**How Many Eggs Does a Woman Have?**

The vast majority of the eggs within the ovaries steadily die, until they are depleted at menopause. At birth, there are approximately 1 million eggs; and by the time of puberty, only about 300,000 remain. Of these, 300 to 400 will be ovulated during a woman’s reproductive lifetime. The eggs continue to degenerate during pregnancy, with the use of birth control pills, and in the presence or absence of regular menstrual cycles.

**Female Sexual Behavior and the Female Sexual Act**

1. Female sex drive is partially influenced by androgens (produced by the adrenal gland) and steroids (produced by the ovaries).

2. Events of the female sexual act including the following:
   - The erectile tissue of the clitoris and the bulbs of the vestibule become filled with blood.
   - The vestibular glands secrete mucus, and the vagina extrudes a mucuslike substance.
   - Orgasm and resolution occur.

**Fertilization**

1. Intercourse must take place 5 days before to 1 day after ovulation if fertilization is to occur.

2. Sperm cell transport to the ampulla depends on the ability of the sperm cells to swim and possibly on contractions of the uterus and the uterine tubes.

3. Implantation of the developing embryo into the uterine wall occurs when the uterus is most receptive.

**Menopause**

1. Menopause is the cessation of menstrual cycles.
2. Perimenopause is the time between the beginning of irregular menstrual cycles and menopause.

DISORDERS OF THE FEMALE REPRODUCTIVE SYSTEM

Amenorrhea- refers to a condition in which an individual fails to menstruate

Primary- abnormal delay for the menstrual cycle to initiate

Secondary- abrupt cessation of menstrual cycle after years of regular menses.

Atrophic vaginitis- is characterized by redness, itching, and dryness of the vagina. This problem happens after Menopause in up to 75% of all women, and can also happen to some women after childbirth.

Cervical erosion- is the condition in which ulcers are formed in the cervix region

Cervicitis- basically an inflammation of uterine cervix

Dysmenorrhea- is painful menstruation. It may include pain in the abdomen, back and legs, abdominal cramps, headache, and fatigue.

Primary- painful regular (ovulatory) menstrual cycles

Secondary- painful periods due to an underlying condition or infection, that can begin at any age

Dyspareunia- refers to pain in the pelvic area. It occurs during or after sexual intercourse.

Oligomenorrhea- is a condition characterized by prolonged gaps between two menses

Ovarian Cancer- is a disease in which cancer cells grow in the ovaries

Premenstrual syndrome (PMS)- is a disorder marked by physical and emotional symptoms. It affects women 1-2 weeks before the beginning of their menstrual period.

Puerperal Fever- is also called childbed fever as it mostly occurs within 10 days of childbirth or miscarriage. The raw placenta, after separation becomes very prone to infections and lacerations.

Throat Cancer- is a disease in which cancer cells grow in one or both testicles.

1. Uterine fibroids- are benign growths that develop in the wall of the uterus. In rare cases, fibroids may protrude outside of the uterus toward nearby organs.

2. Uterine cancer is a disease in which cancer cells grow in the uterus (womb).

3. Vaginal yeast infection- is caused by a yeast fungus called Candida albicans

4. Vaginismus- is an uncontrolled, involuntary spasm of the muscles surrounding the vagina

TRIVIAS

-At 15, a boy’s testes can make 200 million sperm a day.

What is the length of the average ovarian cycle? 28 d

What part of the ovarian cycle has a fixed duration and how long is it? The luteal phase is fixed at 14-16 days

What part of the ovarian cycle varies from lady to lady? The follicular phase

What part of the endometrial cycle correlates with the follicular phase? Proliferative phase

What part of the endometrial cycle correlate with luteal phase? Secretory phase

What hormones are responsible for ovulation? LH surge in presence of local progesterone

Which of E or P predominates during the follicular phase of the ovarian cycle? Estrogen
Which of E or P predominates during the luteal phase of the ovarian cycle? Progesterone

Which of E or P predominates during the proliferative phase of the endometrial cycle? Estrogen induces endometrium to proliferate in preparation for implantation

What is a term that means ‘painful or difficult menstruation’? Dysmenorrhea. Menorrhagia is increased or excessive bleeding during a (period) amenorrhea is the absence of menstruation; metrorrhagia is irregular bleeding between periods.

Do you know your own penis, how it works and what makes it tick that you get an erection even if you do not want to? In truth, the penis is just an external structure of the male reproductive system. The body or male organ is cylindrical in shape and consists of three internal chambers.

These chambers are made up of some erectile tissues which are filled with blood when a man is sexually aroused. To further give you an idea, I have come up with the list so that you can understand your own penis.

So here are the 10 things that you should know to better understand your own penis and how it works.

1. No brain is necessary for ejaculation. The order comes from the spinal cord.

2. Smoking can shorten your penis by as much as 1 centimeter. So even you do not care about your heart or lungs and you feel that you will not die young, think about your manhood.

3. Did you know that doctors can now use the circumcised foreskin of infants in growing skin of burned victims? One foreskin can produce 23,000 square meters which can be enough to cure human flesh.

4. The oldest known species with a penis is a hard-shelled sea creature called ColymbosathinusEcplecticos. This is a Greek term which means amazing swimmer for large penis.

5. The average male orgasm lasts for 6 seconds while 23 seconds for women. So if the ladies are really interested with equal orgasms, they have to make sure that the men will get 4 orgasms of every one of theirs.

6. There are two types of penises, the growers and the showers. Growers are those that expand and lengthen during the erection while the showers are those who look bigger most of the time but cannot be much bigger after achieving an erection. A research shows that 79% of men are growers and 21% of men are showers.

7. Only one in 400 men is flexible enough to give themselves oral pleasure.

8. German researchers said that the average sexual intercourse lasts for 2 minutes and 50 seconds but women can prolong it to 5 minutes and 30 seconds. Are men that good or bad?

9. The common penile rupture is vigorous masturbation. Anyways, as men look over it, some risks are just worth taking.

10. The penis that the woman most enjoyed in the history of sexual intercourse is owned by King Fatefehi of Tonga, who de-virginized 37,800 women between the years 1770-1784. It is about 7 virgins a day. Yes, it is good to be a king.

If you want to know more on how to make your penis larger without using anything and make your partner fully satisfied just click here and I will show you how it can be achieved naturally.

A woman’s reproductive system is where her body stores, releases and nurtures the egg cells (ova – singular, ovum) that create a new human life when joined with a male sperm cell.

All the egg cells are stored from birth in the ovaries – two egg-shaped glands inside the pelvic region. Each egg is stored in a tiny sac called a follicle.

One egg cell is released every monthly menstrual cycle by one of the ovaries.

A monthly menstrual cycle starts when follicle-stimulating hormone (FSH) is sent by the pituitary gland in the brain to spur follicles to grow.

As follicles grow, they release the sex hormone estrogen. Estrogen makes the lining of the uterus (womb) thicken.

When an egg is ripe, it slides down a duct called a Fallopian tube.

If a woman has sexual intercourse at this time, sperm from the man’s penis may swim up her vagina, enter her womb and fertilize the egg in the Fallopian tube.

If the egg is fertilized, the womb lining goes on thickening ready for pregnancy, and the egg begins to develop into an embryo.
If the egg is not fertilized, it is shed with the womb lining in a flow of blood from the vagina. This shedding is called a menstrual period.

A man’s reproductive system is where his body creates the sperm cells that combine with a female egg cell to create a new human life.

Sperm cells look like microscopically tiny tadpoles. They are made in the testes, which is inside the scrotum.

The testes and scrotum hang outside the body where it is cooler, because this improves sperm production.

At 15, a boy’s testes can make 200 million sperm a day.

Sperm leave the testes via the epididymis — a thin, coiled tube, about 6 m long.

A mature sperm cell consists of a head, where the genetic information is stored, a midsection and a tadpole-like tail, which allows it to swim rapidly towards the female egg cell.

When the penis is stimulated during sexual intercourse, sperm are driven into a tube called the vas deferens and mix with a liquid called seminal fluid to make semen.

Semen shoots through the urethra (the tube inside the penis through which males urinate) and is ejaculated into the female's vagina.

The male sex hormone testosterone is also made in the testes.

Testosterone stimulates bone and muscle growth.

Testosterone also stimulates the development of male characteristics such as facial hair and a deeper voice.