Chromosomal Sex Determination

- our cells contain 23 pairs of chromosomes
  - 22 pairs of autosomes
  - 1 pair of sex chromosomes (XY males: XX females)
    - males produce half Y carrying sperm and half X carrying sperm
    - all eggs carry the X chromosome

- sex of child determined by type of sperm that fertilizes mother’s egg
  - X-carrying sperm fertilizes female
  - Y-carrying sperm fertilizes male

Figure 27.2
Prenatal Hormones and Sex Differentiation

• initially, a fetus is **sexually undifferentiated** as to which sex it will become

• **SRY gene** (sex-determining region of Y chromosome)
  – in males, codes for a protein, **testes-determining factor (TDF)**, that initiates development of testes
    • begin to secrete testosterone **8 to 9 weeks**

• **estrogen levels** are always high in pregnancy
  – if estrogen was the hormone that directed the female development, all fetuses would be feminized

• female development occurs in **absence of androgen hormones**
Male Reproductive System

Figure 27.11a

(a) Sagittal section
Testis and Associated Structures

Figure 27.9b

- Spermatic cord
- Blood vessels and nerves
- Head of epididymis
- Ductus deferens
- Efferent ductule
- Rete testis
- Body of epididymis
- Tail of epididymis
- Seminiferous tubule
- Septum
- Lobule
- Tunica vaginalis
- Tunica albuginea
- Spermatic cord
- Blood vessels and nerves
- Head of epididymis
- Ductus deferens
- Efferent ductule
- Rete testis
- Body of epididymis
- Tail of epididymis
- Seminiferous tubule
- Septum
- Lobule
- Tunica vaginalis
- Tunica albuginea

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Testes

- **testes** (testicles) – combined endocrine and exocrine glands that produce **sex hormones** and **sperm**

- **seminiferous tubules**
  - each tubule lined with a thick germinal epithelium for sperm generation

- **interstitial (Leydig) cells** between tubules produce testosterone
Spermatic Ducts

• spermatic ducts from testis to the urethra
  – epididymis
    • site of sperm maturation and storage (fertile for 40 to 60 days)
    • contains a single 6 m long coiled duct adhering to posterior of testis
    • sperm mature as they travel through the duct
    • if not ejaculated, they disintegrate and epididymis reabsorbs them
  – vas deferens
    • muscular tube 45 cm long passing up from scrotum through inguinal canal to posterior surface of bladder
    • duct ends by uniting with the duct of the seminal vesicle

– ejaculatory duct
  • 2 cm duct formed from ductus deferens and seminal vesicle and passing through prostate to empty into urethra
Male Duct System

Figure 27.11b
• 18 cm long male urethra is shared by the reproductive and urinary systems
Accessory Glands

- there are three sets of glands in the male reproductive system
  - **seminal vesicles**
    - forms 60% of semen
    - Secretes – alkaline fluid containing fructose, prosemingelatin and prostaglandins.
  - **prostate gland**
    - Secretes – seminalplasmin (antibiotic), serine protease
    - thin milky secretion forms 30% of semen
  - **bulbourethral (Cowper) glands**
    - Secretes – alkaline mucous
Endocrine Control

As hypothalamus matures it produces gonadotropin-releasing hormone (GnRH)

- GnRH stimulates anterior pituitary cells (gonadotropes) to secrete:
  - follicle stimulating hormone (FSH)
    - stimulates spermatogenesis
  - luteinizing hormone (LH)
    - stimulates interstitial cells to produce testosterone
Spermatogenesis

Cross section of seminiferous tubules

Lumen of seminiferous tubule

Sperm

Spermatid

Secondary spermatocyte

Blood–testis barrier

Primary spermatocyte

Sustentacular cell

Type B spermatogonium

Tight junction

Type A spermatogonium

Basement membrane of seminiferous tubule

Figure 27.15
Histology of Testis

Figure 27.10 a-b

Interstitial cells
Blood vessel
Germ cells
Sustentacular cell
Tails of spermatozoa

(a)

Blood vessel
Seminiferous tubule
Spermatids
Sustentacular cell nuclei
Tubule lumen
Germ cells
Connective tissue wall of tubule
Interstitial cells

(b) 50 µm

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Spermatozoon

Figure 27.17 a-b