3 HUMAN REPRODUCTION

Introduction

Reproduction: Reproduction means the ability to produce individuals of the same species.

Reproductive events in humans

1. **Gametogenesis:** Formation of gametes, i.e., sperms in male and ovum in female.
2. **Insemination:** Transfer of sperms into the female genital tract.
3. **Fertilisation:** Fusion of male and female gametes leading to the formation of zygote.
4. **Implantation:** Attachment of blastocyst to the uterine wall for nourishment.
5. **Gestation:** Embryonic development.
6. **Parturition:** Delivery of the baby.

Reproductive System

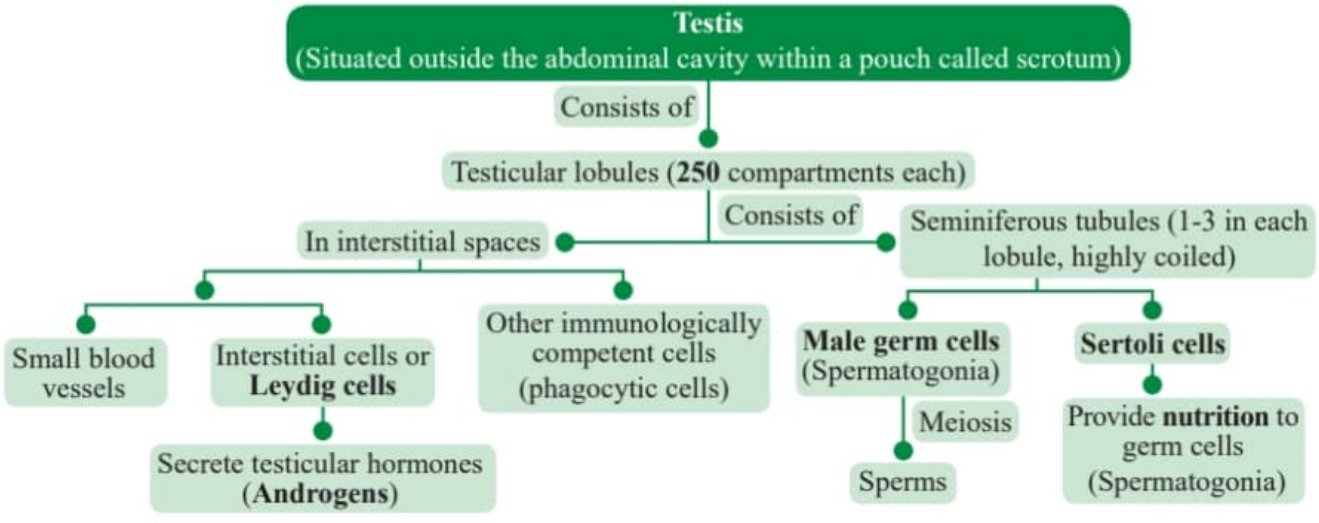
- The formation of gametes takes place in the reproductive organs.
- **Male gamete:** Spermatozoan.
- **Female gamete:** Ovum.

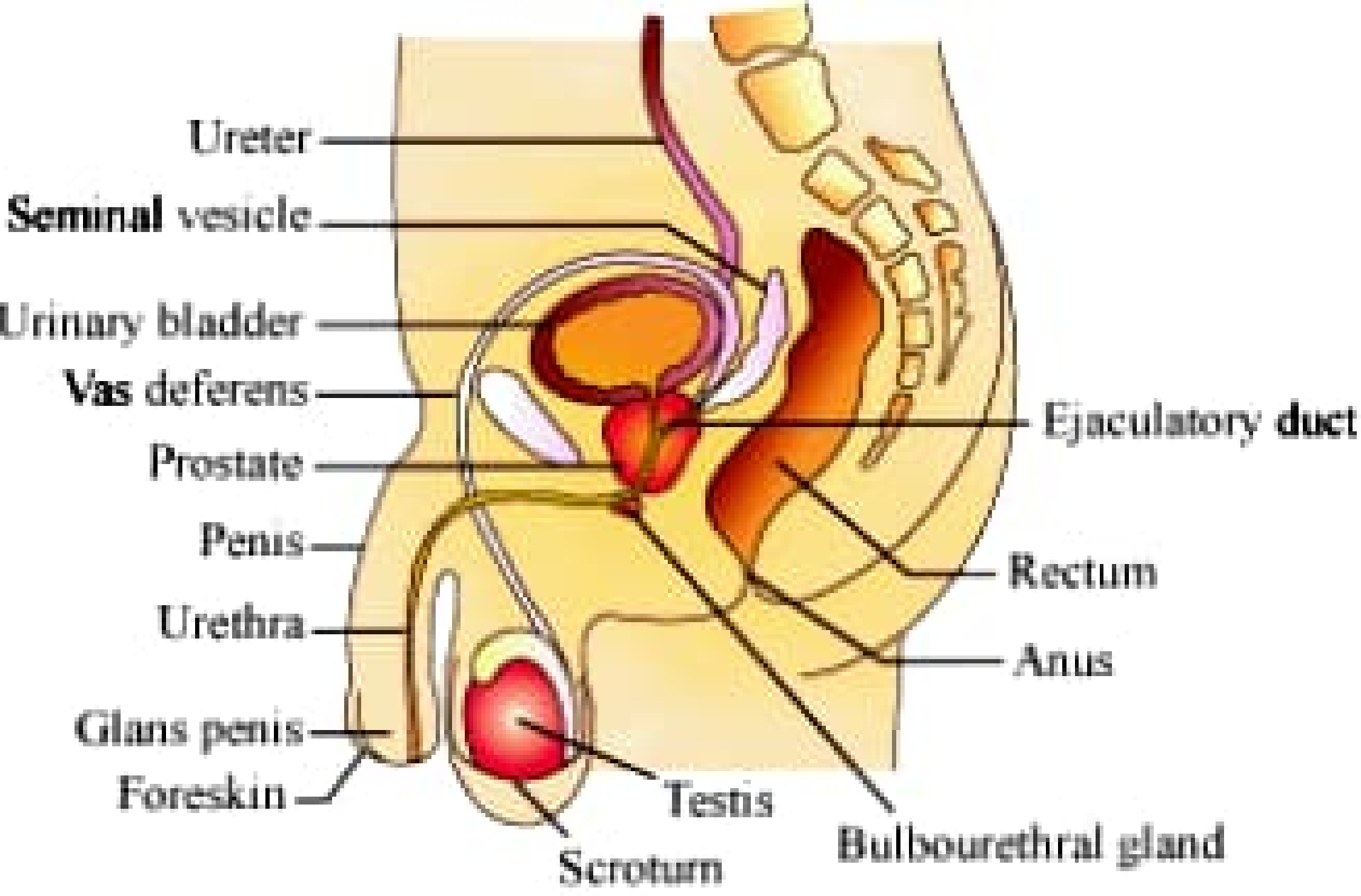
Table: Primary and Secondary sex organs in male and female

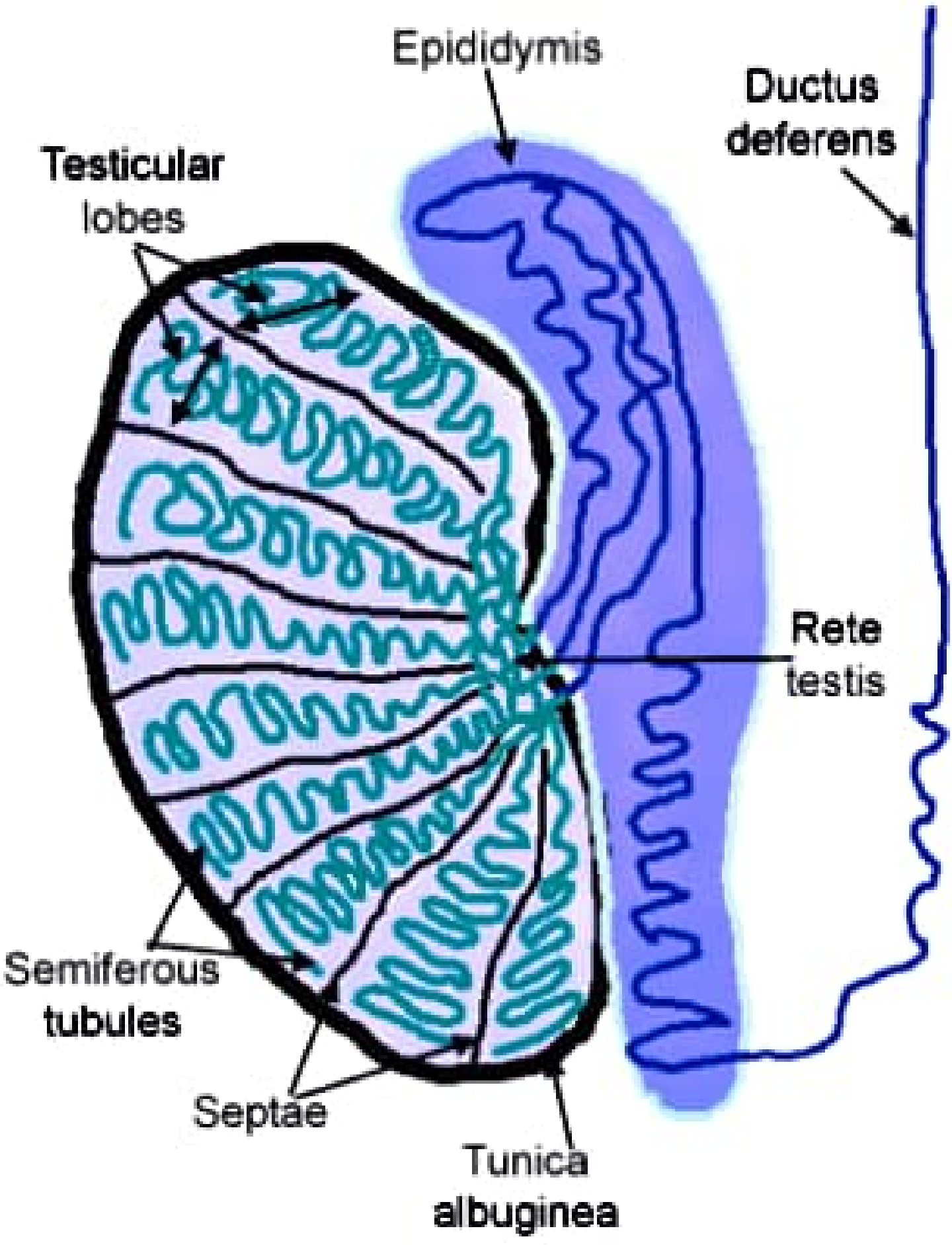
Sex	Primary Sex Organ	Secondary Sex Organ	Accessory or external Sex character
Male	Testis	Prostate, seminal vesicle, vas deferens, epididymis, penis	Low - pitch voice, beard, broad shoulder, narrow hips
Female	Ovary	Fallopian tubes, uterus, vagina, mammary glands	High - pitch voice, smooth face, narrow shoulder, broad hips

Male Reproductive System

In adults, each testis is **oval** in shape, with a **length** of about 4 to 5cm and a **width** of about 2 to 3cm.




Ureter
Seminal vesicle
Urinary bladder
Vas deferens
Prostate
Penis
Urethra
Glans penis
Foreskin
Ejaculatory duct
Rectum
Anus
Testis
Scrotum
Bulbourethral gland


Epididymis
Ductus deferens
Testicular lobes
Rete testis
Semiferous tubules
Septae
Tunica albuginea

Male sex accessory ducts

- Rete testes (inside the testis)
- Vasa efferentia (Leaving the testis)
- Epididymis (Outside of testis)
- Vas deferens (Leaving the scrotal sac and enter into abdominal cavity)

☑ Maximise Your Marks

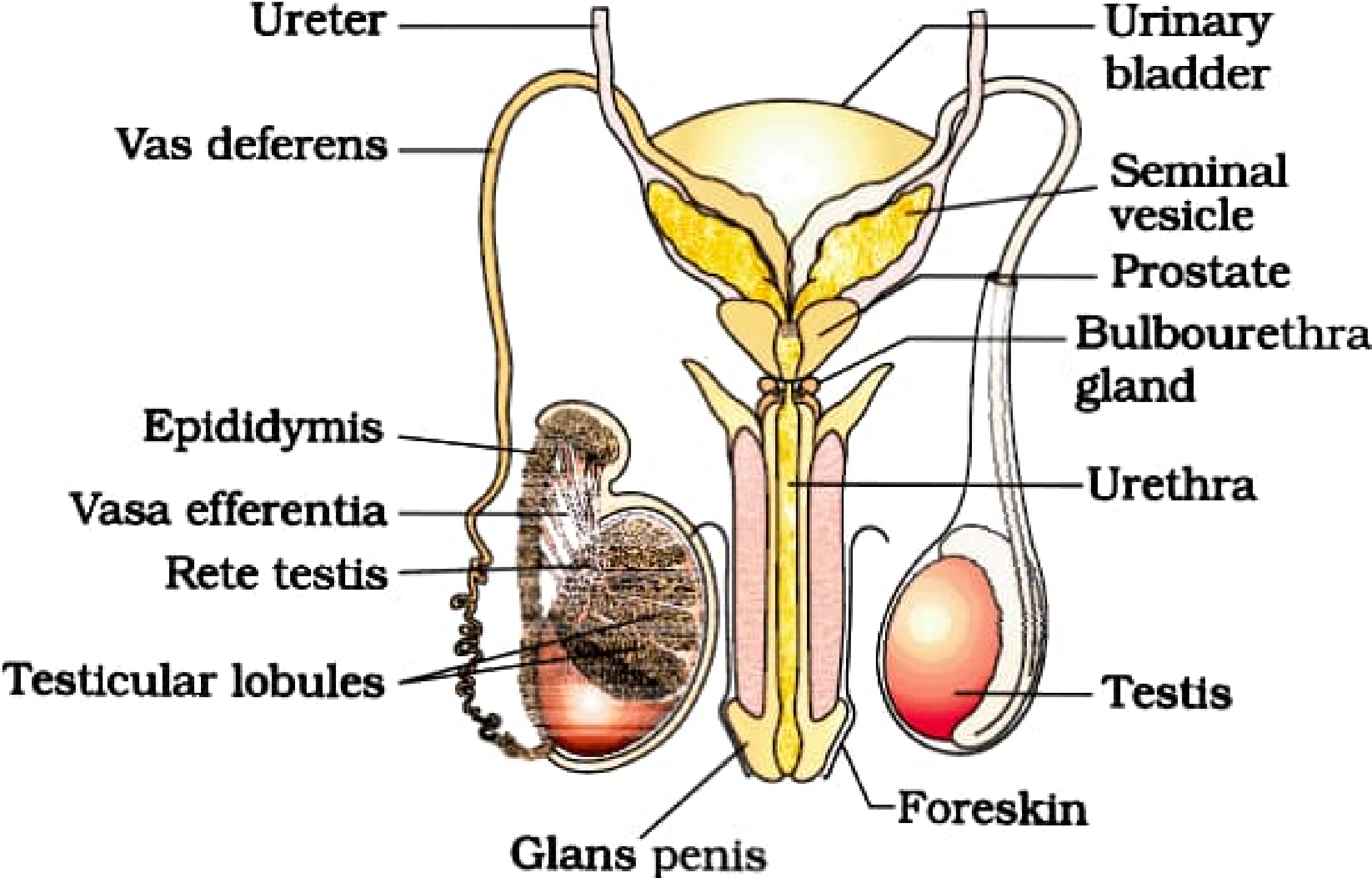
The temperature in scrotum is 2 to 2.5°C below the temperature of abdominal cavity because maturation of sperm needs low temperature.

Pathway of transport of sperms

Seminiferous tubules
↓
Rete testis
↓
Vasa efferentia
↓
Epididymis (Located along the posterior surface of each testis)
↓
Vas deferens (Ascends to the abdomen and loops over the urinary bladder)

☑ Maximise Your Marks

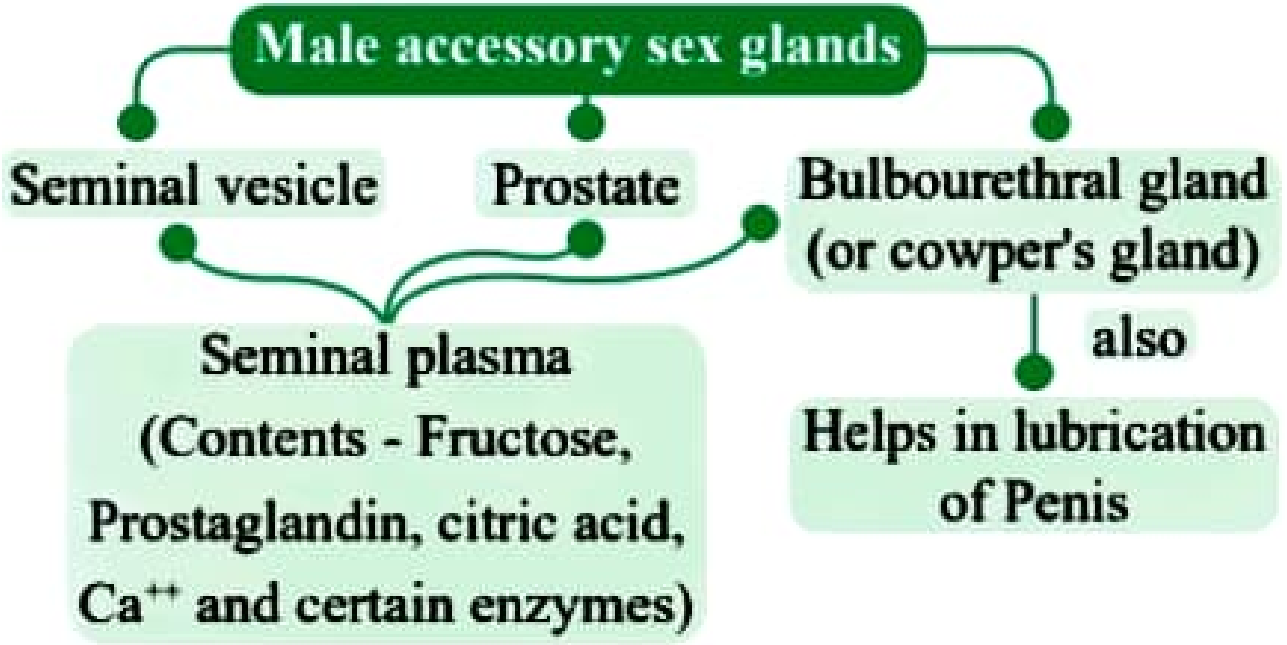
- Sperms achieve maturity and motility in epididymis.
- Epididymis can temporarily stores the sperms.


Ureter
Urinary bladder
Vas deferens
Seminal vesicle
Prostate
Bulbourethral gland
Epididymis
Urethra
Vasa efferentia
Rete testis
Testicular lobules
Testis
Foreskin
Glans penis

☑ Maximise Your Marks

- Vas deferens receive a duct from seminal vesicle and opens into urethra as **ejaculatory duct**.
- The urethra originates from the urinary bladder and extends through the penis to its external opening called **urethral meatus**.
- Penis is made up of special tissue that helps in erection of the penis to facilitate insemination.

Male accessory glands



Gametogenesis

- Gametogenesis is the process of gamete (sperm or egg) formation.
- It include **spermatogenesis** and **oogenesis**.

Spermatogenesis

- Spermatogenesis results in the formation of sperms that are transported by the male sex accessory ducts.
- **Spermiogenesis** begins in the seminiferous tubules but usually completed in epididymis.

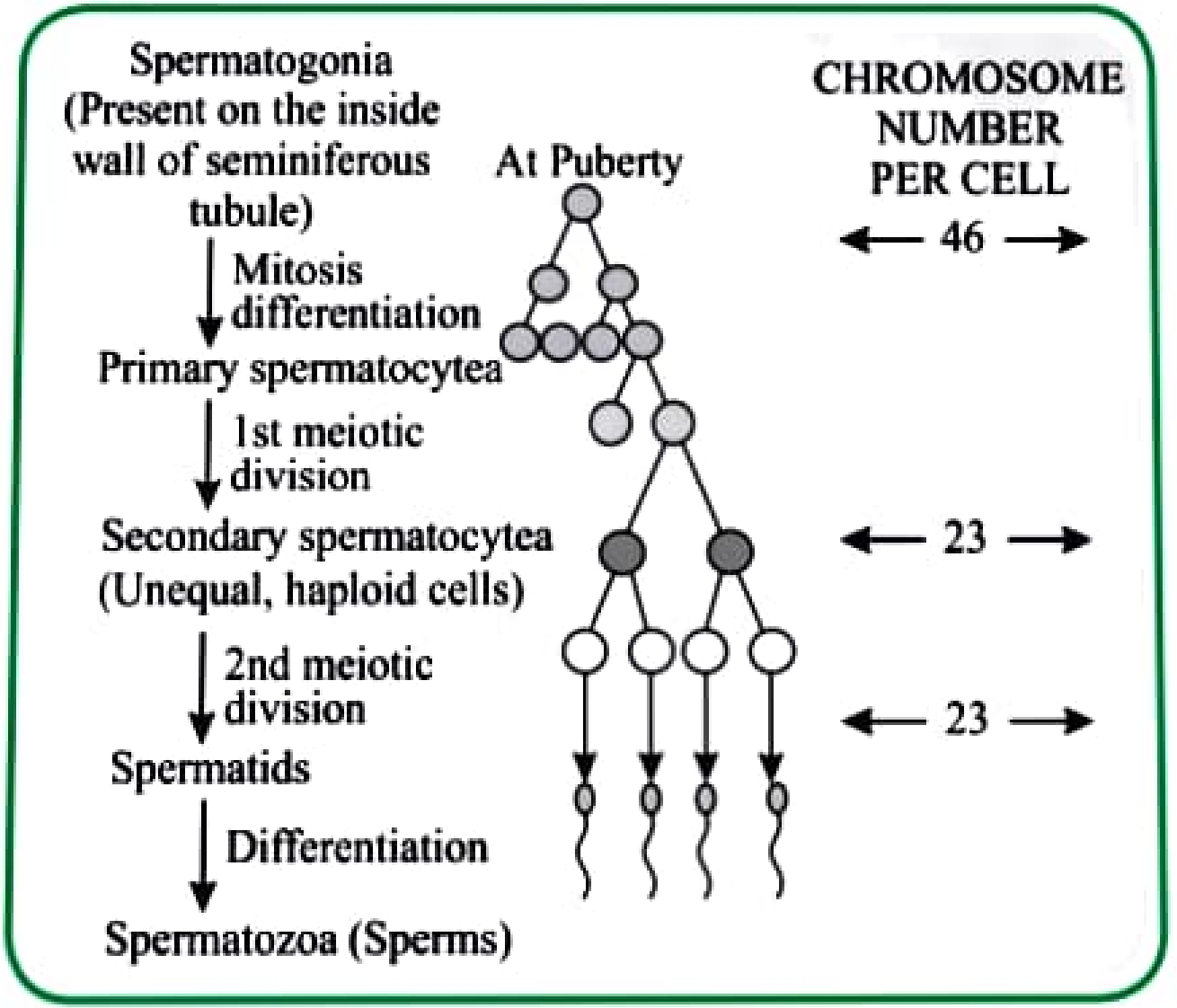


Fig.: Schematic representation of spermatogenesis

- After spermiogenesis, sperm heads become embedded in the sertoli cells, and are finally released from the seminiferous tubules by the process called **spermiation**.

Structure of Sperm

- Sperm is a microscopic structure composed of four parts, i.e., head, neck, middle piece and tail.

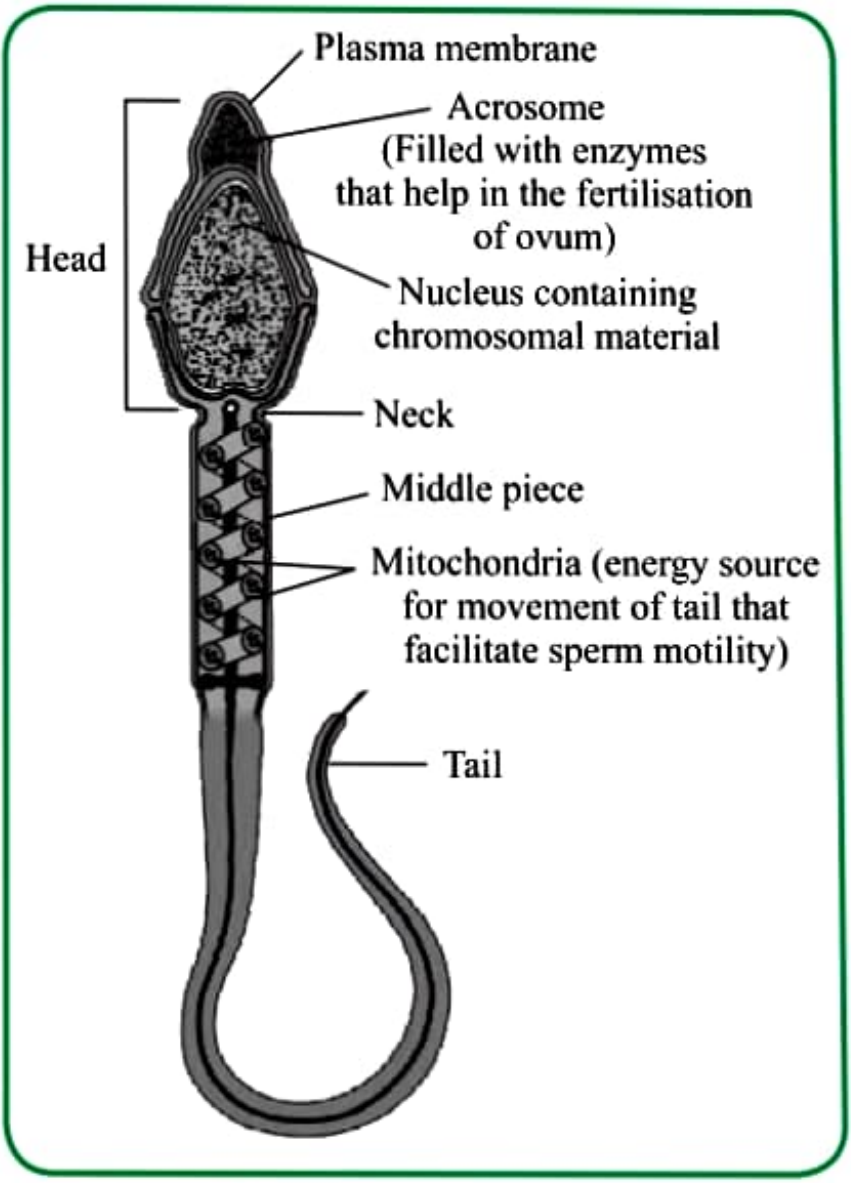


***Fig.*: Structure of a sperm**

- The spiral sheath of mitochondria around the axonema is known as **Nebenkern sheath**.

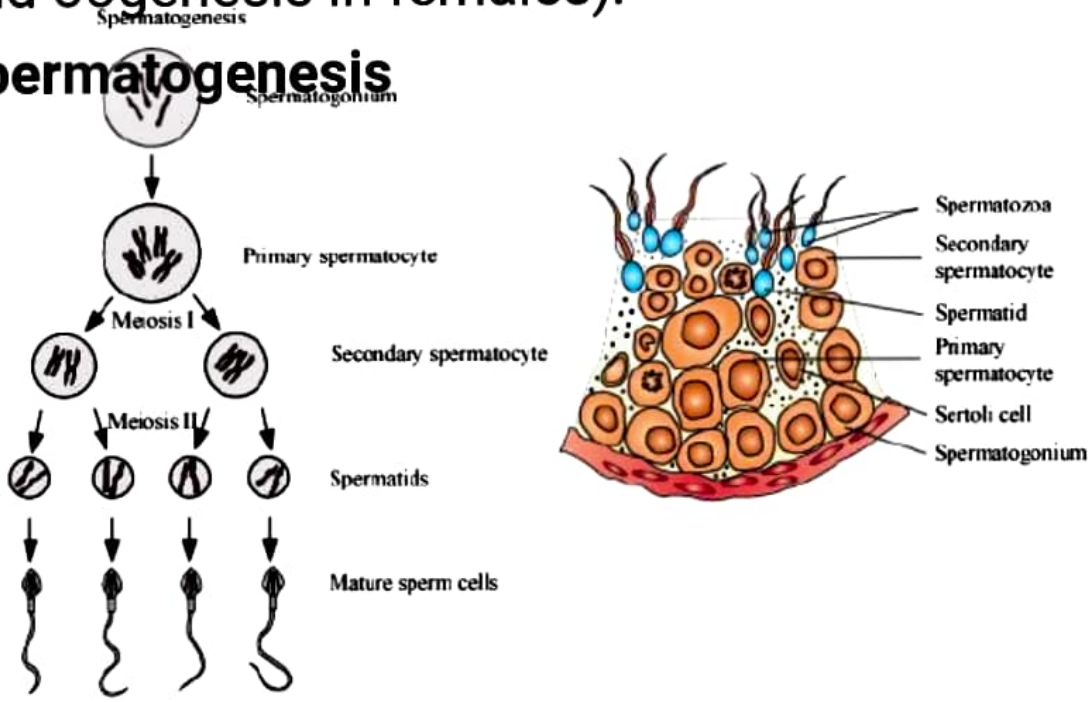
☑ Maximise Your Marks

Mitochondria produce energy for the movement of tail that facilitate sperm motility essential for fertilisation.

Gametogenesis

The testis and ovary produce the male and female gametes respectively by gametogenesis (spermatogenesis in males and oogenesis in females).

Spermatogenesis

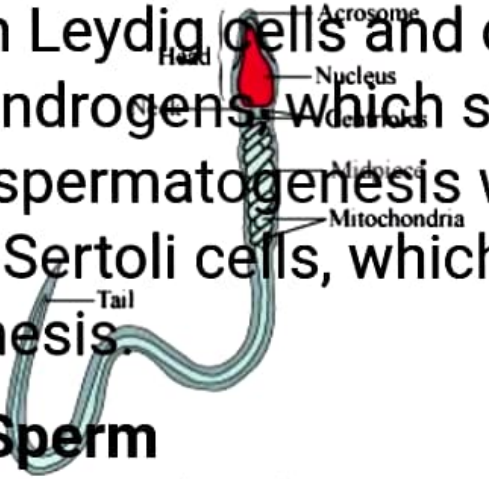


- In males, sperms are produced by the **spermatogonia** (immature germ cells), which are present in the inner walls of the seminiferous tubules.
- Spermatogonia increase in number by mitosis. These are diploid.
- Some of the spermatogonia called **primary spermatocytes** periodically undergo meiosis.
- After the first meiotic division, two haploid and equal **secondary spermatocytes** are formed.
- These further undergo meiosis to give rise to four haploid

spermatids.

- These spermatids are converted into sperms by **spermiogenesis.**
- The sperm head gets embedded in the Sertoli cells after spermiogenesis and is released from the seminiferous tubules by **spermiation.**
- Spermatogenesis starts at puberty by the action of the gonadotropin releasing hormone (GnRH), which in turn causes the release of two gonadotropins called Luteinizing Hormone (LH) and Follicle Stimulating Hormone (FSH).
- LH acts on Leydig cells and causes them to release androgens, which stimulate the process of spermatogenesis while the FSH acts on the Sertoli cells, which help in spermiogenesis.

Structure of a Sperm



Sperm cell

- A mature sperm consists of:
  - Head
  - Neck
  - Middle piece
  - Tail
- The whole sperm is enclosed in a plasma membrane.
- The head consists of a haploid nucleus and a cap-like **acrosome**, which contains enzymes that aid in fertilisation.
- The middle piece contains several mitochondria, which produce energy for the motility of the sperm.
- Sperms released by the seminiferous tubules are transported by the accessory ducts.
- Secretions of epididymis, vas deferens, seminal vesicles, and prostate are essential for maturation and motility of sperms.