

26.1 OVERVIEW OF THE REPRODUCTIVE SYSTEM AND MEIOSIS

INTRODUCTION TO THE MALE AND FEMALE REPRODUCTIVE SYSTEMS

- Similarities between male and female reproductive organs:
 - _____ secrete **sex hormones**, including testosterone and estrogen
 - Gonads produce _____ by meiosis; male gametes are called _____ and female gametes are called _____, or egg cells
 - Both genders have additional organs **accessory reproductive organs**

Cell division can occur either by **mitosis** that produces identical daughter cells or **meiosis** that produces sex cells

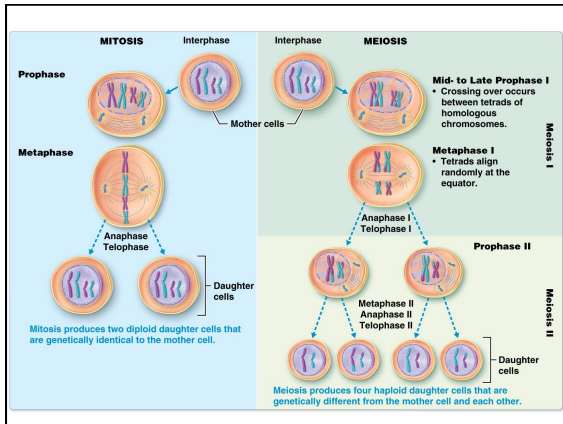
- **Fertilization** – process by which a sperm and egg cell fuse to form a new cell called a **zygote**
 - _____ – cell that divides to produce all of cells in a new individual
 - Must contain correct number of chromosomes; half from ovum and half from sperm

OVERVIEW OF MEIOSIS

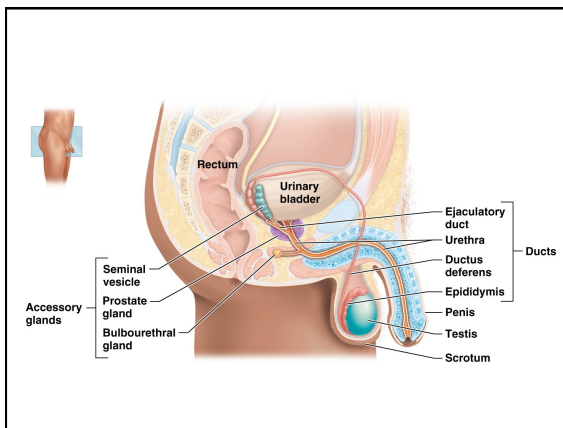
- _____ – process during which a cell divides to form daughter cells with half number of chromosomes; ensures correct number in gametes and eventually zygote
 - All human somatic cells have a nucleus with 46 chromosomes (23 pairs)
 - Somatic cells are _____ (**2n**) because they have full paired set of chromosomes

COMPARING MITOSIS AND MEIOSIS

- Mitosis occurs because new cells are needed for tissue growth or repair; new cells must be genetically identical to original
- Meiosis produces sperm and ova for reproduction; cells need to have half chromosome number of original cell



26.2 ANATOMY OF THE MALE REPRODUCTIVE SYSTEM



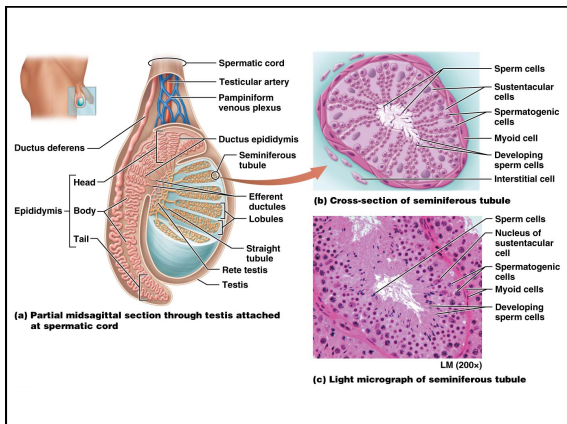
TESTES

_____ (testicles) – located outside abdominopelvic cavity in the **scrotum**

- Each testis is divided into **lobules**; contain tightly coiled loops called **seminiferous tubules** where sperm is produced
- Testes perform two important functions: sperm production and secretion of _____

- **Seminiferous tubules** contain two cell types:
 1. spermatogenic (sperm-forming cells) and
 2. _____ cells; *support* sperm production
- **Interstitial cells (Leydig cells)** – found between seminiferous tubules
 - Produce testosterone

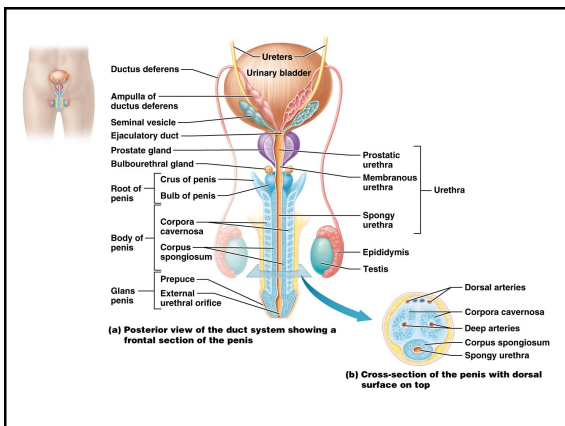
- **Myoid cells**, muscle-like cells that surround seminiferous tubules, contract to push sperm and testicular fluid through tubules
- Seminiferous tubules** →
Straight tubule →
 →
Efferent ductules →



DUCT SYSTEM

- Epididymis – filled with ductules; site of sperm
- Ductus deferens begins at end of epididymis
 - Travels with testicular arteries, veins, and nerves within a **spermatic cord** through the _____ into pelvic cavity
 - Mucosa consists of PSCCE and smooth muscle, called **muscularis**
 - Ductus deferens can store sperm for months and reabsorb any sperm that has not been ejaculated

- Ejaculatory duct –receives sperm from ductus deferens at the **seminal vesicle**
 - Joins urethra in the _____
- Urethra – transports both



THE PENIS

_____ – attaches to body wall

Body or shaft – contains erectile tissue

_____ where external urethral orifice is located

Loose skin of penis forms a circular fold called **prepuce**, or **foreskin**; portion removed by **circumcision**

- **Internal penis** – includes three cylindrical **erectile bodies (corpora)**
 - Each erectile body is a *spongy network* of connective tissue and smooth muscle with vascular spaces
 - _____ paired erectile bodies
 - _____ at base

(b) Cross-section of the penis with dorsal surface on top

ACCESSORY SEX GLANDS

- **Seminal vesicles** –found on posterior surface of urinary bladder meets with ductus deferens to form ejaculatory ducts
- **Seminal fluid** – _____ of semen volume
 - _____ – sugar that sperm utilize for ATP synthesis
 - **Prostaglandins** – stimulate smooth muscle contraction
 - **Coagulating proteins**
 - pH of seminal fluid is _____ to neutralize acids

- _____ – inferior to urinary bladder; surrounds urethra and ejaculatory ducts
 - Made up of 20–30 tubular glands and smooth muscle
- **Prostatic secretions** – _____ of semen volume
 - _____ –sugar that sperm can utilize
 - **Prostate specific antigen (PSA)**– dissolve semen clot in female reproductive tract to allow sperm to proceed further into tract
 - **Antimicrobial chemicals** – inhibit some bacterial growth to decrease risk of infection in female reproductive system



BENIGN PROSTATIC HYPERPLASIA (BPH) AND PROSTATE CANCER

- Enlargement of the prostate that is noncancerous but expands to point of compressing urethra, condition is called **benign prostatic hyperplasia**, or **BPH**
- **Prostate cancer**; second most common cancer in U.S. men
- Screening for prostate cancer usually includes a digital rectal examination and assessment of blood **prostate-specific antigen (PSA)** levels
- PSA blood levels below 2.5 ng/ml are considered normal

- **Bulbourethral glands (Cowper's glands)** – paired glands found at base of penis on either side of membranous urethra
 - Secrete a thick, alkaline mucus-like fluid that helps neutralize
 - Also lubricate glans penis during intercourse
 -

SEMEN


Semen – _____ of semen volume

- Typical **ejaculate** is between 2.5 and 5 ml in volume; contains between 40–750 million sperm cells



MALE INFERTILITY

- **Infertility** – inability to produce a pregnancy after one year of unprotected intercourse
- Approximately 40 percent of all infertility cases result from male infertility; usually due to a low sperm count
 - Less than 15 million sperm cells per milliliter of semen usually indicates infertility
 - Low sperm count can result from any sort of damage to testis, such as physical trauma, exposure to radiation, or disease; could also be due to developmental defects



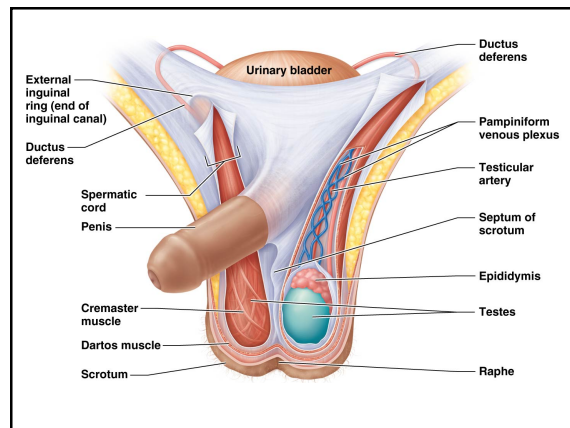
MALE INFERTILITY

- During normal development, testes begin forming inside abdominopelvic cavity and then descend into scrotum
- If a testis does not descend into scrotum (disorder called **cryptorchidism**) sperm cells will not be produced
- In addition, inadequate secretion of GnRH, FSH, LH, or testosterone for any reason will also lower sperm count.

SUPPORT STRUCTURES: SCROTUM AND SPERMATIC CORD

- **Scrotum**
 - Midline _____ divides scrotum into two compartments
 - Scrotum wall contains a layer of smooth muscle called _____

- **Spermatic cord** – tube extending from scrotum; contains ductus deferens, blood and lymph vessels, and nerves; leads to pelvic cavity
 - **Inguinal canal** leads into abdominal cavity
 - _____ muscle – smooth muscle that controls height of testes
 - Normal bodytemperature (37° C) is too warm for mass production of viable sperm cells; scrotum is generally 3° C cooler



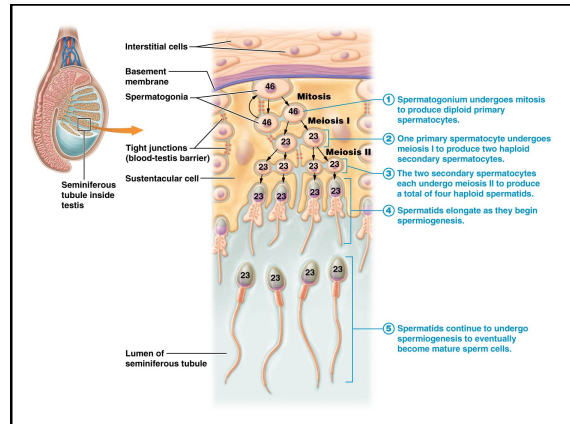
26.3 PHYSIOLOGY OF THE MALE REPRODUCTIVE SYSTEM

SPERMATOGENESIS

Spermatogenesis

- Begins at *puberty* and continues for duration of lifespan
- Occurs in seminiferous tubules

Spermatogonia (2n) - stem cells
 - divide by _____
 - some differentiate into →
(1) Primary spermatocytes (2n)
 _____ →
(2) Secondary spermatocytes (n)
 _____ →
(4) Spermatids (n) → spermatozoa



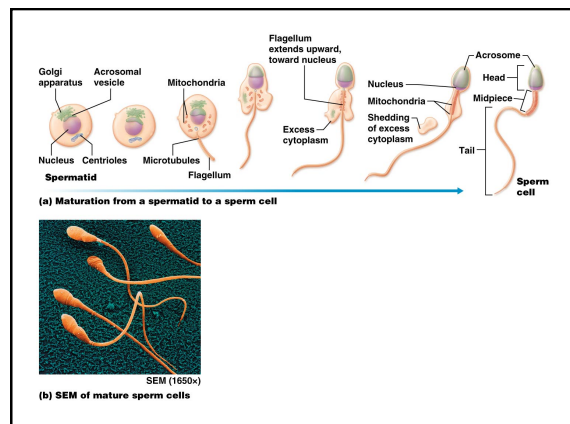
SUSTENTACULAR CELLS
Sustentacular cells (nurse cells, Sertoli cells)

- Provide nutrients for dividing cells and produce _____, which help regulate spermatogenesis
- Phagocytize damaged spermatogenic cells

SPERM

- Spermatids develop a head, midpiece, and tail as they mature into sperm cells
 - _____ – contains nucleus and acrosome
 - _____ – contains mitochondria
 - _____ – flagellum

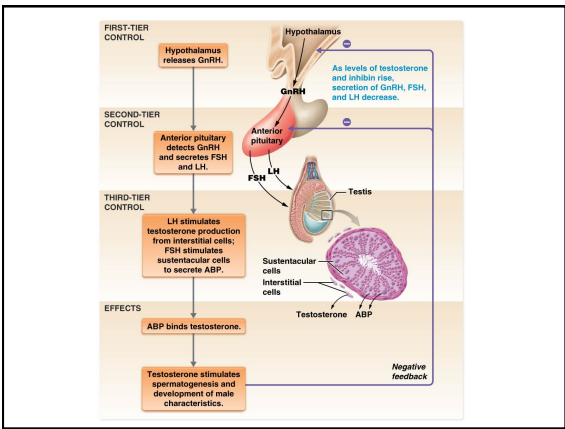
- Sperm are still nonmotile as they migrate to epididymis where they will complete maturation process
 - Trip takes about 12 days to reach epididymis and mature where sperm cells will remain viable for months
 - Entire process takes 60–70 days to complete
 - Sperm cells that are not ejaculated within a few months are reabsorbed



HORMONAL CONTROL

- **Gonadotropin-releasing hormone** (_____) – hypothalamus
- Anterior pituitary detects GnRH; stimulates secretion of **follicle-stimulating hormone** (_____) and **luteinizing hormone** (_____)
- FSH stimulates sustentacular cells to work and release **inhibin** hormone

- LH stimulates interstitial cells to produce testosterone
- _____ – main hormone involved in regulation of spermatogenesis and male reproductive physiology
- Elevated testosterone and inhibin levels are sensed in hypothalamus and anterior pituitary causing negative feedback loop to close
- Inhibin decreases release of FSH; testosterone reduces GnRH secretion



MALE SEXUAL RESPONSE

- Erection and ejaculation are basic phases of male sexual response (similar affects in females)
 - **Erection** – _____ reflex triggers release of nitric oxide (NO) from blood vessels
 - Arterioles dilate in erectile tissue; allows for a large volume of blood to enter tissue
 - In non-aroused state penis is **flaccid** (relaxed) as blood vessels supplying penis are constricted


- _____ – time period during which feelings of pleasure are experienced; coincides with ejaculation
- _____ – process to expel semen from penis; under **sympathetic** nervous system control that occurs in two stages:
 - _____ – movement semen into urethra
 - _____ – occurs as semen pushes from urethra

EFFECTS OF TESTOSTERONE

Testosterone levels increase dramatically at puberty typically between 12 and 14 years of age in males

- Spermatogenesis begins
- Increased testosterone levels trigger spermatogenesis and appearance of **secondary sexual characteristics**
 - Growth of pubic, axillary, chest, and facial hair
 - _____
 - Skin thickens and sebaceous glands increase secretion

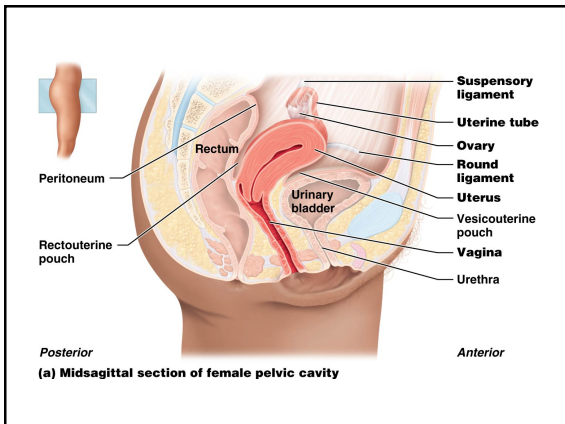
- Bone density increases
- Skeletal muscle mass increases
- Erythrocyte production increases as testosterone increases _____ secretion
- Testosterone influences behavior; basis for male **libido**



ERECTILE DYSFUNCTION

- Various psychological and physical factors may cause **erectile dysfunction (ED)**
 - Psychological influences include stress, depression, and anxiety;
 - Physical causes include cardiovascular disease and diabetes mellitus; obesity, tobacco, and alcohol use, and certain prescription medications
 - Older men have a greater risk because the amount of connective tissue in erectile tissue of penis increases with age, reducing blood flow to penis

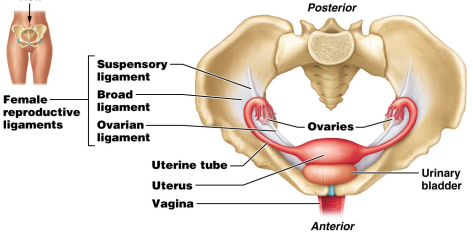
26.4 ANATOMY OF THE FEMALE REPRODUCTIVE SYSTEM



OVARIES

- Produce ova
- Secrete hormones: estradiol, estrone, and estriol, as well as progesterone, inhibin, and relaxin
- _____ – superficial region where **oogenesis** (production of gametes) occurs within saclike **follicles**; develop and mature along with gametes
- _____ – inner region where blood vessels, lymphatic vessels, and nerves are found

- Ovaries are held in place by three ligaments
 1. _____ ligament – connects ovary to bony pelvis
 2. **Ovarian ligament** – connects ovary to uterus
 3. **Suspensory ligament** – connects ovary to pelvic wall

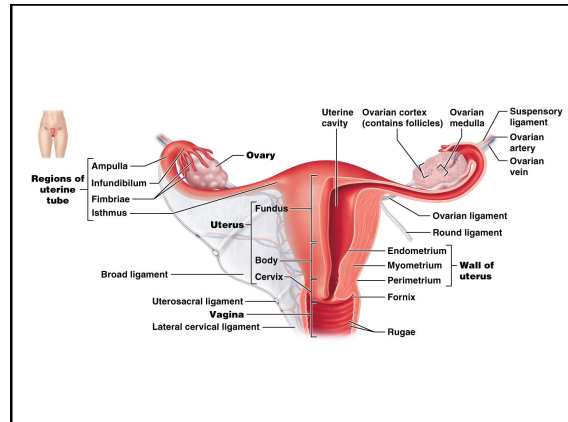


(b) Superior view of female pelvic cavity

UTERINE TUBES

Uterine tubes (fallopian tubes, or oviducts)

- Extend from ovary to; covered by peritoneum
- _____ – found at proximal end of tube, connects to uterus
- _____ – expansion at distal end that connects tube to infundibulum
- **Infundibulum** – funnel-shaped opening at distal end of uterine tube (**Fimbriae** – finger-like projections)



- **Ovulation** – an oocyte is expelled from ovary; fimbriae sweep ovary surface to catch oocyte and direct it into uterine tube
 - Peristaltic contraction and ciliated cells work to move the oocyte toward uterus
 -

UTERUS

Uterus (womb) – hollow organ located in pelvis anterior to rectum and posterior to urinary bladder

- _____ – main region
- _____ – rounded region superior to entrance to uterine tubes
- _____ – narrow neck

- Uterine wall is composed of three layers:
 1. _____ – Outermost serous layer
 2. _____ – middle layer of smooth muscle
 3. _____ – innermost layer that lines uterine cavity; composed of simple columnar epithelium

VAGINA

Organ of copulation; receives penis and semen during sexual intercourse; passageway for giving birth and for menstrual flow

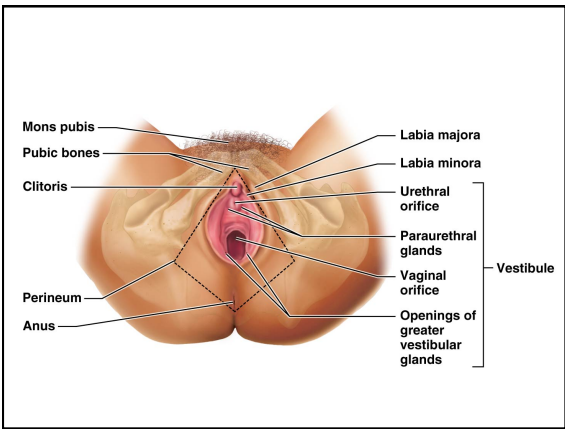
- Tube that extends from cervix to exterior of body
- Parallel to urethra; lies between urinary bladder and rectum

- Vaginal wall is lined with transverse ridges called **rugae**
- Mucosa is composed of stratified squamous epithelium
 - Epithelial cells secrete glycogen into vaginal lumen
 - Metabolized by bacteria
 - Generates lactic acid that helps maintain acidic pH
- _____ – vascular partition of mucosa near distal vaginal orifice; commonly ruptured during first sexual intercourse

FEMALE EXTERNAL GENITALIA

Vulva – external reproductive structures

- **Mons pubis** –rounded region overlying pubic symphysis
- _____ – pair of elongated protective skin folds
- **Labia minora** – pair of thinner skin folds found enclosed within labia majora
 - _____ – recess enclosed within labia minor contains **Vestibular glands (Bartholin’s glands)**
- **Clitoris** – anterior to vestibule; small protrusion composed of erectile tissue

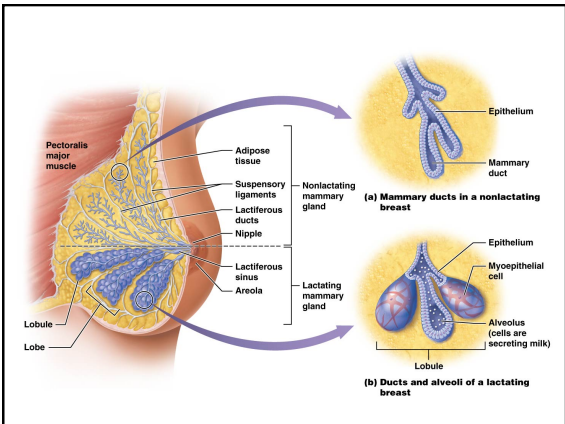



MAMMARY GLANDS

Modified sweat glands of the integumentary system to produce milk

- Each mammary gland is found within hypodermis and enclosed within a rounded, skin-covered breast
- **Areola** – surrounds a **nipple** through which milk exits

- Each mammary gland is composed of 15–25 **lobes**
 - Each lobe is subdivided into smaller **lobules**; contain _____ which produce milk when a woman is lactating
 - **Myoepithelial cells** that surround alveoli helps propel milk toward nipple
 - Milk passes from alveoli → lactiferous ducts → lactiferous sinus → nipple





BREAST CANCER

- **Breast cancer** – second most common type of cancer in women
- **Risk factors** for breast cancer include maternal relatives with breast cancer, longer reproductive span (early first menstrual cycle coupled with menstruation continuing until a later age), obesity, no pregnancies or first pregnancy at or after age of 35, and presence of breast cancer genes; two genes that increase susceptibility to breast cancer have been identified: *BRCA1* and *BRCA2*

26.5 PHYSIOLOGY OF THE FEMALE REPRODUCTIVE SYSTEM

OOGENESIS

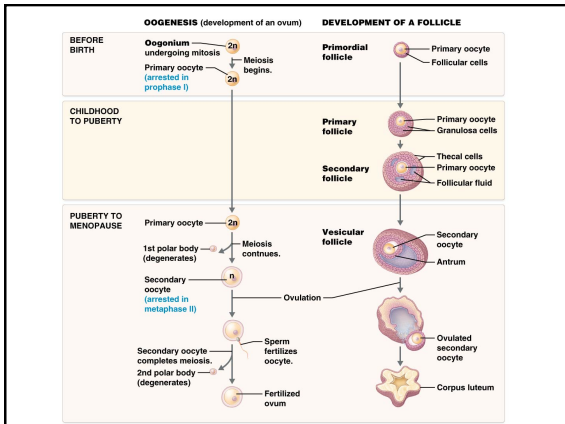
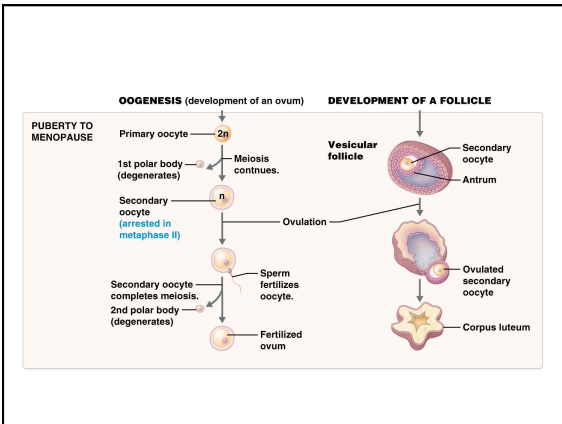
- Begins before female infant is born, then is suspended until puberty
- Once reactivated at puberty continues until it ceases operation at **menopause**, somewhere between 45 and 55 years of age
- Occurs about once per month as a part of _____

oogonia (2n) - stem cells in female complete mitosis 3-7th month of fetal development

primary oocytes (2n) - about 2 million present at birth
- undergo _____ (degeneration) → 400,000 at puberty

secondary oocyte (n) - ovulated mid-cycle each month, alternating ovaries (polar body formed)

_____ (**n**) - completes meiosis II after fertilization



SPERMATOGENESIS VERSUS OOGENESIS

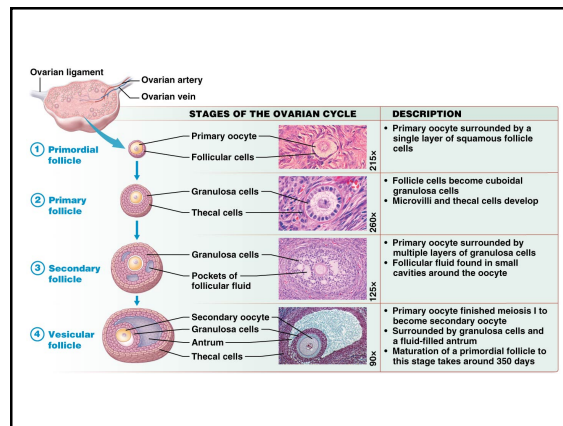
- Spermatogenesis produces millions of sperm every day (in case they are needed), whereas oogenesis produces one viable secondary oocyte approximately once a month

Characteristic	Spermatogenesis	Oogenesis
Time of onset	Begins at puberty	Begins before birth
What happens at puberty	Begins and continually produces sperm cells	Continues meiosis and releases an immature gamete (the secondary oocyte) each month
Number of cells produced	Produces millions of small, motile sperm each day	Produces one large oocyte each month
When process ends	Continues until death	Continues until age 45-55
Duration of meiosis	Continuous throughout life	Pauses twice: at prophase I from prenatal development to puberty, and at metaphase II from ovulation to fertilization

HORMONAL CONTROL OF FEMALE REPRODUCTION

- Ovarian cycle** – includes *monthly* series of events associated with maturation of an oocyte and its follicle in an ovary

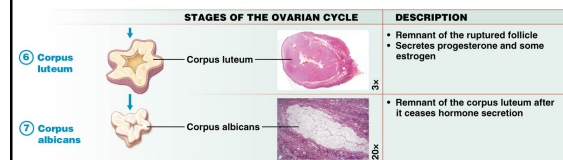
- Follicular phase (stages 1–4):** During this phase follicles grow and develop:
 - Primordial follicle** – single layer of squamous follicular cells surrounds primary oocyte
 - Primary follicle** – follicular cells become grow around primary oocyte
 - Secondary follicle**: increases volume and size of follicle, small pockets of fluid form
 - Vesicular (tertiary) follicle**: large cavity called **antrum** forms, primary oocyte, completes meiosis I to form a secondary oocyte and first polar body

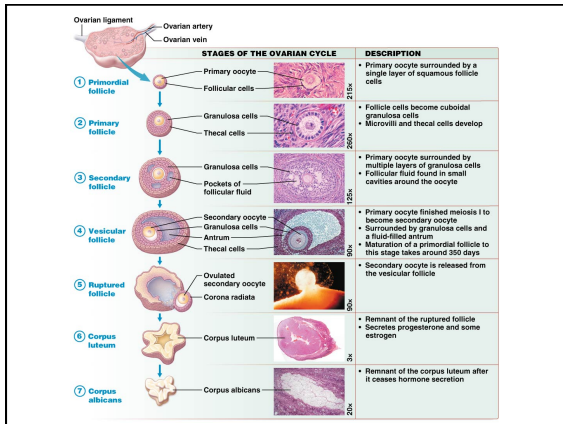


- Phase (stage 5)**
- Vesicular follicle _____ from ovary wall into peritoneal cavity releasing its secondary oocyte



- Luteal phase (stages 6–7):**
 - _____ is formed by the remaining follicle; secretes progesterone and some estrogen
 - _____ – scar tissue that remains after corpus luteum is degraded



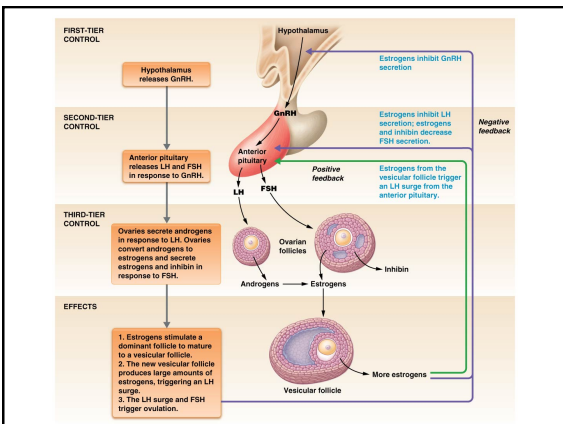


- Ovarian cycle averages about 28 days overall, with each stage accounting for following amount of time:
 - Follicular phase extends from day one to day 14
 - Luteal phase extends from day 14 to day 28

- Hormones of 28-day cycle:
 - Hypothalamus secretes **GnRH (gonadotropin-releasing hormone)**
 - Anterior pituitary releases _____ and _____ in response to GnRH
 - FSH stimulates follicle cells to secrete estrogens and secretes inhibin
 - Estrogens typically stimulate dominant follicle to continue developing into a vesicular follicle

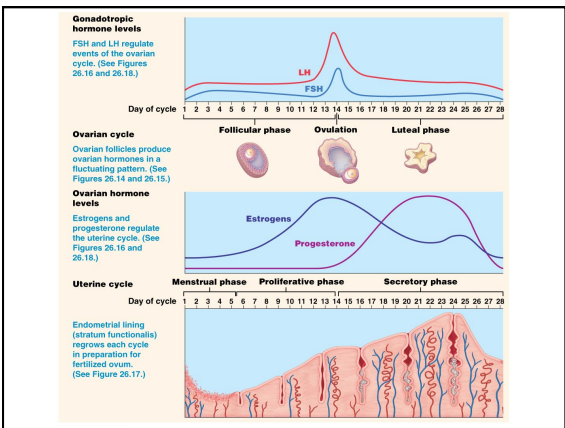
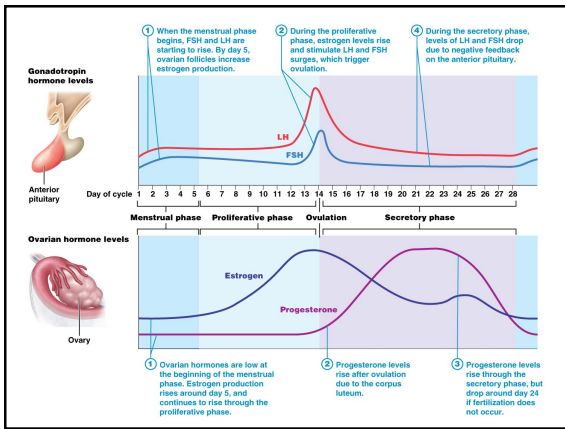
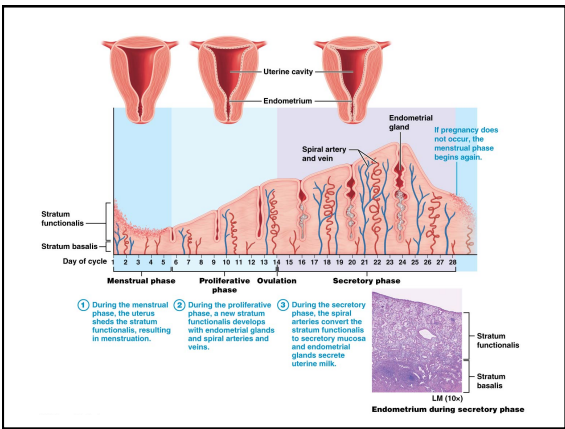
- LH triggers _____
- Corpus luteum produces progesterone and estrogens
- Increased levels of estrogen and inhibin exert negative feedback control on hypothalamus and pituitary
- Estrogen inhibits _____ and _____ secretion
- Inhibin inhibits _____ secretion

- Estrogen and progesterone stimulate development of **female sex characteristics**:
 - Maturation of sex organs and development of external genitalia
 - _____
 - Progesterone is responsible for maintenance of a pregnancy once fertilization has occurred
 - Estrogens increases bone density and increasing HDL cholesterol level
 - Estrogen promotes blood coagulation that can lead to formation of blood clots in specific circumstances



- **Uterine cycle (menstrual cycle)** – series of cyclic events that uterine **endometrium** goes through each month
 - Uterine changes are coordinated with estrogen and progesterone levels released during ovarian cycle
- Endometrium is composed of two main layers:
 1. **Stratum functionalis (functional layer)** detaches from uterine wall and is shed usually monthly during _____
 2. **Stratum basalis (basal layer)** does not thicken or shed, it replaces stratum functionalis at end of menstruation

1. **Menstrual phase, days 1–5:**
2. **Proliferative (preovulatory) phase, days 6–14:** stratum functionalis thicken; these glands enlarge and veins and arteries increase in number
3. _____ **phase, days 15–28:** arteries form in stratum functionalis and endometrial glands increase
 - If pregnancy doesn't occur, cells of stratum functionalis die and on day 28 menstrual phase begins
 - If pregnancy occurs, secretory phase continues and uterus continues to develop in preparation for an embryo




- ## PUBERTY AND MENOPAUSE
- **Puberty** – typically begins between 9 and 11 years old for females with increase in estrogen and progesterone resulting secondary sex characteristics
 -
 - Appearance of pubic and axillary hair and an increase in secretions from sebaceous glands
 - Adipose tissue increases in subcutaneous layer throughout body, with additional deposits in hips, thighs, and breasts
 - Individual's height increases; _____

- _____ – first episode of menstrual bleeding; occurs approximately two years after onset of puberty
 - Will not occur unless a girl has at least 15–17% body fat
 - **Leptin** – hormone secreted by adipocytes; stimulates gonadotropin secretion

- **Menopause** – point when menstruation has not occurred for at least one year
 - Number of primary follicles left that can respond to LH and FSH is diminished after thirty or more years of ovarian cycles
- Reduced levels of estrogens and progesterone may alter female secondary sex characteristics
 - Breasts, uterus, and uterine tubes may shrink, while pubic and axillary hair may thin
 - Bone density may decrease
 - **Hot flashes** may occur due to changes in rhythmic secretion of GnRH


Hormone	Source	Target Tissue(s)	Response
Males			
Gonadotropin-releasing hormone (GnRH)	Hypothalamus	Anterior pituitary	Stimulates secretion of LH and FSH
Follicle-stimulating hormone (FSH)	Anterior pituitary	Testes (Sustentacular cells)	Stimulates production of androgen-binding protein (ABP), inhibits unnecessary spermatogenesis
Luteinizing hormone (LH)	Anterior pituitary	Testes (Interstitial cells)	Stimulates production and secretion of testosterone
Testosterone	Testes (Interstitial cells)	Testes Other body tissues	Stimulates spermatogenesis Stimulates development and maintenance of reproductive organs, responsible for development of secondary sex characteristics
Inhibin	Testes (Sustentacular cells)	Anterior pituitary	Inhibits FSH secretion
Females*			
Gonadotropin-releasing hormone (GnRH)	Hypothalamus	Anterior pituitary	Stimulates secretion of LH and FSH
Follicle-stimulating hormone (FSH)	Anterior pituitary	Ovarian follicles and granulosa cells	Stimulates follicles to begin development; stimulates granulosa cells to convert androgens to estrogens
Luteinizing hormone (LH)	Anterior pituitary	Ovarian follicles and theca cells	Stimulates production of gonadal hormones (e.g., estrogens); stimulates follicles to finish maturation; stimulates ovulation; contributes to development of corpus luteum
Estrogens	Ovaries (follicles) and granulosa cells	Uterus Mammary glands Other body tissues	Stimulate proliferation of endometrial cells; stimulate uterine contractions Stimulate development of ducts of mammary glands Stimulate development of secondary sex characteristics
Progesterone	Ovaries (corpus luteum)	Hypothalamus and anterior pituitary Ovaries Mammary glands Other body tissues	Before ovulation, cause positive feedback to increase LH and FSH secretion Inhibit adjacent follicles Causes hypertrophy of endometrial cells; stimulates secretion of mucus from uterine glands; helps maintain pregnancy and prevents uterine contractions Stimulates alveoli of mammary glands to develop during pregnancy
Inhibin	Ovaries (follicles) and granulosa cells	Anterior pituitary	Stimulates development of secondary sex characteristics Inhibits FSH secretion

*Other hormones secreted in females, primarily during pregnancy, include relaxin, prolactin, oxytocin, and human chorionic gonadotropin. (These hormones are covered in Chapter 27.)



CERVICAL CANCER

- **Cervical cancer** occurs most often in women between the ages of 30 and 50
- Frequently caused by human papillomavirus (HPV), which is transmitted sexually
- The number of cases and number of deaths from cervical cancer have decreased significantly; projected to decrease further as **HPV vaccine** becomes more widespread



CERVICAL CANCER

- Decline is due in large part to **Pap (Papanicolaou) smear test**; detects precancerous cells and early-stage cancers before symptoms are noticeable; involves scraping loose cells from external os of cervix and examining them microscopically
- Cells showing signs of abnormal development (**dysplasia**) warrant further investigation, including visual examination of cervix or a **biopsy** to determine if cancerous cells are present

27




Development and Heredity



27.1 OVERVIEW OF HUMAN DEVELOPMENT

PRENATAL DEVELOPMENT

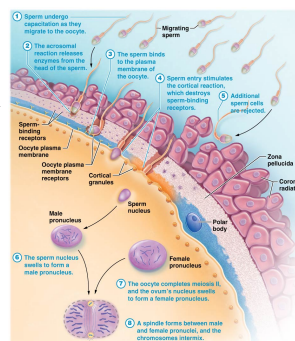
- **Pre-embryonic period** – lasts for first 2 weeks after fertilization; zygote divides that implants in endometrium
- **Embryonic period** – extends from week 3 through 8 of gestation; **embryo** grows, folds, and forms rudimentary organ systems
- **Fetal period** – lasts from week 9 until birth; **fetus** grows larger and continues to develop until its organ systems can function without assistance from mother

	PRE-EMBRYONIC PERIOD	EMBRYONIC PERIOD	FETAL PERIOD
Developmental stage	 Blastocyst	 Embryo	 Fetus
Events	<p>Weeks 1 and 2:</p> <ul style="list-style-type: none"> • Zygote divides mitotically many times to produce a multicellular blastocyst that implants in the uterus. 	<p>Weeks 3 through 8:</p> <ul style="list-style-type: none"> • Blastocyst grows, folds, and forms rudimentary organ systems. • It is now called an embryo. 	<p>Weeks 9 through 38 (until birth):</p> <ul style="list-style-type: none"> • Embryo is now called a fetus. • It grows larger and develops until its organ systems can function without assistance from the mother.

27.2 PRE-EMBRYONIC PERIOD: FERTILIZATION THROUGH IMPLANTATION

FERTILIZATION

- Fusion of **sperm cell** and **secondary oocyte** to form a _____



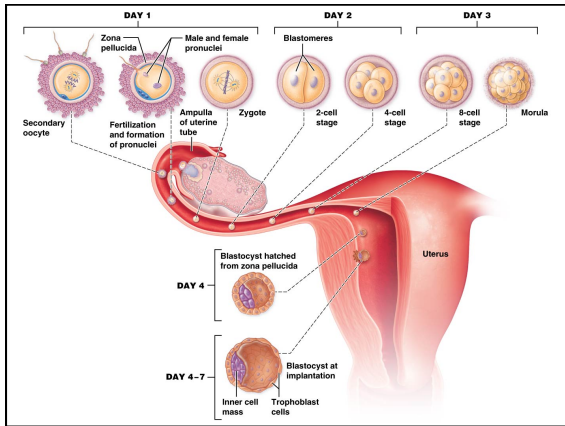
CLEAVAGE AND BLASTOCYST FORMATION

Cleavage - series of rapid mitotic divisions that produce genetically identical cells called _____

At this stage, cells start to differentiate known as a _____

Cell division continues producing a _____ :

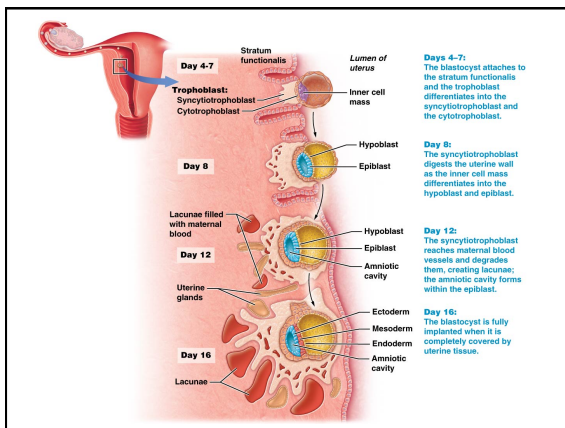
- An outer layer of cells, called **trophoblast cells**, participate in forming _____
- **Inner cell mass**, or embryoblasts, form embryo



IMPLANTATION

Implantation occurs approximately 4 – 7 days after fertilization when blastocyst begins to attach to endometrium

- Trophoblast secretes **human chorionic gonadotropin** (_____)
- Stimulates corpus luteum in ovary to secrete estrogen and progesterone
- Progesterone maintains endometrium
-



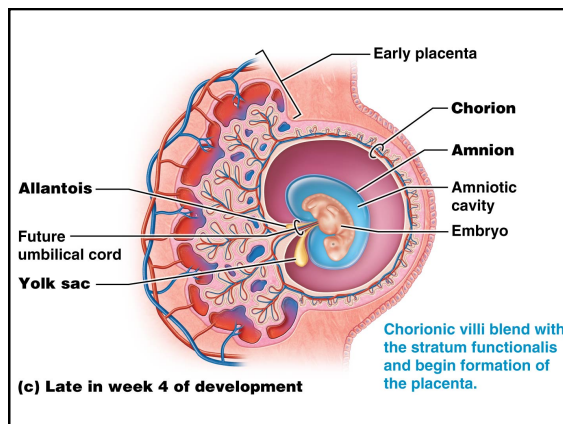
DEVELOPMENT OF EXTRAEMBRYONIC MEMBRANES


Extraembryonic membranes first appear during second week of development, continue to develop during embryonic and fetal periods

-
- Nutrition uptake
-
- Storage and removal of waste

EXTRAEMBRYONIC MEMBRANES

- _____
- Encloses embryo in fluid-filled **amniotic cavity**; penetrated only by **umbilical cord**
- Secretes **amniotic fluid** into cavity
- Protects embryo from trauma and drying out
- _____ – outermost extraembryonic membrane
- Forms **chorionic villi**





ECTOPIC PREGNANCY

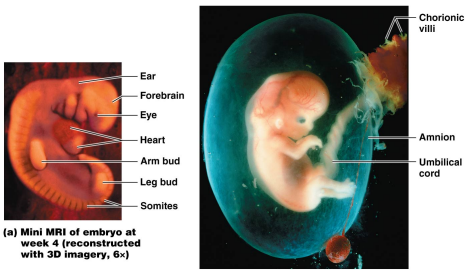
- In an **ectopic pregnancy**, implantation and growth in any location other than endometrium (1–2% of all pregnancies are ectopic)
- Almost all of these are “**tubal pregnancies**” but can occur in other locations (abdominal cavity, ovary, or cervix)
- Presents a large risk to mother, as only uterus is able to expand and sustain the pregnancy

27.3 EMBRYONIC PERIOD: WEEK 3 THROUGH WEEK 8

EMBRYONIC PERIOD

- Embryonic period** - starts with formation of **gastrula**
- Three germ layers develop during this period that will become all of major organ systems in process of _____
 - Placenta forms during this period and begins to provide nutrition and oxygen to embryo and remove wastes

ORGANOGENESIS



(a) Mini MRI of embryo at week 4 [reconstructed with 3D imagery, 6x]

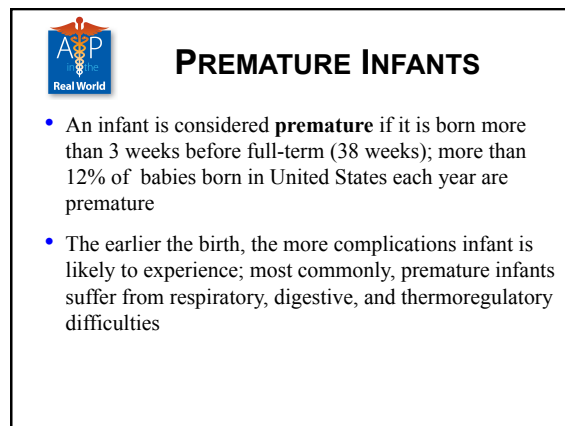
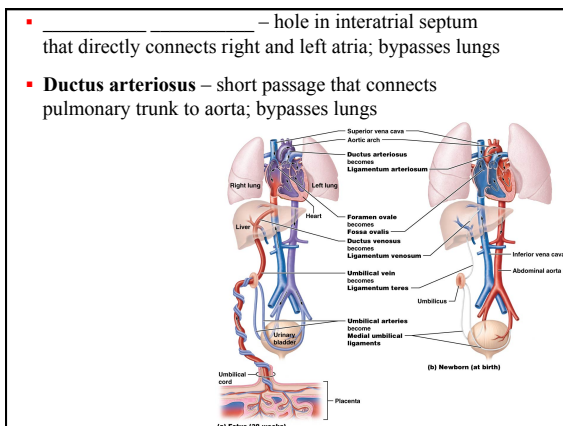
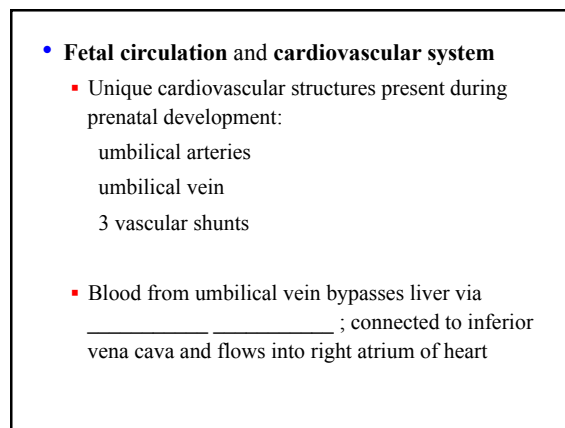
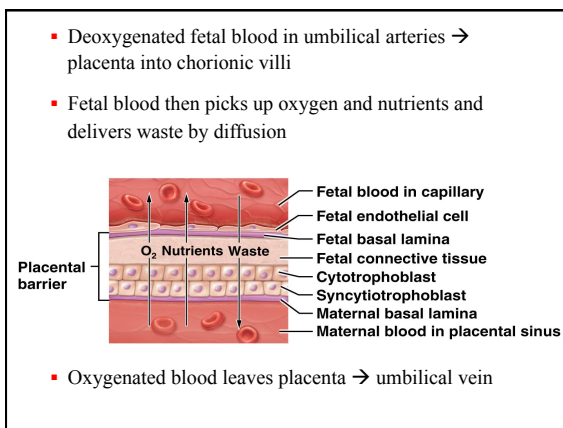
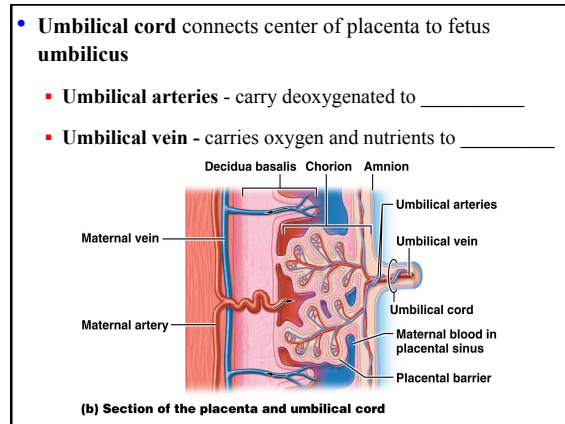
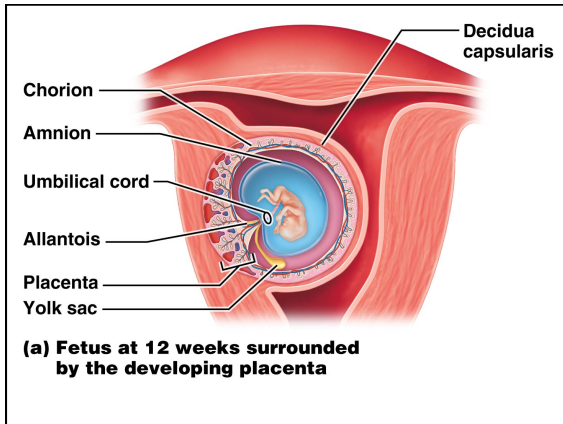
(b) Fiber optic view of embryo at week 8 (1.5x)

27.4 FETAL PERIOD: WEEK 9 UNTIL BIRTH (ABOUT WEEK 38)

PLACENTATION

Placentation – formation of placenta; attaches to uterine wall and to embryo/fetus through umbilical cord

- _____ – organ that is shed after infant is born develops from both fetal (chorionic villi) and maternal (decidua basalis) structures
 - Site of exchange of oxygen, nutrients, and waste between mother and fetus
 - Produces _____ to support pregnancy
 - Blood separated by _____



MODULE 27.5 PREGNANCY AND CHILD BIRTH

CHANGES DURING PREGNANCY

- **First trimester (months 1–3)** pre-embryonic and embryonic development is completed and fetal development begins
 - By end of first trimester, basis of all of major organ systems are present making it most critical stage of development

- **Second trimester (months 4–6)** fetus continues to grow and develop; pregnancy usually becomes obvious as uterus and abdomen expand
 - Ossification begins in most bones
 - Genitals are distinguishable as male or female
 - Heartbeat can be heard with a stethoscope
 - **Lanugo** and **vernix caseosa** present
 - Skeletal muscles begin to contract

- **Third trimester (months 7–9)** fetus grows rapidly and gains a significant amount of weight
 - Woman's uterus and abdomen enlarge further and many women exhibit new symptoms related to size of the fetus
 - Eyelids open completely
 - Fetus usually turns upside down
 - In males, testes begin to descend through inguinal canal
 - Fetal neurons form networks



(a) Fiber optic view of embryo at month 3



(b) Fiber optic view of embryo at month 5

- Placenta also functions as an endocrine organ:
 -
 - Corpus luteum relinquishes production of progesterone and estrogens to placenta by end of third month of gestation
 - **Human placental lactogen** and **placental prolactin** - prepare mammary glands for milk production
 - **Relaxin** - relaxes body's muscles, joints, and ligaments
 -
 - _____ hormone
 - _____ from fetal and maternal hypothalamus is secreted during second and third trimesters and peaks during labor to stimulate uterine contractions and allow milk release from mammary glands

CHILDBIRTH (PARTURITION)

- Series of events collectively called **labor**
 - Both fetal and maternal hypothalamus secrete oxytocin; stimulates placenta to secrete prostaglandins
 - Prostaglandins dilate cervix and with oxytocin, increase strength of uterine contractions
 - As head of fetus pushes on and stretches cervix, more oxytocin is released
 - As more oxytocin is released, myometrium contracts more forcefully and placenta secretes more prostaglandins
 - Both effects cause cervix to stretch more, which stimulates release of more oxytocin (positive feedback)



PRENATAL AND NEWBORN GENETIC SCREENING

- Cells and amniotic fluid may be withdrawn and analyzed to test for chromosomal abnormalities.
- Usually recommended for women 35 years or older at delivery, as their oocytes are older; increases risk of chromosomal abnormalities; also recommended for women who know they or father are carriers of inherited diseases, or when possible fetal abnormalities are discovered on ultrasound



PRENATAL AND NEWBORN GENETIC SCREENING

- **Amniocentesis** – done between 14 and 20 weeks of pregnancy; amniotic fluid is withdrawn using a needle inserted into amniotic cavity, as shown



PRENATAL AND NEWBORN GENETIC SCREENING

- **Chorionic villi sampling**, withdraws chorionic villi tissue

