

## Reproductive System

### Chapter 26

#### → 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 **sperm** and female gametes are called **ova**, 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

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

- Each testis is divided into \_\_\_\_\_; 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. \_\_\_\_\_ (sperm-forming cells) and
  2. \_\_\_\_\_ cells; *support* sperm production
- **Interstitial cells** (Leydig cells) – found between seminiferous tubules
    -
  - **Myoid cells**, muscle-like cells that surround seminiferous tubules, contract to push sperm and testicular fluid through tubules

**Seminiferous tubules** →

\_\_\_\_\_ →

**Rete testis** →

**Efferent ductules** →

\_\_\_\_\_

### Duct System

- **Epididymis** – filled with ductules; site of sperm \_\_\_\_\_ and \_\_\_\_\_
- **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
- \_\_\_\_\_ – receives sperm from ductus deferens at the **seminal vesicle**
  - \_\_\_\_\_
- \_\_\_\_\_ – transports both urine and semen

### The Penis

- \_\_\_\_\_ – attaches to body wall
- \_\_\_\_\_ 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

### Accessory Sex Glands

- \_\_\_\_\_ –found on posterior surface of urinary bladder meets with ductus deferens to form ejaculatory ducts
  - **Seminal fluid** –
    - **Fructose** – sugar that sperm utilize for ATP synthesis
    - **Prostaglandins** – stimulate smooth muscle contraction
    - 
    - pH of seminal fluid is alkaline to *neutralize* acids
- \_\_\_\_\_ – inferior to urinary bladder; surrounds urethra and ejaculatory ducts
  - Made up of 20–30 tubular glands and smooth muscle
  - **Prostatic secretions** –
    - **Citrate** –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**
- \_\_\_\_\_; 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** (\_\_\_\_\_) levels
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- \_\_\_\_\_ **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

**Sperm** –5% 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
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  - 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
- 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**

- - Midline \_\_\_\_\_ divides scrotum into two compartments,
  - Scrotum wall contains a layer of smooth muscle called \_\_\_\_\_
- \_\_\_\_\_ – tube extending from scrotum; contains ductus deferens, blood and lymph vessels, and nerves; leads to pelvic cavity
  - **Inguinal canal** leads into abdominal cavity
  - \_\_\_\_\_ – 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**

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

\_\_\_\_\_ (2n) - stem cells

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- some differentiate into →

(1) \_\_\_\_\_ (2n)

- meiosis I →

(2) \_\_\_\_\_ (n)

- meiosis II →

(4) \_\_\_\_\_ (n) → spermatozoa

### Sustentacular cells (nurse cells, Sertoli cells)

- Provide nutrients for dividing cells and produce **inhibin**, 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
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### 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 \_\_\_\_\_ hormone
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- \_\_\_\_\_ – 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)
  - \_\_\_\_\_ – \_\_\_\_\_ 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 \_\_\_\_\_ 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

- \_\_\_\_\_
- Increased testosterone levels trigger spermatogenesis and appearance of **secondary sexual characteristics**
  - Growth of pubic, axillary, chest, and facial hair



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- Skin thickens and sebaceous glands increase secretion
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- Erythrocyte production increases as testosterone increases erythropoietin 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

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- 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. \_\_\_\_\_ **ligament** – connects ovary to uterus
  3. \_\_\_\_\_ **ligament** – connects ovary to pelvic wall

### Uterine tubes (fallopian tubes, or oviducts)

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- **Isthmus** – found at proximal end of tube, connects to uterus
- **Ampulla** – expansion at distal end that connects tube to infundibulum
- **Infundibulum** – funnel-shaped opening at distal end of uterine tube (**Fimbriae** – finger-like projections)
- \_\_\_\_\_ – 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

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- Parallel to urethra; lies between urinary bladder and rectum
- Vaginal wall is lined with transverse ridges called \_\_\_\_\_
- Mucosa is composed of stratified squamous epithelium
  - Epithelial cells secrete glycogen into vaginal lumen
  - Metabolized by bacteria
  -
- \_\_\_\_\_ – vascular partition of mucosa near distal vaginal orifice; commonly ruptured during first sexual intercourse

### Female External Genitalia

- \_\_\_\_\_ – external reproductive structures
- \_\_\_\_\_ – 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)**
- \_\_\_\_\_ – anterior to vestibule; small protrusion composed of erectile tissue

## Mammary Glands

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- 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
  - \_\_\_\_\_ 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 \_\_\_\_\_ continues until it ceases operation at \_\_\_\_\_, somewhere between 45 and 55 years of age
- Occurs about once per month as a part of **ovarian cycle**

\_\_\_\_\_ (2n) - stem cells in female complete mitosis

3-7th month of fetal development

\_\_\_\_\_ (2n) - about 2 million present at birth

- undergo \_\_\_\_\_ (degeneration) → 400,000 at puberty

\_\_\_\_\_ (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

### Hormonal Control of Female Reproduction

- \_\_\_\_\_ – 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:
  1. \_\_\_\_\_ – single layer of squamous **follicular cells** surrounds primary oocyte
  2. \_\_\_\_\_ **follicle** – follicular cells become grow around primary oocyte
  3. \_\_\_\_\_ **follicle**: increases volume and size of follicle, small pockets of fluid form
  4. **Vesicular** (\_\_\_\_\_) **follicle**: large cavity called **antrum** forms, primary oocyte, completes meiosis I to form a secondary oocyte and first polar body
- **Ovulation phase (stage 5)**

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- **Luteal phase (stages 6–7):**
  - 6. \_\_\_\_\_ is formed by the remaining follicle; secretes progesterone and some estrogen
  - 7. \_\_\_\_\_ – 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 \_\_\_\_\_ (**gonadotropin-releasing hormone**)
  - Anterior pituitary releases LH and FSH 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
  - 
  - Corpus luteum produces progesterone and estrogens
  - Increased levels of estrogen and inhibin exert negative feedback control on hypothalamus and pituitary
  - Estrogen inhibits GnRH and LH 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 \_\_\_\_\_ 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. \_\_\_\_\_ (**functional layer**) detaches from uterine wall and is shed usually monthly during **menstruation**
    2. \_\_\_\_\_ (**basal layer**) does not thicken or shed, it replaces stratum functionalis at end of menstruation
  - 1. \_\_\_\_\_ **phase, days 1–5**: uterus sheds stratum functionalis, resulting in **menstruation**
  - 2. \_\_\_\_\_ (**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

- Breasts development begins
- Appearance of pubic and axillary hair and an increase in secretions from sebaceous glands
- \_\_\_\_\_ tissue increases in subcutaneous layer throughout body, with additional deposits in hips, thighs, and breasts
- 
- \_\_\_\_\_ – first episode of menstrual bleeding; occurs approximately two years after onset of puberty
  - Will not occur unless a girl has at least \_\_\_\_\_ body fat
  - **Leptin** – hormone secreted by adipocytes; stimulates gonadotropin secretion
- \_\_\_\_\_ – 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
  - 
  - \_\_\_\_\_ may occur due to changes in rhythmic secretion of GnRH



### 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 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

## Development and Heredity

### Chapter 27

#### → 27.1 Overview of Human Development

##### Prenatal Development

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

#### → 27.2 Pre-embryonic Period: Fertilization through Implantation

##### Fertilization

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

##### Cleavage and Blastocyst Formation

\_\_\_\_\_ - 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 **blastocyst** (\_\_\_\_\_):

- An outer layer of cells, called **trophoblast cells**, participate in forming **placenta**
- **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

- Protecting embryo
- Nutrition uptake
- Gas exchange
- Storage and removal of waste
- - 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 \_\_\_\_\_



## 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 \_\_\_\_\_
- 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

### 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 hormones to support pregnancy
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- **Umbilical cord** connects center of placenta to fetus **umbilicus**
  - \_\_\_\_\_ - carry deoxygenated to placenta
  - \_\_\_\_\_ - carries oxygen and nutrients toward fetal
  - Deoxygenated fetal blood in umbilical arteries → placenta into chorionic villi
  - Fetal blood then picks up oxygen and nutrients and delivers waste by diffusion
  - Oxygenated blood leaves placenta → umbilical vein
  - **Fetal circulation** and **cardiovascular system**
  - Unique cardiovascular structures present during prenatal development:
    - umbilical arteries
    - umbilical vein
    - 3 vascular shunts
      - Blood from umbilical vein bypasses liver via \_\_\_\_\_; connected to inferior vena cava and flows into right atrium of heart
      - \_\_\_\_\_ – hole in interatrial septum that directly connects right and left atria; bypasses lungs
      - \_\_\_\_\_ – short passage that connects pulmonary trunk to aorta; bypasses lungs



### Premature Infants

- An infant is considered **premature** if it is born more than 3 weeks before full-term (38 weeks); more than 12% of babies born in United States each year are premature

- The earlier the birth, the more complications infant is likely to experience; most commonly, premature infants suffer from respiratory, digestive, and thermoregulatory difficulties

→ **Module 27.5 Pregnancy and Childbirth**

**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
  - \_\_\_\_\_ and \_\_\_\_\_ 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

Placenta also functions as an endocrine organ:

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- 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
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- 
- **Oxytocin** 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 (\_\_\_\_\_)



### **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
  - \_\_\_\_\_ – done between 14 and 20 weeks of pregnancy; amniotic fluid is withdrawn using a needle inserted into amniotic cavity, as shown
  - \_\_\_\_\_, withdraws chorionic villi tissue