Reproductive Physiology

Male reproductive physiology

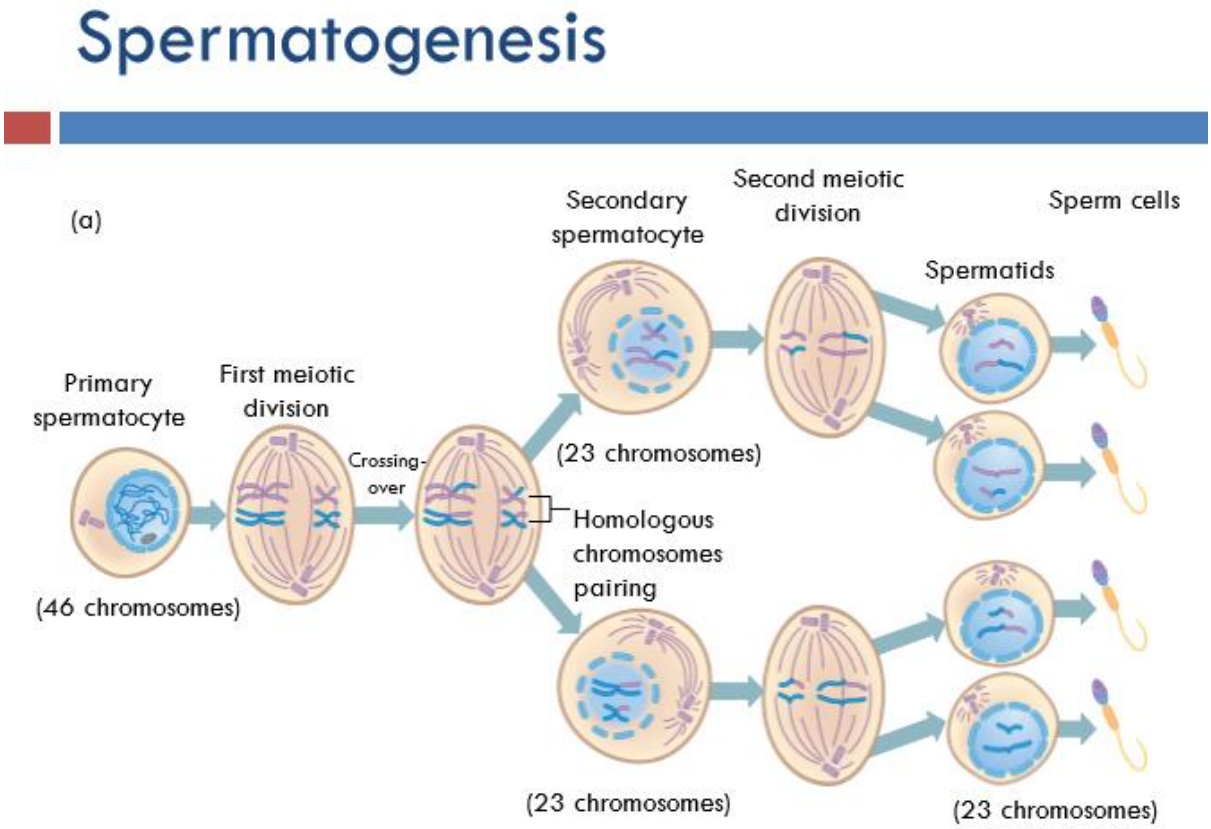
Objectives

- Describe the structure and function of male reproductive organs
- Specify the composition of semen
- Understand the hormonal mechanisms that regulate male reproductive function

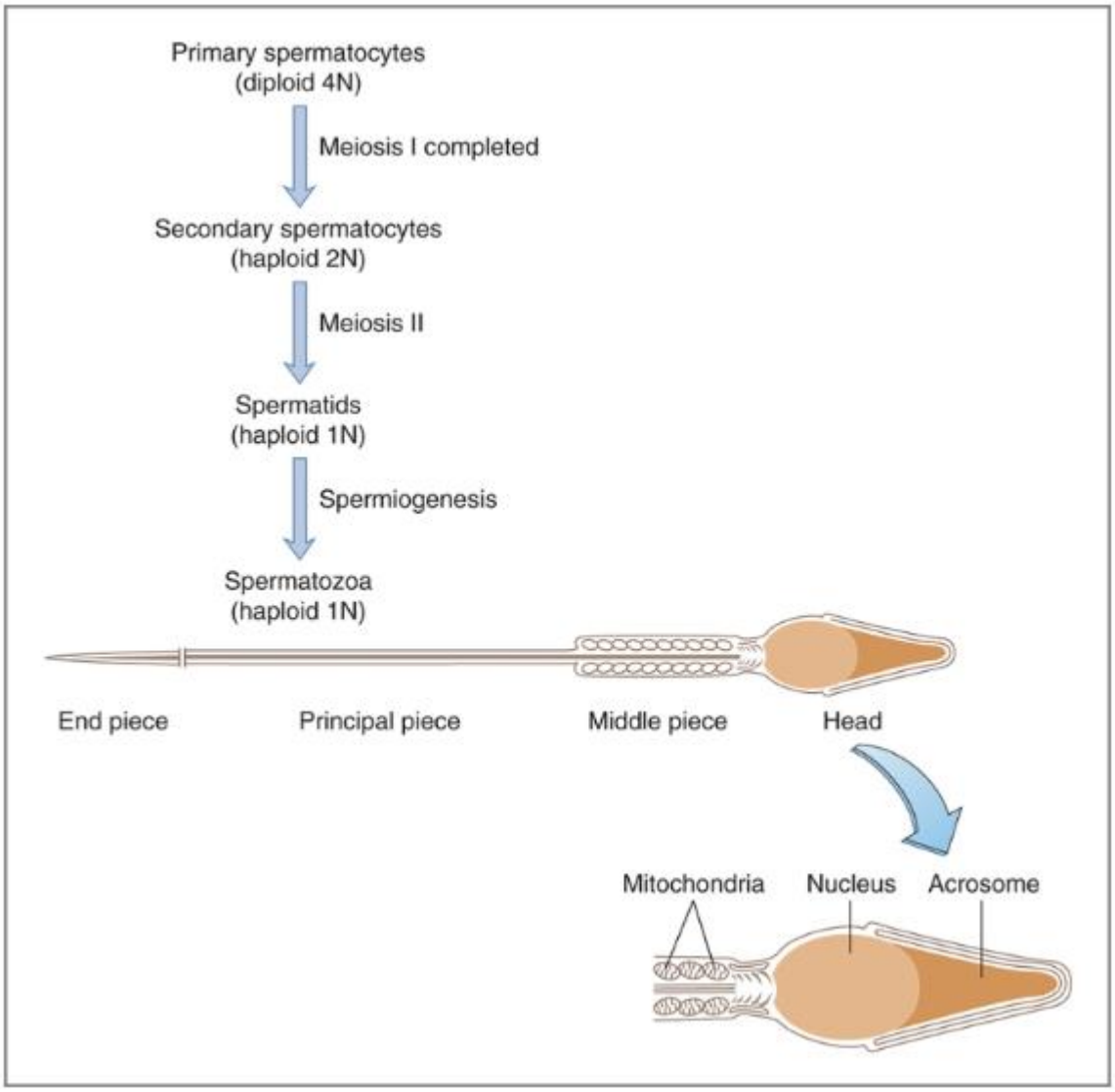
Structure of the testes

- The male gonads are the testes which serve to participate in spermatogenesis and the secretion of testosterone.
- The testes are in the scrotum and are maintained at 1-2 degrees below basal body temperature, which is essential for spermatogenesis. This temperature is maintained by a countercurrent heat exchange of the arteries and veins surrounding the testes.
- Testes are predominantly comprised of seminiferous tubules (80%), arranged in loops and surrounded by connective tissue, and serve to produce sperm.
- The epithelium lining the seminiferous tubules is comprised of three cell types:
    - Spermatogonia – stem cells
    - Spermatocytes – precursor sperm cells
    - Sertoli cells – support the developing sperm via three functions:
        - Provide nutrition to the differentiating sperm
        - Form tight junctions with each other to create the blood-testes barrier, isolating the testes from the bloodstream. The barrier is selective to testosterone but prohibits substances which may damage the sperm
        - Secrete an aqueous fluid into the seminiferous tubules to transport sperm into the epididymis
- The remaining 20% of testes is comprised of connective tissue interspersed with Leydig cells, which secrete and synthesise testosterone. Testosterone has both paracrine and endocrine functions on other target tissue such as skeletal muscle and the prostate.

Spermatogenesis



- Spermatogenesis occurs from puberty to senescence and occurs along the length of the seminiferous tubules in three phases:
    - Mitotic divisions of spermatogonia stem cells to create spermatocytes
    - Meiotic divisions of spermatocytes to produce haploid spermatids
    - Spermiogenesis in which spermatids lose cytoplasm and develop flagella to become mature sperm.



Storage of sperm, ejaculation, and function of sex accessory glands

- Sperm exit the seminiferous tubules to the epididymis where they are stored and remain viable for several months.
- During arousal, contractions of smooth muscle around seminiferous tubule ducts move sperm through the epididymis and during ejaculation, sperm are forced into the vas deferens and into the urethra. The ampulla of the vas deferens secretes a fluid containing fructose and citrate to nourish the sperm.
- Seminal vesicles secrete a fluid containing fructose, citrate, prostaglandins and fibrinogen.
    - Prostaglandins assist in fertilisation by reacting with cervical mucus to make it less viscous and more penetrable and they also induce peristaltic contraction in the uterus and fallopian tubes to propel the sperm up the tract.
- The prostate gland secrets a milky solution containing citrate, calcium and enzymes which has a slightly alkaline pH to increase sperm motility and neutralising acidic secretions from the vas deferens and vagina.
    - The accessory glands of the male reproductive tract comprise 90% of semen volume and sperm comprises 10%.