

I. Male Reproductive System

A. **Spermatogenesis** is the formation of sperm.

1. Infant males are born with **spermatogonia**, which are diploid sex cells.
2. Once the male reaches puberty the spermatogonia undergo mitosis and give rise to **primary spermatocytes**.
3. The primary spermatocytes go through the first meiotic division to produce two **secondary spermatocytes**.
4. The second meiotic division of the secondary spermatocytes produces four **spermatids**.
5. The spermatids go through **spermiogenesis** in order to develop a head and tail.
6. The spermatids differentiate into **spermatozoa**, the mature male sex cell.
7. In the last 50 years there has been a 40% drop in the average American male's sperm count. Factors include:
 - a. Pollutants (DDT)
 - b. Stress
 - c. Smoking
 - d. Tight clothing

B. Anatomy of the male

1. The **scrotum** is a pouch that holds the testes outside the body wall.
 - a. Helps to maintain the testes at the optimum temperature of 91.4° F for viable sperm production.
 - b. If testes are too cool, **dartos muscles** within the wall of the scrotum contract to generate heat and **cremaster muscles** contract to elevate the testes closer to the body wall to absorb body heat.
2. The **testes** are paired glands that produce spermatozoa and male hormones.
 - a. A fibrous capsule called the tunica albuginea covers the testes.
 - b. Inwardly the testes are divided into about 250 lobules.
 - i. Each lobule consists of 1-4 **seminiferous tubules** which are approximately two feet in length.
 - (a) Spermatogenesis occurs within the seminiferous tubules.
 - (b) Mature spermatocytes are moved towards the lumen of the tubules.
 - (c) The tubules contain **Sertoli cells (sustentacular cells, Nurse cells)** which provide support and nutrition for the developing spermatozoa.
 - (i) Release the hormone **inhibin** to regulate sperm production.
 - ii. In between the seminiferous tubules are **Interstitial Cells of Leydig**, which produce the hormone **testosterone**.

- c. **Cryptorchidism** refers to the failure of the testes to descend into the scrotum.
 - i. Because the testicle remains in the body cavity at a higher temperature it results in sterility.
 - ii. It also increases the chance of the testes to develop testicular cancer.
- 3. The ductile system of the male
 - a. From the seminiferous tubules the sperm move into the **epididymis**.
 - i. The sperm continue to mature and acquire the ability to swim.
 - ii. The sperm are stored here for up to one month (if not expelled within that month the sperm are broken down and absorbed).
 - b. The epididymis becomes the **ductus (vas) deferens** which carries the sperm up through the **inguinal canal** of the body wall, over the bladder where it joins with the duct from the **seminal vesicles** to form the **ejaculatory duct**.
 - i. The ductus deferens secretes a weak acid to expose the spermatozoa to a pH under 6.5 so they won't swim (the optimum pH for sperm mobility is 6.5).
 - c. The ejaculatory duct carries the spermatozoa and secretions of the seminal vesicle to the **urethra**.
 - d. The urethra passes through the prostate and penis.
- 4. Accessory glands
 - a. The **seminal vesicles** are a pair of glands located at the base of the bladder.
 - i. Produce an alkaline, fructose rich substance that provides nutrition and protection for the sperm.
 - ii. Produce **prostaglandins** to stimulate contraction of the female reproductive tract to assist the movement of the spermatozoa up the tract.
 - b. The **prostate gland** is a doughnut shaped gland that surrounds the first inch of the urethra.
 - i. Secretes a milky, alkaline fluid designed to neutralize vaginal secretions.
 - ii. An **enlarged prostate** can constrict the urethra and interfere with the flow of urine.
 - (a) Usually occurs as a man ages.
 - c. The **bulbourethral (Cowper's) glands** are paired glands on either side of the urethra.
 - i. Secrete an alkaline mucus-like fluid that lubricates the end of the penis in preparation for intercourse.
 - d. The final pH of the semen is 7.5 which neutralizes the 5.5 pH of the female reproductive tract to 6.5, the pH required for sperm motility.

5. The **penis**
 - a. Consists of 3 columns of erectile tissue (a maze of vascular channels).
 - i. The **corpus spongiosum** is the column that surrounds the urethra.
 - (a) Expands distally to form the **glans penis**.
 - ii. The **corpora cavernosa** are the two lateral columns.
 - b. Penile reflexes
 - i. The **erection phase**:
 - (a) A parasympathetic reflex which relaxes smooth muscle in the penile arteries.
 - (b) This allows larger quantities of blood to enter the erectile tissue, compressing the veins draining blood away from the penis.
 - (c) More blood enters than leaves the penis resulting in firmness of the penis which continues until after spermatozoa are released from the body.
 - ii. The **emission phase**:
 - (a) A sympathetic reflex that results in peristaltic contractions of the epididymis, vas deferens and accessory glands.
 - (b) Moves semen into the urethra.
 - iii. The **ejaculation phase**:
 - (a) A continuation of the emission phase, the ejaculation phase forces the semen from the body.
- C. Hormonal control of the male reproductive system.
1. In response to the secretion of **gonadotropin-releasing hormone (GnRH)** from the hypothalamus, the anterior pituitary secretes **luteinizing hormone (LH)** and **follicle-stimulating hormone (FSH)**.
 - a. Luteinizing hormone targets the Interstitial cells of Leydig in the testis, stimulating them to produce **testosterone**.
 - b. Follicle-stimulating hormone targets Sertoli cells, stimulating them to produce **inhibin**.
 - i. Inhibin feeds back to the anterior pituitary gland inhibiting the secretion of more FSH, thereby inhibiting sperm production.
 2. Testosterone is secreted by the Interstitial cells of Leydig.
 - a. This is the primary male sex hormone.
 - b. Stimulates the development and maintenance of the male sex organs (primary sex characteristics).
 - c. Stimulates the development and maintenance of tissues involved in the secondary sex characteristics (muscle and skeletal growth, hair distribution, enlargement of the larynx, etc.)
 - d. Stimulates spermatogenesis.
 - e. Stimulates protein synthesis, especially in muscle and bone.

- f. Testosterone feeds back to the anterior pituitary and hypothalamus to inhibit the production of more LH and GnRH.