Reproductive system

I. Little difference between the organs of the genders with the exception of the reproductive systems.
   A. Male produces sperm and can transfer them to the female
   B. Female produces oocytes and can receive sperm cells then can nurture a developing individual.
   C. Male and Female system share a number of similarities
      1. Many structures are derived from autologous structures.
      2. Some hormones are the same.

II. Male Reproductive System
   A. Testes and epididymus are outside of the body cavity.
      1. Sperm are sensitive to temp.
      2. Temp is regulated by the dartos muscle and cremasteric muscle.
         a. Cool
         b. Warm
   B. Testes
      1. Testicular Histology
         a. Both an exocrine and endocrine organ
            (1) sperm - exocrine
            (2) testosterone - endocrine
         b. Tunica albuginea
            (1) thick white capsule
         c. Septa - divides testes into 300 cone shaped lobules
         d. Lobules composed of seminiferous tubules and leydig cells
            (1) seminiferous tubules - sperm development
               (a) combined length ½ mile
               (2) leydig cells (interstitial cells) - testosterone
            e. Rete testes - collect sperm from seminiferous tubules and empty into efferent ductules
            f. efferent ductules - 15-20 tubes
               (1) ciliated pseudostratified columnar epi
                  (a) move sperm cells
               (2) exit the testes through tunica albuginea.
         2. Descent of Testes
            a. Develop retroperitoneal in abdominal cavity
            b. Move through the inguinal canal to the scrotum
            c. Inguinal hernia - week spot often develops in inguinal ligament where
testes descend resulting in inguinal hernia

C. Sperm Cell Development

1. Following puberty the interstitial cells increase in number and size and begin to produce testosterone. Sperm cells begin to be produced.

2. Stages of spermatogenesis (sperm cell development)
   a. Seminiferous tubules contain two cell types
      (1) **germ cells**
         (a) divide to form sperm cells
      (2) **Sertoli (nurse) cells (sustentacular cells)**
         (a) large cells that extend from the periphery to the lumen of seminiferous tubules
         (b) nurse the germ cells
         (c) may produce (with Leydig cells) hormones such as androgens and estrogens.
         (d) form tight junctions (blood-testes barrier)
            i) isolates sperm from immune system
            ii) sperm cells develop antigens that could stimulate an immune response.
      (3) **Leydig cells** outside of seminiferous tubule produce testosterone
         (a) testosterone binds to Sertoli cells.
         (b) stimulates Sertoli cells to produce dihydrotestosterone (DHT) and estradiol
            i) DHT and estradiol promote sperm production
      (4) Maturation of Sperm cells
         (a) germ cells are arranged in seminiferous tubules by maturity (Fig. 28.4)
            i) **spermatogonia** - closest to basement membrane
               a) divide by **mitosis**
               b) some daughter cells remain spermatogonia and continue to divide
               c) other differentiate into Primary spermatocytes
            ii) **Primary spermatocytes**
               a) pass through the first **meiotic division**
               b) become secondary spermatocytes
            iii) **Secondary spermatocytes**
               a) undergo a **second meiotic division**
               b) become spermatids
            iv) **Spermatids**
               a) each spermatid will become a sperm cell or
spermatozoon

v) Spermatozoon develop:
   a) head - contains chromosomes and an acrosome for
      penetration of female sex cell.
   b) tail - flagellum with middle piece (contains mitochondria to
      power sperm movement) and tail (with microtubules the
      slide over each other to produce movement.)

(5) Sperm cells gather in the lumen of the semiferous tubules.

D. Ducts - carry sperm to outside of body
1. Epididymis
   a. Location of final maturation of sperm
   b. Sperm taken directly from the testes are not capable of fertilizing an
      egg.
2. Ductus (vas) deferens
   a. Run from epididymis through spermatic cord
   b. Spermatic cord contains:
      (1) ductus deferens
      (2) artery and vein
      (3) lymph vessels
      (4) nerves
      (5) cremasteric muscle - internal oblique extension
      (6) external and internal fascia layer.
   c. Spermatic cord
      (1) runs through inguinal ligament and enter the pelvic cavity
      (2) loops over bladder to prostate
      (3) enlarged at end to form **ampulla**
3. Ejaculatory Duct
   a. Seminal vesseicle joins with ductus deferens to form the ejaculatory
      duct
   b. Projects into the prostate
4. Urethra
   a. Prostatic, membranous and penile urethra
   b. Carries both urine and semen
E. Penis
1. Consists of three columns that become engorged with blood
2. Transfers sperm cells from male to the female
3. Anatomy:
   a. Corpora cavernosa (2)
b. Corpora spongiosum - expands to form the glans
4. Root of penis (Bulb and crus) attach penis to coxae.
5. Primary nerves and arteries pass along the dorsal surface
F. Accessory Glands
1. Seminal vesicles
   a. 5 cm long
G. Prostate Gland
1. Glandular and muscular tissue
2. At base of bladder
3. Prostate cancer is the most common cause of male cancer death in U.S.
H. Bulbourethral glands
I. Secretions
1. Semen composite of sperm cells and secretions
2. Seminal vesicle 60%
   a. Fructose for nourishing sperm
   b. Thick mucoid secretion
   c. Prostiglandins which cause uterine contractions
3. Prostate 30%
   a. Thin milky secretion
   b. Fibrin - sticky mass of sperm
   c. Fibrinolysin - releases sperm in vagina to travel
d.
4. Testes 5%
   a. Sperm
   b. Small amount of fluid
5. Bulbourethral glands 5%
   a. Mucous secretion
   b. Lubricates uretha / for intercourse
   c. Neutralizes acidic urethra
III. Female Reproductive System

A. Ovaries

1. The **suspenory ligament, ovarian ligament** and **mesovarium** (a peritoneal fold) hold the ovaries in place.

2. Layers
   a. Ovarian epithelium - peritoneum covering
   b. Tunica albuginea - dense fibrous CT
   c. Cortex - dense outer part
      (1) ovarian follicles which contain oocytes.
   d. Medulla - loose inner part
      (1) contains blood and lymph vessels, nerves

B. Follicle and Oocyte Development

1. Oogenesis - production of secondary oocytes

   a. **primary oocyte**
      (1) Meiosis stops at the first meiotic division (prophase I)
      (2) 2,000,000 at birth
      (3) Surrounded by granulosa cells and primordial follicle.
      (4) 2-300,000 at puberty
      (5) converted to primary follicle by FSH after puberty

   b. **Primary follicle**
      (1) oocyte enlarges and
      (2) single layer of granulosa cells enlarge and divide to form more layers.
      (3) zona pellucida forms - clear substance surrounding oocyte

   c. **Secondary Follicle**
      (1) granulosa cells multiply
      (2) vesicles form among granulosa cells.
      (3) vesicles fuse to form antrum
      (4) **Theca** capsule is formed around follicle with two layers
         (a) Theca interna
         (b) Theca externa

   d. **Mature or Graafian follicle**
      (1) single fluid filled antrum
      (2) antrum increases in size
      (3) follicle forms a bulge on the surface of the ovary
      (4) oocyte is pushed to one side of antrum forming the **cumulus mass or cumulus oophorus** with an inner **corona radiata**.

   e. **Secondary Oocyte**
(1) primary oocyte completes first meiotic division to form a secondary oocyte and a **polar body** (due to unequal division of the cytoplasm).

(2) The second meiotic division is completed and the **secondary oocyte stops at metaphase II**.

C. **Ovulation**

1. Follicle swells - granulosa cells and theca become thin.
2. Graafian follicle ruptures and
3. secondary oocyte and corona radiata are expelled.**(Ovulation)**
4. **Fertilization triggers the continuation of the second meiotic division**
   a. Secondary Oocyte will only progress past metaphase II if penetrated by the sperm.
   b. A second polar body will then be formed.
5. Fertilized oocyte is called a **zygote**.

D. **Fate of the follicle**

1. Remaining follicle within the ovary becomes a **corpus luteum**
   a. Secretes **progesterone** and small amounts of estrogen.
   b. Remains for 10-12 days unless pregnancy occurs.
   c. In pregnancy the corpus luteum enlarges
   d. Degenerates without pregnancy into the **corpus albicans**

E. **Uterine Tubes** - know structures

F. **Uterus** - know structure

1. **Uterine position** -
   a. Anteverted - tipped anterior most common
   b. retroverted - tipped posteriorly
   c. Prolapsed uterus - weakening in muscle of pelvic floor allowing uterus to drop into the vagina.
2. **Endometrium** - simple columnar epithelial lining and a CT lamina propria.
   a. Two layer
      (1) Basal layer - next to myometrium
      (2) Functional layer - lines the cavity.
      (a) undergoes menstrual changes - slough off during menstration.

G. **Vagina** - know structure

1. Functions:
   a. receives penis during intercourse
   b. Allows menstrual flow
   c. Allows childbirth.
2. **Histology** - stratified squamous epithelium that produces mucous for
lubrication.

H. External genitalia - know structures
I. Perineum - know structures
J. Mammary glands.
   1. Are modified sweat glands within the mammas or breasts
   2. Areola contains areolar glands that secrete fluids that prevent chafing during nursing/
   3. Enlargement during puberty may cause increased sensitivity or pain
      a. Enlargement may also occur in males at puberty but generally subsides quickly
      b. Gynecomastia - enlargement of male breasts.
   4. Ducts - covered in lab.
      a. Mammary glands, mammary ducts, lacteriferous ducts and sinuses
   5. Support
      a. Cooper’s ligaments - extend from fascia over pectoralis major to skin
         (1) prevents excessive sagging
         (2) ligaments weaken in older adults.
   6. Nipples - contain erectile tissue
      a. Become erect in response to stimulation or sexual arousal.
   7. Breast cancer - often fatal, need for self examination and mammography for early detection.
   8. Control of milk production.
      a. See figure 29.20 hormonal control of mammary gland development
      b. See figure 29.21 Milk production and milk ejection reflex.

IV. Physiology of Female reproduction.
A. Puberty
   1. Characteristic changes
      a. Menarche - first marked menstrual episode
      b. Enlargement of vagina, uterus, uterine tubes, external genitalia.
      c. Fat deposits in breasts and on hips.
         (1) Assume adult form.
      d. Ducts in breasts develop
      e. Pubic and axillary hair grows
      f. Voice changes - not as noticeable as in male
   2. Causes
      a. Elevated estrogen and Progesterone secretion.
      b. GnRH, LH and FSH develop a monthly cycle.
         (1) Control of Estrogen and progesterone secretion - also cycle
c. Results in characteristic changes in uterus (menstrual cycle)

B. Menstrual cycle.
1. Refers to cyclic changes within uterus that culminate in menses.
2. 28 day average (range 18 - 40 days)
3. Menses (lat. Month)
4. Characterized by;
   a. Mild hemorrhage while uterine epithelium is sloughed and expelled from uterus
5. Also Accompanied by changes in hormone level, ovary, uterus.
6. Day 1 - considered first day of menstruation
   a. Menses generally lasts 4-5 days
7. Day 14 - ovulation generally occurs (varies by person and from one cycle to next )
8. Follicular or Proliferative phase - end of menses to ovulation
9. Luteal or secretory phase - ovulation to next menses.

C. Ovarian cycle
1. Refers to changes in ovaries/hormones over the cycle
2. See figure 29.14 and 29.15
3. See figure 29.17 Endocrine control of the ovarian cycle