

## Chapter Outline

### 43.1 How Animals Reproduce

- A. There are two patterns of reproduction.
  1. **Asexual**—only one parent is involved.
  2. **Sexual**—two parents are involved.
- B. Asexual Reproduction
  1. Some animals usually reproduce asexually but most use a combination of sexual and asexual.
  2. Hydra undergo **budding**; a new individual arises as an outgrowth (bud) of a parent.
  3. *Obelia* polyps produce a medusa by budding; the medusa produces eggs and sperm.
  4. Flatworms can constrict and pinch off.
  5. Fragmentation followed by **regeneration** is seen among sponges and echinoderms.
  6. **Parthenogenesis** is found among some insects, worms, fish, lizards and some other animals; the egg develops without fertilization.
  7. In honeybees, the queen can decide to fertilize or not fertilize the eggs, producing diploid female workers or haploid male drones.
- C. Sexual Reproduction
  1. In **sexual reproduction**, the egg of one parent is fertilized by the sperm of the other.
  2. Hermaphroditic organisms possess both male and female organs.
    - a. A pair of earthworms cross-fertilize each other.
    - b. Sex reversal involves the changing of sex; a male wrass (a reef fish) has a harem but if the male dies, the largest female becomes a male.
  3. **Gonads** are organs specialized to produce **gametes**.
    - a. Sponges are an exception since their collar cells give rise to sperm and eggs.
    - b. Hydroids produce only temporary gonads in the fall when sexual reproduction occurs.
    - c. Animals in other phyla have permanent gonads.
  4. There are two types of gonads: **testes** produce sperm and **ovaries** produce eggs.
  5. Eggs and sperm cells derive from germ cells that specialize early for this development.
  6. Other cells in the gonads support and nourish the developing gametes or produce hormones for reproduction.
  7. **Accessory organs** form ducts and storage areas that aid in bringing gametes together.
  8. Sexually-reproducing animals have various methods to ensure that the gametes find each other.
    - a. Aquatic animals that practice external fertilization must synchronize egg release.
    - b. The lunar cycle is one trigger that cues animals by tides.
    - c. Hundreds of thousands of palolo worms rise to the surface to release eggs during a 2–4 hour period.
  9. **Copulation** is sexual union to facilitate the reception of sperm by a female.
    - a. The **penis** is a male copulatory organ typical of terrestrial males; it deposits sperm into the female's vagina.
    - b. Aquatic animals have other types of copulatory organs or employ other strategies for delivering sperm:
      - 1) Lobsters and crayfish have modified swimmerets.
      - 2) Cuttlefish and octopuses use an arm.
      - 3) Sharks have a modified pelvic fin to pass packets of sperm to the female shark.
    - c. Birds lack a penis and vagina; they transfer sperm from cloaca to cloaca.

#### D. Life History Strategies

1. Many aquatic animals use **external fertilization**; eggs and sperm join outside the body in the water.
2. Terrestrial animals tend to practice **internal fertilization**; eggs and sperm join inside the female's body.
3. Both types of animals are usually **oviparous**; they deposit eggs in the external environment.
4. Insect eggs are produced in ovaries; they mature and increase in size as a result of the accumulation of yolk.
  - a. **Yolk** is stored food to be used by the developing embryo.
  - b. To prevent insect eggs from drying out, their eggshell has several layers of protein or wax.
  - c. In insects, small holes are left at one end to allow for the entry of sperm.
5. Some insects have a special organ to store sperm so the eggs can be fertilized later.
6. A **larval stage** is often quite different in appearance and way of life from the adult form.
  - a. The larva is able to seek its own food to sustain itself until it becomes an adult.
  - b. **Metamorphosis** is a major change in form that some animals undergo during development.
  - c. Incomplete metamorphosis lacks a pupal stage and the nymphs look more like adults.
  - d. Larval aquatic forms can utilize a different food source than the adults.
  - e. The bilaterally symmetrical sea star larvae attach to a substrate and become radially symmetrical adults.
  - f. The free-swimming barnacle larvae metamorphose into sessile adults with calcareous plates.
  - g. The crayfish lacks a larval stage; eggs hatch into tiny juveniles with same form as the adults.
7. Reptiles and birds provide their eggs with plentiful yolk; there is no larval stage.
  - a. Complete development takes place within a shell containing **extraembryonic membranes**.
  - b. The **chorion** is the outermost membrane that lies next to the shell and functions in gas exchange.
  - c. The **amnion** forms a water-filled sac around the embryo ensuring that it will not dry out.
  - d. A **yolk sac** holds yolk which nourishes the embryo.
  - e. The **allantois** holds nitrogen waste products.
  - f. A **shelled egg** frees an animal from any need to reproduce in water and also helps it live completely on land.
8. Birds tend their eggs.
  - a. Newly hatched birds have to be fed before they develop to where they can seek food on their own.
  - b. Parent bird's reproductive behaviors involve complex hormone and neural regulation.
9. In oysters and sea horses; the eggs remain inside the body until they hatch fully-developed.
10. Garter snakes, water snakes, and pit vipers also retain eggs until they hatch and give birth to live young.
11. Mammals are **viviparous**; the embryo remains in female's body during development.
  - a. The nutrients needed for development are constantly supplied by the mother.
  - b. Viviparity represents the ultimate in caring for the zygote and the embryo.
  - c. The evolution of viviparity can be seen in the primitive mammals.
    - 1) The exceptions are the duckbill platypus and the spiny anteater, which are egg-laying mammals.
    - 2) Marsupials give birth to immature offspring that finish developing within a pouch.
    - 3) In all other mammals, development occurs in a placenta.
12. The **placenta** is a complex organ comprised of maternal and embryonic tissues.
  - a. A placenta exchanges O<sub>2</sub>, CO<sub>2</sub>, nutrients, wastes, etc., between the fetal and maternal circulations.
  - b. Evolution allowed embryos to exchange materials with the mother; this made the shell unnecessary.

### 43.2 Male Reproductive System

#### A. Male Gonads

1. Paired testes are suspended in the **scrotal sacs** of the **scrotum**.
2. The testes began development in the abdominal cavity but descend into the scrotal sac during development.
3. If the testes do not descend, without surgery or hormonal therapy, sterility results.
4. The lower temperature of the scrotum is vital to normal sperm production.

## B. Sperm

1. Sperm produced in the testes mature within the **epididymides**.
  - a. These are tightly coiled tubules outside of the testes in which the sperm undergo maturation.
  - b. The maturation time in the epididymis is required for the sperm to develop the ability to swim to the egg.
2. Once sperm have matured, they are propelled into the **vasa deferentia** by muscular contractions.
3. Sperm are stored in both the epididymides and the vasa deferentia.
4. When a male is sexually aroused, the sperm enter the urethra, part of which extends through the penis.
5. The **penis** is a cylindrical copulatory organ used to introduce spermatozoa into the female vagina.
  - a. Three columns of spongy, erectile tissue extend down the penile shaft.
  - b. During sexual arousal, nervous reflexes cause an increase in the arterial blood flow to the penis.
  - c. Increased blood flow fills and distends the erectile tissue, and the penis stiffens and increases in size.
  - d. These changes cause an **erection**; failure to achieve an erection is called **impotency**.
6. **Semen** (seminal fluid) is thick, whitish fluid that contains sperm and glandular secretions.
  - a. The seminal fluid is formed by the seminal vesicles, prostate gland, and bulbourethral glands.
  - b. The **seminal vesicles** lie at the base of the urinary bladder.
    - 1) Each joins a vas deferens to form an ejaculatory duct that enters the urethra.
    - 2) They secrete into the ejaculatory duct a thick fluid containing nutrients for use by the sperm.
  - c. The **prostate gland** is located just below the urinary bladder and surrounds the upper portion of the urethra.
    - 1) It secretes a milky, slightly alkaline solution that promotes sperm motility and viability.
    - 2) In older men, the prostate gland may become enlarged and constrict the urethra.
    - 3) Prostate cancer is also common in older men.
  - d. The **bulbourethral glands** are located below the prostate gland and on either side of urethra; they release mucus secretions that provide lubrication.
7. The **urethra** also conducts urine from the bladder during urination.

## C. Ejaculation

1. **Ejaculation** results in the expulsion of semen; this is achieved at the peak of sexual arousal.
2. The first phase of ejaculation is **emission**.
  - a. Nerve impulses from the spine trigger the epididymides and vasa deferentia to contract.
  - b. Subsequent motility causes the sperm to enter the ejaculatory duct; seminal vesicles, the prostate gland, and the bulbourethral glands release their secretions.
  - c. A small amount of secretion from the bulbourethral glands may leak from the end of penis; it functions to clean the urethra of acid but it may contain sperm.
3. The second phase of ejaculation is **expulsion**.
  - a. Rhythmical contractions at the base of the penis and within the urethral wall expel the semen in spurts.
  - b. Rhythmical contractions are a release from **myotonia**, or muscle tenseness, an important sexual response.
4. An erection lasts for a limited time and the penis generally returns to a flaccid state following ejaculation.
5. A **refractory period** follows during which stimulation does not bring about an erection.
6. **Orgasm** is the physiological and psychological sensations that occur at the climax of sexual stimulation.

## D. The Testes

1. A longitudinal section shows compartments called lobules, each of which contains one to three **seminiferous tubules**.
  - a. Altogether, seminiferous tubules have a combined length of about 250 meters.
  - b. In a microscopic cross section, tubules show cells undergoing **spermatogenesis**, a process of meiosis.
  - c. The **sustentacular (Sertoli) cells** support, nourish, and regulate spermatogenic cells.

2. Mature **sperm (spermatozoa)** have three parts.
    - a. The sperm **head** contains a nucleus covered by an acrosome.
      - 1) **Acrosome** is caplike covering over anterior end of nucleus; stores enzymes to penetrate egg.
      - 2) A human egg is surrounded by several layers of cells and thick membrane; the enzymes allow the sperm to penetrate.
    - b. The **middle piece** contains mitochondria wrapped around microtubules of the flagellum; the mitochondria provide the energy for movement.
    - c. The **tail** also contains microtubules as components of a flagellum; its movement propels sperm.
  3. The ejaculate of a normal human male contains several hundred million sperm.
  4. Fewer than 100 ever reach the vicinity of an egg; and only one sperm normally enters an egg.
- E. Hormonal Regulation in Males
1. The hypothalamus has ultimate control of the testes' sexual function through secreting of **gonadotropic-releasing hormone (GnRH)** that stimulates the pituitary to produce gonadotropic hormones.
  2. There are two gonadotropic hormones, **follicle-stimulating hormone (FSH)** and **luteinizing hormone (LH)** found in both males and females.
  3. In males, **FSH** stimulates spermatogenesis in the seminiferous tubules.
  4. In males, **luteinizing hormone (LH)** is also called interstitial cell-stimulating hormone (ICSH); it stimulates testosterone secretion by interstitial cells of testes.
  5. The seminiferous tubules also release the hormone **inhibin**.
  6. The hypothalamus-pituitary-testis system are involved in a negative feedback relationship that maintains a fairly constant production of sperm and testosterone.
- F. Functions of Testosterone
1. **Testosterone** is main sex hormone in males.
  2. Testosterone is essential for the development of **male secondary sex characteristics** and for the maturation of sperm.
    - a. It causes the tallness, longer legs and broader shoulders of males.
    - b. Testosterone causes the larynx and vocal cords to enlarge, thus causing a deeper voice.
    - c. It is responsible for greater muscle strength of males; some athletes take supplemental anabolic steroids that are testosterone or mimics, but which have serious side effects.
    - d. Testosterone is largely responsible for sex drive and may contribute to aggressiveness.
    - e. It causes oil and sweat glands in the skin to secrete and it is largely responsible for acne and body odor.
    - f. Testosterone causes males to develop hair on the face, chest, and back.
    - g. Testosterone is also involved in triggering baldness if baldness genes are present.

### 43.3 Female Reproductive System

- A. Internal Reproductive System
1. The female reproductive system includes: **ovaries, oviducts, uterus, and vagina**.
  2. The **ovaries** produce a secondary oocyte each month; the ovaries are located in the abdominal cavity.
  3. The **oviducts** (Fallopian tubes) extend from the ovaries to the uterus.
    - a. The oviducts are not attached to the ovaries.
    - b. Fingerlike projections called **fimbriae** sweep over the ovaries and waft in the egg when it erupts.
    - c. This is the normal site for fertilization; the embryo is slowly moved by ciliary movement toward the uterus.
  4. The **uterus** is a hollow, thick-walled muscular organ the size and shape of an inverted pear.
    - a. Embryo completes development by embedding itself in uterine lining, the **endometrium**.
    - b. The narrow end of the uterus is the cervix.
    - c. A small opening at the cervix of the uterus leads to the vaginal canal.
  5. The **vagina** is a tube at a 45° angle with the small of the back.
    - a. Its mucosal lining lies in folds and it can extend, as necessary in childbirth.
    - b. It receives the penis during copulation and also serves as the birth canal.

- B. The external genitalia of women are known collectively as the **vulva**.
1. The **mons pubis**, **labia minora**, and **labia majora** are to the side of the vaginal and urethral openings.
  2. At the front juncture of the labia minora is the **clitoris**.
    - a. This is homologous to the penis in males.
    - b. The clitoris has a short shaft of erectile tissue and is capped by a pea-shaped glans.
    - c. It contains many sensory receptors that allow it to function as a sexually sensitive organ.
  3. **Orgasm** involves the release of neuromuscular tension in the muscles of the genital area, vagina, and uterus.
- C. The Ovaries
1. The ovaries alternate in producing one oocyte each month.
  2. The ovaries produce both the egg (ovum) and the female sex hormones, **estrogens** and **progesterone**, during the **ovarian cycle**.
- D. The Ovarian Cycle
1. In longitudinal section, an ovary shows many cellular follicles, each containing an oocyte (egg).
  2. A female is born with as many as two million follicles; the number is reduced to 300,000–400,000 by the time of puberty; and only a small number of follicles (about 400) ever mature.
  3. As a follicle matures, it develops from a **primary follicle** to secondary follicle to a vesicular (Graafian) follicle.
  4. As **öogenesis** is occurring; a **secondary follicle** contains a **secondary oocyte** pushed to one side of fluid-filled cavity.
  5. The **vesicular follicle** fills with fluid until the follicle wall balloons out on the surface and bursts, releasing a secondary oocyte surrounded by a zona pellucida and follicular cells.
  6. **Ovulation** is the rupture of the vesicular follicle with the discharge of the secondary oocyte into pelvic cavity.
  7. The secondary oocyte completes a second meiotic cell division when **fertilization** occurs.
  8. Meanwhile, the follicle develops into the **corpus luteum**; if pregnancy does not occur, the corpus luteum begins to degenerate in 10 days.
  9. The ovarian cycle is under the control of gonadotropic hormones: **follicle-stimulating hormone (FSH)** and **luteinizing hormone (LH)**.
  10. The gonadotropic hormones are not present constantly but are secreted at different rates during the cycle.
  11. During the **follicular phase**, FSH promotes the development of a follicle that secretes estrogen.
  12. As the estrogen level in the blood rises, it exerts feedback control over the anterior pituitary secretion of FSH; the follicular phase comes to an end.
  13. Estrogen levels in the blood rise, causing the hypothalamus to secrete more GnRH; this causes a surge in LH secretion.
  14. The LH spike then triggers ovulation.
  15. The **luteal phase** is the second half of the ovarian cycle following ovulation.
    - a. LH promotes the development of the corpus luteum, which secretes large amounts of progesterone.
    - b. Progesterone causes the endometrium to maintain.
    - c. As the blood level of progesterone rises, negative feedback to anterior pituitary's secretion of LH causes the corpus luteum to degenerate.
    - d. As the luteal phase ends, menstruation occurs.
- E. The Uterine Cycle
1. Estrogens and progesterone affect the endometrium of the uterus to cause a cycle of events known as the **uterine cycle**.
  2. An average 28-day uterine cycle is divided into four sections.
    - a. During **days 1–5**, low levels of estrogen and progesterone in the body cause menstruation.
      - 1) **Menstruation** is the periodic shedding of tissue and blood from the endometrium; this lining disintegrates and the blood vessels rupture.
      - 2) A flow of blood and tissues, known as **menses**, passes out of the vagina.
    - b. During **days 6–13**, an increased production of estrogens by an ovarian follicle causes the endometrium to thicken and become vascular and glandular (**proliferative phase**).

- c. Ovulation usually occurs on **day 14** of the 28-day cycle.
  - d. **Days 15–28** see increased production of progesterone by the corpus luteum that causes the endometrium to double in thickness; uterine glands mature, producing a thick mucoid secretion (**secretory phase**).
    - 1) The endometrium is now prepared to receive a developing embryo.
    - 2) If no pregnancy occurs, the progesterone and estrogen levels decline and the corpus luteum degenerates.
    - 3) With low levels of progesterone, the uterine lining also begins to degenerate.
    - 4) During menstruation, the anterior pituitary increases FSH production; a new follicle begins to mature.
  - 3. The ovarian cycle controls the uterine cycle.
- F. Events Following Fertilization
- 1. If fertilization occurs, the embryo begins development as it travels down the oviduct to the uterus.
  - 2. The embryo becomes embedded in the endometrium several days following fertilization.
  - 3. The **placenta** develops from both maternal and embryonic tissues.
    - a. The placenta functions to exchange gases and nutrients between the fetal and maternal circulation.
    - b. There is normally no mixing of the blood between the maternal and fetal circulations.
  - 4. Initially, the placenta produces **human chorionic gonadotropin (HCG)** which maintains the corpus luteum.
  - 5. The corpus luteum is maintained by the HCG until the placenta produces its own progesterone and estrogens.
  - 6. The progesterone and estrogens have two effects at this stage.
    - a. They shut down the anterior pituitary so that no new follicles mature.
    - b. They maintain the lining of the uterus so the corpus luteum is not needed.
  - 7. There is no menstruation during pregnancy.
- G. Functions of Estrogen and Progesterone
- 1. Estrogens maintain the normal development of the related organs and are responsible for the secondary sex characteristics of females.
  - 2. There is less body and facial hair, and more fat beneath the skin provides a more rounded appearance.
  - 3. The pelvic girdle enlarges and the pelvic cavity is larger; therefore, women have wider hips.
  - 4. Both estrogen and progesterone are required for breast development.
- H. The Female Breast
- 1. The female breast contains 15–24 **lobules**, each with a **mammary duct**.
  - 2. The mammary duct begins at the **nipple** and divides into numerous ducts which end in **alveoli** (blind sacs).
  - 3. **Prolactin** hormone is needed for **lactation** (milk production) to begin.
  - 4. Production of prolactin is suppressed by the feedback inhibition that estrogens and progesterone have on the anterior pituitary during pregnancy.
  - 5. Therefore it takes a couple of days after delivery of a baby for milk production to begin.
  - 6. The breasts produce a watery, yellowish white fluid (**colostrum**) similar to milk but containing more protein and less fat, and it is rich in IgA antibodies providing some immunity to a newborn.
  - 7. Breast cancer is the most common form of cancer in females; women should have regular breast checks and mammograms when recommended.

#### 43.4 Control of Reproduction

##### A. Problems

- 1. The two major causes of female infertility are blocked oviducts and a failure to ovulate due to low body weight.
  - a. **Endometriosis**, the spread of uterine tissue beyond the uterus, is another cause.
  - b. If no obstruction is apparent and body weight is normal, HCG from the urine of pregnant women, along with HMG (human menopausal gonadotropin) from postmenopausal women, causes multiple ovulations.
- 2. The most frequent causes of male sterility and infertility are low sperm count and abnormal sperm.
  - a. Disease, radiation, chemical mutagens, and too much heat near the testes can all cause sterility.
  - b. The use of psychoactive drugs can also contribute to this condition.

## B. Birth Control Methods

1. The most reliable birth control is abstinence; it has the advantage of preventing transmission of a STD.
2. Numerous birth control methods and devices are available to prevent pregnancy.
3. Their effectiveness is based on the number of sexually active women per year who do not get pregnant.
4. Both male and female condoms also offer protection against STDs.
5. Researchers are searching for a “male pill.”
  - a. Analogues of gonadotropic-releasing hormone prevent the hypothalamus from stimulating the anterior pituitary, but this also causes feminization.
  - b. Inhibin inhibits spermatogenesis but this must be administered by injection.
6. Morning-After Pills
  - a. These regimens either prevent fertilization or stop a fertilized egg from ever implanting.
  - b. Preven is a kit of four synthetic progesterone pills.
    - 1) Two are taken up to 72 hours after unprotected intercourse.
    - 2) Two more are taken 12 hours later.
    - 3) Preven upsets the normal uterine cycles and makes implantation difficult; it is 85% effective.
  - c. Mifepristone, also known as RU-486, causes the loss of an implanted embryo.
    - 1) It blocks the progesterone receptors of the endometrial cells.
    - 2) Without functioning receptors for progesterone, the uterine lining sloughs off carrying the embryo with it.
    - 3) Taken in conjunction with a prostaglandin to induce uterine contractions, it is 95% effective.
    - 4) It is possible that it could be taken by women with delayed menstruation without knowing if they are pregnant.

## C. Infertility

1. Causes of Infertility
  - a. Blocked oviducts can be due to inflammation caused by a STD.
  - b. Endometriosis is the presence of uterine tissue outside of the uterus.
  - c. If no obstruction is apparent and body weight is normal, females can be given fertility drugs.
  - d. Hormone treatments carry the risk of multiple pregnancy.
  - e. The most common infertility problem is low sperm count or too many abnormal sperm.
  - f. A vasectomy can sometimes be reversed but the success rate is only 40%.
2. Artificial Insemination (AI)
  - a. A sperm sample is injected by a physician.
  - b. If the husband’s sperm count is low, many samples can be combined.
  - c. Artificial insemination from a donor is necessary when the husband lacks viable sperm.
  - d. Intrauterine insemination can be coordinated with drugs used to stimulate the ovaries.
  - e. With artificial insemination, sperm can be sorted into those that are X-bearing (producing a girl) or Y-bearing (producing a girl).
3. In Vitro Fertilization (IVF)
  - a. In IVF, conception occurs in laboratory glassware.
  - b. Ultrasound machines spot maturing follicles and a laparoscope is used to harvest the eggs using a needle.
  - c. When sperm and egg are combined in glassware, they can be transferred to the uterus after 2–4 days.
  - d. While in glassware, the new embryos can be tested for genetic diseases.
4. Gamete Intrafallopian Transfer (GIFT)
  - a. Due to the low success rate of IVF (15–20%), GIFT immediately places the sperm and egg in the oviduct.
  - b. A variation is to fertilize the eggs in the laboratory and then place the zygotes in the oviducts.
5. Surrogate Mothers
  - a. Women can be contracted and paid to have babies; they are then surrogate mothers.
  - b. The sperm and/or egg can be contributed by the contracting parents.
6. Intracytoplasmic Sperm Injection
  - a. A single sperm is injected into an egg.
  - b. This is used when a man has severe infertility problems.

### 43.5 Sexually Transmitted Diseases

#### A. General Sexually Transmitted Diseases (STDs)

1. STDs are caused by organisms ranging from viruses to arthropods.
2. Humans cannot develop lasting immunity to any STDs; therefore, prompt medical treatment should be received when exposed to an STD.
3. To prevent STDs, a condom can be used; a spermicide with nonoxynol 9 gives added protection.
4. It is difficult to cure STDs caused by viruses; treatment is available for AIDS and genital herpes.
5. STDs caused by bacteria (e.g., gonorrhea, chlamydia, and syphilis) are treatable with antibiotics.

#### B. AIDS

1. **Acquired immunodeficiency syndrome (AIDS)** is caused by the **human immunodeficiency virus (HIV)**.
2. HIV attacks the helper T cells that stimulate the activity of B lymphocytes to produce antibodies.
3. After an HIV infection begins, helper T cells decline in number and a person becomes more susceptible to infections.
4. AIDS has three stages of infection called category A, B, and C
  - a. The category A stage may last about a year.
    - 1) An individual is asymptomatic but can pass on the infection.
    - 2) Immediately after infection but before testing positive, a large number of infectious viruses are in blood.
    - 3) After testing positive, a person may remain well for as long as he or she can maintain sufficient helper T cells (above  $500 \text{ mm}^3$ ).
  - b. The category B stage may last six to eight years.
    - 1) Lymph nodes swell.
    - 2) There is weight loss, night sweats, fatigue, fever, and diarrhea.
    - 3) Infections such as thrush and herpes reoccur.
  - c. The category C stage is full-blown AIDS.
    - 1) Nervous disorders and opportunistic diseases (e.g., an unusual type of pneumonia or skin cancer) occur.
    - 2) Without intensive medical treatment, an AIDS patient usually dies by about 7–9 years after infection.
    - 3) A recent combination therapy of several drugs allows AIDS patients in the United States to live longer.
5. Transmission
  - a. AIDS is transmitted by sexual contact with an infected person (vaginal or rectal intercourse and oral/genital contact).
  - b. Needle sharing among intravenous drug users is a high-risk behavior.
  - c. Transfusions of blood or clotting factors is now a rare mode of transmission and can be screened.
  - d. The largest increases in AIDS cases now involve heterosexual contact and intravenous drug use.
  - e. Women now account for 19% of all newly diagnosed cases of AIDS.
  - f. Increase of AIDS among women of reproductive age causes an increase in AIDS in children.
  - g. HIV also crosses the placenta and is transferred through breast feeding.

#### C. Genital Warts

1. **Genital warts** are caused by the human papillomaviruses (HPVs).
2. Many carriers are asymptomatic or they have minimal symptoms.
3. If visible warts are removed, they may recur.
4. HPVs are now associated with cancer of the cervix as well as tumors of the vulva, vagina, anus, and penis.
5. Some researchers believe viruses are involved in 90–95% of all cases of cancer of the cervix.

#### D. Genital Herpes

1. **Genital herpes** is caused by the herpes simplex virus.
2. Type 1 causes cold sores and fever blisters; type 2 more often causes genital herpes.
3. Individuals infected with this type of virus can be asymptomatic carriers.
4. Symptoms include painful ulcers on the genitals, fever, painful urination, and swollen lymph nodes.
5. Exposure to herpes in the birth canal can cause neurological disorders and even death in a newborn; birth by cesarean section avoids this possibility.



#### E. Hepatitis

1. Hepatitis A is usually acquired from sewage-contaminated drinking water but is also an STD contracted by oral/anal contact.
2. Hepatitis B is spread in the same manner as AIDS but is more infectious; a vaccine is available.
3. Hepatitis C is called post-transfusion hepatitis.
4. Hepatitis infections infect the liver and can lead to liver failure, liver cancer, and death.

#### F. Chlamydia

1. **Chlamydia** is named for the bacterium that causes it: *Chlamydia trachomatis*.
2. New chlamydial infections have increased faster than any other STD.
3. It also causes cervical ulcerations which increase the risk of acquiring AIDS.
4. It also causes pelvic inflammatory disease (PID).
5. If a baby is exposed at birth, inflammation of the eyes or pneumonia can result.

#### G. Gonorrhea

1. **Gonorrhea** is caused by the bacterium *Neisseria gonorrhoeae*.
2. Male diagnosis is easy: typical symptoms include urination pain and a thick, greenish yellow discharge.
3. In males and females, latent infections lead to **PID**; the vasa deferentia or the oviducts become infected and inflamed.
4. As these tubes heal, they may become partially blocked, resulting in sterility or infertility.
5. If a baby is exposed at birth, an eye infection can lead to blindness; therefore all newborns are given eye drops.
6. Previously easily cured by antibiotics, nearly 40% of modern strains are now antibiotic resistant.

#### H. Syphilis

1. **Syphilis** is caused by the bacterium *Treponema pallidum*.
2. This disease has three stages typically separated by latent periods.
  - a. The primary stage involves the appearance of a hard chancre (ulcerated sore).
  - b. The second stage involves the appearance of a rash all over the body, including the palms and feet.
  - c. The third stage involves neurological and cardiac disorders.
    - 1) An infected individual may become mentally retarded, blind, walk with a shuffle, or become insane.
    - 2) Large destructive ulcers (**gummas**) develop on the skin or within internal organs.
3. Syphilitic bacteria can cross the placenta, causing birth defects or stillbirth.
4. Unlike the other STDs discussed, there is a blood test to diagnose syphilis.
5. Tracing sexual partners is very important in controlling syphilis.

#### I. Two Other Infections

1. **Vaginitis** is caused by *Trichomonas vaginalis* (a flagellated protozoa) or *Candida albicans* (a yeast).
2. The protozoan infection causes a frothy, foul-smelling discharge with itching.
3. Trichomoniasis is most often transmitted through sexual intercourse.
4. The *Candida* yeast infection causes a white, curdy discharge with itching.
5. *Candida albicans* is a normally-occurring organism in the vagina; yeast infections can result from taking birth-control pill or antibiotics.