

## SEXUAL REPRODUCTION IN HUMANS

### MALE REPRODUCTIVE SYSTEM

#### I. *Functions:*

- a. production of sperm cells, which begins at puberty and continues until death
- b. deposition of sperm within the female reproduction system

#### II. *Male Reproductive Organs*

##### a. PENIS

- ◆ Structural adaptation for life on land.
- ◆ Ensures the safe delivery of sperm into the moist reproductive tract of the female.

##### b. TESTES

- ◆ There are two testicles located in the **SCROTUM**
- ◆ The testes are outside the body because they must be 1-2° cooler than normal body temperature for optimal production and storage of **SPERM**
- ◆ Testes produces the hormone **TESTOSTERONE** which:
  - regulates maturation of the sperm
  - regulates secondary **male sex characteristics** (widening of shoulders, development of beard and secondary hair under arms and in groin, deepening in the pitch of the voice)

##### c. VAS DEFERENS or SPERM DUCTS (there are two)

- ◆ Tubes that lead from each testis to the **URETHRA** (vessel inside penis that eliminates both **urine** and **sperm**)
- ◆ **Vasectomy**: male sterilization by the surgical cutting of the sperm duct
  - the vas deferens from each testis is cut and tied to prevent transfer of sperm during ejaculation.

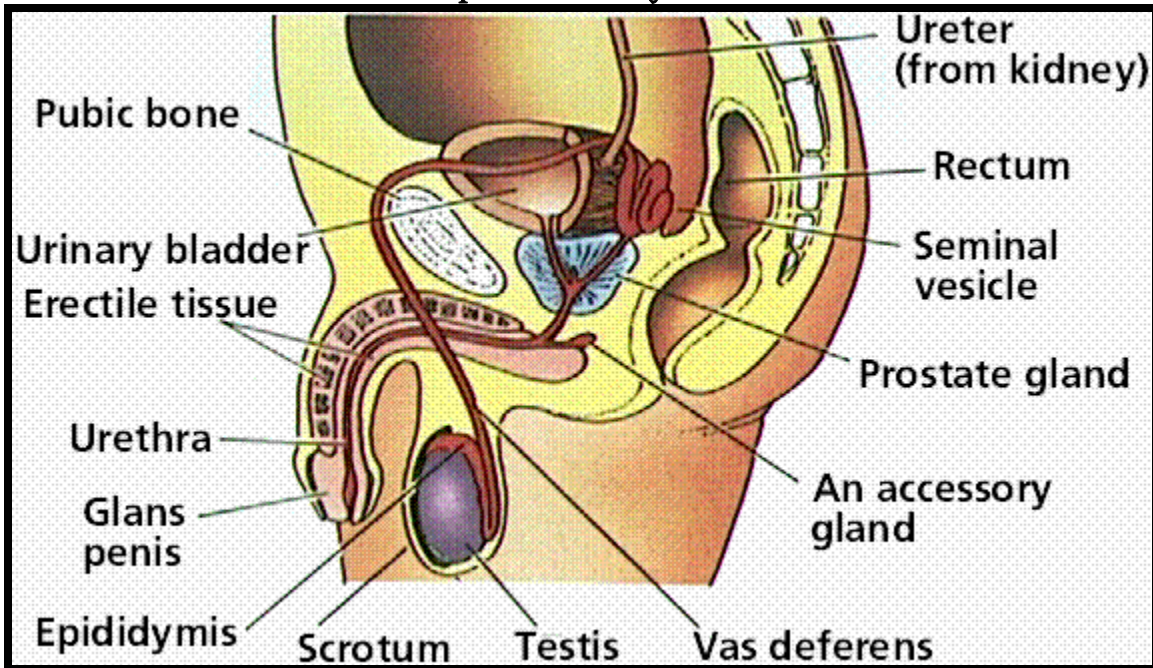
##### d. SEMEN

- ◆ Semen is formed when fluid secretions are from the **SEMINAL VESICLES**, the **PROSTATE GLAND**, and the **COWPER'S GLAND** are released into sperm ducts and mix with sperm
- ◆ This fluid serves as a transport medium for sperm and is an adaptation for gamete survival on land.

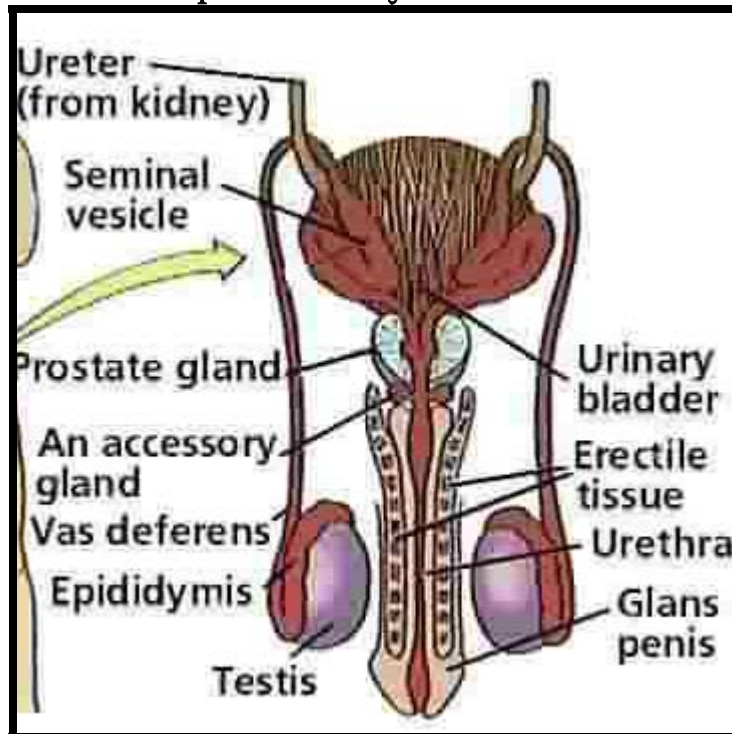
#### III. *Pathway of SPERM/SEMEN through the male reproductive organs*

- ◆ **Spermatogenesis** occurs in each testis.
- ◆ **Sperm** is stored in the **EPIDIDYMUS** (organ on top of each testis) for about 2 weeks until it matures.
- ◆ On arousal, sperm from each testis is released into each vas deferens (sperm duct)
- ◆ When the sperm passes the seminal vesicles, prostate and cowper's gland, fluids are added that contain food, lubrication and other important substances that aid in the transport and survival of the sperm
- ◆ Semen continues into the urethra, where it then will be ejected from the penis

Male Reproductive System – Side View



Male Reproductive System – Front View



## FEMALE REPRODUCTIVE SYSTEM

### I. *Functions:*

- a. produce monoploid egg cells
- b. site of fertilization
- c. site of development of **EMBRYO/FETUS**

### II. *Female Reproductive Organs*

#### a. **OVARIES:**

- ◆ Paired gonads in the lower female body cavity

- ◆ Produce monoploid (n) eggs (ova) in tiny compartments called **FOLLICLES**
- ◆ Produces the female hormones **ESTROGEN** and **PROGESTERONE**
  - these hormones have a coordinating role in the menstrual cycle
  - ESTROGEN** also regulates the development of secondary sex characteristics such as the broadening of the pelvis (hips), development of breasts, and secondary hair under the arms and groin,

b. **OVIDUCTS (FALLOPIAN TUBES)**

- ◆ Pair of tubes that lead into the **UTERUS**
- ◆ When an egg is released during **OVULATION** from a **FOLLICLE** in an **OVARY**, it enters an oviduct
- ◆ Site of **FERTILIZATION** where sperm meets egg and forms a **ZYGOTE** (fertilized egg)

c. **UTERUS**

- ◆ a hollow muscular organ in the pelvic cavity of the female in which the embryo is nourished and develops before birth

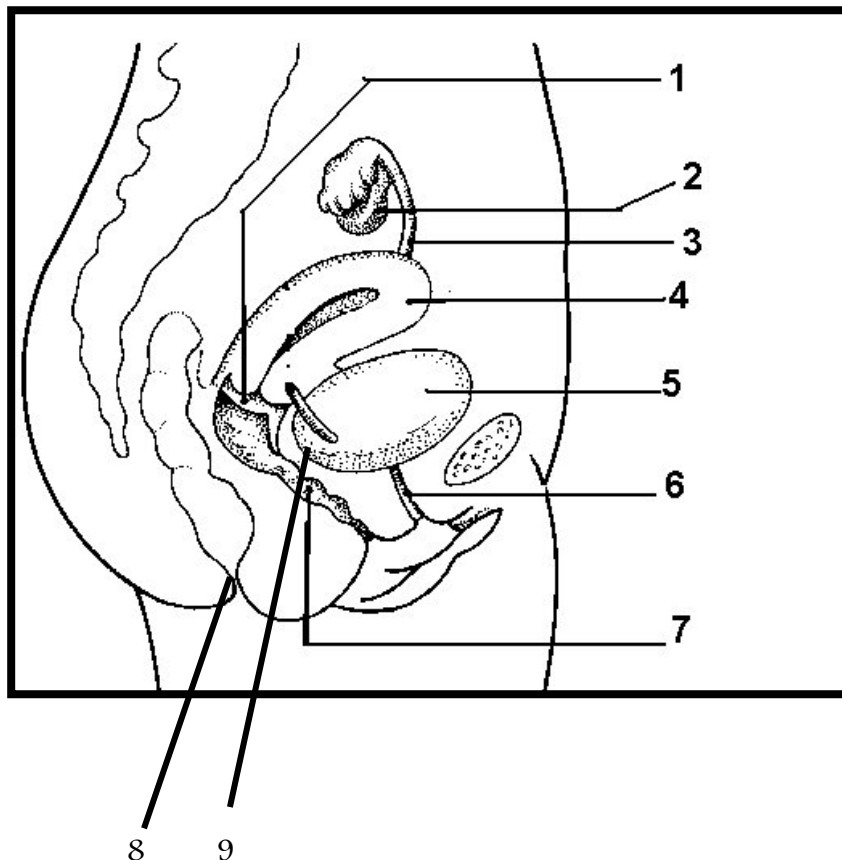
d. **CERVIX**

- ◆ Lower end or neck of the **UTERUS** which opens into the **VAGINA**

e. **VAGINA**

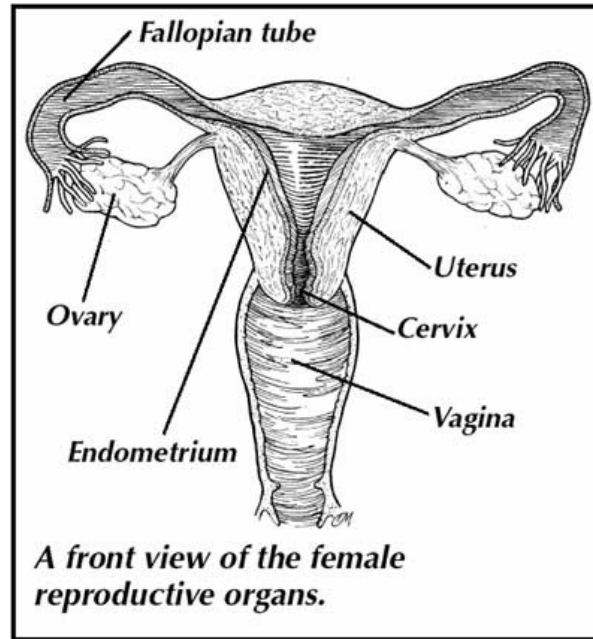
- ◆ Muscular tube that leads from the **CERVIX** to the opening of the vagina
- ◆ Also known as the **BIRTH CANAL** or **VAGINAL CANAL**

Female Reproductive System (side view)



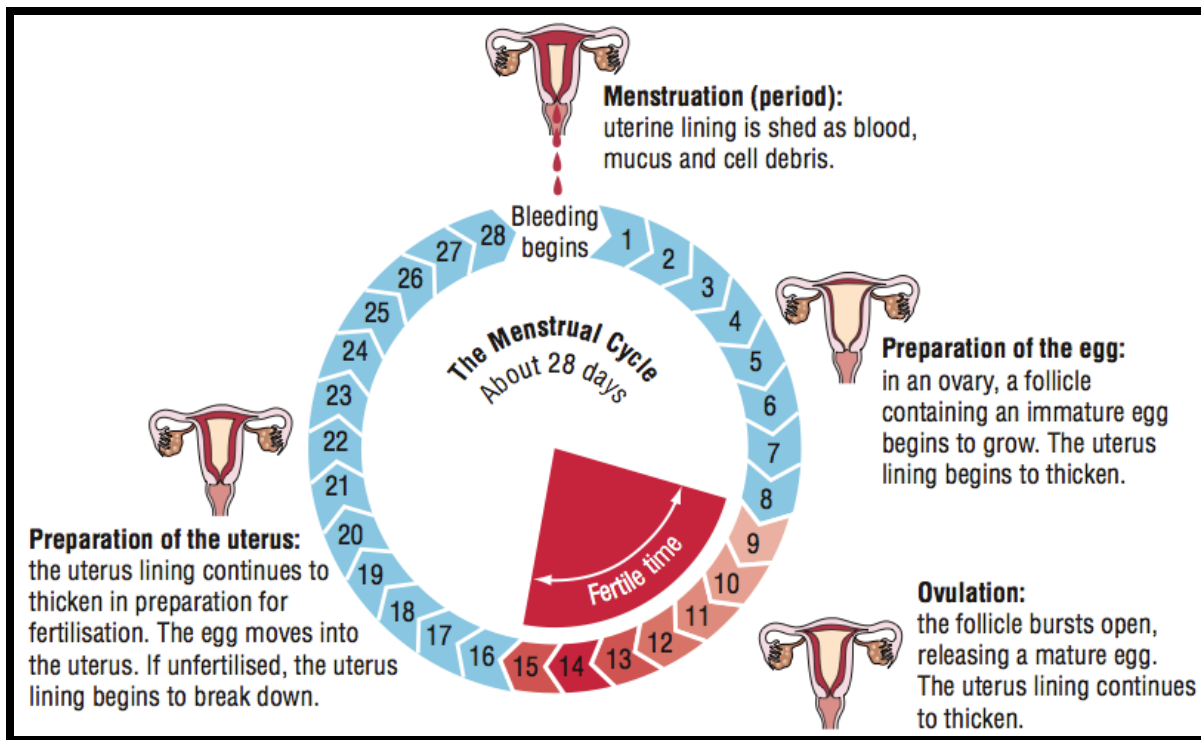
1. Cervix
2. Ovary
3. Oviduct (fallopian tube)
4. Cervix
5. Urinary Bladder
6. Urethra
7. Vaginal (birth) canal
8. Rectum
9. Ureter (leads to kidney)

## Female Reproductive System (frontal view)

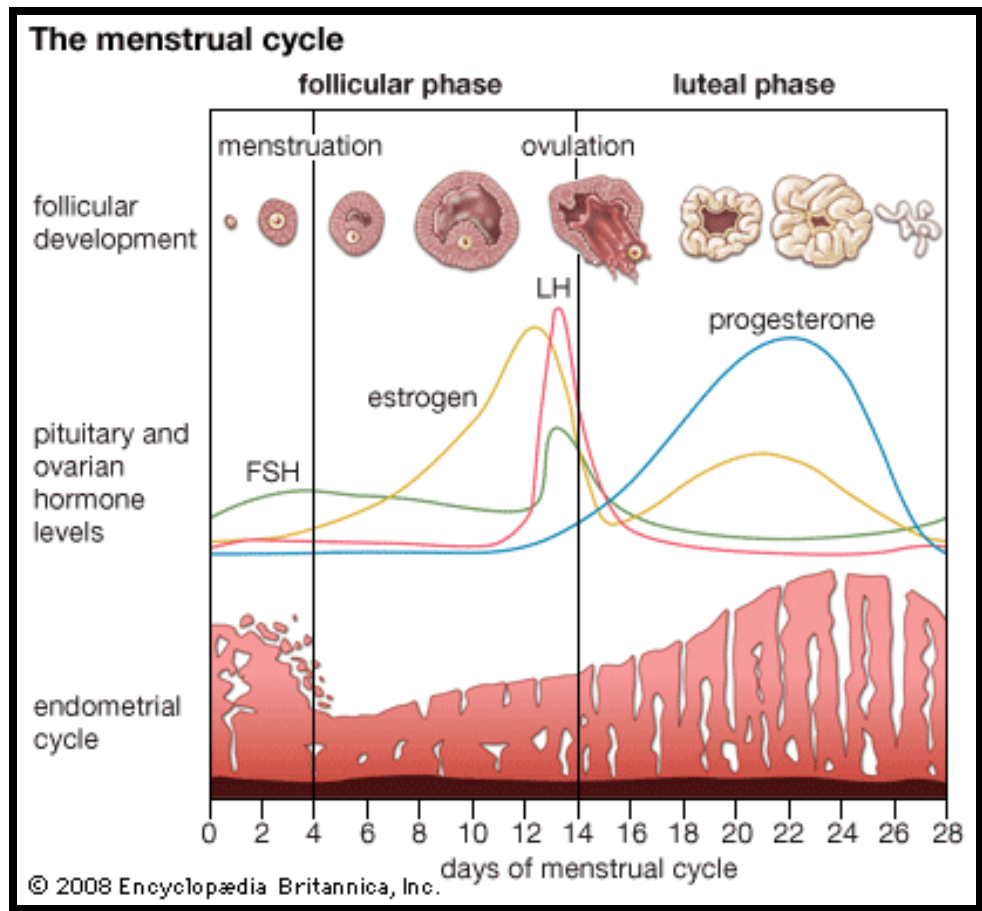


### FEMALE MENSTRUAL CYCLE

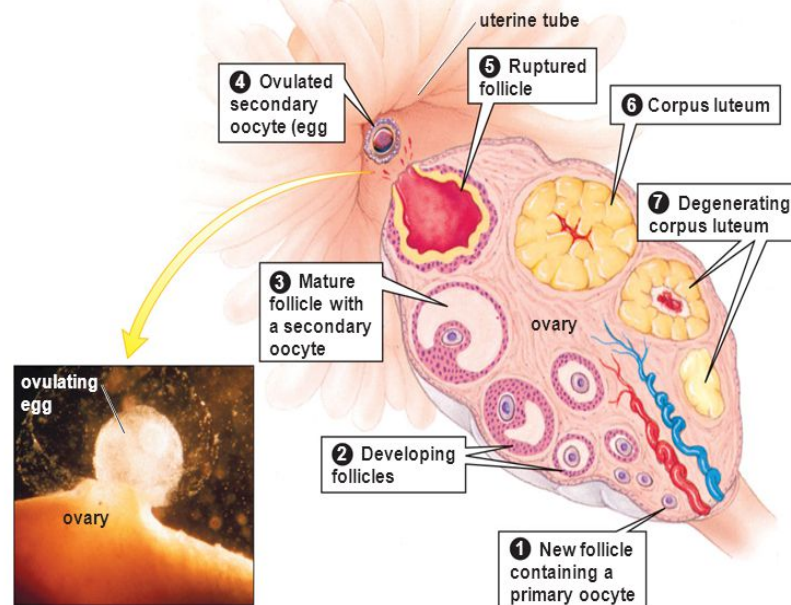
- ◆ Begins at **PUBERTY** and ends at **MENOPAUSE**, the permanent cessation of the menstrual cycle.
- ◆ Average duration of cycle is approximately 28 days. This cycle varies considerably by pregnancy, breast-feeding, illness, and stress.
- ◆ The menstrual cycle consists of 4 stages:



- a. **FOLLICLE STAGE:** from about day 4- day 14  
 ---**FOLLICLE STIMULATING HORMONE (FSH)** is released into the blood stream from the **PITUITARY GLAND**.  
 ---**FSH** stimulates a follicle in an ovary to begin the process of maturing the egg in the chamber.  
 ---As the follicle matures the egg, getting it ready for **OVULATION**, it begins to secrete **ESTROGEN**.  
 ---**ESTROGEN** begins to thicken the **UTERINE LINING** with blood and vessels to get it ready in case the egg is fertilized.  
 ---As **ESTROGEN** levels rise, this shuts down the release of **FSH** from the pituitary gland.
- b. **OVULATION:** occurs on DAY 14  
 ---with **FSH** production down, the **PITUITARY GLAND** then secretes **LUTINIZING HORMONE (LH)** to be released in the blood.  
 ---**LH** stimulates the ovary to rupture and release the egg from the follicle.  
 ---the egg then enters the **OVIDUCT** with the help of the **FIMBRIAE**
- c. **CORPUS LUTEUM STAGE:** lasts about 12 days from the time of **OVULATION**  
 ---the ruptured follicle becomes a yellow colored body called the **CORPUS LUTEUM**  
 ---the **CORPUS LUTEUM** (ruptured follicle) secretes **PROGESTERONE**, which continues to enhance the thickening of the **UTERINE LINING**  
 ---If the egg is **NOT** fertilized, then the **UTERINE LINING** must be shed.
- b. **MENSTRUATION:** around day 28  
 ---All hormone levels drop and the uterine lining is shed  
 ---the day the menstrual period begins is the **FIRST DAY OF THE NEXT MENSTRUAL CYCLE**.



# Follicle Development



## HORMONES INVOLVED IN THE MENSTRUAL CYCLE:

- ◆ **Pituitary Hormones:**
  - FSH: influences follicle development and maturation of an egg in a follicle
  - LH: stimulates ovulation; influences the formation of the corpus luteum from the ruptured follicle.
- ◆ **Ovary Hormones:**
  - Estrogen: produced by the maturing follicle; starts the thickening of the uterine lining
  - Progesterone: produced by the corpus luteum; maintains the thickening of uterine lining

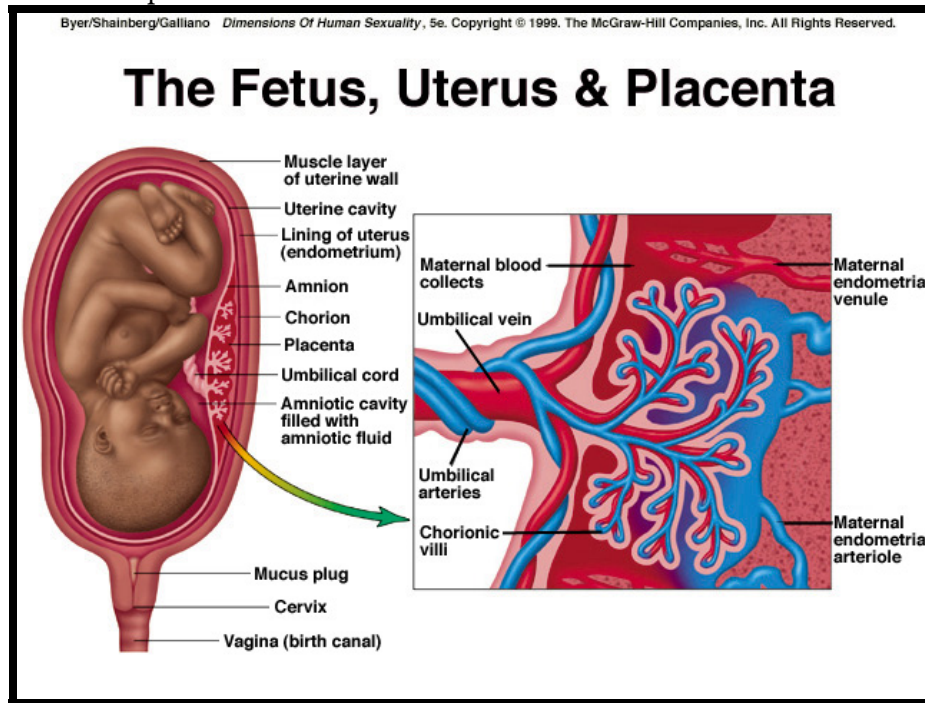
## NEGATIVE FEEDBACK

- ◆ Def: when the first step inhibits or stops the last step
- ◆ Negative Feedback controls the menstrual cycle in the following way:
  - FSH increases, stimulating a follicle to develop and mature an egg and begin estrogen production.
  - Estrogen levels rise, inhibiting FSH from being released from the pituitary gland. (**NEGATIVE FEEDBACK**)
  - With FSH shut down, then LH is released into the bloodstream by the pituitary gland
  - When LH levels are high enough, ovulation occurs

## FERTILISATION & DEVELOPMENT

- ◆ Usually occurs in the oviduct
- ◆ The egg must be fertilized with **24 hours** after ovulation or the egg will begin to deteriorate
- ◆ Cleavage of zygote usually begins in oviduct
- ◆ 6-10 days later, the fertilized egg becomes planted in the uterus
- ◆ Gastrulation of the zygote usually occurs around the time of implantation
- ◆ **EMBRYO** – 2 -8 weeks; **FETUS** – 8 weeks to birth

- ◆ Once implantation occurs, the **PLACENTA** forms from **MATERNAL** and **FETAL** tissue..
  - the **PLACENTA** forms a barrier between maternal and fetal blood systems
  - nutrients and wastes are exchanged between the mother and fetus
- ◆ The **UMBILICAL CORD** contains the fetal blood vessels that bring the nutrients to the fetus and take away the wastes to the placenta.



- ◆ Damage to the developing embryo/fetus can occur due to genetics, poor maternal diet, and/or mother's exposure to harmful environmental factors.
  - alcohol, drugs, and tobacco can all lead to the birth of a baby with brain damage, underdeveloped lungs, drug addiction, small head size, and/or low birth weight
  - in addition, exposure to certain infections, such as HIV and German measles can also harm the developing fetus.

#### ENDING NOTES:

- ◆ **GESTATION**:: time it takes from fertilization to birth. For humans, gestation is about 40 weeks or 280 days.
- ◆ **PRENATAL development**: development inside the uterus
- ◆ **POSTNATAL development**: development from birth until death
- ◆ **Identical Twins**: 1 egg, 1 sperm; **Fraternal Twins**: 2 eggs, 2 sperm

#### REPRODUCTIVE TECHNOLOGY

- ◆ **Cloning of Plants**
  - through genetic engineering, scientists have produced plants that are resistant to insects, weed killers, infection, and even frost.
  - these genetically altered plants are then cloned to produce thousands of genetically identical offspring.
- ◆ **Artificial Insemination**:
  - can produce hundreds offspring from one farm animal
  - sperm or fertilized eggs can be frozen and transported easier and cheaper than transporting the animals themselves

- ◆ ***Endangered Species***
  - populations of endangered species can be increased by transplanting embryos of endangered animals into related species (surrogate parent) who give birth to offspring of the endangered animals.
- ◆ ***Hormone Traps for Insects***
  - hormones that regulate reproduction and development in insects have been studied to identify ways to control insects without using poisonous chemicals
- ◆ ***In Vitro Fertilization:***
  - female is given special medication so that several eggs mature in follicles at once
  - before ovulation, these eggs are removed from the follicles
  - sperm is obtained from male. Which is cleaned and healthy sperm are chosen
  - sperm and eggs are united in a Petri dish
  - fertilized eggs are allowed to undergo cleavage
  - embryos are implanted into female uterus and allowed to develop normally
- ◆ ***Amniocentesis:***
  - a sample of amniotic fluid is taken by inserting a needle in the mother's abdomen and through the amnion in order to retrieve fetal cells that are in the fluid
  - chromosomes from these cells can be analyzed to determine the genetic make-up of the fetus to identify the sex of the child and if there are any genetic disorders
  - the amniotic fluid can be examined for biochemical deficiencies that may threaten the health of the fetus