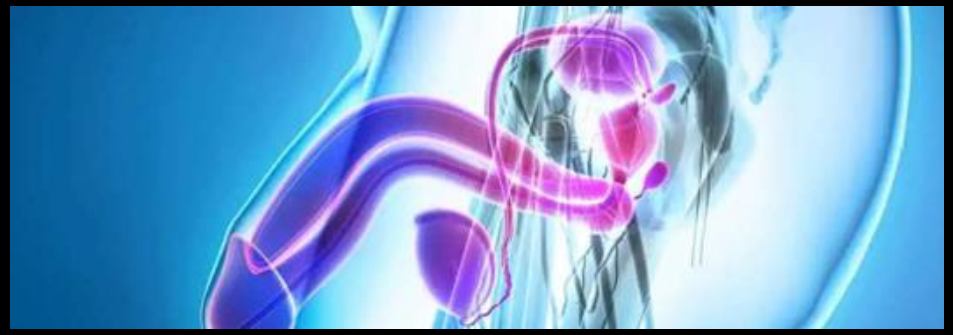
ANATOMY & PHYSIOLOGY II

GHC 2013 / NMS 2012 / OHC 3013 / PTAP 1123



CHAPTER 5

REPRODUCTIVE SYSTEM - MALE

Topic Outlines

- 5.1 Introduction to Reproductive System
- 5.2 Male Reproductive Organs
  - 5.2.1 Scrotum
  - 5.2.2 Testes
  - 5.2.3 Epididymis
  - 5.2.4 Ductus Deferens
  - 5.2.5 Urethra
  - 5.2.6 Seminal Vesicles
  - 5.2.7 Prostate Gland
  - 5.2.8 Penis
- 5.3 Sperm
- 5.4 Semen
- 5.5 Spermatogenesis
- 5.6 Process of Ejaculation
- 5.7 Hormonal Regulation
- 5.8 Secondary Sex Characteristics - Male

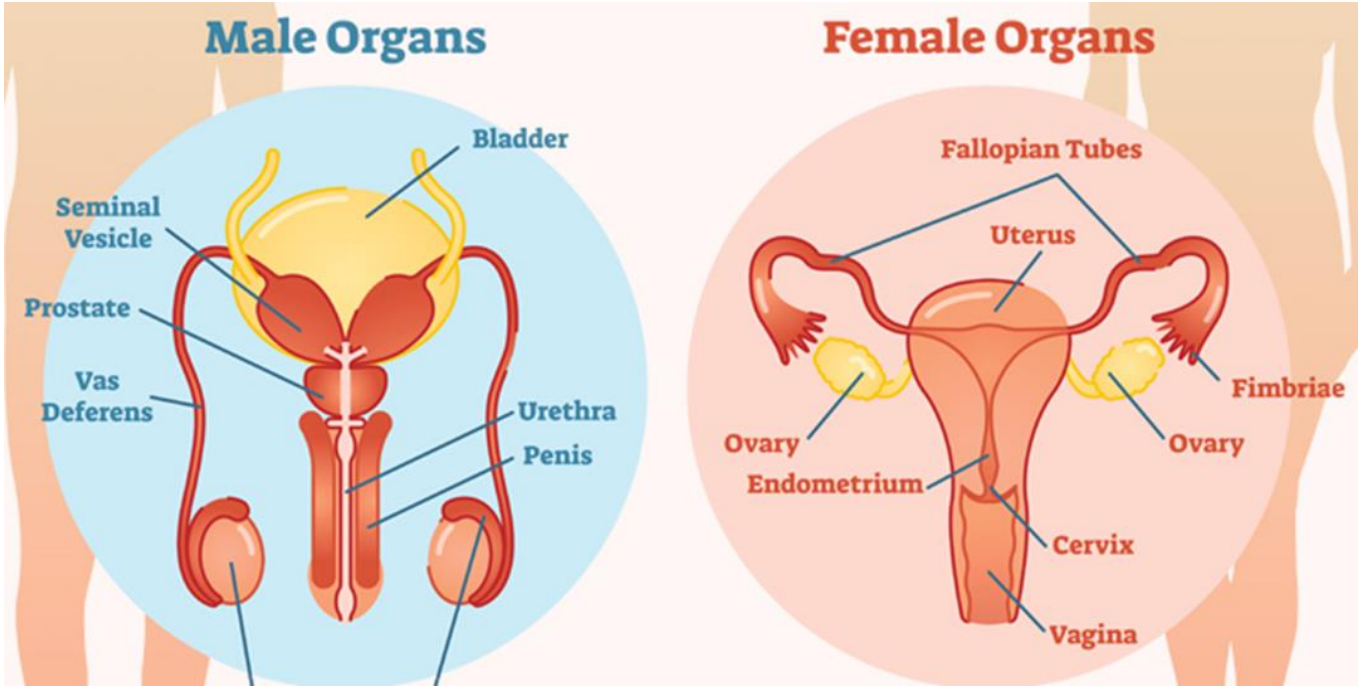
Learning Outcomes

At the end of this chapter, students should be able to:

- Identify the male reproductive organs
- Describe the functions for each of the organs
- Describe semen and spermatogenesis process

5.1 Introduction to Reproductive System

- A system of sex organs within an organism which work together for the purpose of sexual reproduction
- Primary sex organs (gonads) :
    a) Testes in males
    b) Ovaries in females
- Functions of gonad :
    - **Primary organ for sexual growth**
    - **Produce gametes (germ cell)**
    - **Secrete sex hormones**



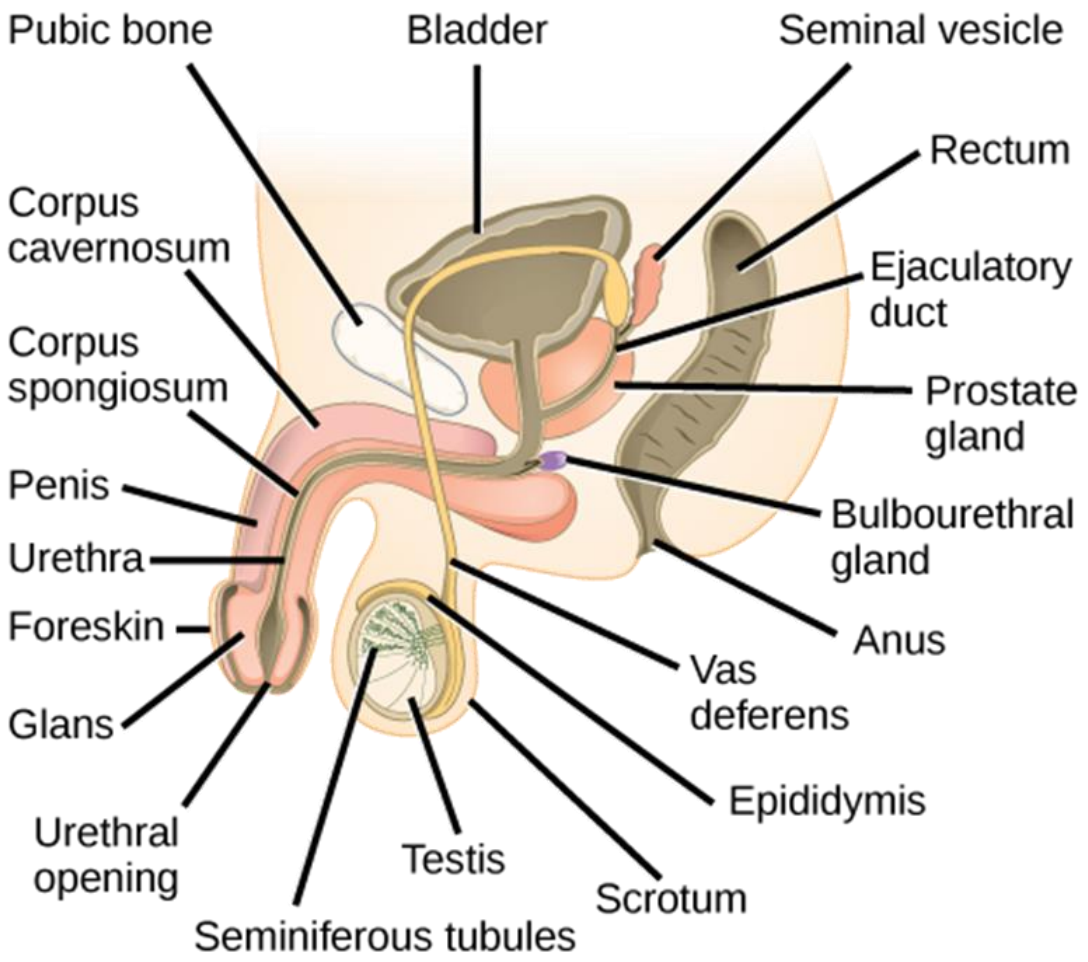
5.1 Introduction to Reproductive System

- Accessory reproductive organ :
  - Ducts, glands & external genitalia
- Sex hormones :
  - Testosterone (males)
  - Estrogen and progesterone (females)
- Sex hormone's function :
  - Development of reproductive organs
  - Sexual behavior and drives (libido)
  - Growth and development of many other organs and tissues

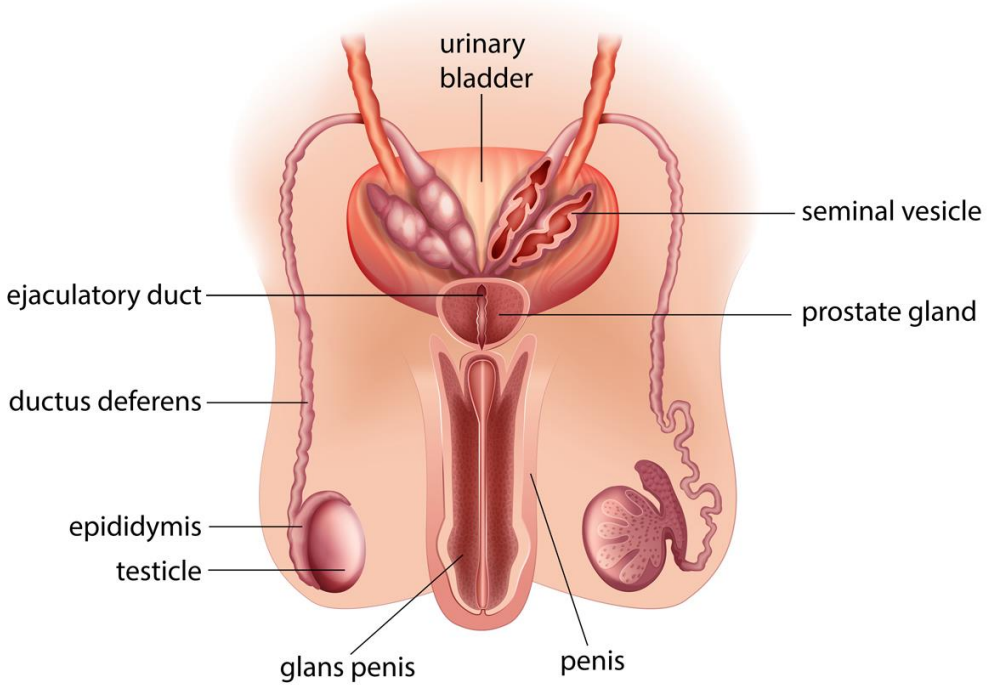
5.2 Male Reproductive Organs

Consist of:-

- scrotum
- testis
- epididymis
- ductus deferens
- urethra
- seminal vesicles
- prostate gland
- penis

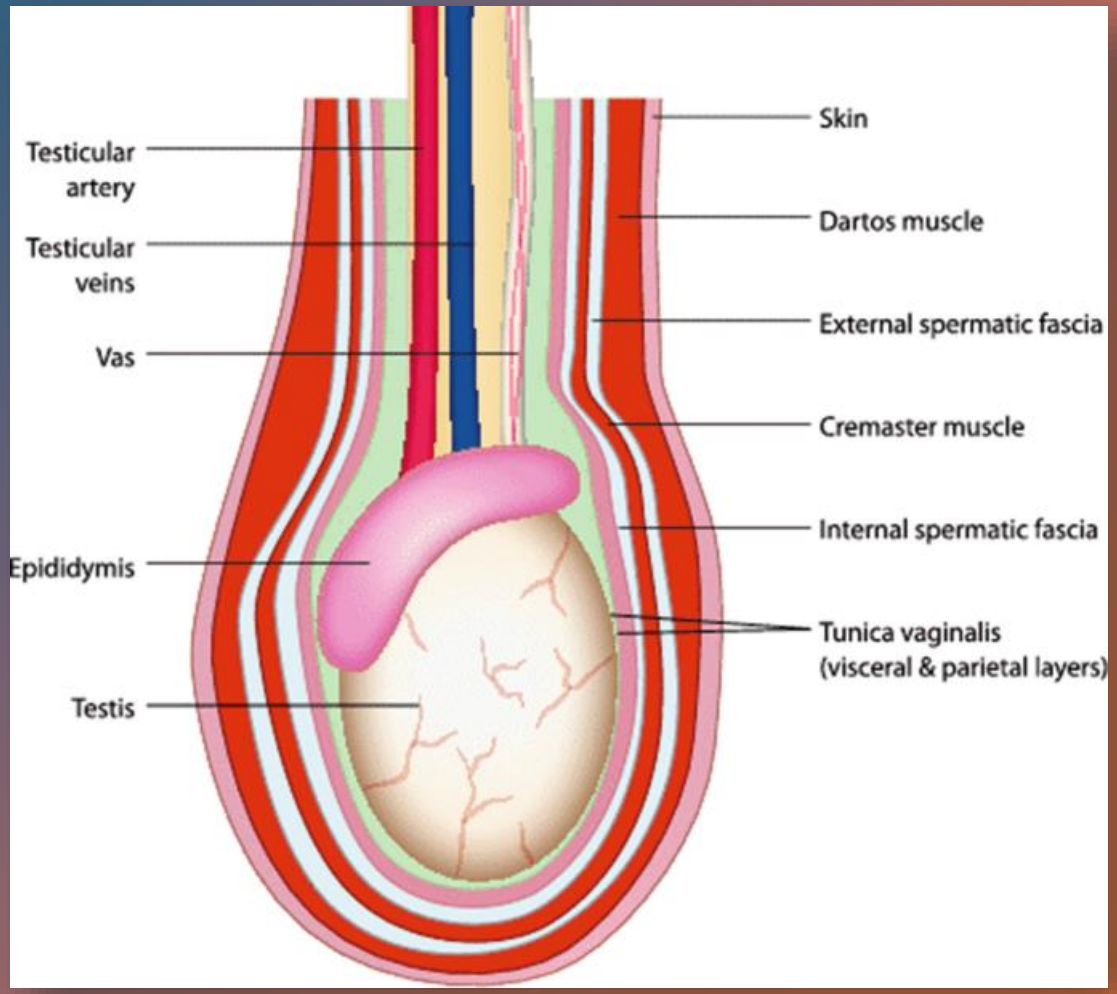


Main Functions of Male Reproductive Organs



- To produce, maintain and transport sperm (the male reproductive cells)
- To produce protective fluid (semen) for the sperm
- To discharge sperm within the female reproductive tract
- To produce and secrete male sex hormones

5.2.1 Scrotum



- Skin structure that support testes
- Function :
  - **help regulate the temperature of the testes for normal sperm production** *(by maintaining the temperature of 2°C – 3°C below the normal body temperature)*
- Intra-scrotal temperature is kept constant by two sets of muscles :

i. **Dartos** = smooth muscle that wrinkles scrotal skin

ii. **Cremaster** = bands of skeletal muscle that elevate the testes

5.2.2 Testes

- Paired, oval shaped
- Function :
  - **Produce sperm (spermatogenesis)**
  - **Synthesize testosterone (male sex hormone)**

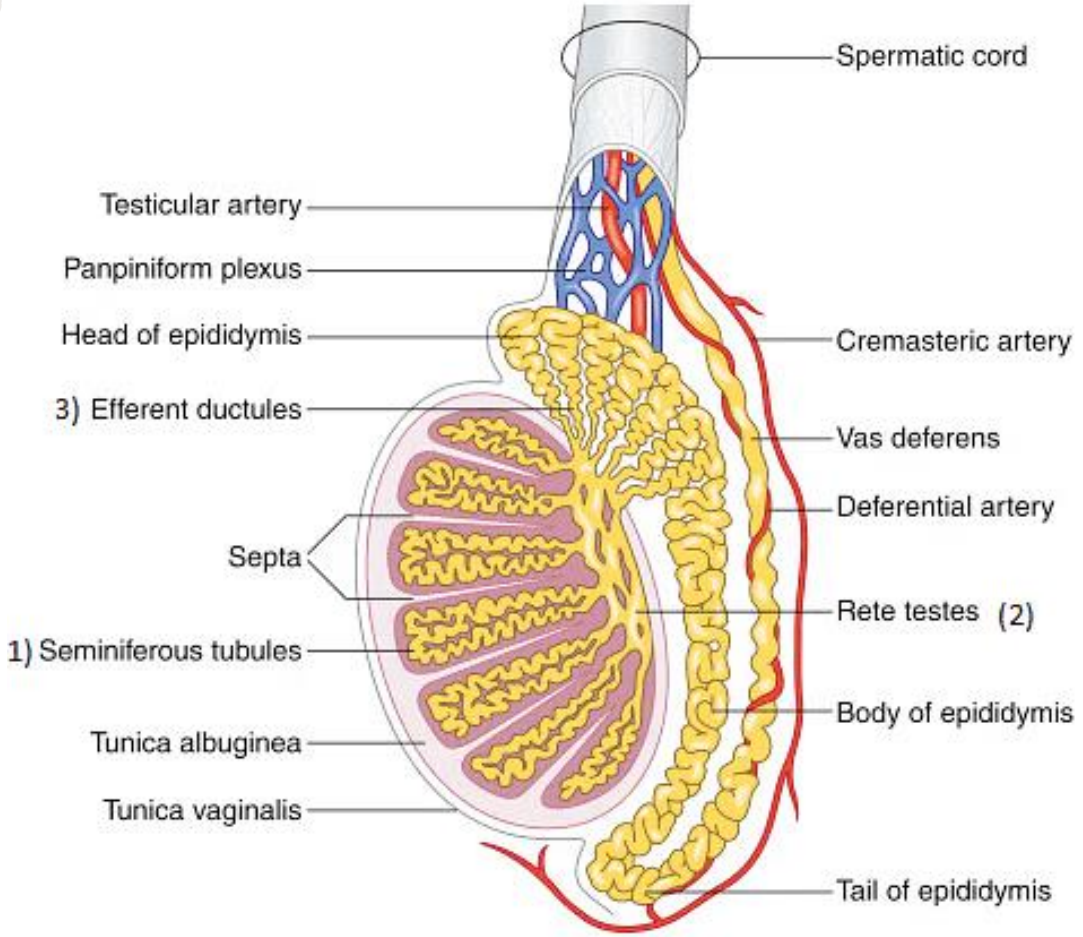
- Inside the testes :

a) **Seminiferous tubules = place where sperm are produced**

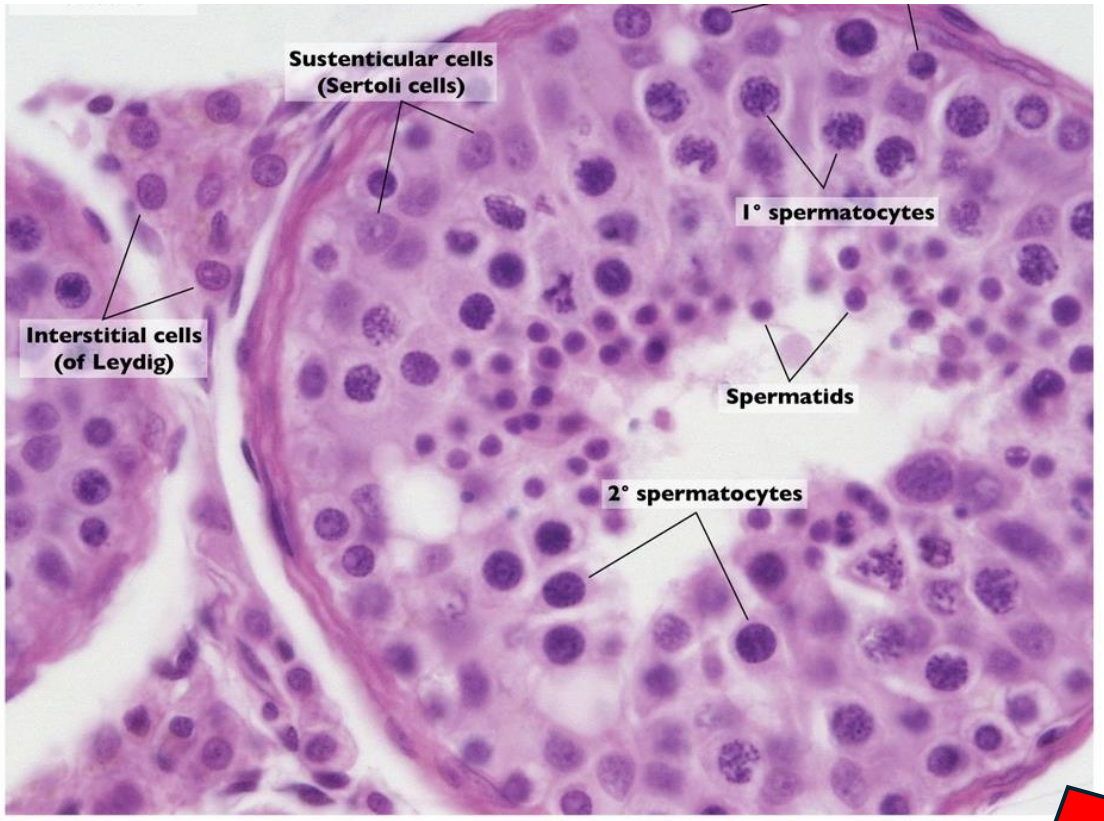
b) **Sertoli cells = supporting spermatogenesis by giving nutrients to developing sperm**

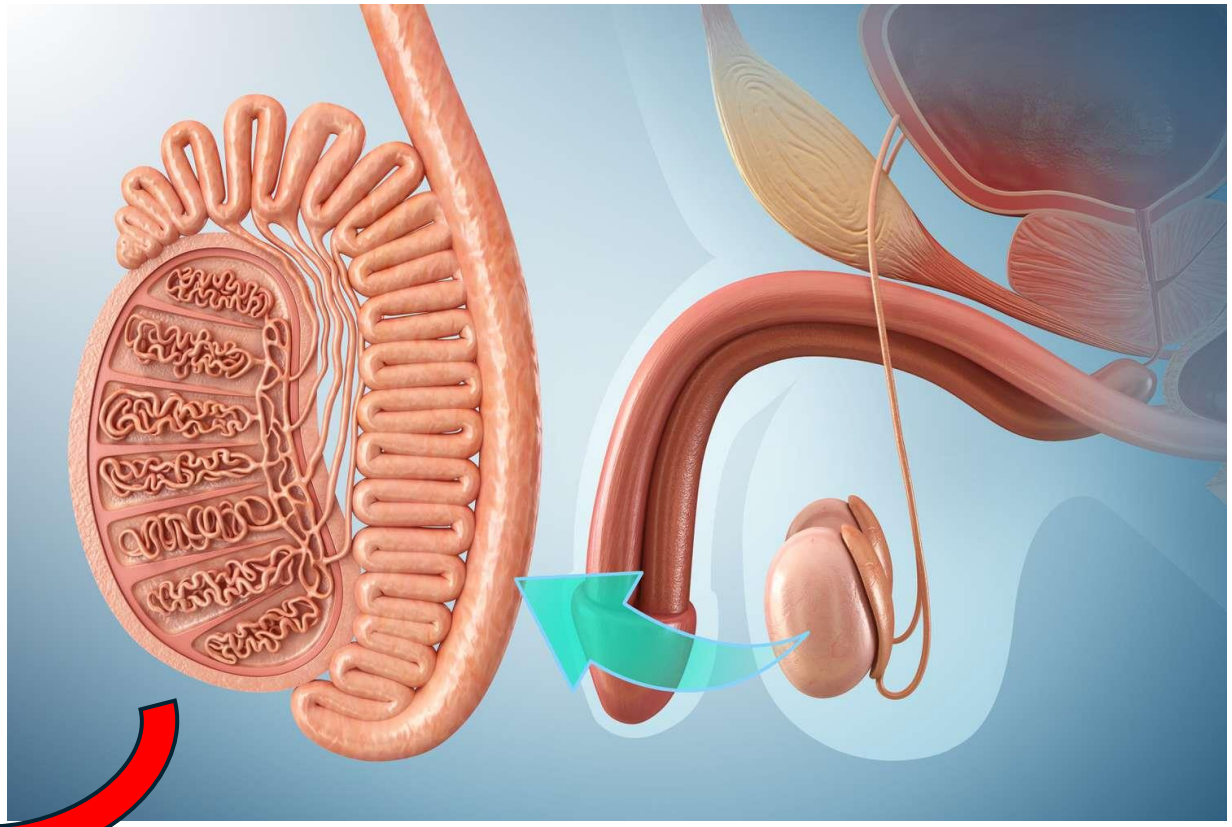
c) **Leydig cells = secrete testosterone**

- Spermatic cord encloses nerve fibers, blood vessels & lymphatics



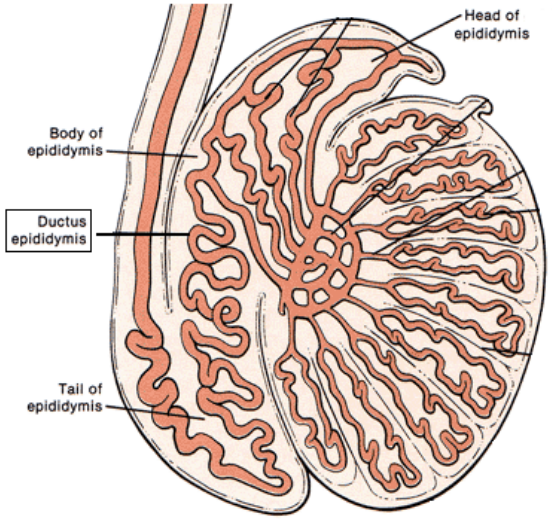
5.2.2 Testes

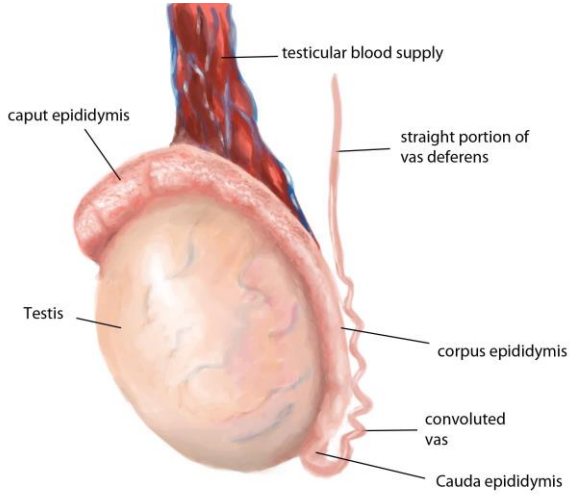

Sustenticular cells
(Sertoli cells)
1° spermatocytes
Interstitial cells
(of Leydig)
Spermatids
2° spermatocytes

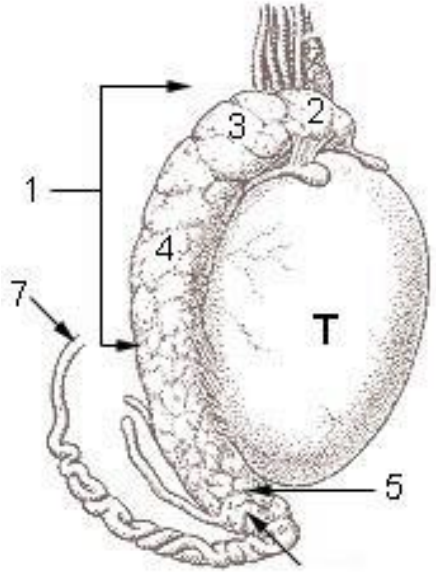


5.2.3 Epididymis

- Comma-shape structure
- Lies along posterior border of testes
- 3 parts – head, body & tail
- Inside = ductus epididymis (*Function:* ***Absorb testicular fluid & Pass nutrients to sperm***)
- Non-motile sperm (unmatured) = *enter, pass through its tubes and become motile*
- Upon ejaculation = *epididymis contracts, expelling sperm into ductus deferens*







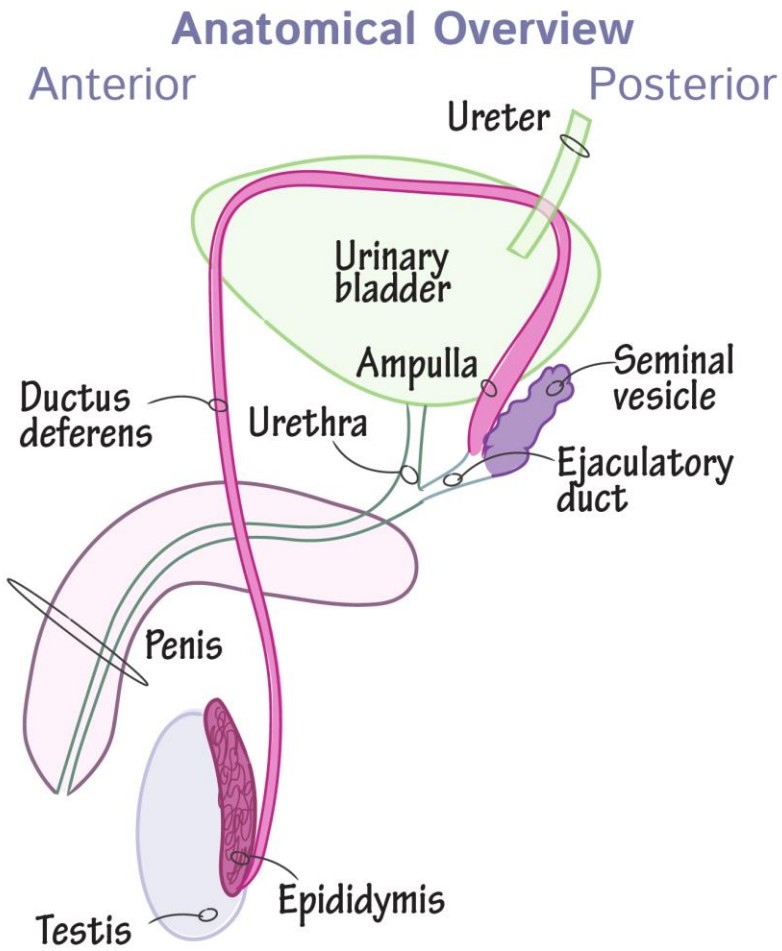
1 = epididymis

2 = head

4 = body

5 = tail

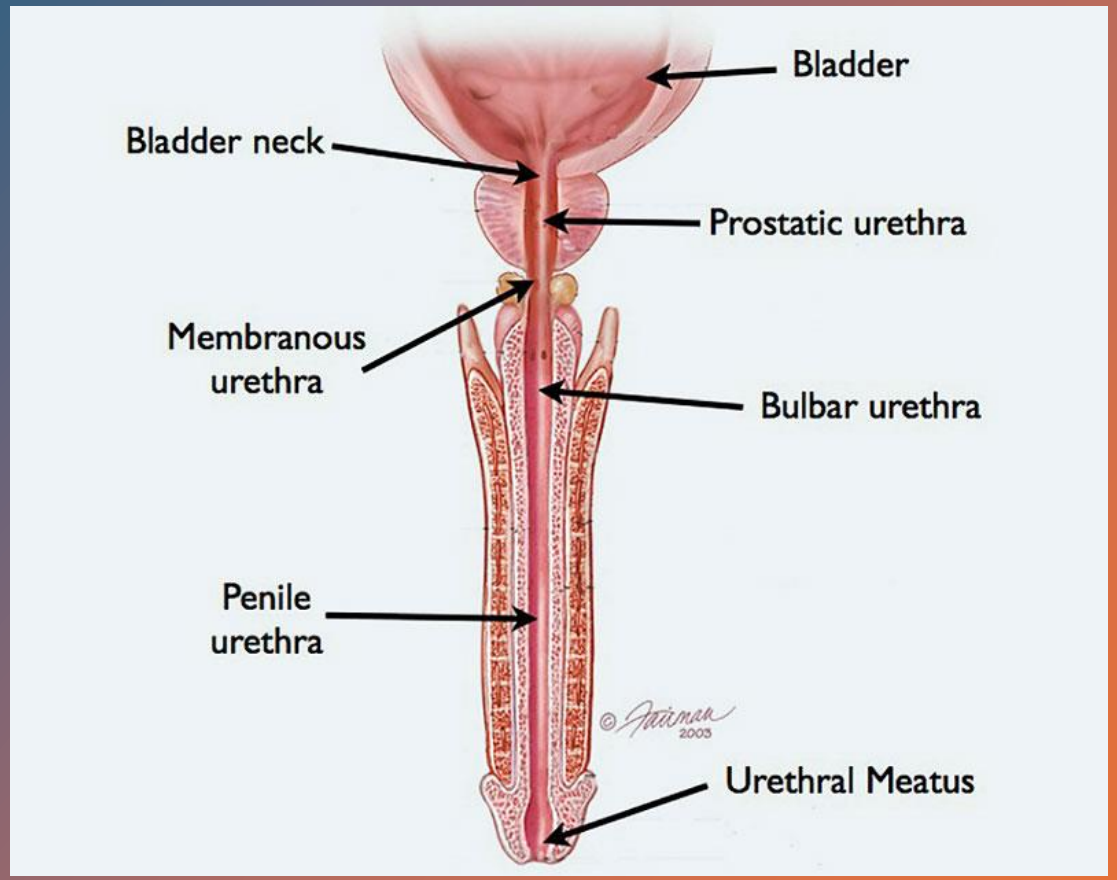
T = testis



5.2.4 Ductus Deferens

- Also called = vas deferens
- Long = 45 cm
- Pass through inguinal canal, in front symphysis pubis & enter pelvic cavity, finally loop over ureter
- Terminal end = ampulla (dilated portion) and joins duct of seminal vesicle to form **ejaculatory duct**
- Function: **Propels sperm from epididymis to urethra**
- **Vasectomy** – a process in birth control
  - cutting and ligating ductus deferens
  - nearly 100% effective form of birth control

5.2.5 Urethra



- Male = convey both urine & semen (at different times)
- About 20 cm
- 2 ductus from ampulla & urinary bladder meet inside prostate gland. Then, go through until end of penis
- 3 parts of male urethra :

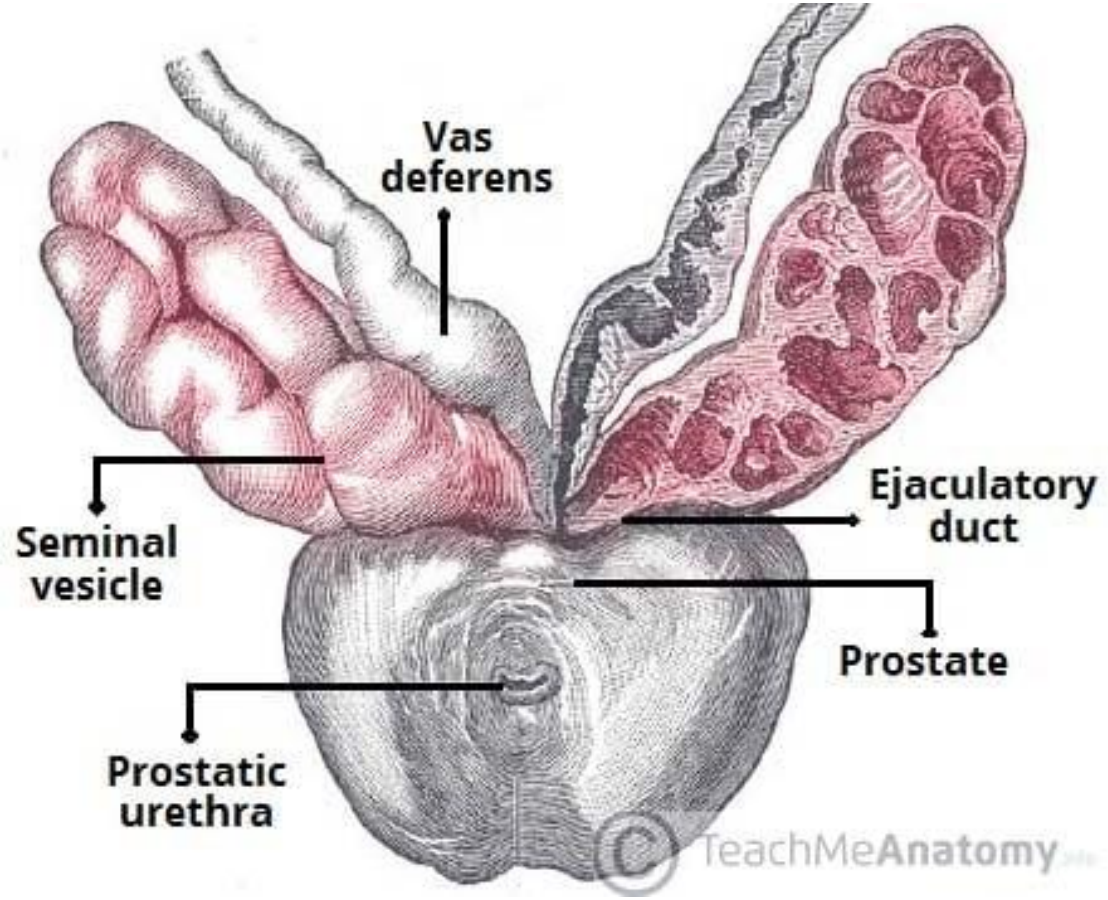
  → prostatic urethra = surround by prostate

  → membranous urethra = lies in urogenital diaphragm

  → penile urethra = run through penis

5.2.6 Seminal Vesicles

- Paired
- Location = posterior urinary bladder
- Shape = convoluted pouchlike structure
- Contributes ~60% total volume of semen
- Function = **secrete alkaline fluid as protective environment for sperm when enters vagina (acidic)**
- Secretions contain fructose, prostaglandins, fibrinogen = **nourishment for sperm**

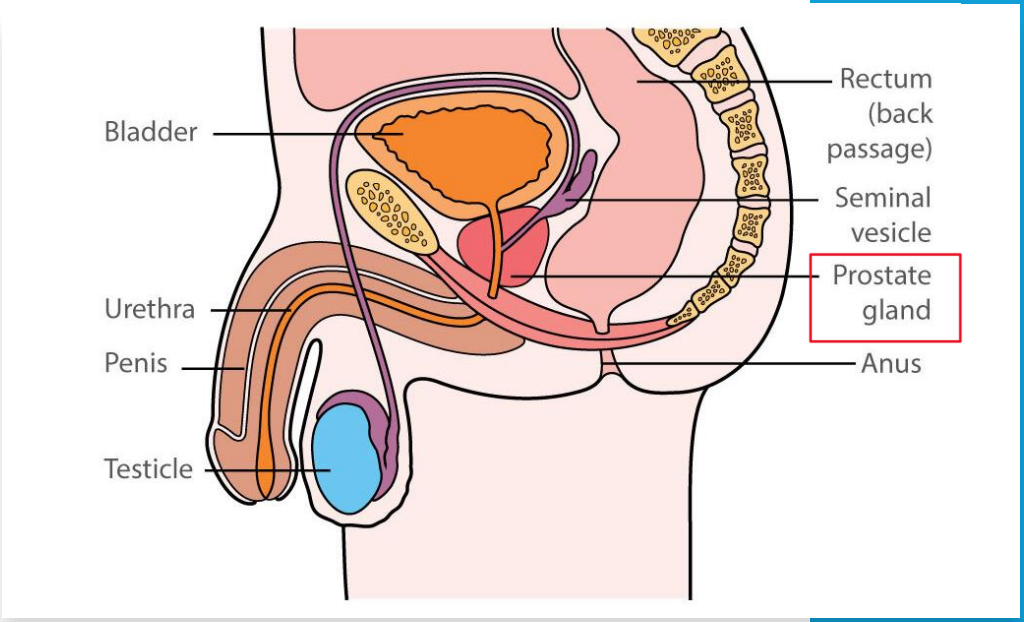


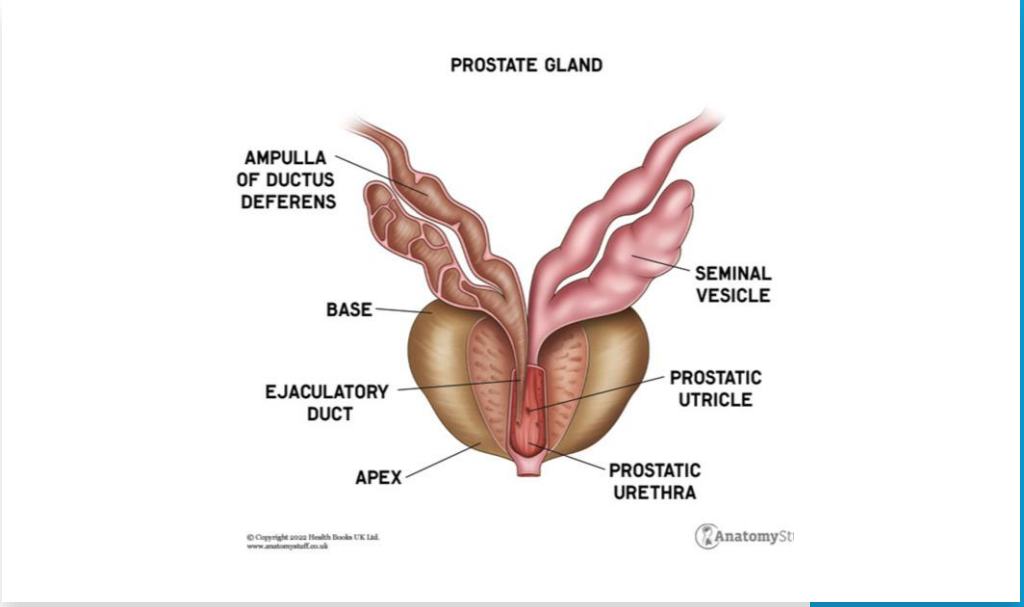
5.2.7 Prostate Gland

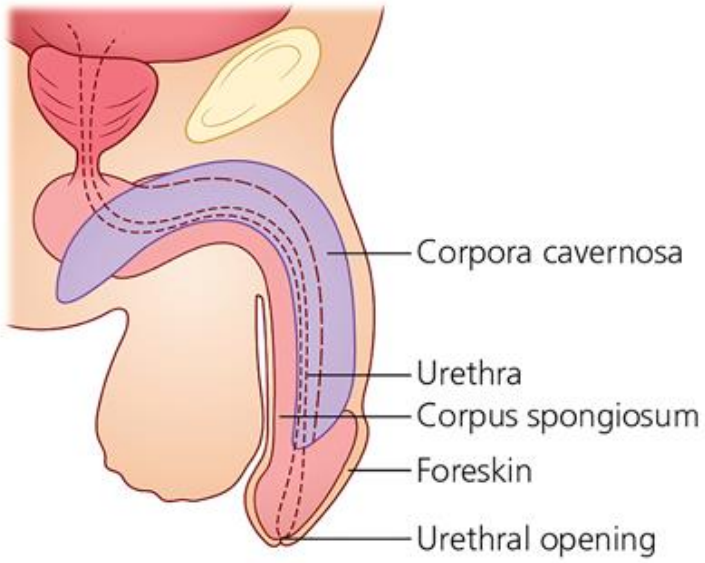
- Single
- Doughnut-shaped
- Location = Inferior urinary bladder
- Function:

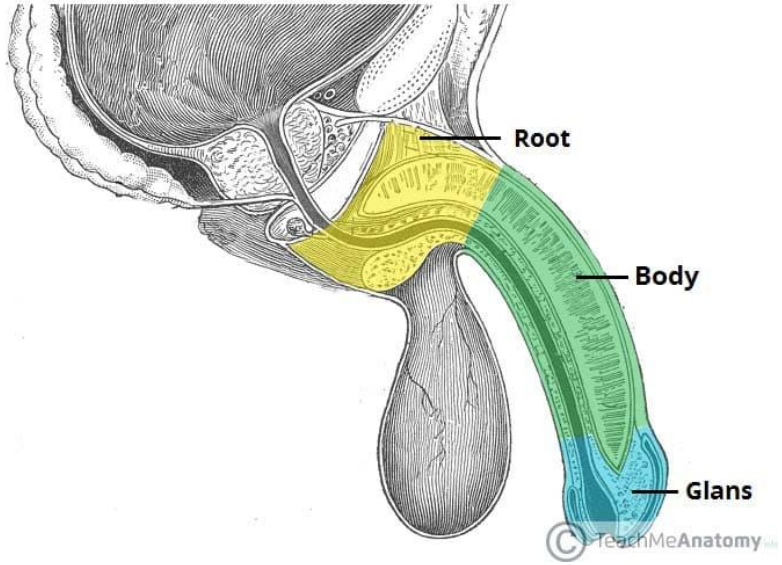
→ **secrete acidic fluids to help sperms get energy (ATP)**

→ **enhance spermatozoa's motility**





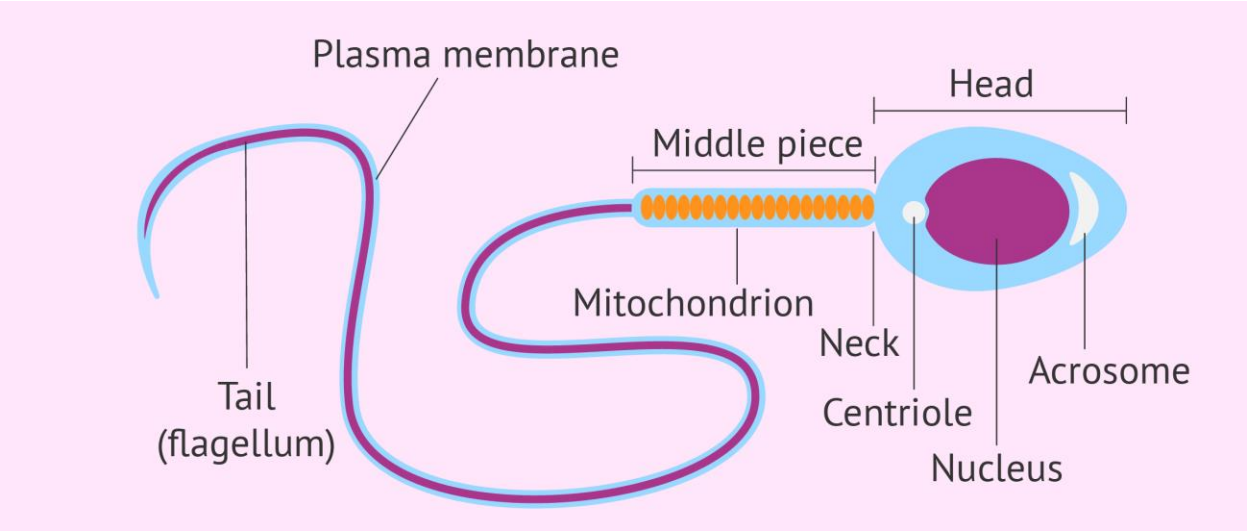




5.2.8 Penis

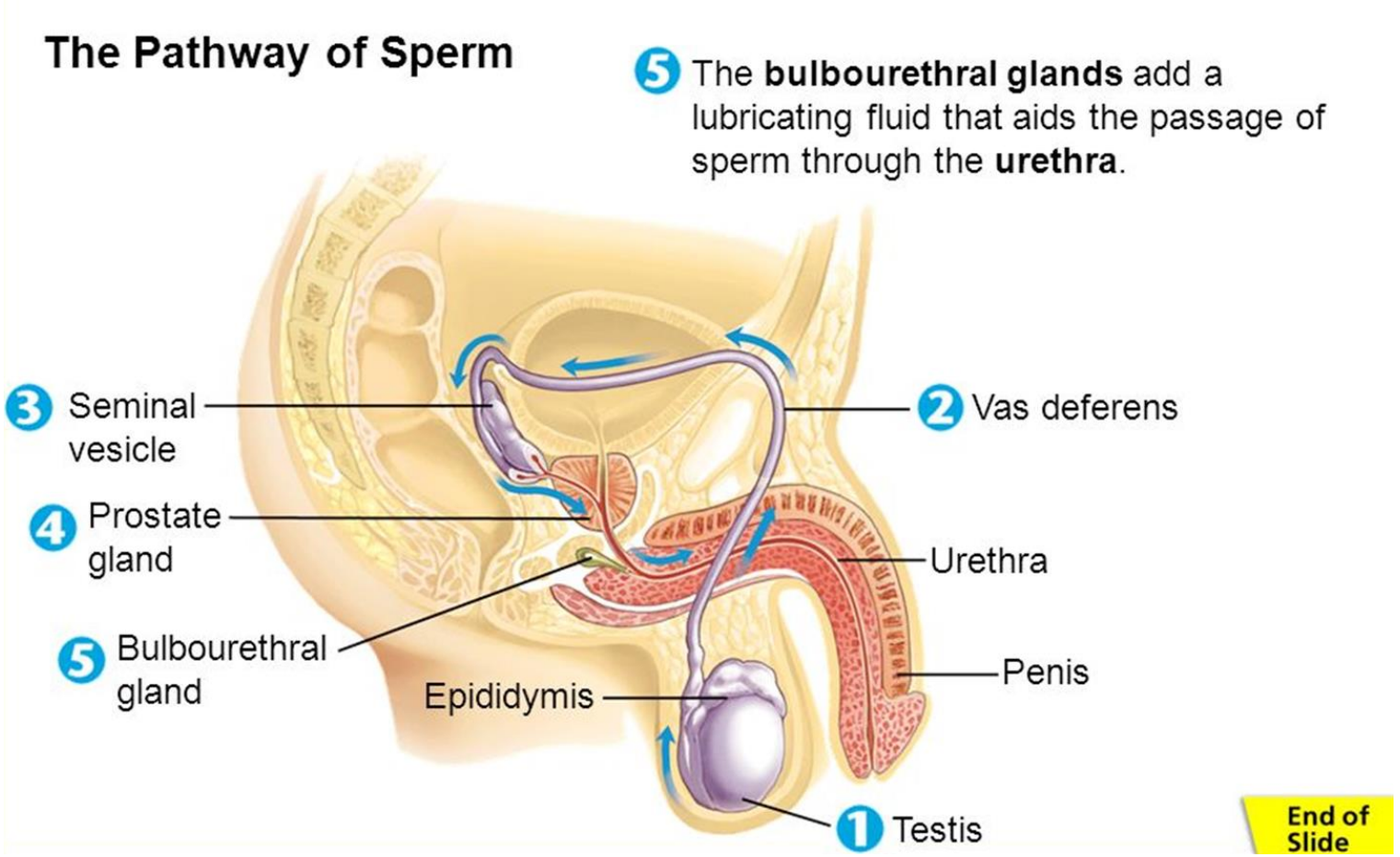
- Inside = membranous urethra to passageway of semen & urine
- Consist = body, root & glans penis
- End opening = external urethral orifice
- Foreskin (prepuce) = cuff of skin covering distal end of penis, can be retracted (pulled back toward the abdomen)
- Around the membranous urethra : → corpus spongiosum
  → corpus cavernosa
- Function:
  - **Deliver sperm into female reproductive tract (sexual intercourse)**
  - **Ejaculation**
  - **Urination**

5.3 Sperm



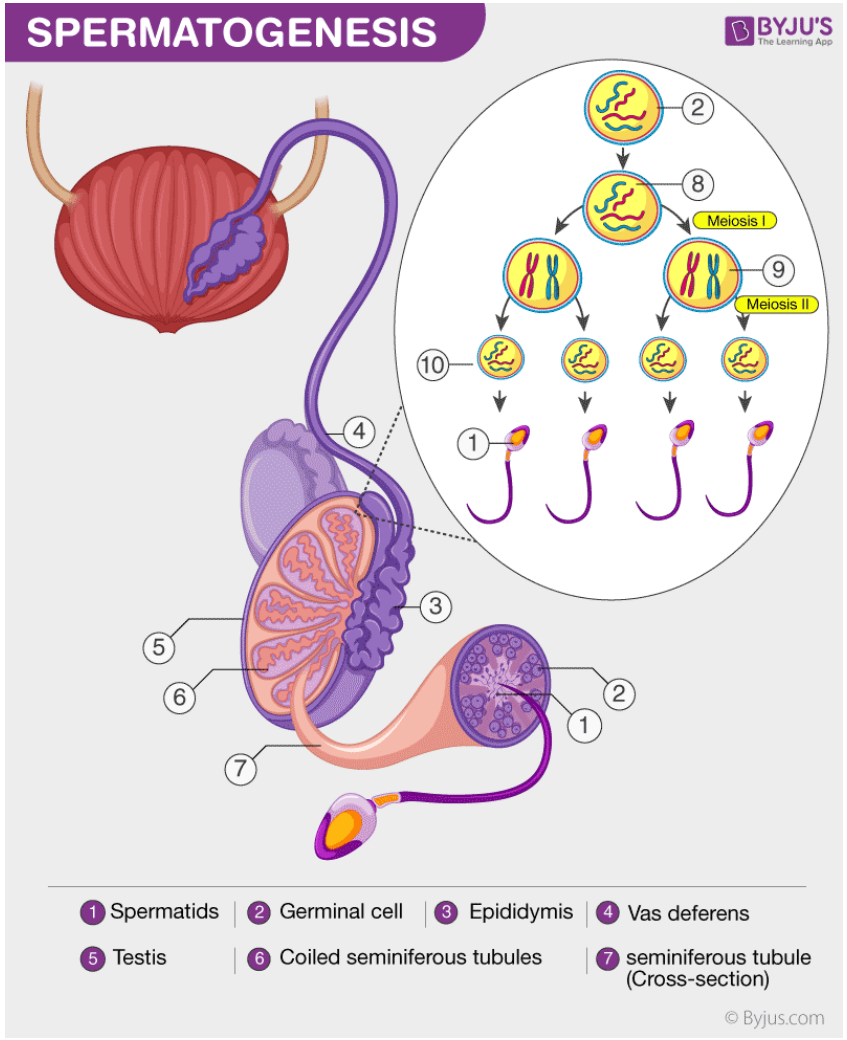
- Three major regions:
  - a) **Head**
    - contains DNA
    - acrosome containing hydrolytic enzymes → allow sperm to penetrate and enter egg
  - b) **Midpiece (body)**
    - contains mitochondria spiralled around tail filaments
    - providing energy for sperm tail to swim
  - c) **Tail**
    - typical flagellum produced by a centriole (cause sperm to swim)

5.3.1 Pathway of Sperm



5.4 Semen

- Mixture of sperm & seminal fluid
- Milky appearance
- Alkaline *(pH = 7.2 – 7.7)*
- Is a **transport medium**
- Contains nutrients (fructose)
- It **protects** the **vitality of sperm**
- It facilitates the **sperm movement**
- **Neutralize acidity** of male urethra and female vaginal tract
- **Lubricate** reproductive tract during sexual intercourse
- **Prevent infection** with antibacterial enzymes and antibodies
- Normal sperm count (concentration) = 50 – 150 million sperm/ mL
- Typical ejaculate = 2 – 5 ml fluid



5.5 Spermatogenesis

- ***Spermato*** = sperms
- ***Genesis*** = generate or produce
- Definition: **A process to produce haploid sperm inside the seminiferous tubules (testes)**
- Inside the area where the sperm are produced:

  a) Contain spermatogonic cells (spermatogonium)

  - *Stem cells involved in spermatogenesis*

  b) Contain sustentacular cells (eg : Sertoli cells)

  - *Sustain and promote development of sperm*
  - *Nourishment*
  - *Control movement & release of sperm*
  - *Produce inhibin*

5.5.1 Process of Spermatogenesis

MITOSIS

Spermatogonium (2n) → Primary spermatocytes (2n)

MEIOSIS I

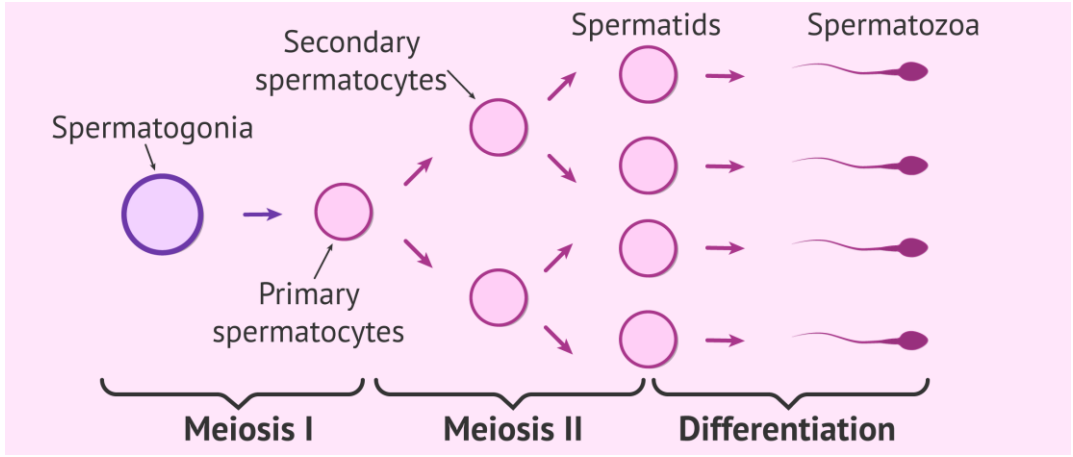
Primary spermatocytes (2n) → Secondary spermatocytes (n)

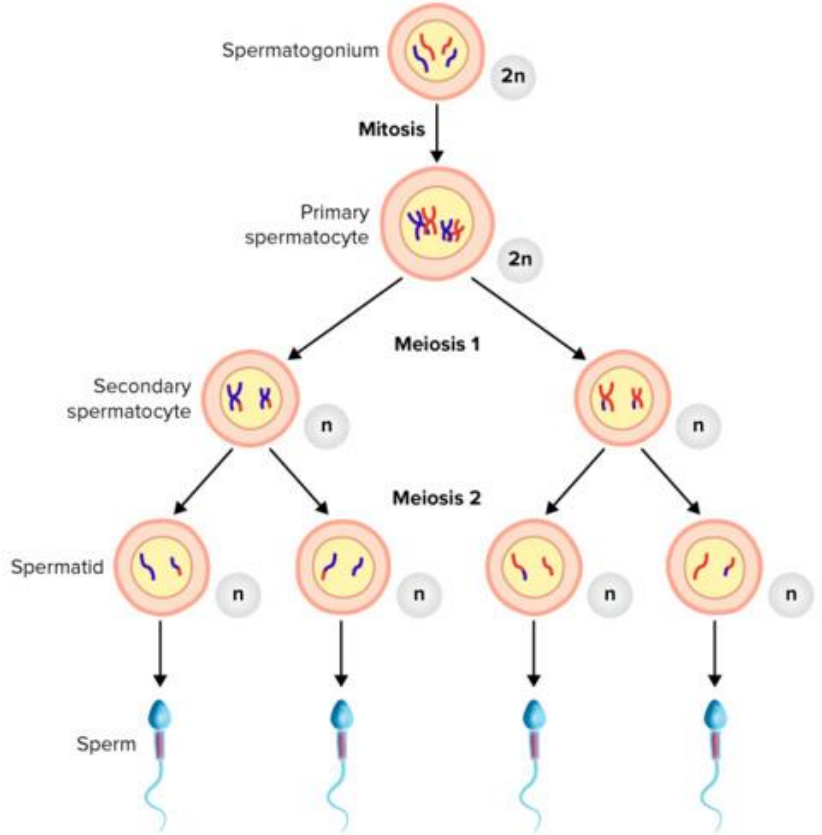
MEIOSIS II

Secondary spermatocytes (n) → Spermatids (n)

SPERMIOGENESIS

Spermatids → spermatozoa → matured sperms





5.5.1 Process of Spermatogenesis

5.6 Process of Ejaculation

1) Seminal vesicle secretes a thick whitish fluid (viscid) to provide nutrients for the spermatozoa

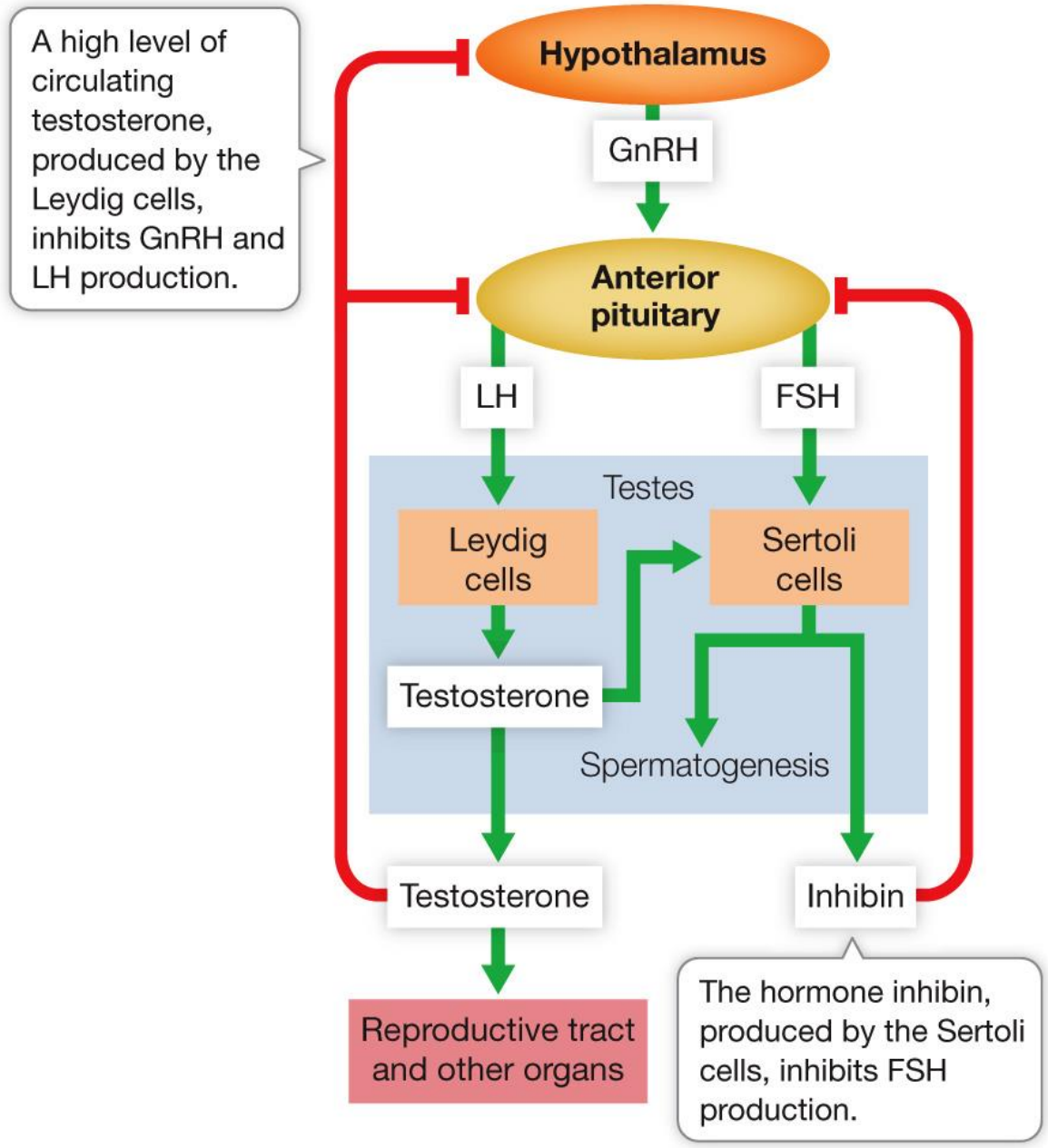
2) Prostate gland secrets solution (fluid) to smoothen the spermatozoa movement

3) Penis will erect to made it easy to enter the vagina then ejaculation of spermatozoa take place

5.7 Hormonal Regulation

GnRH (Gonadotropin releasing hormone)	• The principle regulator of LH and FSH secretion
FSH (Follicle stimulating hormone)	• Targets sustentacular cells (**Sertoli cell**) = **Promote spermatogenesis**
LH (Luteinizing hormone)	• Stimulate interstitial cell (Leydig cell) between seminiferous tubule • **Leydig cell** = **Produce testosterone** and other androgens

Hormonal Regulation in Male Reproductive System



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5.7.1 Testosterone

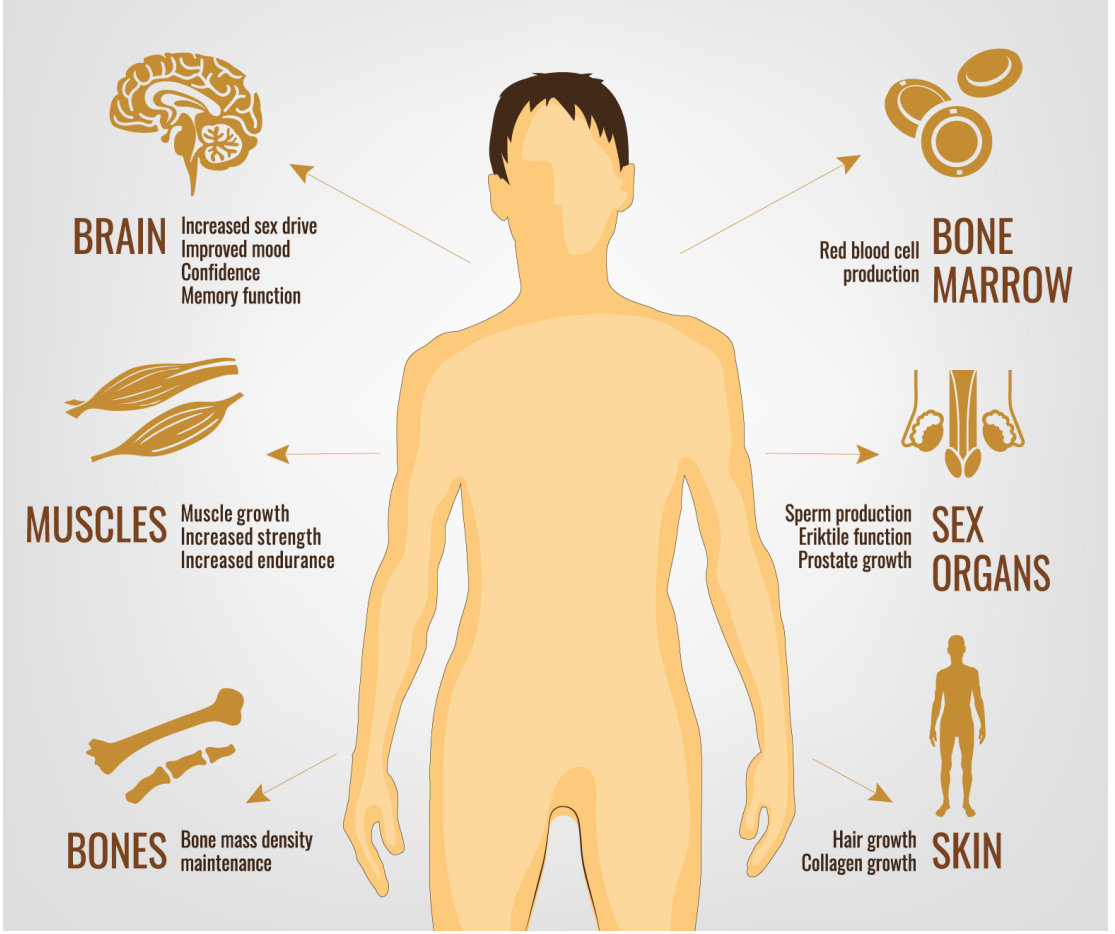
Development and maintenance of reproductive structure

Development of spermatozoa

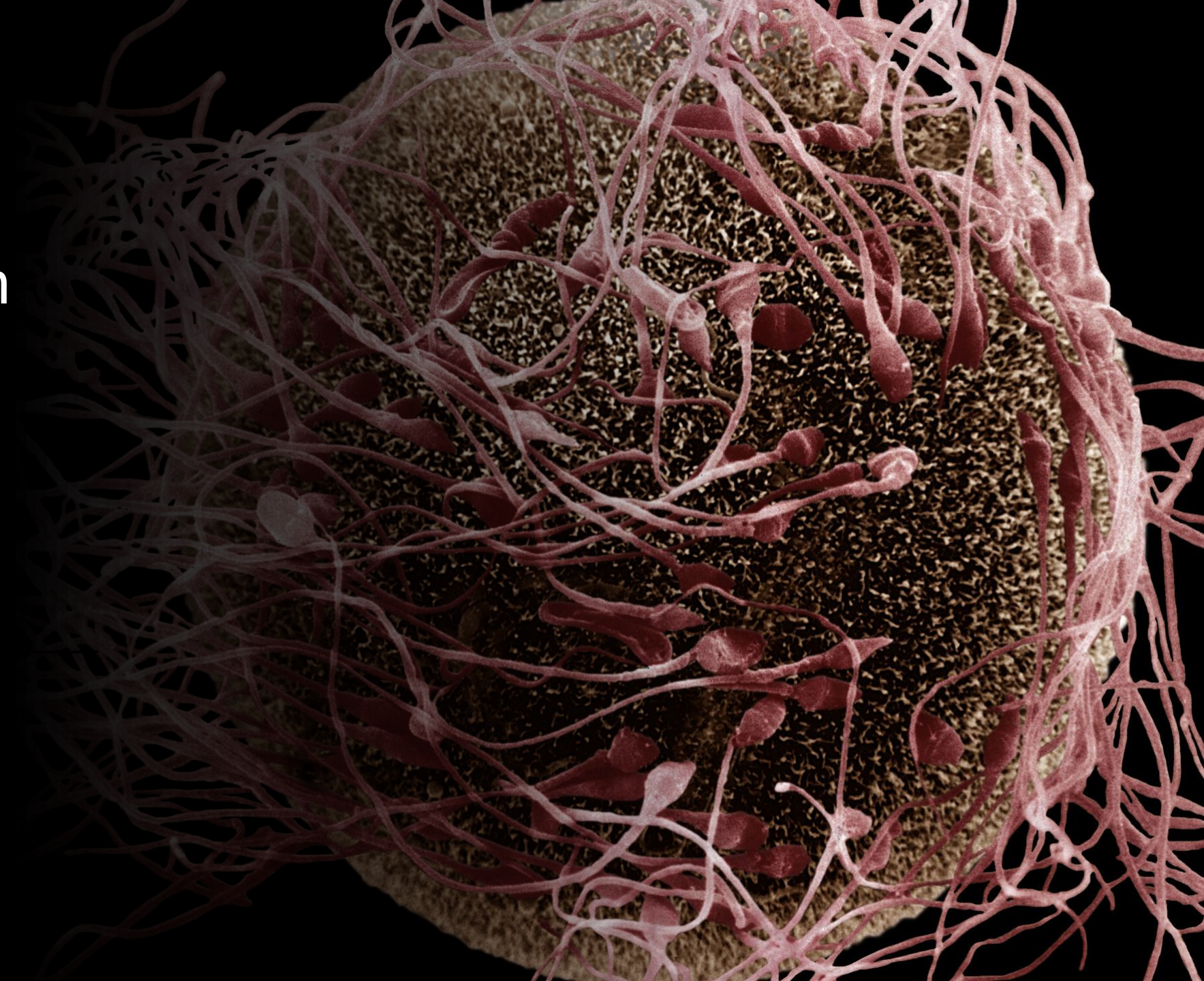
Development of secondary sex characteristics

5.8 Secondary Sex Characteristics - MALE

- Definition:
  - **Any physical characteristic that is different in males and females, and that is not directly related to reproduction**
- Examples of secondary sex characteristics for MALE:
  - a) appearance of pubic, axillary and facial hair
  - b) enhanced growth of chest
  - c) deepening of voice
  - d) skin thicken and oily
  - e) bones grow and increase in density
  - f) skeletal muscle increase in size and mass



We are the only lucky sperm from over others 50 millions that success to enter the ovum



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THANK YOU