Reproductive System

LEARNING OBJECTIVES
- Define at least 10 terms relating to the reproductive system.
- Describe the function of the reproductive system.
- Identify at least 10 reproductive system structures and the function of each.
- Identify at least three methods of assessment of the reproductive system.
- Describe common patterns of growth and development of the neonate.
- Describe at least five disorders of the reproductive system.

KEY TERMS
- Conception (kon-SEP-uhn) Onset of pregnancy; union of sperm and egg (ovum)
- Ectopic (ek-TOP-ik) Located away from normal position
- Erectile (er-REK-tul) Capable of becoming rigid and elevated when filled with blood
- Fertile (fer-TIL) Capacity to conceive or induce conception
- Fibroid (FIE-broid) Tissue composed of threadlike, fibrous structure
- Genital (jeN-in-tal) Reproductive organ
- Gestation (jes-TAY-shun) Development of young from conception to birth; pregnancy
- Intercourse (in-ter-kors) Sexual union
- Lactation (lak-TAY-shun) Production and secretion of milk by the mammary glands (breasts)
- Mammography (ma-MOG-ruh-fe) Radiologic view of breasts
- Menopause (MEN-sep) Normal flow of blood and uterine lining that occurs in cycles in women
- Menstrual cycle (MEN-struh-ul) The recurring cycle of change of the reproductive organs induced by hormones in women
- Ovulation (o-vyoo-LAY-shun) Release of the egg (ovum) from the ovary
- Sterile (ster-IL) Being unable to produce offspring
Growing cells are called an embryo. From 8 weeks to birth, the unborn baby is called a fetus. During the first 30 days of life, the infant is considered to be a neonate.

**Male Organs of Reproduction**

The organs of reproduction of the male are shown in Fig. 21-2. The testes, about 4 to 5 cm long, produce the sperm. The testes also secrete an androgentic hormone (testosterone), causing the appearance of secondary sexual characteristics such as facial hair, deepened voice, increased muscle mass, and thickening of the skin.

The epididymis is a tubule on the surface of each testis that stores the sperm while they mature. Sperm are transported by the vas deferens into the ejaculatory duct below the bladder. The seminal vesicle adds fluid that increases the volume and nourishes the sperm. The prostate gland, located below the bladder, secretes a fluid that protects the sperm.

The penis becomes rigid and elevated when filled with blood (erection). The penis encloses the urethra. The glans penis is covered with a loose-fitting, retractable casing called the foreskin (prepuce), which may be removed (circumcision). Both semen and urine are excreted through the urethra, but the systems operate separately. Semen is a thick, white secretion that contains the sperm and fluid. Epacket of semen is called ejaculation. Approximately 200 million sperm are in each ejaculation.

The National Cancer Institute (NCI) recommends a monthly self-examination of the tests to detect testicular cancer (Fig. 21-3). For 2009, the NCI estimated that 8400 new cases and 380 deaths occurred as a result of testicular cancer in the United States. Testicular cancer represents about 1% of all cancers in men. However, it is the most common form of cancer in men between 15 and 40 years of age.
Female Organs of Reproduction

The organs of reproduction in the female are shown in Fig. 21-4. The ovaries are glands that produce eggs (ova) and the hormones estrogen and progesterone.

**BRAIN BYTE**
The largest cell in the female body is the egg.

The fallopian tubes (oviducts) transport the mature ovum from the ovary to the uterus. Fertilization usually occurs in the fallopian tubes during the 5 days required for the ovum to move to the uterus. If the ovum is not fertilized, it degenerates and is excrated as part of the menstrual cycle.

The uterus is a muscular structure about the size of a small finger. The zygote is implanted in the uterus after conception. The cervix, or neck of the uterus, thins and opens for delivery of a fetus. The inner layer of the uterus, called the endometrium, is shed during each menstrual cycle.

The vagina is a muscular tube that extends from the cervix to the exterior of the body. It is the site of sexual intercourse and the passageway (birth canal) for delivery of the fetus.

The external structures of the female reproductive system are collectively called the vulva (Fig. 21-5). The labia majora are folds of adipose tissue that protect the vaginal opening. The mons pubis is a pad of fat that joins the labia majora. The labia minora are pinkish folds of skin between the labia majora.

The clitoris is a small projection of erectile tissue located between the labia minora. The Bartholin glands secrete mucus and a lubricating fluid into the vaginal opening. The mammary glands (breasts) enlarge during puberty. The mammary glands have a system of ducts that secrete milk (lactation) after pregnancy.

**Menstrual Cycle**
The shedding of blood tissues of the uterus (menstruation) in the female signals the onset of puberty at about 10 to 16 years of age. The menstrual cycle, which lasts about 28 days, is a complex process of hormone secretion and tissue changes in the uterus (Table 21-1). A mature ovum is released from an ovary on about the 14th day of each cycle (Fig. 21-6). Some women experience pain a few hours after ovulation called mittelschmerz. This “middle pain” is believed to be caused by irritation of the peritoneum. If the released ovum is not fertilized, the lining of the uterus (endometrium) is released from the body along with the ovum. The sloughing of this bloody tissue, or menstruation, lasts from 3 to 7 days. The menstrual cycle continues until 45 to 50 years of age. The cessation of the cycle is called menopause (climacteric). Reduction in hormone production that occurs with menopause may cause a variety of symptoms, including “hot flashes,” or transient periods of feeling warm. Reduced levels of both estrogen and pituitary gonadotropins occur with menopause. Without these hormones, the woman’s ability to conceive or reproduce ceases.

Endometrial ablation is the removal or destruction of the lining of the uterus. Methods used to destroy the tissue include laser beam, heat, electricity, freezing, and microwave. It is an alternative to hysterectomy used to control heavy, prolonged menstrual bleeding. The procedure reduces or stops the menstrual cycle.

**Pregnancy**
Growth of an offspring in the uterus lasts about 280 days (9 months), or through the period of pregnancy. Pregnancy results from the union of the ovum and sperm, usually in the fallopian tube. The fertilized egg is known as a zygote for about 3 days. It is then considered to be the morula and enters the uterus. As a blastocyst, it implants in the uterine wall and is considered an embryo through the eighth week. From the eighth week until birth, it is considered a fetus.

Changes in the female reproductive system during pregnancy include an increase in muscle mass of the uterus and an elongation of the vagina. The uterus increases to 16 times its normal size during pregnancy. The secretions, vascularity, and elasticity of the cervix and vagina also increase in preparation for the delivery of the fetus.

The amniotic sac is a membrane that surrounds the fetus in the uterus. The sac is filled with fluid to cushion and protect the fetus against infection and temperature changes. A portion of the uterus forms the placenta, which filters the blood of the mother to provide oxygen and nutrients for the fetus.

**BRAIN BYTE**
In the uterus, prior to birth, the infant’s body is covered by a thin layer of hair called lanugo.
TABLE 21-1
Menstrual Cycle

<table>
<thead>
<tr>
<th>Day(s)</th>
<th>Hormone Activity</th>
<th>Change in System</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>P Pituitary secretes FSH</td>
<td>Follicle cells mature and produce estrogen</td>
</tr>
<tr>
<td>2</td>
<td>Pituitary secretes LH</td>
<td>Promotes estrogen production</td>
</tr>
<tr>
<td>3-13</td>
<td>Estrogen increases</td>
<td>Uterine lining begins to thicken; secondary sexual characteristics are maintained</td>
</tr>
<tr>
<td>14</td>
<td>No hormone activity</td>
<td>No change in system</td>
</tr>
<tr>
<td>15</td>
<td>Pituitary secretes FSH and LH</td>
<td>Mature follicle ruptures causing release of ovum (ovulation); follicle of ovary becomes corpus luteum</td>
</tr>
<tr>
<td>16-23</td>
<td>Corpus luteum secretes</td>
<td>Lining of uterus becomes more vascular; secretions of pituitary inhibited progesterone and estrogen</td>
</tr>
<tr>
<td>24</td>
<td>No hormone activity</td>
<td>No changes in system</td>
</tr>
<tr>
<td>25</td>
<td>No hormone activity</td>
<td>Corpus luteum degenerates if ovum is not fertilized</td>
</tr>
<tr>
<td>26-27</td>
<td>Progesterone and estrogen</td>
<td>Blood vessels to uterine lining contract; tissues disintegrate and slough secretion decreases</td>
</tr>
<tr>
<td>28</td>
<td>No hormone activity</td>
<td>Menses begin and last approximately 5 days</td>
</tr>
</tbody>
</table>

*If the ovum is fertilized after leaving the ovary, it is implanted in the rich uterine wall. The corpus luteum continues to secrete progesterone throughout the pregnancy to maintain the uterine wall and inhibit the secretion of pituitary hormones. FSH, Follicle-stimulating hormone; LH, luteinizing hormone.

An infant born before the 37th week of pregnancy or weighing less than 2500 g (5 1/2 lb) or (5 lb, 8 oz.) is considered premature. About 10% of babies in the United States fall in this category. Although there is no single cause for premature birth, some influencing factors have been identified. These include social, environmental, economic, and nutritional deficits. The cost of care for a premature neonate ranges from $12,000 to $130,000.

![FIGURE 21-1] The menstrual cycle.

Labor and Delivery

Labor is muscle contractions that signal the onset of delivery of the fetus. Labor consists of three stages. In the first stage, muscle contractions of the uterus cause the amniotic sac to rupture and the cervix to open (dilate) to about 10 cm in diameter, allowing passage of the fetus. The second stage of labor is delivery of the baby, called parturition. Delivery of the afterbirth, or placenta, takes place about 15 minutes later and is the third stage of labor.

In the first 6 to 8 weeks after delivery of the baby, the mother is considered to be postpartum. During this time, the uterus shrinks back to normal size and the hormonal balance of the body is reestablished.

Growth and Development

The physical and psychological stage of the newborn (neonate) changes rapidly from the moment of birth. Growth refers to the changes that can be measured by changes in height and weight, as well as changes in body proportions. Development describes the stages of change in psychological and social functioning. These changes occur in stages throughout the lifespan. At birth the baby, or neonate, is about 19 to 21 inches long and weighs 7 to 8 lb. The head is one fourth the length of the body compared with the adult ratio of one eighth. For the first 4 weeks, the baby is referred to as a neonate.

Assessment Techniques

Many disorders of the reproductive system can be assessed by palpation. Others are determined by blood tests, tissue culture, or by visual examination of the organs.

The most common methods of assessment of the male reproductive system are palpation and inspection of the organs (Box 21-1). Most disorders of the male reproductive system are treated by a physician specializing in urinary conditions (urologist). Cystoscopy can be used to view some of the reproductive structures. A blood test that measures a prostate-specific antigen may be used to detect prostate cancer.

Disorders of the female reproductive system are treated by a specialist called a gynecologist. The vagina can be opened with an instrument called a speculum to allow inspection of the cervix. With a Papanicolaou (Pap) smear, a few cells of the cervix are removed and studied microscopically to detect any potentially cancerous cells. Women older than 35 years of age should have a Pap smear every 1 to 3 years.

Many abnormalities of the breast may be first discovered by self-examination (Box 21-2). Mammography is an X-ray technique used to visualize breast tissue to detect any possible cancerous changes early. Digital imaging software used in computerized mammograms can eliminate some errors in the reading. Although there is some disagreement regarding how frequently a mammogram should be performed, the American Cancer Society (ACS) recommends that women have a yearly mammogram starting at age 40. Mammography may be followed by a biopsy to determine whether breast tissue is cancerous (Fig. 21-7). In 2009 the United States Preventative Services Task Force (USPSTF) changed its guidelines for mammography to no longer recommend routine screening for women between 40 and 49 years of age. The ACS responded by renewing their annual screening recommendation for women beginning at age 40. The ACS states that the data show that lives are saved with this screening, but the USPSTF states that not enough lives are saved to warrant the cost of routine testing.

Several tests can be used to detect abnormalities of the breast during gestation. These include amniocentesis, ultrasonography, and chorionic villus sampling.
Amniocentesis is a procedure that removes a small amount of amniotic fluid between the 16th and 20th week of pregnancy. This fluid can be used to detect fetal abnormalities. Ultrasonography uses high-frequency sound waves to visualize structures deep in body cavities (Fig. 21-9). Some evidence indicates that frequent sonograms (five or more) during pregnancy may lead to low birth weight. Chorionic villi are tiny vascular fibrils that help to form the placenta. Sampling of these fibrils by using laseroscopy allows prenatal evaluation of the fetus. This procedure is often done in earlier stages of pregnancy than amniocentesis. Chorionic villus sampling may cause birth defects such as missing fingers and toes in the unborn infant when performed early in the pregnancy.

**DISORDERS OF THE Reproductive System**

Benign prostatic hypertrophy (BPH) is a benign growth of the prostate gland that can cause problems with urination. When the prostate grows and obstructs the urethra, urine flow is impeded. If the flow becomes too slow, it can lead to bladder problems and hydronephrosis. The growth can also cause chronic retention, which is a condition in which urine collects in the bladder and cannot be voided.

In which the prostate grows and may stiffen, causing blockage of the urethra (prostate-urethral). Men with this condition may experience difficulty and frequent urination and bloody urine, known as hematuria (hem=red, -ur=urine). Treatment may include surgical removal of part of the entire gland to remove the blockage.

Cancer of the female reproductive system occurs in several ways. With the exception of skin cancer, breast cancer is the most common cancer in women. Second to lung cancer, it is the second most common cause of death in women. According to the ACS, about one in eight women in the United States will be diagnosed with breast cancer in their lifetime. The chance of dying of breast cancer is 1 in 35.

Breast cancer can be painful and will spread, or metastasize, to other areas of the body if not detected early. Breast cancer can be detected by regular palpation for growths and with mammography (Fig. 21-10) and see Box 21-2). Less than 1% of breast cancers occur in men; however, the outcome for treatment is usually not as successful in men as it is in women.

**CASE STUDY 21-1**  
Your friend tells you she is destined to have breast cancer because she has all of the risk factors except the gene that causes it. What should you say?

**Answers to Case Studies are available on the Evolve website:** http://evolve.elsevier.com/Geradin

Endometrial cancer is the most common cancer in the reproductive organs of women, with a lifetime chance of 1 in 40. Cervical cancer is associated with a history of sexually transmitted infection (STI), smoking, and multiple sexual partners. Cervical cancer can be detected early with a Papanicolaou test (Pap smear). Treatment for invasive cervical cancer may include surgery, radiation, and biologic therapy or chemotherapy.

Cancer of the prostate is the second leading cause of death in men older than 50 years of age. According to the ACS, there were 192,300 new cases and 27,300 deaths resulting from cancer of the prostate in 2009. It is a slow-growing cancer that may show no symptoms for years. The affected person may experience a urinary disorder. Treatment may include removal of cancerous tissue and radiation.

Cancer of the testis, usually occurring in men 15 to 30 years of age, appears as a painless swelling of the scrotum. Rapid spread, or metastasis, is possible. Testicular cancer can be treated with surgery, radiation therapy, and chemotherapy. A survival rate greater than 95% has been reported for testicular cancer that is detected early.

**CASE STUDY 21-2**  
Your friend says while he was showering he noticed that his testicles are not the same size. He says he also has some pain in the groin area. What should you say?

**Answers to Case Studies are available on the Evolve website:** http://evolve.elsevier.com/Geradin

Chancroid (SHANG-kroid) is a contagious bacterial infection characterized by painful sores (ulcers) on the genital area. The person may also have enlarged, painful lymph nodes, fever, and headaches. Chancroid is associated with poor hygiene and is transmitted by sexual contact. Treatment includes antibiotic medication and cleansing of the lesions.

**Chlamydia** (klah-MID-ee-uh), caused by the bacterium Chlamydia trachomatis, is the most commonly reported STI or disease according to the National Institute of Allergy and Infectious Diseases (NIAID). An estimated three million new cases occur each year. Chlamydia infection causes symptoms similar to those of gonorrhea, including painful urination and a discharge in both sexes. One of every two women infected has no symptoms. Pelvic inflammatory disease (PID) is a serious complication of chlamydial infection and may result in infertility in women. A pregnant woman may pass the infection to the newborn during delivery, leading to neonatal problems such as eye infections or pneumonia. Chlamydia can be treated successfully with antibiotics in 95% of cases.

**Cryptorchidism** (krip-TOR-kid-izm) is the failure of the testes to descend into the scrotal sac before birth (Fig. 21-11). The undescended testes often descend later without intervention. If not descended by age 5, treatment may include hormone supplementation. Surgical correction, known as orchiopexy (OR-key-oh-pexy), is possible but may result in reduced fertility.

An **ectopic pregnancy** is one that occurs in an abnormal location in the body. In **ectopic pregnancies**,
Fetal alcohol syndrome (FAS) and fetal alcohol effect (FAE) include a group of physical and mental birth defects that result from damage to the fetus by alcohol consumed by the mother. The alcohol crosses the placenta, and the fetus’s liver is unable to remove it quickly. An estimated 0.5 to 2 of every 1000 live births in the United States involves FAS each year with FAE three times as prevalent. The affected infant is often premature with a smaller head and brain, low birth weight, and unusual facial features of the disorder. In addition to learning and behavior problems, the infant may also suffer seizures and heart defects. No safe level of alcohol consumption by the expectant mother is recommended to prevent this disorder. No cure is available for the affected child. Children affected with FAE and FAS are often placed in programs for children with special needs because of learning and behavioral problems and may need anticonvulsant medication or even brain surgery.

Fibroid tumors or fibromyomas are benign uterine growths found in 50% of women older than 50 years of age. The person may experience bleeding or no symptoms. Treatment may include surgical removal if the tumors cause symptoms.

Genital warts are caused by one type of human papilloma virus called Condyloma acuminatum. According to Planned Parenthood, about 1% of the American population contracts genital warts each year. About two thirds of the people having sexual contact with people who have genital warts develop the wart. Warts on the external genitalia can be treated by surgical removal, freezing (cryotherapy), chemical or electrical burning, or injection of the warts with interferon. Although treatment removes the warts, it does not kill the virus, so they often reappear.

Gonorrhea (gon-er-ee-uh) is a bacterial infection and is one of the most prevalent STIs. According to the NIH, 335,981 new cases were reported in 2007. Because not all cases are reported, it is estimated that the real number may be closer to one million. The most common symptom is painful urination and a white to yellowish green discharge from the urethra. Females often experience no symptoms but may have dysuria or pain in the abdomen. Gonorrhea can lead to sterility and arthritis if untreated. Gonorrhea may result in blindness in infants born to infected mothers. Treatment includes penicillin, but penicillin-resistant strains of gonorrhea are increasing.

Herpes simplex (HER-pree SIM-pleks) virus (HSV-2), or genital herpes, is the most common STI, affecting an estimated 30 million Americans. According to the CDC, 16.2% of people aged 14 to 49 years of age have herpes simplex virus 2. Herpes is caused by a virus that results in blisters, which open into painful sores. Herpes lesions appear in episodes, triggered by factors such as sunlight, friction, emotional stress, and fever. Herpes is spread by sexual contact or secretions from open lesions. Women who have herpes lesions can transfer the virus to their infants during birth, causing mental retardation or death. No cure exists, but new treatment includes an antiviral medication that controls symptoms. In 2009, the National Institute of Allergy and Infectious Diseases (NIAID) and GlaxoSmithKline partnered in a clinical study of the vaccine Herpevec.

Human papilloma virus (HPV) newly infects an estimated six million Americans each year according to the CDC. More than 40 types of HPV have been identified. HPV infection often does not cause visible symptoms. It may appear as genital warts. HPV is the most important risk factor for development of cervical cancer. HPV may be treated by cryotherapy, burning (electrocauterity), injection of interferon, or application of chemicals. Treatment removes the warts but does not eliminate the virus. In 2006 a vaccine to prevent HPV was approved for use in the United States by the FDA. The vaccine prevents infection by four strains of HPV, including the two types that are responsible for 70% of cervical cancer cases. It also blocks other strains of HPV that are responsible for about 90% of genital wart cases.

Klinefelter (KLINE-fel-tur) syndrome is a defect appearing in males who carry an extra chromosome resulting in a karyotype of XXX. Males with this syndrome may develop breast tissue, tall stature, small testicles, below-normal intelligence, and sterility. No treatment is available.

Leukorrhea (loo-ko-REE-uh) is a whitish vaginal discharge. A slight discharge is normal in the menstrual cycle when the ovum is released (ovulation) and just before menstruation (Fig. 21-12). Any change in the color, odor, or character of the discharge may indicate a disorder. An excessive discharge may occur as a result of infection. Leukorrhea may be accompanied by redness, painful urination, or discomfort. Treatment of leukorrhea depends on the cause.

Menses (MEN-stu-uhl) disorders may result from endocrine, metabolic, and nutritional imbalances. Painful menstrual cramping, called dysmenorrhea (dis-men-o-REE-uh), is often due to hormonal imbalance and faulty uterine structure. Excessive bleeding, or menorrhagia (men-o-RAY-gee-uh), or no bleeding, known as amenorrhea (a-men-oh-REE-uh), may also occur. Menorrhagia may occur as a result of benign fibromas of the uterus. Amenorrhea may result from hormone imbalances, structural deformities, weight loss, and excessive exercise. Treatment depends on the severity and cause but may include surgical removal of the uterus in severe cases of menorrhagia.

Orchitis (or-KYE-tis) is an inflammation of the testes usually resulting from STI or urinary tract infection. Men may experience swelling, redness, and pain in the scrotum. Treatment may include elevation of the scrotum, ice packs, and pain-relieving medication.

Pelvic inflammatory disease (PELV-ik in-FLAM-ah-boree) disease (PID) is relatively common, particularly in teenage women. Approximately one million women develop PID each year. Development of PID is usually associated with infection by gonorrhea or chlamydia.
and can become chronic. It affects all the reproductive organs of the pelvis and causes scarring of the fallopian tubes. The woman experiences lower abdominal pain, fever, vaginal discharge, and menstrual disorders. According to the NIAID, an estimated 100,000 women become infertile each year as a result of PID. Ectopic pregnancy may result from damage to the fallopian tubes. Diagnosis can be done rapidly with a biotechnology technique called polymerase chain reaction. Treatment includes antibiotics and sometimes surgery.

**Phimosis** (fib-MO-sis) is a narrowing (stenosis) of the foreskin of the glans penis. Usually caused by infections, phimosis may interfere with urination and cause redness, swelling, pain, and pus formation. Treatment includes antibiotics, soaping, and surgical removal of the foreskin (circumcision).

**Premenstrual** (pre-MEN-struel) (PMDS) is a common collection of up to 150 symptoms occurring 3 to 14 days before the beginning of the bleeding phase (menstrual) cycle of the menstrual cycle. The woman may experience irritability, depression, impaired concentration, headache, and edema (ed-DEE-ma). The symptoms vary greatly and disappear with the menstrual cycle. Several hypotheses have been offered to explain the symptoms of PMDS, including hormonal or biochemical imbalance and poor nutrition. Treatment includes diet modification to eliminate sugar, caffeine, alcohol, nicotine, and processed foods. Vitamin B, calcium, magnesium, and chromium are prescribed in some cases. Exercise and stress-reduction training may also be helpful. Evidence indicates that a brain chemical (serotonin) may affect a severe and disabling form of PMDS called premenstrual dysphoric disorder (PMDD). The FDA has approved three medications for treatment of PMDD.

**Pubic** (PYOO-ik) **lice** are yellow-gray parasites found in the pubic hair. They become dark when engorged with blood. They are usually transmitted sexually, but they can also be spread through clothes and bed linens. They cause itching. Treatment includes medicated shampoo, cream, or lotion to kill the parasites. 

**Sexually transmitted diseases (STD) or infections (STI)** affect men and women of all social and economic backgrounds. More than 30 STDs have been identified. The CDC estimates there are more than 19 million new cases each year, with half in people age 15 to 24. Some common STIs are chlamydia, herpes simplex, HIV, gonorrhea, and syphilis. Other STIs include trichomoniasis, hepatitis B, scabies, AIDS, and pubic lice.

**CASE STUDY 21-4** Your friend tells you that she is taking birth control pills so she will not have to worry about getting human immunodeficiency virus (HIV) and other STIs. What should you say?

**TABLE 21-2**

<table>
<thead>
<tr>
<th>Contraceptive Methods</th>
<th>Effectiveness</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abstinence</td>
<td>100%</td>
<td>Refraining from sexual activities that could result in pregnancy</td>
</tr>
<tr>
<td>Barrier methods</td>
<td>88%</td>
<td>Condoms cover the erect penis to collect sperm entry into uterus</td>
</tr>
<tr>
<td></td>
<td>94%</td>
<td>Diaphragms cover the entrance to the cervix with a soft cap that prevents the sperm from entering; best used with spermicidal jelly; must be individually fitted and checked yearly</td>
</tr>
<tr>
<td>Birth control pills</td>
<td>79%</td>
<td>Spermicidal agents are chemicals in creams, jellies, suppositories, or foams inserted into the vagina before intercourse to kill sperm cells</td>
</tr>
<tr>
<td>Implanon</td>
<td>73%-92%</td>
<td>Cervical cap inserted 1 hour before intercourse, blocking entry of sperm</td>
</tr>
<tr>
<td>IUD</td>
<td>94%</td>
<td>Contain estrogen and progesterone hormones to prevent ovulation or progestrone only to prevent implantation of the ovum; not recommended in some women because of health risk; Depo-Provera developed in 1992 as a synthetic form of progesterone Flexible, plastic implant inserted under the skin of the upper arm; effective for 3 years</td>
</tr>
<tr>
<td>“Natural” methods</td>
<td>60%-75%</td>
<td>Inserted into uterus by doctor; IUD scrapes lining of uterus to prevent implantation of ovum</td>
</tr>
<tr>
<td>Norplant</td>
<td>81%-96%</td>
<td>Rhythm method, or fertility awareness, requires abstinence during ovulation by counting days or checking body temperature</td>
</tr>
<tr>
<td>Ortho Evra</td>
<td>99%</td>
<td>Withdrawal is the removal of the penis before ejaculation Capsules implanted under the skin of the upper arm containing a synthetic progesterone that stops ovulation; effective for 5 years. Still used in developing countries although use discontinued in United States</td>
</tr>
<tr>
<td>RU486</td>
<td>100%</td>
<td>Thin, plastic patch stuck to skin once a week for 3 weeks followed by patch-free week</td>
</tr>
<tr>
<td>Tubal ligation</td>
<td>90.6%</td>
<td>Abortifacient drug (mifepristone) taken orally up to 9 weeks of pregnancy along with prostaglandin, resulting in abortion of fetus 1 to 1.5 weeks later; ban against use lifted in United States in 1993; also used for treatment of breast cancer, endometriosis, glaucoma, and brain tumors</td>
</tr>
<tr>
<td>Vasectomy</td>
<td>98.6%</td>
<td>Surgical cutting of the fallopian tubes of the woman so that the ovum does not reach the uterus; may be reversed in 25% of cases Surgical cutting of the vas deferens of the man so that sperm does not leave the testes; may be reversed in about 50% of cases</td>
</tr>
</tbody>
</table>

**BRUTE BYTE**

The cost of STDs to the U.S. health care system is estimated to be as much as $15.9 billion annually.

**SYPHILIS** (SYF-i-lis) is caused by a spirochete (SPI-ru-ket) bacteria, Treponema pallidum (tree-pon-uh-NAY-muh PAY-luh-dum), and it occurs in three stages. Painless sores, or chancres, first appear 10 to 90 days after infection and disappear in a few weeks in the second stage. The infection spreads into the bloodstream and causes fever, swollen glands, and rash that disappear in 10 to 14 days. Third-stage syphilis may appear years later as the nervous system is damaged, leading to death in one third of untreated cases. Unfortunately, the rate of syphilis infection increased by 11.8% between 2005 and 2006. Syphilis may cause birth defects in the infants of mothers with syphilis. Syphilis can be successfully treated with antibiotics.

**Trichomonas vaginalis** (trik-oh-MON-ahs VAJ-i-nal-ayz) is a parasitic protozoa. The infected person may have no symptoms or may experience a foul-smelling, yellowish-green discharge and odor due to the vulva, urinary frequency, or painful urination (dysuria). Treatment includes oral medication.

**Vaginitis** (vaj-i-NIE-tiss) is a nonspecific infection that may cause a scar, gray, foul-smelling discharge. Treatment includes antibiotics such as ampicillin.

** Yeast infection** is an overgrowth of yeast in the vagina that appears as a curly, cheesy discharge. This infection commonly occurs in women who are diabetic or are taking medication such as antibiotics, steroids, or commercial douches that alter the pH of the vagina. Treatment includes antifungal, or mycotic acid (MY-koe-stat-ik), medication or potassium hydroxide.

**Issues and Innovations**

**Alternatives in Conception**

Technological advances have given people many choices regarding reproduction. Effective birth control methods have been developed to prevent pregnancy (Table 21-2). The United States continues to have a higher rate of teenage pregnancy and abortion than other industrialized countries. The CDC reported a 4.19% rate of pregnancy for mothers aged 15 to 19 in 2006. The effectiveness of contraceptive methods varies a great deal (Fig. 21-13). Abortion remains a controversial moral and legal issue.

**Assisted reproductive technology (ART)** refers to the treatment of sperm and eggs to increase the chance of reproduction. The most common types of ART include in vitro fertilization, in which the egg and sperm are mixed outside of the body and then transferred to the uterus. The first "test tube" infant was born in England in 1978, with hundreds more now living throughout the world. The procedure involves removal of eggs from the ovaries with a small incision. The eggs are incubated and then joined with sperm cells. Some of the fertilized eggs are then implanted by laparoscopy into the uterus of the female who will...
carrying the pregnancy. An ethical concern of this method relates to the status of the unused embryos, which can be frozen and implanted later or discarded. Intracytoplasmic sperm injection is the injection of a single sperm into an egg. The egg is then implanted in the uterus or fallopian tube. Gamete intratranen transfer occurs when eggs are placed in a thin tube with the sperm. The mixture is then injected into the woman's fallopian tube. Zygote intratranen transfer mixes the sperm and eggs outside of the body and then places them in the fallopian tubes. In 2006 about 1% of children born in the United States were conceived by using ART.

The issue of surrogacy has become an ethical and legal concern. In surrogacy the sperm and ovum are artificially fertilized and implanted in a woman who agrees to give the infant to the couple after birth. A fee is usually given to the woman for bearing the child. Surrogate mothering is an alternative for women for whom pregnancy is a health risk or impossibility. In some cases, the woman bearing the child has been reluctant to give the infant to the couple as agreed. Some states have passed laws to make surrogacy illegal.

In 2009 the March of Dimes reported that one of eight infants born in the United States are premature or less than 37 weeks of gestation. With innovations such as the drugs used to replace pulmonary surfactant in the care of premature infants, a fetus can now survive outside the uterus (called viability) at a much younger age, even at less than 20 weeks' gestation.

Surgery has also been successful to correct a defect in a fetus as early as the 21st week of gestation. The fetus is partially removed from the uterus in a procedure similar to a cesarean section and replaced after the surgical correction is completed. "Closed" fetal procedures are more common and use ultrasound to place a needle in the uterus or umbilical cord to treat the fetus. Some closed fetal procedures include transfusion in cases of Rh blood incompatibility, removal of excess lung fluid, administration of heart medication, and clearing urinary system obstructions.

**Infertility**

Infertility is defined as the inability to conceive after 1 year of trying. About one of every 10 women is infertile because of abnormalities in the reproductive system or problems with production of gametes. About one third of cases of infertility are caused by problems in the woman, and another third is caused by the man. The remaining third are unknown or a result of problems in both the man and woman. Factors that increase the risk of infertility include age, smoking, stress, alcohol use, athletic training, weight, and STIs. The tendency of couples to delay childbearing until their late 20s or early 30s may also be a factor.

**Redefining the Sexes**

Changes in family structure and sexual orientation have become more common lifestyle alternatives. These gender roles remain a controversial issue, such as relations between members of the same gender (homosexual) or both genders (bisexual). Transvestites dress in the clothes of the opposite gender. Transgender refers to an individual whose "gender identity" or self-identification is not the same as the "assigned sex" or physical structures.

Some people have surgeries to change their sexual appearance (transsexual). The person who seeks transsexual treatment is given hormones to produce secondary sexual characteristics, such as voice and hair changes and breast tissue growth. Plastic surgery cosmetically changes genital structure. Internal reproductive organs and the genetic makeup of the cells are not changed. Sexual intercourse is possible for the transsexual, but conception is not possible.

**Summary**

- The function of the reproductive system is to produce offspring.
- Reproductive structures of the man include the testes, prostate gland, penis, ejaculatory duct, and seminal vesicle.
- Reproductive structures of the woman include the ovaries, fallopian tubes, vagina, uterus, and cervix.
- Methods to assess the reproductive system include self-examination, mammography, cystoscopy, and chorionic villus sampling.
- Growth and development of the neonate changes rapidly after birth and occur in spurts throughout the lifespan.
- Disorders of the reproductive system include STDs, cancers, ectopic pregnancies, erythroblastosis fetalis, and fetal alcohol syndrome.

**Review Questions**

1. Describe the function of the reproductive system.
2. Describe the location and function of each of the following parts of the reproductive system: cervix, fallopian tube, ovary, penis, uterus, vagina.
3. Describe three reproductive system disorders that are caused by a pathogen.
4. Describe three methods used to assess the reproductive system.
5. Differentiate between the effectiveness of three methods of contraception.
6. Describe three methods of assisted reproductive technology and the circumstances that might lead to the choice of each method.
7. Describe the development of the newborn from conception to neonate.
8. Use the following terms in one or more sentences that correctly relate their meaning: conception, fertility, gestation, and intercourse.

**Explore the Web**

**HPV Vaccine**

CDC

http://www.cdc.gov/std/STDFact-HPV-vaccine-fact.html

**Sexually Transmitted Infections**

NIH

http://www5.niaid.nih.gov/topics/stds/

**Critical Thinking**

1. Investigate and compare the cost of at least three tests used in diagnosing disorders of the reproductive system.