HUMAN REPRODUCTIVE

Gamete Formation:

Gametes, or sex cells, are the functional reproductive cells. They are haploid cells, each containing a half-complement of genetic material (23 single chromosomes).

Fertilization of an ovum by a spermatozoon produces a normal diploid cell, the zygote, with 23 paired chromosomes.

Primary and Secondary Sex Organs

The primary sex organs, or gonads, are the testes in the male and the ovaries in the female. The gonads function as mixed glands, producing both hormones and gametes. The secondary, or accessory, sex organs are those structures that mature at puberty under the influence of sex hormones and that are essential in caring for and transporting gametes. Secondary sex characteristics are features that are considered sexual attractants.

Male Reproductive System

The male sex organs are formed prenatally under the influence of testosterone secreted by the gonads (testes). During puberty, the secondary sex organs mature and become functional. Male reproductive organs and their functions are listed below.
THE TESTES:
Each testis is oval, with a length of about 4.0 cm and a width of 2.5 cm. On the outside of each testis is a shiny covering, the tunica vaginalis. Immediately under the tunica vaginalis is a thin, dense covering of the testis itself, the tunica albuginea; Inside each testis are about 250 compartments, testicular lobules, which are separated from each other by septa (tissue barriers). Each lobule contains one to three highly coiled seminiferous tubules. If a single seminiferous tubule were stretched to its maximal length, it would measure about 30 to 91 cm.

The male germ cells lie next to the inner wall of each tubule, and sperm are produced in the seminiferous tubules.

The testes also contain some of the male sex accessory ducts. Each testis is suspended from the body wall by a spermatic cord which contains one of the accessory ducts (the vasa deferens), a testicular nerve, and three coiled-blood vessels (the testicular artery, or spermatic artery, carrying blood to the testis and epididymis, and two testicular veins, or spermatic veins, carrying blood away from the testis).

Male Sex Accessory Ducts ~

The male sex accessory ducts include the tubuli recti, rete testis, vasa efferentia, ductus epididymis, vas deferens, ejaculatory duct, and urethra.
These ducts serve to mature and transport sperm. Mature sperm, suspended in testicular fluid, leave the somniferous tubules and enter the tubuli recti. These tubules, in turn, join a network of tubules still within the testis, the rete testis. The sperm then enter ducts, that eventually leave the testis, the vasa efferentia. The vasa efferentia lead to an organ lying outside the testis, the epididymis.

Epididymis The epididymis is a comma-shaped structure, about 3.8 cm long, that lies along the posterior surface of each testis. The epididymis is a coiled tube about 20 feet (6 m) long. Within the epididymis the sperm complete their maturation, and their flagella become functional. Smooth muscle in the wall of the epididymis propels the sperm into the ductus deferens.

DUCTUS DEFERENS
Also called the vas deferens, the ductus deferens extends from the epididymis in the scrotum on its own side into the abdominal cavity through the inguinal canal. Once inside the abdominal cavity, the ductus deferens extends upward over the urinary bladder, then down the posterior side to join the ejaculatory duct on its own side.

The smooth muscle layer of the ductus deferens contracts in waves of peristalsis as part of ejaculation.

EJACULATORY DUCTS
Each of the two ejaculatory ducts receives sperm from the ductus deferens and the secretion of the seminal vesicle on its own side. Both ejaculatory ducts empty into the single urethra.

Male sex accessory glands
Male sex accessory glands include the seminal vesicles, prostate gland, and bulbourethral glands.

These glands secrete substances into ducts that join the sex accessory ducts. Thus, the secretion of these glands, seminal plasma, mixes with the sperm to form semen or seminal fluid.

SEMINAL VESICLES

The paired seminal vesicles are posterior to the urinary bladder. About 5 cm in long. Their secretion contains an alkaline, viscous fluid rich in the sugar fructose to provide an energy source for sperm and is alkaline to enhance
sperm motility. The duct of each seminal vesicle joins the ductus deferens on that side to form the ejaculatory duct. A majority of the seminal plasma is secreted by the seminal vesicles (about 65%)

PROSTATE GLAND
A muscular gland just below the urinary bladder, the prostate gland is about 1.2 inches high by 1.6 inches wide by 0.8 inch deep (3 cm by 4 cm by 2 cm, about the size of a walnut). It surrounds the first inch of the urethra as it emerges from the bladder.

The glandular tissue of the prostate secretes an alkaline fluid that helps maintain sperm motility. The smooth muscle of the prostate gland contracts during ejaculation to contribute to the expulsion of semen from the urethra. The alkaline secretion of this gland makes up about 13 to 33% of seminal plasma. The secretion enters the prostatic urethra through many (up to a dozen) tiny ducts.

BULBOURETHRAL GLANDS
Also called Cowper’s glands, the bulbourethral glands are about the size of peas and are located below the prostate gland; they empty into the urethra. Their alkaline secretion coats the interior of the urethra just before ejaculation, which neutralizes any acidic urine that might be present.

Penis. The penis consists of an attached root, a free body, and an enlarged tip, the glans penis. The penis is specialized with three columns of erectile tissue to become engorged with blood for insertion into the vagina during coitus. The urethra also passes through the penis as a conduit for urine. Erection of the penis depends on a surplus of blood entering the arteries of the penis as compared to the volume exiting through venous drainage. This is stimulated by parasympathetic innervation. Ejaculation, expulsion of semen through the urethra, is a result of sympathetic innervation.
Clinical Disorders Related to Male Reproductive System:

1- Prostatic hypertrophy is enlargement of the prostate gland. Benign prostatic hypertrophy is a common occurrence in men over the age of 60 years. The enlarged prostate compresses the urethra within it and may make urination difficult or result in urinary retention.

2- Cancer of the prostate is the second most common cancer among men (lung cancer is first). Most cases occur in men over the age of 50 years. Treatment may include surgery to remove the prostate, radiation therapy, or hormone therapy to reduce the patient’s level of testosterone.

**HORMONES OF MALE REPRODUCTION**

<table>
<thead>
<tr>
<th>Hormone</th>
<th>Secreted by</th>
<th>Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>FSH</td>
<td>Anterior pituitary</td>
<td>• Initiates production of sperm in the testes</td>
</tr>
<tr>
<td>LH (LH-hCG)</td>
<td>Anterior pituitary</td>
<td>• Stimulates secretion of testosterone by the testes</td>
</tr>
<tr>
<td>Testosterone*</td>
<td>Testes (interstitial cells)</td>
<td>• Promotes maturation of sperm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Initiates development of the secondary sex characteristics:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>—growth of the reproductive organs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>—growth of the larynx</td>
</tr>
<tr>
<td></td>
<td></td>
<td>—growth of facial and body hair</td>
</tr>
<tr>
<td></td>
<td></td>
<td>—increased protein synthesis, especially in skeletal muscles</td>
</tr>
<tr>
<td>Inhibin</td>
<td>Testes (sustentacular cells)</td>
<td>• Decreases secretion of FSH to maintain constant rate of spermatogenesis</td>
</tr>
</tbody>
</table>
Negative feedback. Regulation of testosterone secretion involves negative feedback (reverse arrows) by testosterone on GnRH and LH. Regulation of sperm production involves negative feedback by inhibin on GnRH and FSH.