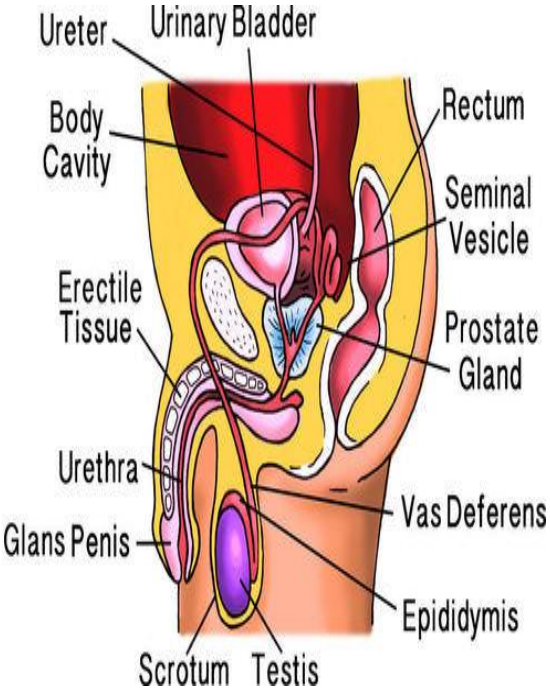
The Male Reproductive System:

- testes,
- genital ducts,
- accessory glands
- Penis

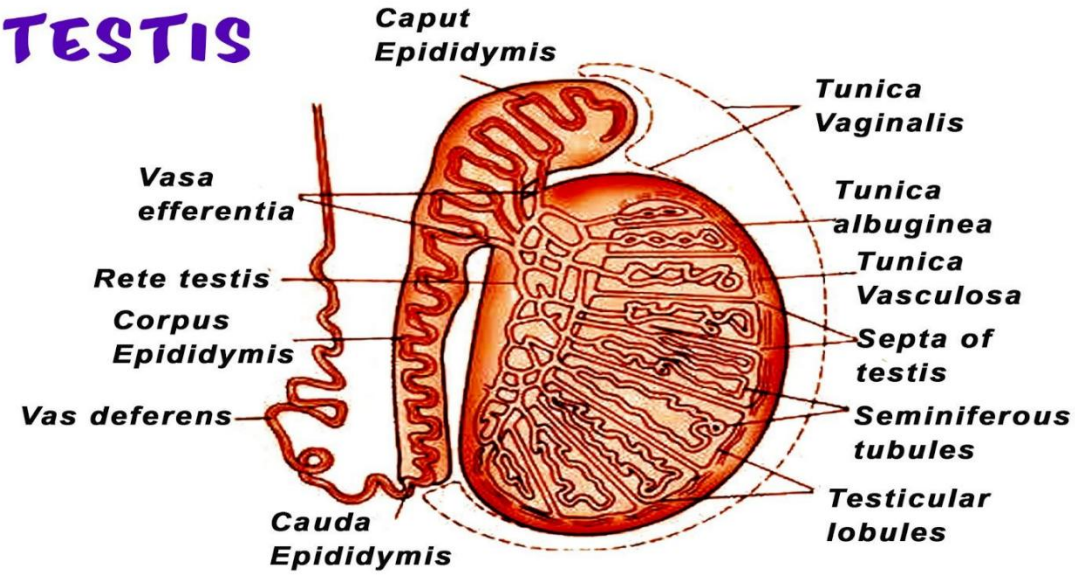


TESTES:

Testes consists of:

A-capsule :

The **testis** is covered by a dense connective tissue capsule called the **tunica albuginea**, which is thicker on the posterior side and forms the **mediastinum testis**. Septa extend from this capsule into the testis, dividing it into about **250 testicular lobules**. Each lobule contains **sparse connective tissue with Leydig (interstitial) cells** and **one to four highly coiled seminiferous tubules**, where sperm production takes place.

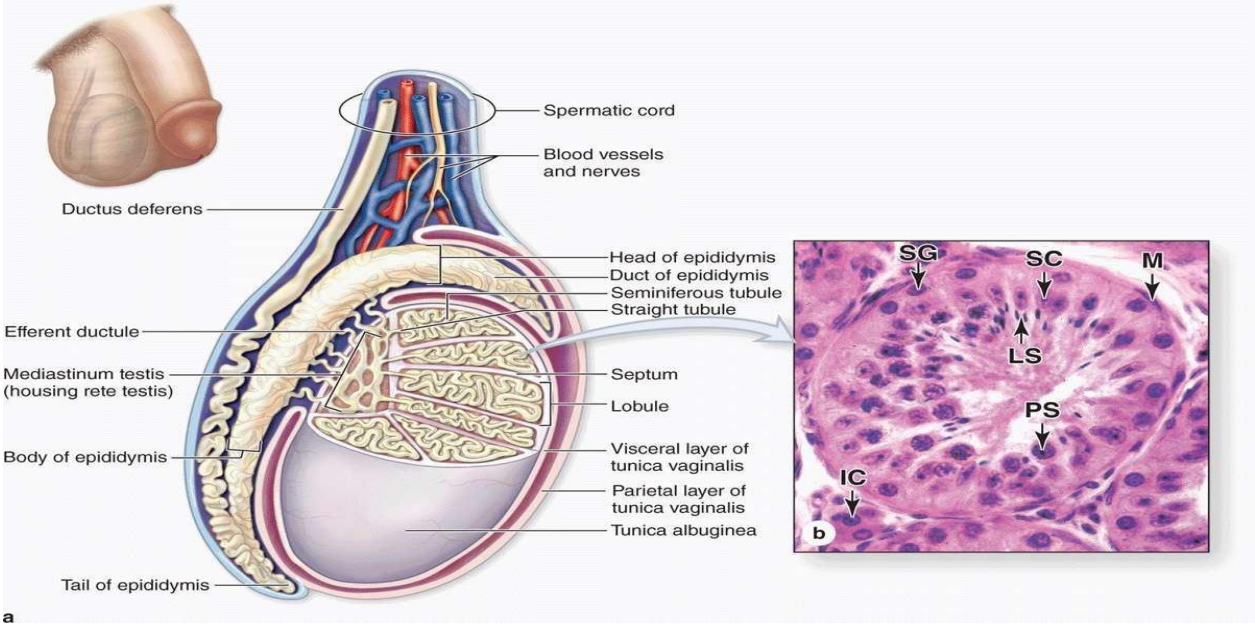


The **testes** develop in the dorsal wall of the embryonic abdominal cavity behind the peritoneum and later descend into the **scrotum** during fetal development. During this descent, each testis carries a serous sac called the **tunica vaginalis**, derived from the peritoneum. It consists of two layers: the **parietal layer**, which lines the scrotum, and the **visceral layer**, which covers the anterior and lateral surfaces of the testis over the tunica albuginea.

The **interstitial tissue** of the testis lies between the seminiferous tubules and contains connective tissue with fibroblasts, lymphatic vessels, and fenestrated capillaries. During puberty, **Leydig cells** develop and produce **testosterone**, the hormone responsible for secondary male sex characteristics. Testosterone is synthesized by enzymes in the **smooth**

endoplasmic reticulum and mitochondria, similar to those in adrenal cortical cells.

Seminiferous tubules are the structures where sperm are produced, generating about **200 million sperm per day** in young adults. Each testis



contains **250–1000 seminiferous tubules** within its lobules. Each tubule forms a loop that connects through a short **straight tubule** to the **rete testis**, a network of epithelial channels in the **mediastinum testis**. From the rete testis, **10–20 efferent ductules** carry sperm to the head of the epididymis. The seminiferous tubules are lined with a specialized **germinal (spermatogenic) epithelium**. Their basement membrane is surrounded by fibrous connective tissue and an inner layer of **myoid cells**, which can produce weak contractions to help move sperm through the tubules.

The germinal epithelium consists of two types of cells:

1- Spermatogenic cells
2- Sertoli cells

1- Spermatogenic cells:

*The cells of the spermatogenic cells comprising four or more concentric layers of cells in the germinal epithelium

*develop from progenitor cells to fully formed sperm cells over a period of approximately 10 weeks.

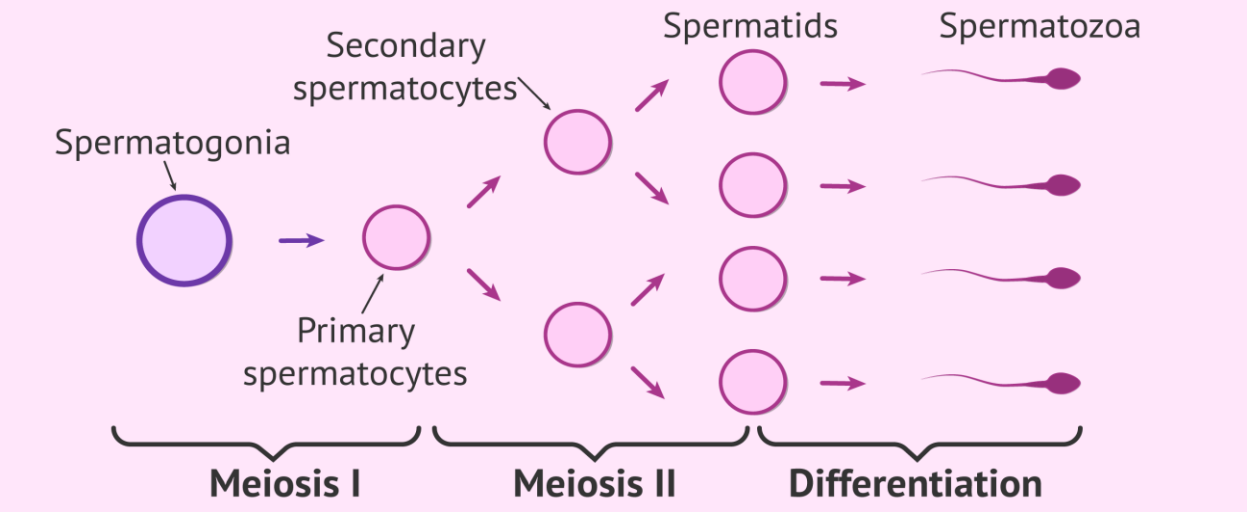
Sperm production:

Spermatogenesis begins at puberty with the proliferation of **spermatogonia**, which are stem cells located near the basement membrane of seminiferous tubules and associated with **Sertoli cells**. **Dark type A spermatogonia** divide slowly to maintain stem cells and produce **pale type A spermatogonia**, which divide more actively and form **type B spermatogonia**.

Each **type B spermatogonium** undergoes mitosis to produce **primary spermatocytes**, which are the largest spermatogenic cells and contain the **diploid number of chromosomes (46)**. These cells enter the **first meiotic**

division, which lasts about three weeks, producing **secondary spermatocytes** with **23 chromosomes**.

Secondary spermatocytes are short-lived and quickly undergo the **second meiotic division**, separating chromatids and forming **haploid spermatids**, which later differentiate into sperm cells.



Spermiogenesis is the final stage of sperm formation in which **haploid spermatids differentiate into spermatozoa**. No cell division occurs during this process, and the cells remain associated with **Sertoli cells**. Spermatids are small cells located near the lumen of the seminiferous tubules. During spermiogenesis, the **acrosome forms, the nucleus condenses and elongates, a flagellum develops, and excess cytoplasm is removed**, producing a mature sperm cell.

Spermiogenesis is divided into **four phases**:

1. **Golgi phase:** The Golgi apparatus forms proacrosomal vesicles that fuse to create the **acrosomal cap**, while centrioles organize the **flagellum**.
2. **Cap phase:** The acrosome spreads over about half of the nucleus and contains enzymes that help the sperm penetrate the **corona radiata and zona pellucida** during fertilization.
3. **Acrosome phase:** The nucleus becomes **elongated and highly condensed**, the flagellum continues to grow, and **mitochondria gather in the middle piece** of the sperm.
4. **Maturation phase:** Excess cytoplasm is shed as a **residual body**, and fully formed **spermatozoa** are produced and released into the lumen of the seminiferous tubule.

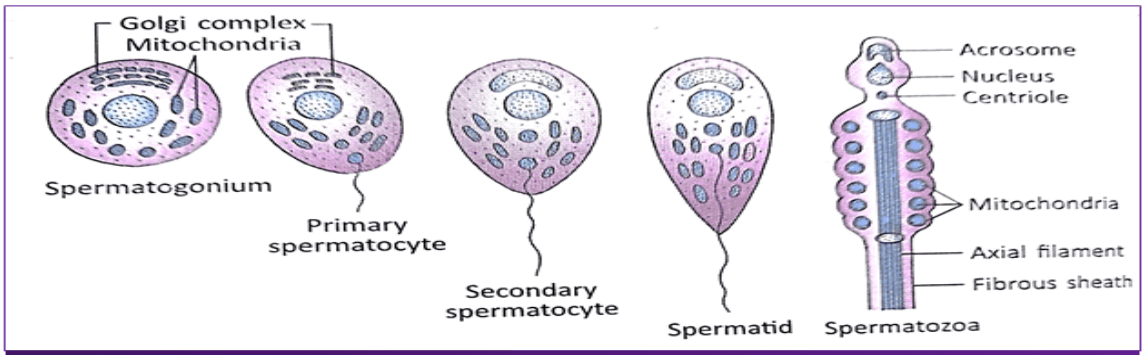


Fig: Stages of Spermiogenesis