Chapter 26: Reproductive System

Reproductive System:

Gonads: Reproductive organs (testes / ovaries)
Gametes: Reproductive cells (sperm / egg)

Zygote: Diploid cell

Semen = spermatozoa (20 – 100 million) + seminal fluids (2 – 5 ml)

Male Reproductive Anatomy:

- Testes (spermatozoa production)
- Duct system (spermatozoa transport)
- Glands ( seminal fluids)

Only system not essential to life of individual
Testes:
- Descent of the testes (~ 7 months in utero)
- Cryptorchidism ("hidden testis")
  - Undescended testis(es)
  - ~ 3% full-term (~ 30% premature)
  - Undescended = sterile

Cryptorchidism

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Spermatic Cord:
- Includes ductus deferens, blood vessels, nerves, and lymphatic vessels
- Passes via inguinal canal
  (weak point – inguinal hernia...)

Scrotum:
- Divided internally into two chambers
- Cremaster Muscles: Regulate testes location (cold = muscle contraction)
- Sperm development ~ 97.0°F

Seminiferous Tubules:
- Slender, tightly coiled tubules (~ 0.5 miles / testis);
  sperm production

Rete Testis:
- Passageways collecting sperm from seminiferous tubules

Testes - Histology:

Leydig Cells (interstitial cells)
- Testosterone production

Sertoli Cells (nurse cell)
- Spermatogenesis
Spermatogenesis: (sperm production)

- Spermatogonia (stem cell) (Diploid) 
- Mitosis 
- Primary Spermatocyte (Diploid) 
- Meiosis (crossing over) 
- Spermatids (Haploid) 
- Spermatids 
- Spermatids 
- Spermatids 
- Spermatids 
- Spermatozoa (Haploid) 

Spermiogenesis:
- ~ 14 yrs. of age
- 9 week process
- 400 million / day

Male Reproductive Tract:

1) Epididymis:
   - 7 m long; move immature sperm via currents (2 week journey)
     A) Monitors / Adjusts tubule fluid composition
     B) Recycles damaged / non-utilized sperm
     C) Facilitates functional maturation of sperm
       - Secrete chemicals that prevent capacitation (mobile sperm)
       - Sperm activated via seminal fluids & female reproductive tract

2) Ductus Deferentes:
   - ~ 18 in. long; thick layer of smooth muscle
   - Propel sperm via peristaltic contractions
   - Stores sperm (several months)
   - Ejaculatory Duct: Portion through prostate gland

3) Urethra

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Anatomy of a Sperm:

1) Head:
   - Nucleus - contains DNA
   - Acrosomal cap
   - Hydrolytic enzymes
   - Egg penetration
2) Midpiece:
   - Mitochondria - ATP
3) Tail:
   - Flagellum - movement
   - Lack most intracellular structures
   - Nutrients from environment
Male Reproductive Accessory Glands:

Functions:
1. Activate spermatozoa
2. Provide nutrients (power mitochondria)
3. Propel sperm / fluids (peristalsis)
4. Provide buffers (neutralize urethra / vagina)

1) Seminal Vesicles (60% semen volume):
   - ↑ [fructose] = Activate sperm
   - Prostaglandins = smooth muscle contraction
   - Fibrinogen = temporary clot in vagina
   - Buffers = Neutralize acids

2) Prostate Gland (30% semen volume):
   - Seminalplasm (antibiotic)

3) Bulbourethral Glands (5% semen volume):
   - Thick, alkaline solution (buffer / lubricant)

Penis:

1) Root
   - Attaches penis to body wall
2) Shaft (erectile tissue)
   - Corpora cavernosa / Corpus spongiosum
3) Glans
   - Prepuce (foreskin)

Sexual Response:
1) Erection = Enlargement / stiffening of the penis
   - Parasympathetic reflex:
     - Nitric oxide relaxes erectile tissue sphincters
     - Bulbourethral gland stimulated (pre-ejaculate)
2) Ejaculation = Propulsion of semen from duct system  
   Ejaculate:
   - Accessory glands contract (seminal fluids)
   - Bladder sphincters contract (close off bladder)
   - Penis musculature rhythmically contracts (semen = 200 in / sec)

Male Reproductive System - Hormones:

- Maintains accessory glands
- Stimulates metabolic processes
- Secondary sex characteristics
- Influences brain development

Hypothalamus

Luteinizing Hormone (LH)

Follicle-stimulating Hormone (FSH)

Testes

Leydig Cells

Sertoli Cells

 ↑ Spermatogenesis / Spermiogenesis

Inhibin

Gonadotropin-releasing Hormone (GnRH)

Anterior Pituitary

(+)

(-)

(+)

(+)

(-)
Females:
- Ovaries (egg production)
- Duct / Development System

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Ovary:
- Composed of cortex (egg formation) and medulla (blood/nerve supply)
  - Function: 1) Production of eggs (ova)
  - 2) Secretion of sex hormones

Oogenesis (ovum production – long process):
- Primary Oocytes (~ 400,000)
- Mitosis Before Birth
- Meiosis (I)
  - First polar body
  - At Puberty
  - Meiosis (II)
  - Mature Ovum
  - Second polar body
  - After Fertilization

Atresia: Degeneration of primary oocytes
- ~ 500 eggs released / life

Ovary: Oogenesis occurs within ovarian follicles:
- Primordial Follicle:
  - Primary Oocyte + Follicle cells
- Ovarian Cycle (~ 28 days)
  - 1) Primary Follicle
    - Follicle cells enlarge / replicate
    - Zona Pellucida: Increased surface area around egg for absorption
  - 2) Secondary Follicle
    - Fluid-filled cavity forms between follicle cells
  - 3) Tertiary Follicle
    - Central chamber appears (antrum)
    - 15 mm diameter; bulge in ovarian wall appears

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Ovary:

- Oogenesis occurs within ovarian follicles:
  - Primordial Follicle: Primary Oocyte + Follicle cells
  - Primary Oocyte matures to secondary oocyte (1st polar body formed)
  - Ovarian wall ruptures

Ovarian Cycle (~ 28 days)

4) Ovulation

- Primary oocyte matures to secondary oocyte
- Ovarian wall ruptures

5) Corpus Luteum
- Follicle cells collapse; form endocrine structure
- Pregnancy = CL remains
- No Pregnancy = CL degenerates (12 days)

Duct / Development System:

- Oocytes pass through Fallopian tubes to uterus

- Infundibulum: Expanded funnel
- Fimbriae: Finger-like projections (collect egg)
- Ampulla: Middle segment of tube
- Isthmus: Connection of tube to uterus wall

Trip takes 3 – 4 days
Fertilization must occur within ~ 24 hours of release

- Ciliated columnar epithelium
- Thick smooth muscle layer

Uterus layers = Endometrium / myometrium

- Menses: Endometrium sloughs off from uterine wall (~ 7 days)
- Proliferative Phase: Cells multiple across endometrium (~ 7 days)
- Secretory Phase: Endometrial glands enlarge / increase secretions (~ 14 days; prepares uterus for embryo)

1) Mechanical protection
2) Nutritional support
3) Waste removal
4) Ejection

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**Stratified squamous epithelium**
- Devoid of glands (mucus = cervix)
- Very slight keratinization
- Support bacteria (= lactic acid)

**Vagina:** Elastic, muscular tube between uterus and external environment
1) Passageway for elimination of menstrual fluids
2) Receives penis during sexual intercourse
3) Holds spermatozoa prior to uterus entrance
4) Forms birth canal during fetus delivery

**Chapter 26: Reproductive System**

**Hormonal Regulation of Female Reproductive Cycle:**

<table>
<thead>
<tr>
<th>Phases of the Ovarian Cycle</th>
<th>Follicular Phase</th>
<th>Luteal Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Follicular stage</strong></td>
<td>LH surge triggers ovulation</td>
<td>Corpus Luteum = Follicle cells</td>
</tr>
<tr>
<td></td>
<td>Follicle developing</td>
<td>Release progesterone</td>
</tr>
<tr>
<td></td>
<td>Follicle developing</td>
<td>Maintains uterine lining</td>
</tr>
</tbody>
</table>

**Birth Control Pill**

- Inhibits FSH release