MALE REPRODUCTIVE SYSTEM

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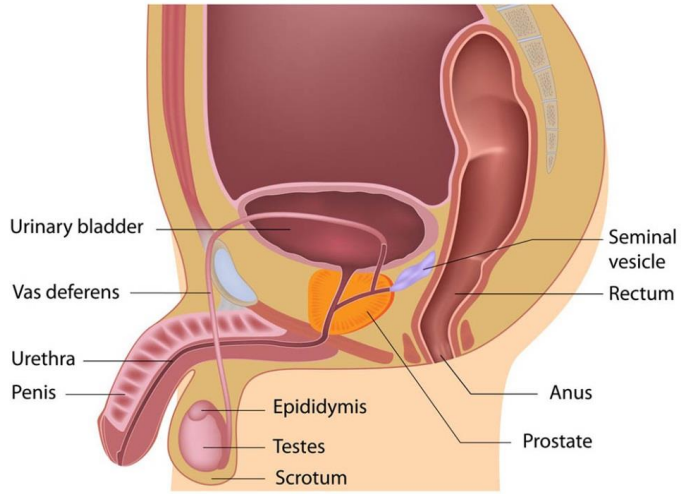
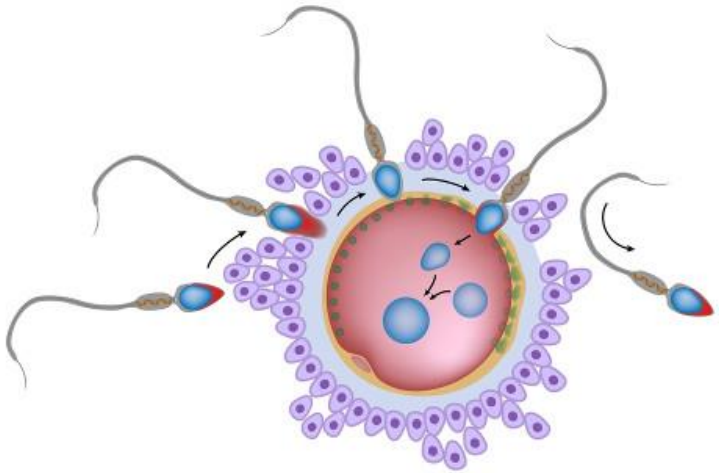
introduction

- The male reproductive system consists of the **male sexual organs** and is involved in ***sexuality***, ***fertility*** and ***propagation*** of the species.
- It is primarily concerned with the **(1)** production of semen and the **(2)** transfer of the semen into the female reproductive tract.
- The male reproductive system also **(3)** secretes various hormones that maintain secondary sexual characteristics.
- It has a very close link to the male urinary system as some of the male reproductive organs also have urinary functions.



functions

- The reproductive system in the male consists of **hormones** that work in combination with the **pelvic organs and structures** to play a part in the process of **reproduction** through **fertilization** of a female **egg**.
- Within the **testes** (testicles), **spermatozoa** (or sperm) are produced and stored until sexual intercourse.
- **Spermatozoa** are the **male gametes**, or sex cells.
- At the time of intercourse, the **sperm** mix with a protective liquid called **semen** in the **epididymis**.
- This is then ejaculated through **ductus deferens** ducts out of the **penis** via the **urethra** and into the **vaginal** tract of the female.



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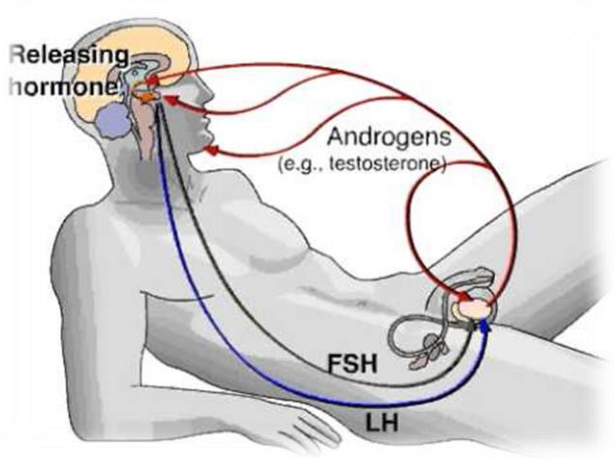
hormones

- The main **hormones** involved in the functioning of the male reproductive system are **follicle-stimulating hormone** (FSH), **luteinizing hormone** (LH) and the main androgen (male sex hormone) called **testosterone**.
- **FSH** and **LH** are manufactured by the **pituitary gland** in the brain.
- **FSH** is responsible for the **production of sperm** in a process called **spermatogenesis**.
- **LH** initiates the **production of testosterone**, which also supports spermatogenesis.
- **Testosterone** is also responsible for the development of the secondary **male sexual characteristics**, including distinctive male muscle dimensions and strength, fat distribution, bone mass, deepening of the voice, growth of facial and body hair, the development of the Adam's apple and sex drive.
- The male reproductive system has both **internal** and **external** organs.



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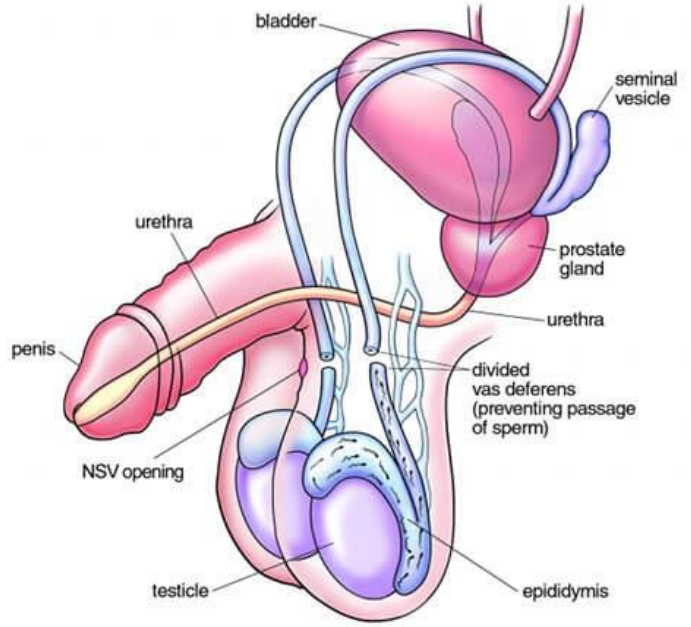
EXTERNAL MALE REPRODUCTIVE STRUCTURES

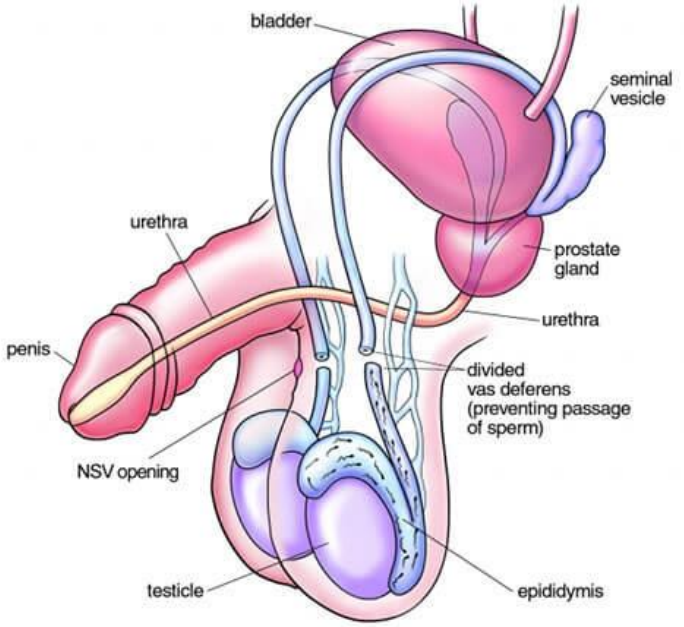
penis

- The human penis consists of three parts: the **root**, which is connected to the abdominal wall, the **shaft** or **body** of the penis and the **glans** penis.
- The foreskin is a loose layer of skin covering the glans.
- The opening of the urethra, the tube that transports semen and urine, is at the head of the glans.
- The penis also has many sensitive nerve endings.
- The body of the penis is shaped like a cylinder and has three internal chambers made up of spongy erectile tissue.
- This tissue contains thousands of large spaces that fill with blood when a male is sexually aroused.
- As the penis fills with blood, it becomes rigid and erect, which allows penetration to occur during sexual intercourse.
- The skin of the penis is loose and elastic to allow it to change size during an erection.



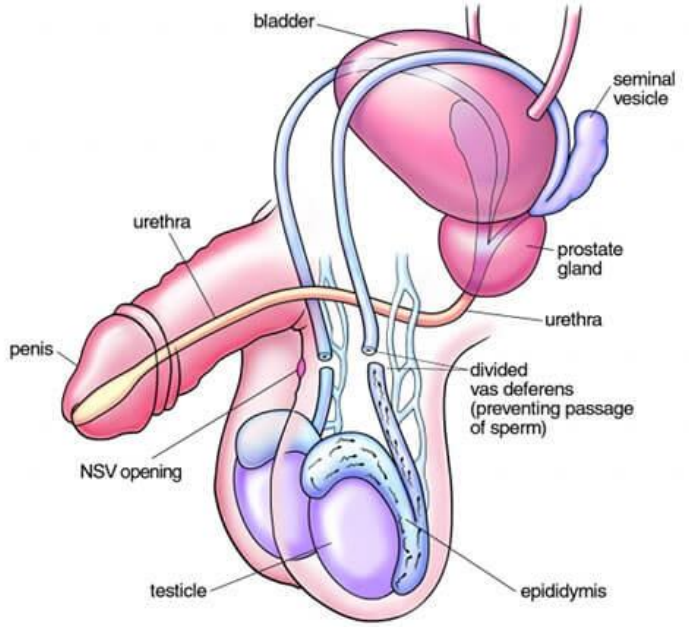
testicles

- The testicles or **testes** (singular: testis) are two oval-shaped organs located behind the penis in an external sac called the **scrotum**.
- Sperm are produced in the testes in a process known as **spermatogenesis**.
- The testes also produce male hormones, such as **testosterone**, which are responsible for the development of the typical male characteristics.
- The anterior pituitary gland in the brain releases two types of gonadotrophins which affect the testes.
- Luteinizing hormone (**LH**) causes the release of testosterone from the testes and follicle-stimulating hormone (**FSH**) which maintains spermatogenesis.



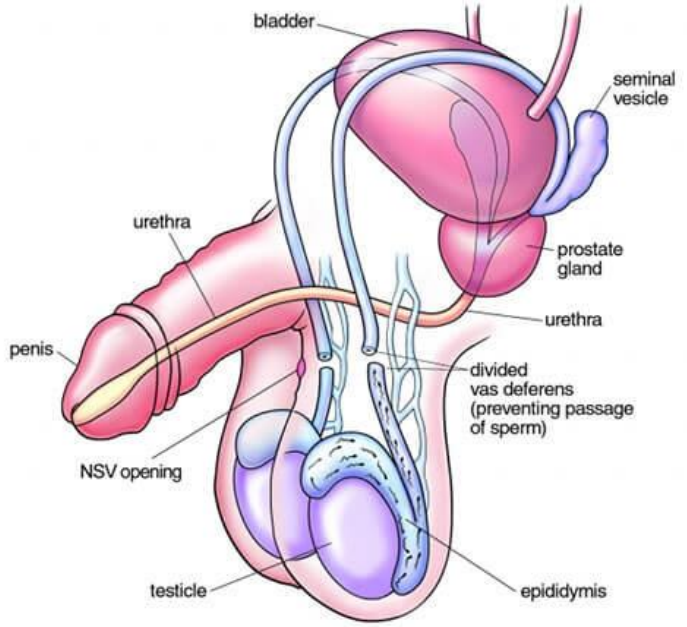
scrotum

- The **scrotum** consists of a sac of skin and muscle divided by a septum, in which the two testes are contained.
- By allowing the testes to hang outside the body and by the action of loosening and tightening the **scrotal muscle** which moves the testes closer to or away from the abdomen, the testes are kept at a slightly cooler temperature to the rest of the body, thus maintaining the viability of the sperm.



epididymis

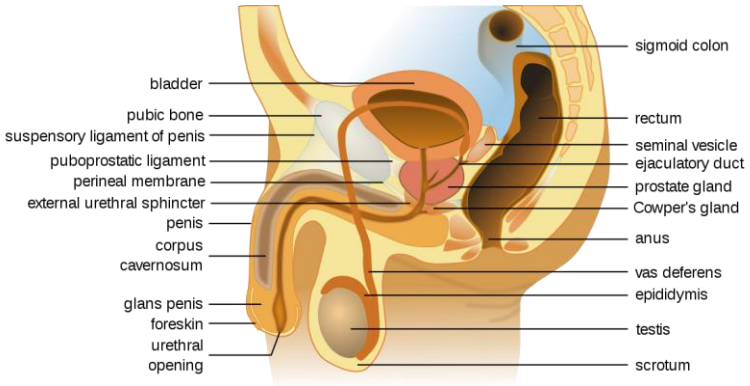
- There are two epididymides (singular: **epididymis**) in the male, formed of a series of small coiled tubes located at the back of the testes.
- The epididymis collects and stores sperm prior to the seminal fluid being ejaculated via the ductus deferens.



INTERNAL MALE REPRODUCTIVE STRUCTURES

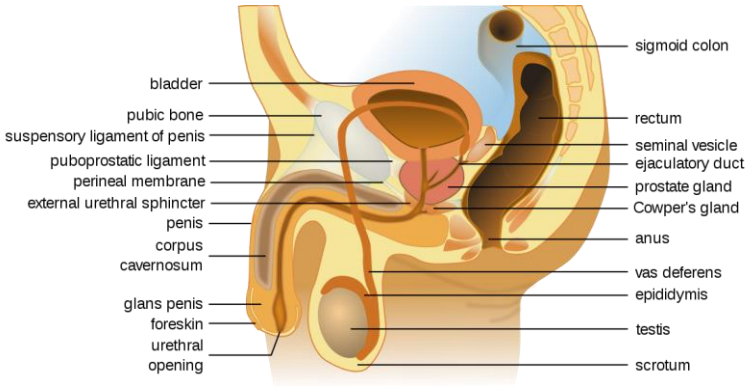
ductus deferens

- The **ductus deferens** (plural: ductus deferentes), is a long muscular tube (duct) that transports sperm via peristalsis from each epididymis to the **ejaculatory ducts** and ultimately to the urethra.
- Along the way, semen is formed from the secretions from other male sex glands such as the **seminal vesicles**, **prostate** and the **bulbourethral gland** and these mix with the sperm prior to ejaculation.



ejaculatory ducts

- The two **ejaculatory ducts** are formed where the ductus deferens connects with the seminal vesicles to pass through the prostate and into the urethra.
- Semen travels along this path before it exits the body through the penis during ejaculation.



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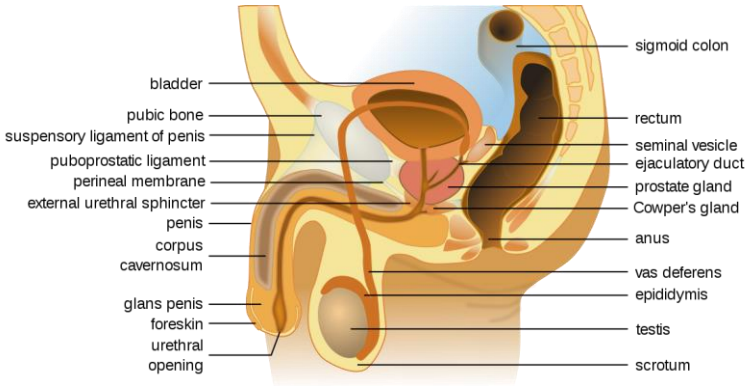
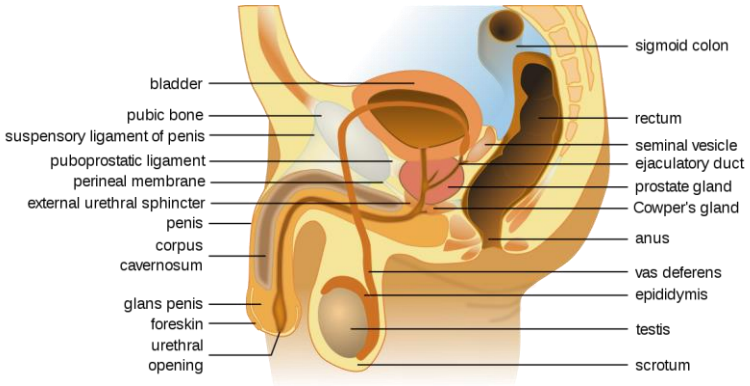
seminal vesicles

- There are two **seminal vesicles** which are tubular glands located near the prostate.
- The main role of the seminal vesicles is to produce a **fluid** that makes up most of the semen.



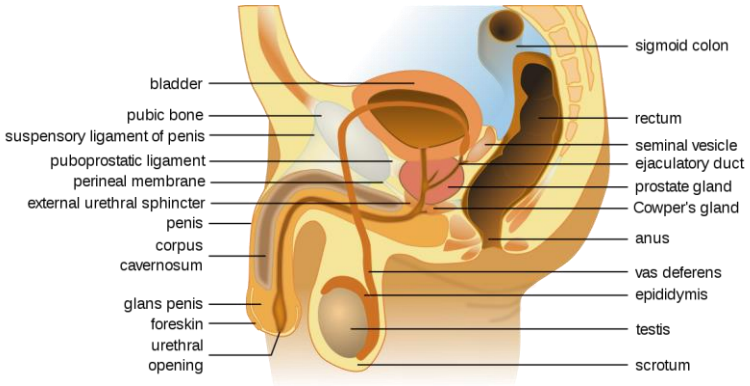
prostates

- The **prostate** is a small muscular gland surrounding the urethra just below the bladder.
- Its function is to **secrete** some of the seminal fluid that protects and enriches the sperm as it is transported out of the body.
- The prostate is enclosed in the muscles of the pelvic floor, which contract during the ejaculatory process and assist with penile erection.
- **Prostate-specific antigen** (PSA) is an enzyme called a **protease** that breaks protein secretions into smaller molecules, thus making the semen liquid.



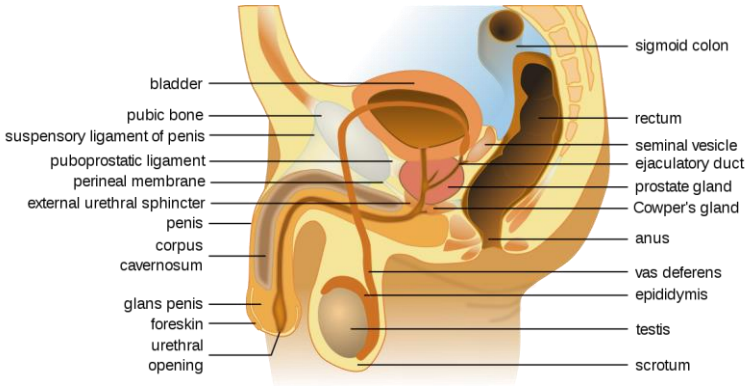
bulbourethral glands

- These glands are also called **Cowper's glands**.
- During sexual arousal each of the bulbourethral glands produces a clear, sticky fluid known as **pre-ejaculate**.
- The pre-ejaculate helps to **lubricate** the urethra for the sperm to pass through and plays a role in **neutralizing** acids from urine that are in the urethra from earlier urination.



urethra

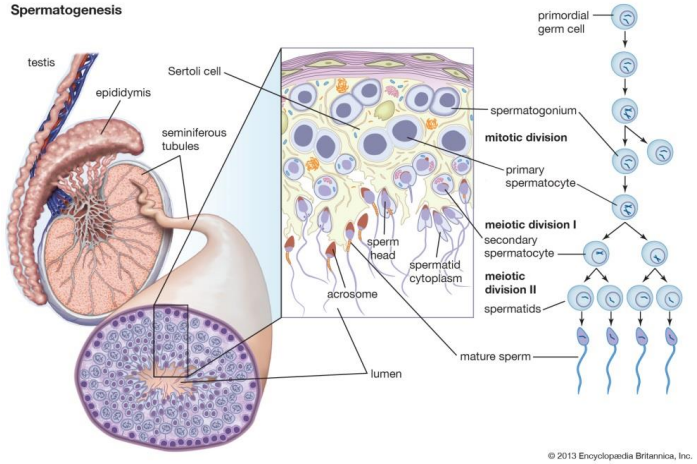
- The **urethra** is the tube that connects the bladder to the penis for the removal of fluids from the body.
- In males, the urethra carries semen as well as urine and hence has a role in the urinary system as well as the male reproductive system.



SPERMATOGENESIS

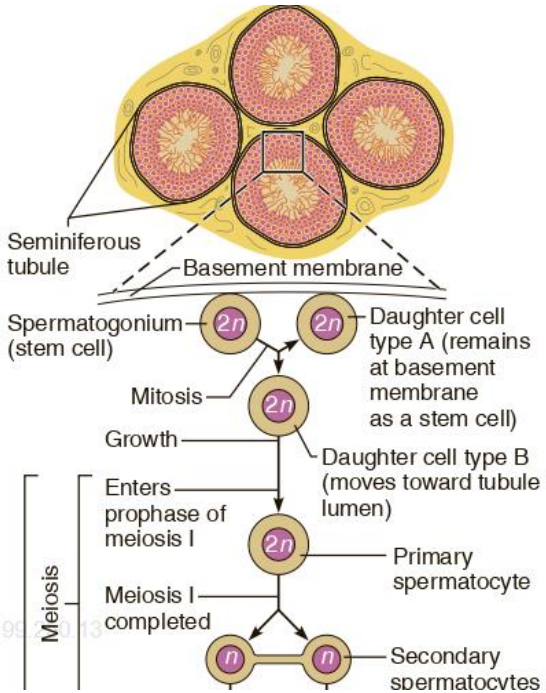
sperm production

- Sperm production, or **spermatogenesis**, begins during puberty and continues throughout life.
- A man makes millions of sperm daily.
- Only one sperm **fertilizes** an egg, so it seems that nature has made sure that the human species will not be endangered for lack of sperm.
- Sperm are formed in the **seminiferous tubules** of the testis, as noted earlier.
- The process is begun by primitive stem cells called **Spermatogonia** (singular spermatogonium) found in the outer edge, or periphery, of each tubule.
- Spermatogonia go through rapid **mitotic** divisions to build up the stem cell line.
- From birth until puberty, all such divisions simply produce more stem cells.
- During puberty, however, follicle-stimulating hormone (**FSH**) is secreted in increasing amounts by the anterior pituitary gland.



spermatogonium

- From puberty on, each division of a spermatogonium produces one stem cell, called **type A** daughter cell, and another cell, called **type B** daughter cell.
- The **type A** cell remains at the tubule periphery to maintain the stem cell population.
- The **type B** cell gets pushed toward the tubule lumen, where it becomes a primary spermatocyte destined to undergo **meiosis** and form four sperm.
- In spermatogenesis, the gametes are called **spermatids**.
- Spermatids have only half as much genetic material as other body cells.
- In humans, this is 23 chromosomes rather than the usual 46.
- Then, when the sperm and the egg (which also has 23 chromosomes) unite, forming the fertilized egg, or **zygote**, the normal **2n** number of 46 chromosomes is reestablished and is maintained in subsequent body cells by the process of mitosis.



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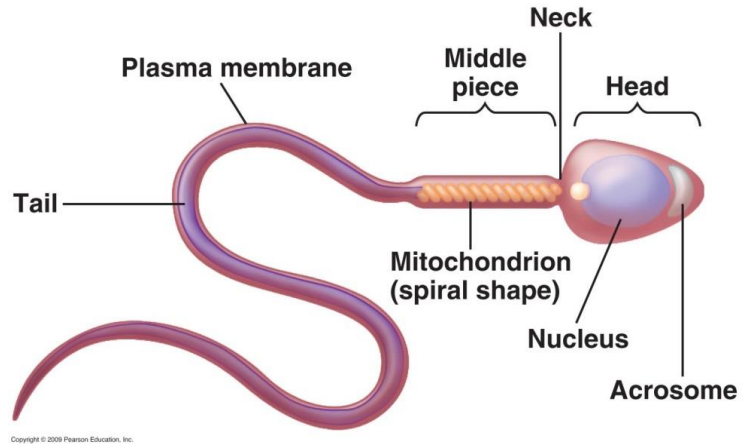
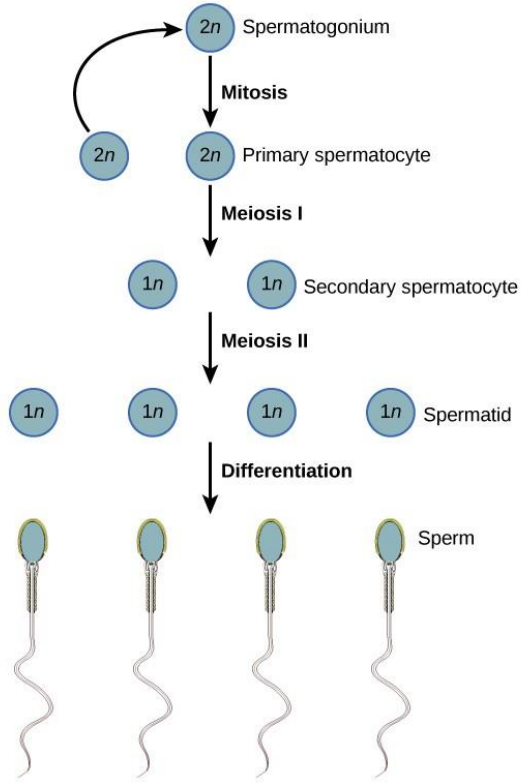
sperm

- The sperm head is the **nucleus** and contains compacted **DNA**, the genetic material.
- Anterior to the nucleus is the helmetlike **acrosome**, which is produced by the Golgi apparatus and is similar to a large lysosome.
- When a sperm comes into close contact with an egg (or more precisely, an oocyte), the acrosomal membrane breaks down and releases enzymes that help the sperm penetrate the capsule of follicle cells that surround the egg.
- Filaments, which form the long tail, arise from centrioles in the midpiece.
- Mitochondria wrapped tightly around these filaments provide the ATP needed for the whiplike movements of the tail that propel the sperm along the female reproductive tract.



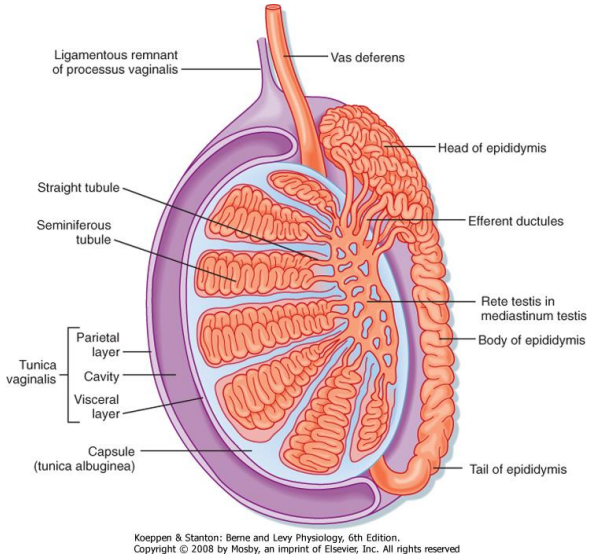
primary spermatocyte

- The entire process from the formation of a primary spermatocyte to release of immature sperm in the tubule lumen takes 64 to 72 days.
- But sperm in the lumen are still unable to “swim” and so are still incapable of fertilizing an egg.
- They are moved by peristalsis through the tubules of the testes into the epididymis.
- There they undergo further maturation, which results in increased motility and fertilizing power.



testosterone production

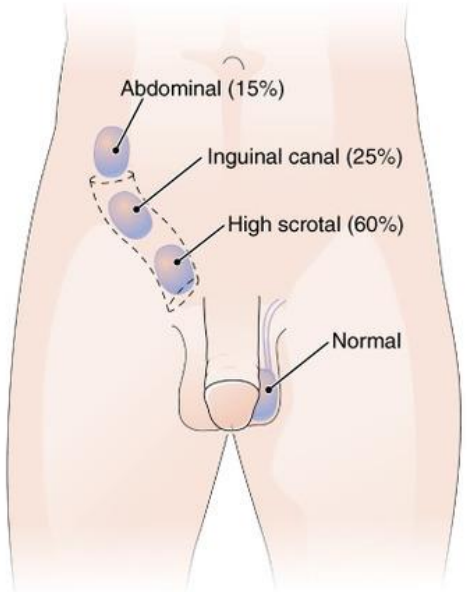
- The testosterone is the most important hormonal product of the testes.
- During puberty, as the seminiferous tubules are being stimulated by **FSH** to produce sperm, the interstitial cells are being activated by **luteinizing hormone** (LH), which is also released by the anterior pituitary gland.
- From this time on, testosterone is produced continuously (more or less) for the rest of a man's life.
- The rising blood level of testosterone in the young man stimulates the **adolescent growth spurt**, prompts his reproductive organs to develop to their adult size, underlies the sex drive, and causes the male secondary sex characteristics to appear.
- Secondary sex characteristics are features induced in nonreproductive organs by sex hormones.
- Male secondary sex characteristics include the following:
    - Deepening of the voice as the larynx enlarges.
    - Increased hair growth all over the body, particularly in the axillary and pubic regions and on the face.
    - Enlargement of skeletal muscles to produce the heavier muscle mass typical of the male physique.
    - Increased heaviness of the skeleton due to bone growth in both size and density.
- Because testosterone is responsible for the appearance of these typical masculine characteristics, it is often referred to as the "**masculinizing**" hormone.



PATHOLOGY & DISEASES

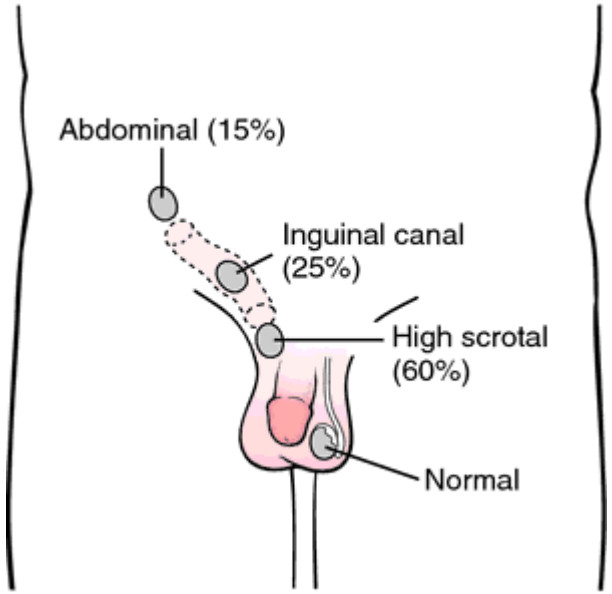
anorchism

- It is a congenital absence of **one** or **both** testes.
- For normal development and optimal sperm production, the testis must descend from its original position near the kidney into the scrotum.



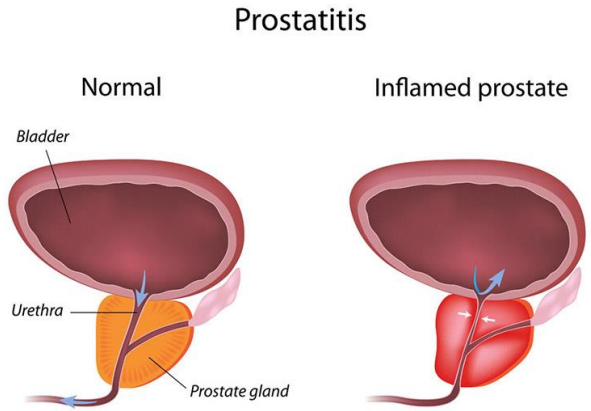
cryptorchism

- It is a failure of one or both testicles to descend into the scrotum before birth.
- It is more common in premature babies than in full term infants.
- The undescended testicle will often descend spontaneously by one year of age.
- If not, surgical intervention such as an orchiopexy may be performed.



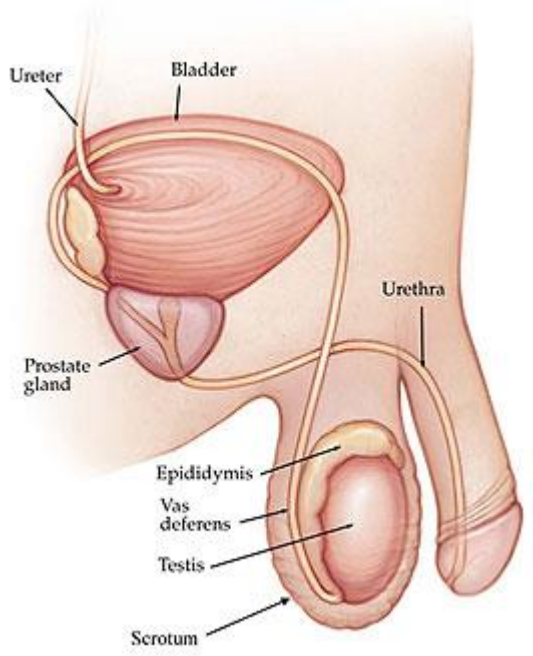
bacterial prostatitis

- It is an infection of the prostate gland caused by bacteria.
- It often occurs in conjunction with urethritis or an infection of the lower urinary tract.
- It is characterized by fever, chills, dysuria, urethral discharge and a tender prostate.



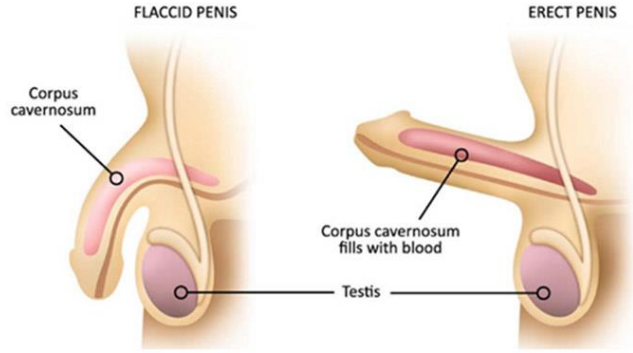
epididymitis

- It is an inflammation of the epididymis usually resulting from a bacterial infection such as chlamydia or gonorrhoea.
- It can also result from other urinary tract infections and prostatitis.
- In some cases, especially in children, epididymitis is due t a non-infectious source such as injury.



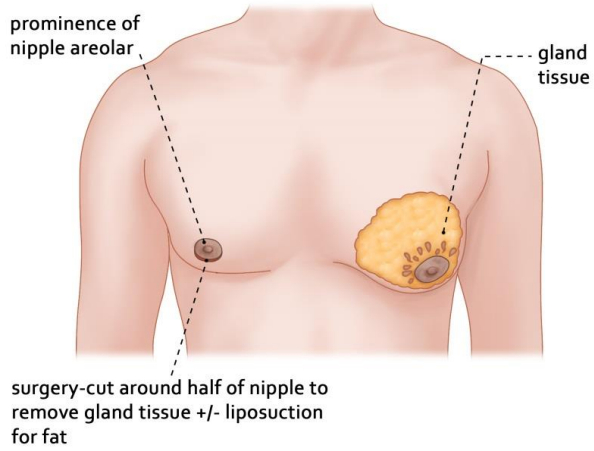
erectile dysfunction

- It is also called impotence.
- It refers to the inability of the male to achieve or maintain a penile erection during sexual intercourse.
- It can be due to organic problems such as diabetes and cardiovascular disease, as a result of nerve damage, for example after prostate surgery, or as a side effect of various drugs.
- In some cases, erectile dysfunction is psychological in aetiology.



gynaecomastia

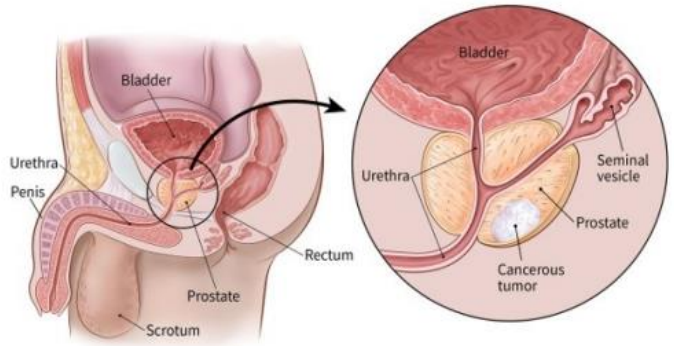
- It refers to an abnormal enlargement of glandular breast tissue in a male.
- It is usually due to a hormonal imbalance where the male has an increased amount of oestrogen in relation to levels of androgen and/or testosterone.



Male Gynaecomastia

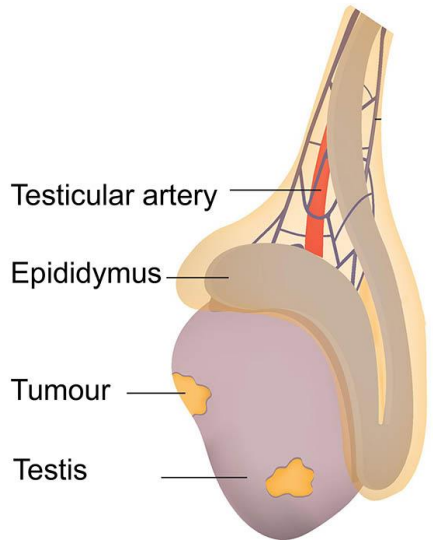
prostate cancer

- It is one of the most common invasive cancers in men.
- Usually, it is one of the slowest growing malignancies but can be aggressive in a small number of patients.
- It is frequently asymptomatic for a period of time with the first symptoms often related to bladder neck obstruction.
- Prostate cancer tends to metastasise in a predictable pattern, usually to the adjacent lymphnodes and bones in the spine and pelvis.



testicular cancer

- It is a malignant tumor of the testes.
- The main histological types include seminoma, choriocarcinoma and teratoma.
- It is the most common malignancy in young men.
- With early detection by testicular self-examination and treatment with combination chemotherapy, testicular cancer is curable.



QUESTIONS?

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