Male Reproductive System

I. Overview
A. gonads – organs producing sex cells (gametes) = ___________
B. support for gonads = ___________
C. ducts – for storage and transport (epididymis, ductus deferens(vas deferens), ejaculatory duct,and urethra)
D. accessory glands – seminal vesicles, prostate gland, bulbourethral gland (Cowpers gland)
E. copulatory organ – delivers semen to female = ___________

II. Testes
A. development
   1. _______________ – posterior wall of abdomen
   2. _______________ – descend to scrotum through inguinal canal
      -about 3 degrees (Kramer and “the boys”)
   5. undescended testes = cryptochidism
B. layers of testes (inside out)
   1. seminiferous tubules – make ________________ inside tubules
   2. tunica albugenia
      a. surrounds testes - dense regular connective tissue
      b. separates testes into 200-300 lobules
   3. tunica vaginalis- extention of ________________
   4. cremaster muscle
      a. adjusts _______________ of testes (George and “shrinkage”)
      b. Why? temperature important for proper sperm production
   5. scrotum
      a. dartos muscle and skin
         - adjusts _______ of testes (wrinkles skin when contracted)
   6. spermatic cord
      a. connects _______ to torso
      b. contains vas deferens, blood vessels, nerves, lymph vessels
C. cells of the seminiferous tubules
   1. spermatocytes – produce sperm in process called spermatogenesis
   2. sustentacular cells = nurse cells = Sertoli cells
      a. help sperm mature – nourishing fluid
      b. protect sperm – from blood, diseases
      c. make inhibin–hormone regulates amount of sperm produced
   3. interstitial cells
      a. produce testosterone
III. Sperm production in testes
A. 3 hormones
   1. Follicle Stimulating Hormone - _______
      a. produced by anterior pituitary gland
      b. stimulates production of sustentacular cells

   2. Luteinizing Hormone - ______
      a. produced by anterior pituitary gland
      b. stimulates interstitial cells to produce testosterone

   3. Testosterone
      a. necessary for meiosis of spermatocyte
      b. secondary sex characteristics in males

B. meiosis
   1. sex cell division

   2. function – to cut the number of chromosomes in half
      (review** mitosis function – produce 2 identical cells)

   3. diploid number = 2n = 46 in humans (   )

   4. haploid number = n = 23 in humans (   )

   5. meiosis I
      a. cuts number of chromosomes in half
         2n to n or 46 to 23
      b. provides genetic variation

   6. meiosis II
      a. chromosomes split into identical halves
      b. identical process to mitosis

   7. pictures of mitosis and meiosis
Mitosis

Meiosis
C. Spermatogenesis - general

1. meiosis to make sperm cells
2. process begins at puberty when levels of testosterone increase
3. increased testosterone levels promote secondary sex characteristics (facial, axillary, and pubic hair, deepening of voice, oilier skin, and increased mass of bones and muscles)
4. process of making sperm in the seminiferous tubules takes about _____ days

D. Spermatogenesis – events in the seminiferous tubules

1. spermatogonia
   a. stem cells that divide by mitosis
   b. “type A” daughter cell is new stem cell
   c. “type B” daughter cell acted upon by meiosis to make sperm

2. primary spermatocyte (“type B” daughter cell)
   a. has 46 chromosomes (   )
   b. meiosis I reduces one cell with 46 chromosomes to two cells with 23 chromosomes
   c. homologous pairs separate

3. secondary spermatocyte
   a. has 23 chromosomes (   )
   b. meiosis II splits chromosome into ________________
   c. 2 cells with 23 chromosomes to 4 cells with 23 chromosome halves (chromatids)

4. spermatids
   a. 4 cells produced from original spermatogonia
   b. cells begin to lose cytoplasm/organelles and form a tail

5. spermatozoa or sperm
   a. ___________ – very front of sperm that contains enzymes for allowing sperm to enter (penetrate) egg
   b. ___________ – nucleus and no cytoplasm
   c. ___________ – lots mitochondria to make ATP for tail
   d. ___________ – flagellum to propel once inside female
IV. storage and transport of sperm
A. testes
1. sperm in the lumen of the seminiferous tubules are pushed by pressure from the testes to the ________________
B. epididymis
1. contains a head, body, and tail
2. sperm mature in epididymis ( )
3. sperm may be stored for several weeks
4. if sperm are held longer, they are phagocytized by the epididymis
C. vas deferens ( )
1. ascends from epididymis around the bladder and connects to a duct from the seminal vesicle
2. vasectomy – cut the vas deferens
D. ejaculatory duct
1. junction of the vas deferens and duct from the seminal vesicle that connects inside the prostate gland to the ________________-
E. urethra
1. prostatic urethra – from bladder through prostate gland
2. membranous urethra – through urogenital diaphragm
3. penile urethra – through the corpus spongiosum of the penis
4. urethra orifice – external opening
   a. reproductive or urinary functions
   b. 200 – 300 million is normal sperm count

V. Accessory Sex Glands
A. secrete fluid that help sperm live and protect sperm
B. sperm and accessory gland secretions = semen
C. glands
1. seminal vesicles (2)
   a. 60% of semen
   b. ________________ rich to nourish sperm
   c. alkaline ( ) to counter acidic vagina
   d. join the urethra in the prostate gland
2. prostate gland
   a. surrounds urethra
   b. secretes fluid containing ________________ that activate sperm
3. bulbourethral gland (Cowpers Gland)
   a. mucus for ________________ -
   b. ________________ fluid for neutralizing acidic vagina
VI. Copulatory organ (penis)
   A. delivers sperm to female
   B. contains erectile tissue
      1. contains _______________ capable of filling with blood
      2. tissue has a good blood supply
   C. parts
      1. root - attached to torso
      2. body or shaft – contains masses of erectile tissue
         a. corpus spongiosum – small singular mass of erectile tissue in which ________________ passes through
         b. corpora cavernosa – 2 larger mass of erectile tissue
      3. glans
         a. slightly enlarged end
         b. extension of the _______________________________
      4. prepuce ( )
         a. extension of skin that covers the glans
         c. circumcision – “pain for no reason”
            - removal of the foreskin

VII. Male sexual response (three E’s)
   A. erection
      1. cerebral or sexual stimulation leads to erection
      2. parasympathetic control***
         a. “ ” nervous system
         b. causes vasodilation of penile ______________
         c. sinuses in erectile tissue fill up with blood
         d. causes vasoconstriction of penile _________
         e. stress and the unattainable erection (Bob Dole syndrome)
         f. Viagra – muscle relaxant therefore more blood flow
   B. emission and ejaculation
      1. sympathetic control
      2. emission
         a. peristaltic contraction of smooth muscle and release of fluid from reproductive glands
         b. sperm and fluids accumulate in _______________ urethra
      3. ejaculation
         a. peristaltic contraction of muscles within penis
         b. ________________stimulation constricts blood vessels in penis and erection ends
Female Reproductive System

I. Overview
A. gonads = _________ - produce gametes and hormones
B. accessory organs
   1. fallopian tubes = uterine tubes = oviducts
   2. uterus (including _________)
   3. greater vestibular glands
   4. external genitalia – labia majora, labia minora, clitoris
C. copulatory organ = vagina - receives semen from male
D. support for reproductive organs = ___________________

II. Ovary
A. location and structure
   1. located in upper pelvic cavity
   2. tunica albuginea
      a. white capsule that covers _________
      b. red marks indicate previous ovulations where eggs have
         “__________” of ovary
   3. follicles
      a. contains ____________(premature egg), follicle cells and
         connective tissue cells
      b. stages of follicles
         i. primordial follicles
            - contains stem cells = _____________
            - begin developing before female is born
            - don’t increase in number after birth
            - 300,000 – 700,000 total; nothing happens to most
         ii. primary and secondary follicles
            - 6 to 12 begin to ____________ each 28 day cycle
         iii. Graafian or vesicular follicle
            - one of these outgrows the rest and releases _______
            (follicle of the month)
            - others degenerate
         iv. corpus luteum
            - develops from follicle after ovulation
              (after egg released)
         v. corpus albicans
            - degenerated corpus luteum
            - only forms if fertilization ____________ occur and
              hormones are not needed
4. egg or ovum
   a. located in follicles
   b. female begins ________ before birth, stops process, and
      stores eggs for 12 years to 50 years (waiting to be released)

5. oogenesis
   a. primary oocyte
      i. born at this stage (__________ or 2n number)
      ii. DNA has replicated
   b. secondary oocyte
      i. released at ovulation
      ii. happens inside ____________ follicle
      iii. ____________ – number of chromosomes cut in half
      iv. unequal distribution of cytoplasm to form larger
          secondary oocyte and smaller polar body
      v. polar body dies into cytoplasm
      vi. IF fertilized secondary oocyte undergoes ________
          to separate identical chromatids
      vii. then another polar body is formed and it degenerates

6. hormones
   a. FSH
      i. stimulates growth of ____________
      ii. produces estrogen
   b. LH
      i. triggers ovulation (about ____________ into cycle)
      ii. produces estrogen and progesterone

III. Fallopian tubes = uterine tubes = oviduct = “catcher’s mitt”
   A. functions
      1. receives ovulated egg from ovary (no ____________ connection)
      2. site of _________________
      3. egg transported using ciliary action and peristalsis
   B. anatomy
      1. infundibulum
         a. expanded proximal end of tube
         b. contains fimbriae or finger-like structures designed to
            “________” secondary oocyte
      2. ampulla
         a. major portion of fallopian tube
         b. site of fertilization
      3. isthmus – distal narrow portion attached to ______________
C. layers of wall
   1. external serosa called the broad ligament
   2. muscularis
      a. thick smooth muscle
      b. ______________
   3. internal mucosa
      a. ciliated simple columnar
      b. produces ___________

IV. Uterus
   A. functions
      1. receive embryo from fallopian tube
      2. place for ______________
      3. helps form placenta
      4. fetal ejection (smooth muscle contraction)
      5. if no embryo, site of ______________
   B. anatomy
      1. ___________ – upper domed section
      2. ___________ – main part where fetus develops
      3. ___________ – narrowing portion
      4. ___________
         a. extends into vagina
         b. pap smear
   C. walls of uterus
      1. perimetrium
         a. outermost layer
         b. ______________ (broad ligament)
      2. myometrium
         a. middle layer
         b. thick smooth muscle
         c. during pregnancy, ____________ increases the mass 24 times
            by increasing the number and size of cells
      3. endometrium
         a. inner most layer
         b. mucus membrane
         c. 2 layers of endometrium
            i. stratum functionalis – ______ during menstrual cycle
            ii. stratum basalis
               - __________
               - retained for healing
V. Vagina
A. functions
   1. inferior portion of ______________
   2. passage for menstrual flow
   3. female copulatory organ
   4. produce ______ for intercourse
B. anatomy
   1. muscular tube about 4 inches in length
   2. extends from __________ to vestibule
   3. orifice located between urethra and rectum
C. histology
   1. adventitia – __________
   2. muscularis – __________
   3. epithelium
      a. stratified squamous
      b. rugae
D. vaginal orifice + external genitalia
   1. ____________ – general area enclosing urethra and vagina
   2. greater vestibular glands – secrete mucus
   3. labia majora, labia minora and clitoris – contain erectile tissue

VI. Female sexual response
A. Parasympathetic effects
   1. erectile tissue
      a. engorgement of labia majora, labia minora, clitoris
      b. process similar to males but no ejaculate
   2. ___________ for lubrication released from cervix, vagina, greater
      vestibule gland, and external genitalia
B. Sympathetic effects
   1. ____________ contractions of vagina
   2. ____________ blood flow to erectile tissue
Female Reproductive Years

I. Years limited, as opposed to males

II. Menarche
   A. onset of bleeding at puberty (about 11-15 years old)
   B. related to heredity, nutrition, body fat

III. Reproductive years
   A. about __________
   B. 28 day cycle of ovulation, pregnancy or menstruation
   C.  
      1. day 1 – bleeding starts (4 days?)  
      2. day 14 ovulation (egg released)  
      3. day 28 last dry day

   *no matter what the length of menstrual cycles, ovulation occurs about 14  
   days before the menstrual period begins

IV. Menopause
   A. cessation of bleeding (about 50 years old)
   B. follicles have degenerated
Cycles

I. Ovarian cycle
   A. pre-ovulatory or follicular phase ( )
      1. FSH stimulates follicle to produce estrogen
      2. FSH stimulates egg to complete meiosis I

   B. Ovulation ( )
      1. LH build-up triggers release of secondary oocyte
      2. ovulation occurs about day 14

   C. Post-ovulatory or luteal phase ( )
      1. corpus luteum produces __________________
      2. progesterone prevents FSH, LH production & uterine contractions
         a. necessary to see if egg is fertilized
         b. if fertilized progesterone levels stay high for 1st trimester of
            pregnancy and ovulation ceases
         c. if not fertilized corpus luteum degenerates, progesterone
            levels decrease and FSH, LH production begins again
            (ovarian cycle begins again)

II. Menstrual Cycle ( )
   A. menstrual phase ( )
      1. lack of progesterone and estrogen signal an unfertilized egg
      2. egg and stratum ________________ is shed from uterine walls

   B. proliferative phase ( )
      1. healing phase
      2. increase in estrogen levels trigger the replacement of
         stratum functionalis
      3. “__________ the house”

   C. secretory phase ( )
      1. increase in progesterone levels triggers stratum functionalis to
         develop more B Vs, store more lipids in anticipation of embryo
      2. “____________ the house”

   D. premenstrual phase ( )
      1. corpus luteum gets message that egg not fertilized and
         progesterone levels drop which means FSH & LH levels increase
      2. corpus luteum ________________ and egg wants to be shed
I. Fertilization to birth
A. fertilization occurs in ampullary region of uterine tube
B. about 1000 sperm surround egg
C. sperm penetrates egg aided by acrosome enzymes, (old meat tenderizers)
D. sperm entrance helps triggers egg to complete meiosis II
E. genetic material from sperm (23 chromosomes) and egg (23 chromosomes) combine and zygote is formed ($23 + 23 = 46$)
F. cleavage occurs and cell divides
G. fertilized egg travels down uterine tube and, about day 6, implants itself on uterine wall
H. naming fertilized egg
   1. ___________ – weeks 0 through 2
   2. ___________ – weeks 3 through 8
   3. ___________ – weeks 9 through birth
   4. ___________ – at birth
I. window of opportunity
   1. sperm can live _________ days inside the female body
   2. egg can live ________ days after ovulation
   3. therefore, fertilization can occur over a _______________ span

II. Placenta
A. disc (Frisbee) shaped on embryo side of uterus
B. fetus connected by umbilical cord
C. barrier between mother’s circulation and fetus’ circulation
D. materials exchanged but not blood (see diagram)

III. ectopic implantations – (out of position or abnormal)
A. ovary – before or after fertilization
B. uterine tubes – may burst as egg swells and grows
C. cervix – lack room for development
D. intestinal mesentery – cesarean birth
E. can males have babies?

IV. fetal development
- handout or book
V. contraception
A. natural methods
   1. abstinence = 100% effective
   2. natural family planning or rhythm method
      a. no intercourse 2-3 days before and after ovulation
      b. 70 – 80 % effective
   3. no contraceptive – 85% - 100% chance of getting pregnant
B. mechanical methods (barriers)
   1. condom – male and female
      a. 90% effective alone
      b. 95 – 99% combined with spermicide
      c. helps prevent sexually transmitted diseases
         (barrier and spermicide kills bacteria/virus)
   2. diaphragm (with spermicide)
      a. doctor fitted and placed over cervix
      b. 81 - 87 % effective
   3. IUD
      a. metal or plastic placed in uterus to prevent implantation
      b. problems – hemorrhage
      c. 95 – 98% effective
C. chemical method
   1. spermicides – alone 75 – 82% effective
   2. oral, implants or injection
      a. high progesterone/low estrogen
      b. tricks body into thinking it just ovulated
      c. 98% effective
   3. morning after pill (MAP)
      a. very high progesterone/low estrogen
      b. taken within 72 hours of unprotected intercourse; it prevents fertilization and implantation
      c. 75% effective
   4. RU486 (abortion pill)
      a. first 7 weeks- uterine contractions inducing miscarriage
D. surgical methods (99.6% effective)
   1. vasectomy and tubal ligation
      a. cut vas deferens
      b. semen still produced
   2. tubal ligation
      a. cut uterine tubes       b. still ovulate and menstruate