Reproductive Systems Handout

Cryptorchidism: When the testes do not descend, the condition is called ‘cryptorchidism’. The condition occurs in about 3% of full-term infants and about 30% of premature infants. Untreated cryptorchidism on both sides results in sterility because the cells involved in the initial development of sperm are destroyed by the higher temperature of the pelvic cavity. The chance of testicular cancer is 3-50 times greater in cryptorchid testes. The testes of about 80% of boys with cryptorchidism will descend spontaneously during the first year of life. When the testes remain undescended, injection of human chorionic gonatotropin (hCG) given at 2-5 years of age may stimulate descent. If such hormonal treatment is unsuccessful, the condition can be corrected surgically at about age 5.

Vasectomy: The principal method for sterilization of males is a vasectomy, in which a portion of each ductus deferens (vas deferens) is removed. It is a relatively uncomplicated procedure and usually is done under local anesthesia. An incision is made in the posterior side of the scrotum, the ducts are located and cut, each is tied in two places, and the portion between the ties is removed. Although sperm production continues in the testes, sperm cannot reach the exterior because the ducts are cut. The sperm degenerate and are destroyed by phagocytosis. Since the blood vessels are not cut and testosterone level in the blood remains normal, vasectomy has no effect on sexual desire and performance. If done correctly, it is close to 100% effective. The procedure can be reversed, but the chance of regaining fertility is only 30-40%.

Inguinal Hernias: The inguinal area is a weak area in the abdominal wall. It often is the site of an inguinal hernia – a rupture or separation of a portion of the inguinal area of the abdominal wall resulting in the protrusion of a part of the small intestine. In an indirect inguinal hernia a part of the small intestine protrudes through the deep inguinal ring and enters the inguinal canal. It can then pass through the superficial inguinal ring and down into the scrotum. In a direct inguinal hernia, a portion of the small intestine pushes into the posterior wall of the inguinal canal and usually causes a localized bulging in the wall of the canal. Inguinal hernias are much more common in males than in females because the inguinal canals in males are larger and represent weak points in the abdominal wall.

Prostate Cancer: Prostate cancer is the leading cause of death from cancer in men in the United States (having surpassed lung cancer in 1991). In 1995 about 200,000 U.S. men were diagnosed and 40,000 died. A blood test can measure the level of prostate-specific antigen (PSA) in the blood. This substances is an enzyme produced only by prostate epithelial cells. The amount of PSA increases with enlargement of the prostate gland and may indicate infection, benign enlargement, or prostate cancer. For males over 40, the American Cancer Society recommends annual examination of the prostate gland by a digital rectal exam, in which the physician palpates the gland through the rectum with the fingers (digits). Many physicians also recommend an annual PSA test for males over 50. A procedure called transrectal ultrasonography, in which a rectal probe is used to image the prostate gland, can detect tumors as small as a grain of rice. Treatment for prostate cancer may involve surgery, radiation, hormonal therapy, and chemotherapy. Because many prostate cancers grow very slowly, some urologists recommend ‘watchful waiting’ before treating small tumors in men over 70.

Semen Analysis: Semen analysis is a valuable test for evaluating male fertility. It is used to determine if sterility is related to sperm production and, after vasectomy, to check that sperm are absent. Among the factors analyzed are the following:
1)Volume: A low volume might suggest an anatomical or functional defect or inflammation.
2)Motility: In a normal semen sample at least 60% of the sperm should show good forward motility within the first 3 hours after collecting the specimen.
3)Count: Sperm counts below 20 million/ml could indicate sterility. Counts of 20-40 million/ml are borderline normal.
4)Liquefaction: Delayed liquefaction of more than 2 hours suggests inflammation of accessory sex glands or enzyme defects in the secretory products of the glands.
5)Morphology: No more than 30-35% of sperm should have abnormal shapes. (poorly formed head or tail)
6)pH: Normal is pH 7.2-7.7. A pH below 7.0 indicates semen that contains primarily prostatic fluid, which may be due to congenital lack of seminal vesicle formation.

7)Fructose: This sugar is present in a normal ejaculate. Its absence indicates obstruction or congenital absence of the ejaculatory ducts or seminal vesicles.

A normal semen analysis does not guarantee fertility. On the other hand, the absence of sperm and zero motility are the only definitive signs of sterility.

**Male Puberty**: Male puberty begins about age 10-11 years and ends at age 15-17. During the prepubertal years, plasma levels of LH, FSH, and testosterone are low. Around age six or seven, a prepubertal growth spurt occurs that is probably related to secretion of adrenal androgens and human growth hormone (hGH). Sleep-associated increases in LH and, to a lesser extent, FSH signal the onset of puberty. As puberty advances, elevated LH and FSH levels are present throughout the day and are accompanied by increased levels of testosterone. The rises in LH and FSH are believed to result from increased GnRH secretion and enhanced responsiveness of the anterior pituitary gland to GnRH. With sexual maturity, the hypothalamic-pituitary system becomes less sensitive to the feedback inhibition of testosterone on LH and FSH secretion. The changes in the testes that occur during puberty include maturation of sustentacular (Sertoli) cells and initiation of spermatogenesis. The anatomical and functional changes associated with puberty are the result of increased testosterone secretion. Usually, the first sign is enlargement of the testes. About a year later, the penis increases in size. The prostate gland, seminal vesicles, bulbourethral glands, and epididymides increase in size over a period of several years. Development of masculine secondary sex characteristics occurs and a growth spurt takes place as elevated testosterone levels increase both bone and muscle growth.

**Testicular Cancer**: Testicular cancer occurs most often between the ages of 15 and 34 and is one of the most common cancers seen in young males. Although the cause is unknown, the condition is more prevalent in males who have a history of cryptorchidism. Most testicular cancers arise from the sperm-producing cells. An early sign of testicular cancer is a mass in the testis, often associated with pain or discomfort. All males should perform regular testicular self-exams. Treatment involves removal of the affected testis.

**Prostate Disorders**: Because the prostate surrounds a portion of the urethra, any infection, enlargement, or tumor can obstruct the flow of urine. Prolonged obstruction may result in serious changes in the urinary bladder, ureters, and kidneys and may perpetuate urinary tract infections. One treatment consists of widening a narrowed urethra with a balloon catheter (balloon urethroplasty). If the obstruction cannot be relieved by other means, the gland may be partially or completely removed. The surgical procedure is called prostatectomy. Acute and chronic infections of the prostate gland are common in postpubescent males, often in association with inflammation of the urethra. In acute prostatitis, the prostate gland becomes swollen and tender. Appropriate antibiotic therapy, bed rest, and above-normal fluid intake are effective treatment. Chronic prostatitis is one of the most common chronic infections in men of the middle and later years. On examination, the prostate gland feels enlarged, soft, and very tender, and its surface outline is irregular. When bacteria are present, treatment is with long-term antibiotics. Often, however, bacteria cannot be detected in the urinary tract, and the symptoms do not resolve with antibiotic therapy. Such cases may be an autoimmune disorder.

An enlarged prostate gland, two to four times the normal size, occurs in approximately one-third of all males over age 60. The condition is called benign prostatic hyperplasia (BPH) and is characterized by nocturia (bed-wetting), hesitancy in urination, decreased force of urinary stream, postvoiding dribbling, and a sensation of incomplete emptying. Surgical correction is possible by a procedure called transurethral resection of the prostate (TURP), in which pieces of the gland are removed using a special cystoscope inserted into the urethra. Both benign and malignant growths are common in elderly men. Both types of tumors put pressure on the urethra, making urination painful and difficult. Therefore, even when the tumor is benign, surgery may be needed.
**Ovarian Cancer:** Ovarian cancer is the sixth most common form of cancer in females and is the leading cause of death from all gynecological malignancies (excluding breast cancer). This is because it is difficult to detect before it metastasizes (spreads) beyond the ovaries. Risk factors associated with ovarian cancer include age (usually over 50); race (Caucasians are at highest risk); family history of ovarian cancer; more than 40 years of active ovulation; nulliparity (never having had children) or first pregnancy after age 30; high-fat, low-fiber, vitamin A deficient diet; and prolonged exposure to asbestos and talc. Early ovarian cancer has no symptoms or only mild ones associated with other common problems, such as abdominal discomfort, heartburn, nausea, loss of appetite, bloating, and flatulence. Later-stage signs and symptoms include an enlarged abdomen, abdominal and/or pelvic pain, persistent gastrointestinal disturbances, urinary complications, menstrual irregularities, and heavy menstrual bleeding.

**Pap Smear:** Early diagnosis of cancer of the cervix of the uterus is accomplished by a Pap smear (Papanicolaou test). A few cells are removed from the part of the vagina surrounding the cervix and the cervix itself and examined microscopically. Malignant cells have a characteristic appearance and indicate an early stage of cancer, even before symptoms occur.

**Uterine Prolapse:** A condition called uterine prolapse may result from weakening of supporting ligaments and pelvic musculature associated with age or disease, traumatic vaginal delivery, chronic straining from coughing or difficult bowel movements, or pelvic tumors. The prolapse may be characterized as first degree (mild), in which the cervix remains within the vagina; second degree (marked), in which the cervix protrudes to the exterior through the vagina; and third degree (complete), in which the entire uterus is outside the vagina. Depending on the degree of prolapse, treatment may involve pelvic exercises, dieting if a patient is overweight, stool softeners to minimize straining during defecation, pessary therapy (placement of a rubber device around the uterine cervix that helps prop up the uterus), and surgery.

**Colposcopy:** Colposcopy is a procedure used to evaluate the status of the mucosa of the vagina and cervix. It is often the first test done after an abnormal Pap smear. Colposcopy is the direct examination of vaginal and cervical mucosa with a low-power binocular microscope called a colposcope that magnifies the mucous membrane 6-40 times its actual size. The application of 3% solution of acetic acid removes mucus and enhances the appearance of mucosal epithelium.

**Hysterectomy:** Hysterectomy refers to surgical removal of the uterus and is the most common gynecological operation. It may be indicated in conditions such as fibroid tumors, endometriosis, pelvic inflammatory disease, recurrent ovarian cysts, excessive uterine bleeding, uterine prolapse, and cancer of the cervix, uterus, or ovaries. The traditional operation to remove the uterus was through an abdominal incision (abdominal hysterectomy). Recently, many have been performed by inserting instruments into the vagina and pulling excised sections out through the vagina, without the need for an abdominal incision (vaginal hysterectomy). A complete hysterectomy is the removal of the body and cervix of the uterus. In a partial or subtotal hysterectomy, the body of the uterus is removed but the cervix is left in place. A radical hysterectomy includes removal of the body and cervix of the uterus, uterine tubes, possibly the ovaries, superior portion of the vagina, pelvic lymph nodes, and supporting structures, such as ligaments.

**Episiotomy:** During childbirth, the emerging fetus stretches the perineal region. To prevent undue stretching and even tearing of this region, a physician sometimes performs an episiotomy, a perineal cut made with surgical scissors. This cut enlarges the vaginal opening to make room for the fetus to pass. In effect, a controlled cut is substituted for a jagged, uncontrolled tear. The incision is closed in layers with a continuous suture that is absorbed within a few weeks, so that stitches do not have to be removed.
**Signs of Ovulation**: One sign of ovulation is an increase in basal temperature (body temperature at rest). A 0.4° to 0.6°F increase in temperature typically occurs about 14 days after the start of the menstrual cycle and is due to a small increase in progesterone just before ovulation. The 24 hours following this rise in temperature is the period immediately after ovulation and is the best time to have intercourse if pregnancy is desired. Another sign of ovulation is the amount and consistence of cervical mucus. Secretion of cervical mucus is regulated by estrogens and progesterone. At midcycle, near the time of ovulation, increasing levels of estrogens cause secretory cells of the cervix to produce large amounts of cervical mucus. As ovulation approaches, the mucus becomes clear and very stretchy. This type of mucus indicates the time of greatest fertility. The cervix also exhibits signs of ovulation. The external os dilates slightly, the cervix rises, and the cervix becomes softer. Some women also experience a pain in the area of one or both ovaries around the time of ovulation. Such pain is called mittelschmerz, meaning ‘pain in the middle’, and may last from several hours to a day or two.

**Ectopic Pregnancy**: Ectopic pregnancy refers to the development of an embryo or fetus outside the uterine cavity. Most occur in the uterine (Fallopian) tube, usually in the ampullar and infundibular portions. Some occur in the abdominal cavity or uterine cervix. Tubal pregnancies usually occur because passage of the fertilized ovum through the uterine tube is impaired. The cause may be decreased motility of the uterine tube smooth muscle or abnormal anatomy. In comparison with nonsmokers, women who smoke and become pregnant are twice as likely to have an ectopic pregnancy. It is thought that the nicotine in cigarette smoke paralyzes the cilia in the lining of the uterine tube as it does in the respiratory passageways. Scars from pelvic inflammatory disease (PID), previous uterine tube pregnancy surgery, and previous ectopic pregnancy may hinder movement of the fertilized ovum. Other causes include repeated elective abortions, pelvic tumors, and developmental abnormalities. Ectopic pregnancy may be characterized by one or two missed menstrual cycles followed by bleeding and acute abdominal and pelvic pain. Unless removed, the developing embryo can rupture the tube, often resulting in death of the mother.

**Female Puberty and Menarche**: In girls, prepubertal levels of LH, FSH, and estrogen are low. Around age seven or eight, girls experience an increase in the secretion of adrenal androgens (adrenarche), which are responsible for the eventual growth of pubic and axillary hair. The onset of puberty is signaled by sleep-associated increases in LH and FSH. As puberty progresses, the increases in LH and FSH are sustained throughout the day. The rising levels stimulate the ovaries to secrete estrogens, which are responsible for the development of feminine secondary sexual characteristics. At birth, both male and female mammary glands are poorly developed and appear as slight elevations on the chest. With the onset of puberty, under the influence of estrogens and progesterone, the female breasts begin to develop. Budding of the breasts is the first outward sign of puberty. The duct system matures, fat deposition occurs, and the areola and nipple grow and become more pigmented. Further mammary gland development occurs at reproductive maturity with the onset of ovulation and the formation of the corpus luteum, which leads to higher levels of estrogens and progesterone. Estrogens and progesterone also stimulate the growth of the uterine tubes, uterus, and vagina. Menarche, the first menses, occurs at an average of 12 years of age. The female must have a minimum amount of body fat to begin and maintain a normal menstrual cycle.

**Morning Sickness**: In the early months of pregnancy, morning sickness (emesis gravidarum) may occur, characterized by episodes of nausea and possibly vomiting that are most likely to occur in the morning. The cause is unknown, but the high levels of human chorionic gonadotropin (hCG) secreted by the placenta and progesterone secreted by the ovaries have been implicated. In some women the severity of these symptoms requires hospitalization for intravenous feeding, and the condition is then known as hyperemesis gravidarum.
Menopause and Age-Related Changes in Older Females: Menopause refers to the permanent cessation of menses. Between the ages of 40 and 50 the ovaries become less responsive to the stimulation of gonadotropic hormones from the anterior pituitary gland. As a result, estrogen and progesterone production decline, and follicles do not undergo normal development. Changes in GnRH release patterns and decreased responsiveness to it by cells of the anterior pituitary gland that secrete LH also contribute to the onset of menopause. Some women experience hot flashes, copious sweating, headache, hair loss, muscular pains, vaginal dryness, insomnia, depression, weight gain, and mood swings. In the postmenopausal woman there will be some atrophy of the ovaries, uterine tubes, uterus, vagina, external genitalia, and breasts. Osteoporosis is also associated with a diminished level of estrogens. Sexual desire (libido) does not show a parallel decline due to continued production of adrenal androgens. The female reproductive system has a time-limited span of fertility between menarche and menopause. Fertility declines with age, possibly as result of less frequent ovulation and the declining ability of the uterine (Fallopian) tubes and uterus to support the young embryo. Uterine cancer peaks at about 65 years of age, but cervical cancer is more common in younger women.

Fertility and Body Fat: Body fat has a regulatory role in reproduction, especially in females. To begin and maintain a normal reproductive cycle, a female must have a minimum amount of body fat. A moderate loss of fat, from 10-15% below normal weight for height, may delay the onset of menstruation (menarche), inhibit ovulation during the reproductive cycle, or induce the cessation of menstruation (amenorrhea). Both dieting and intensive exercise may reduce body fat below the minimum amount and lead to infertility. The resulting infertility is reversible following weight gain or reduction of intensive exercise or both. It appears that in underweight or very lean females, the secretion of gonadotropin releasing hormone (GnRH) by the hypothalamus is abnormal in quantity and timing. The result is abnormally low levels of follicle-stimulating hormone (FSH) and luteinizing hormone (LH). Since these hormones are deficient, ovarian follicles fail to develop normally and there is little secretion of progesterone and estrogens. The same hormonal deficiencies that cause infertility in underweight or athletic females also provide a degree of protection against cancers that are sensitive to estrogens, such as breast cancer, although the reason is not known. Studies of very obese females also indicate that they, like very lean ones, experience problems with amenorrhea and infertility. Males also experience problems related to reproduction in response to under nutrition and weight loss. For example, they produce less prostatic fluid and reduced numbers of sperm with decreased motility.

Early Pregnancy Tests: Early pregnancy tests detect tiny amounts of human chorionic gonadotropic (hCG) in the urine. HCG starts to be released about 8 days after fertilization. The test kits can detect pregnancy as early as the first day of a missed menstrual period, that is, at about 14 days after fertilization. All kits include antibodies to hCG and other chemicals that produce a color change if there is a reaction between hCG in the urine and the hCG antibody in the test kit. Several of the test kits available at pharmacies are as sensitive and accurate as test methods used in many hospitals. Still, false-negative and false-positive results can occur. A false-negative result (test is negative, but the female is pregnant) may be due to excess protein or blood in urine or hCG production due to a rare type of uterine cancer. Thiazide diuretics, hormones, steroids, and thyroid drugs may also affect the outcome of an early pregnancy test.

Chorionic Villi Sampling: Chorionic villi sampling can determine the same defects as amniocentesis because chorion cells and fetal cells contain the same genome. Moreover, CVS offers several advantages over amniocentesis. It can be performed as early as 8 weeks of gestation and test results are available in a few days, which permit an earlier decision on whether or not to continue the pregnancy. In addition, the procedure does not require penetration of the abdomen, uterus, or amniotic cavity by a needle. However, the procedure is slightly more risky than amniocentesis; there is a 1-2% chance of spontaneous abortion after the test. During CVS, a catheter is placed through the vagina and cervix of the uterus and then advanced to the chorionic villi under ultrasound guidance. About 30 mg of tissue are suctioned out and prepared for chromosomal analysis.
**Breast Cancer:** One in nine American women faces the prospect of breast cancer. After lung cancer, it is the second-leading cause of death from cancer in U.S. women but seldom occurs in men. In females, breast cancer is rarely seen before age 30, and its occurrence rises rapidly after menopause. Breast cancer is generally not painful until it becomes quite advanced, so often it is not discovered early or, if noted, is ignored. Any lump, no matter how small, should be reported to a physician at once. Early detection – by breast self-examination and mammograms – is the best way to increase the chance of survival.

**Risk Factors:** Among the factors that increase the risk of breast cancer development are (1) a family history of breast cancer, especially in a mother or sister; (2) never having a child or having a first child after age 34; (3) previous cancer in one breast; (4) exposure to ionizing radiation, such as x-rays; (5) excessive fat and alcohol intake; and (6) cigarette smoking. Recent studies in the United States show that modern, low-dose birth control pills do not increase a woman’s risk of developing breast cancer. An estimated 5% of the 180,000 cases diagnosed each year in the United States, particularly those that arise in younger women, stem from inherited genetic mutations (changes in the DNA). Two genes that increase susceptibility to breast cancer now have been identified – BRCA1 (breast cancer 1), mapped to chromosome 17 in 1990 and BRCA2, mapped to chromosome 13 in 1994. Mutation of BRCA1 (but not BRCA2) also confers high risk for ovarian cancer. In addition, mutations of the p53 gene increase the risk of breast cancer in both males and females and mutations of the androgen receptor gene are associated with occurrence of breast cancer in some males.

**Detection:** The most effective technique for detecting tumors less than 1 cm (about ½ in.) in diameter is mammography. It is a type of radiography using very sensitive x-ray film. The image of the breast, called a mammogram, is obtained by placing the breasts, one at a time, on a flat surface and using a flat plate to compress the breast for better imaging. A supplementary procedure for evaluating breast abnormalities is ultrasound. Although ultrasound cannot detect tumors less than 1 cm. in diameter, it can be used to determine whether a lump is a benign, fluid-filled cyst or a solid and therefore possibly malignant tumor.

The American Cancer Society recommends the following steps to help detect breast cancer as early as possible:

1. A mammogram should be taken between the ages of 35 and 39, to be used later for comparison (baseline mammogram).
2. A physician should examine the breasts every 3 years when a female is between the ages of 20 and 40, and every year after age 40.
3. Females with no symptoms should have a mammogram every year or two between ages 40 and 49, and every year after 50.
4. Females of any age with a history of breast cancer or a strong family history of the disease, or other risk factors such as smoking should consult a physician to determine a schedule for mammography.
5. All females over age 30 should develop the habit of monthly breast self-examination. Each month after the menstrual period, or on the same day each month in women who are not menstruating, the breasts should be thoroughly examined for lumps, puckering of the skin, and nipple retraction or discharge.

**Treatment:** Treatment for breast cancer may involve hormone therapy, chemotherapy, radiation therapy, lumpectomy (removal of just the tumor and immediate surrounding tissue), a modified or radical mastectomy, or a combination of these. A radical mastectomy involves removal of the affected breast along with the underlying pectoral muscles and the axillary lymph nodes. Lymph nodes are removed because metastasis of cancerous cells is usually through lymphatics or blood vessels. Radiation treatment and chemotherapy may follow the surgery to ensure the destruction of any stray cancer cells. By using artificial implants, skin, fat, and muscles from other parts of the body, the breast can be reconstructed after a radical mastectomy. Using these techniques, it is possible to reconstruct a natural-looking breast.
Amniocentesis: Amniocentesis involves withdrawing some of the amniotic fluid that bathes the developing fetus and analyzing the fetal cells and dissolved substances. It is used to test for the presence of certain genetic disorders, such as Down syndrome (DS), spina bifida, hemophilia, Tay-Sachs disease, sickle-cell anemia, and certain muscular dystrophies, or to determine fetal maturity and well-being near the time of delivery. To detect suspected genetic abnormalities, the test is usually done at 14-16 weeks of gestation. To assess fetal maturity, it is usually done after the 35th week of gestation. About 300 chromosomal disorders and over 50 biochemical defects can be detected through amniocentesis. It can also reveal gender. This information is important for diagnosis of sex-linked disorders, in which an abnormal gene is carried by the mother but affects only her male offspring. If the fetus is female, it will not be afflicted unless the father also carries the defective gene. During amniocentesis, the position of the fetus and placenta is first determined using ultrasound and palpation. After the skin is prepared with an antiseptic, a local anesthetic is given, a hypodermic needle is inserted through the mother’s abdominal wall and uterus into the amniotic cavity, and about 10 ml of fluid are aspirated. The fluid and suspended cells are subjected to microscopic examination and biochemical testing. Elevated levels of alpha-fetal protein (AFP) and acetylcholinesterase may indicate failure of the nervous system to develop properly, for example, anencephaly (absence of the cerebrum) or spina bifida. Chromosomal studies, which require growing the cells for 2-4 weeks in a culture medium, may reveal rearranged, missing, or extra chromosomes. There is about 0.5% chance of spontaneous abortion after the test.

Birth Control Methods:
Although there is no single, ideal method of birth control, several methods are available, each with advantages and disadvantages. The methods discussed here are sterilization, hormonal, intrauterine, barrier, chemical, physiological, coitus interruptus (withdrawal), and induced abortion.

Sterilization: One means of sterilization of males is vasectomy. Sterilization in females most often is achieved by performing a tubal ligation, in which the uterine tubes are tied closed and then cut. Thus the secondary oocyte cannot pass to the uterus and sperm cannot reach the oocyte.

Hormonal Methods: By adjusting hormone levels, it is possible to interfere with production of gametes (sperm and ova) or implantation of a fertilized ovum in the uterus. This may be accomplished by use of oral contraceptives (‘the pill’). The pills used most often contain a higher concentration of a progestin (similar to progesterone) and a lower concentration of estrogens (combination pill). These two hormones act via negative feedback on the anterior pituitary gland to decrease the secretion of FSH and LH and on the hypothalamus to inhibit secretion of GnRH. The low levels of FSH and LH usually prevent both follicular development and ovulation; thus pregnancy cannot occur because there’s no secondary oocyte to fertilize. Even if ovulation does occur, as it does in some cases, oral contraceptives also alter cervical mucus so that it is more hostile to sperm. Among the noncontraceptive benefits of oral contraceptives are regulation of the length of menstrual cycles, decreased menstrual flow (and therefore decreased risk of anemia), and prevention of ovarian cysts. The pill also provides protection against endometrial and ovarian cancers. Oral contraceptives may not be advised for women with a history of thromboembolic disorders (predisposition to blood clotting), cerebral blood vessel damage, hypertension, liver malfunction, or heart disease. Women who take the pill and smoke face far higher odds of having a heart attack or stroke than do nonsmoking pill users. Smokers should quit or use an alternative method of birth control. Oral contraceptives do not provide any protection against sexually transmitted diseases. If daily pill-taking is not desired, a woman may opt for Norplant or Depo-provera, two other hormonal methods of contraception. Norplant is six slender hormone-containing capsules that are surgically implanted under the skin of the arm using local anesthesia. They slowly and continually release progestin, which inhibits ovulation and thickens the cervical mucus. The effects last for 5 years, and Norplant is as reliable as sterilization (less than 1% failure rate). Removing the Norplant capsules restores fertility. Over a 5-year period Norplant is less expensive than most birth control pills. Depo-provera is given as an intramuscular injection once every 3 months. It contains a hormone similar to progesterone that prevents maturation of the ovum and causes changes in the uterine lining that make it less likely for pregnancy to occur. The quest for an efficient male oral contraceptive has been disappointing. The challenge is to find substances that will block production of functional sperm without disrupting the ability to have an erection.
Intrauterine Devices: An intrauterine device (IUD) is a small object made of plastic, copper, or stainless steel that is inserted into the cavity of the uterus. IUDs cause changes in the uterine lining that block implantation of a fertilized ovum. The dangers associated with the use of IUDs in some females include pelvic inflammatory disease, infertility, excessive menstrual bleeding, and pain. Females in monogamous (single-partner) relationships have a lower risk of developing PID and recent research discounts IUDs as a cause of PID.

Barrier Methods: Barrier methods are designed to prevent sperm from gaining access to the uterine cavity and uterine tubes. Among the barrier methods are use of a condom, vaginal pouch, diaphragm, or cervical cap.

- The condom is a nonporous, elastic (latex or similar material) covering placed over the penis that prevents deposition of sperm in the female reproductive tract. The vaginal pouch, sometimes called a female condom, is made of two flexible rings connected by a polyurethane sheath. One ring lies inside the sheath and is inserted to fit over the cervix. The other ring remains outside the vagina and covers the female external genitals. Proper use of condoms with each act of sexual intercourse, especially when used with a spermicide (sperm-killing chemical), is a fairly reliable method of birth control. Condom use also greatly reduces, but does not eliminate, the risk of acquiring a sexually transmitted disease (STD) such as AIDS or gonorrhea. Even when used properly, male or female condoms fail to protect against pregnancy and disease transmission 10-20% of the time.

- The diaphragm is a rubber dome-shaped structure that fits over the cervix and is used together with a spermicide. The diaphragm stops the sperm from passing into the cervix. The chemical kills the sperm cells. Toxic shock syndrome (TSS) and recurrent urinary tract infections are associated with diaphragm use in some females, and a diaphragm does not protect against STD’s.

- The cervical cap is a thimble-shaped contraceptive device made of latex or plastic that measures about 4 cm (1 ½ in.) in diameter. It fits snugly over the cervix of the uterus and is held in position by suction. Like the diaphragm, the cervical cap is used with a spermicide. Both the diaphragm and the cervical cap must be fitted initially by a health-care provider. Advantages of the cervical cap in comparison to the diaphragm are (1) the cap can be worn up to 48 hours versus 24 hours for the diaphragm, and (2) since the cap fits tightly and rarely leaks, it is not necessary to reintroduce spermicide before intercourse. The cervical cap is not recommended for females with known or suspected cervical or uterine malignancies and current vaginal or cervical infections, and it also does not protect against STD’s.

Chemical Methods: Chemical methods of contraception are spermicidal agents. Various foams, creams, jellies, suppositories, and douches that contain spermicidal agents make the vagina and cervix unfavorable for sperm survival and are available without prescription. The most widely used spermicide is nonoxynol-9, which kills sperm by disrupting the plasma membrane. It also kills the AIDS virus and decreases the incidence of chlamydia and gonorrhea. A spermicide is most effective when used with a diaphragm or condom.

Physiological Methods: Physiological methods are based on knowledge of certain physiological changes that occur during the menstrual cycle. In females with normal and regular menstrual cycles these events help to predict on which day ovulation is likely to occur. Physiological methods are used both for birth control and for increasing the chance of becoming pregnant.

The first physiological method, developed in the 1930’s, is known as the rhythm method. It takes advantage of the fact that a secondary oocyte is fertilizable for only 24 hours and is available for only 3-5 days in each menstrual cycle. During this time, the couple refrains from intercourse (3 days before ovulation, the day of ovulation, and 3 days after ovulation). The effectiveness of the rhythm method for birth control is poor because few women have absolutely regular cycles.

Another natural family planning system, developed during the 1950’s and 1960’s, is the symptom-thermal method. According to this method, couples are instructed to know and understand certain signs of fertility and infertility. Recall that the signs of ovulation include increased basal body temperature; the production of clear, stretchy cervical mucus; abundant cervical mucus; and pain associated with ovulation (mittelschmerz). If the couple refrains from sexual intercourse when the signs of ovulation are present, the chance of pregnancy is decreased.
**Coitus Interruptus (Withdrawal):** Coitus interruptus refers to withdrawal of the penis from the vagina just before ejaculation. Failures with this method are due to either failure to withdraw before ejaculation or pre-ejaculatory emission of sperm-containing fluid from the urethra. In addition, this method offers no protection against transmission of STDs.

**Induced Abortion:** Abortion refers to the premature expulsion from the uterus of the products of conception, usually before the 20th week of pregnancy. An abortion may be spontaneous (naturally occurring), sometimes called a miscarriage, or induced (intentionally performed). When birth control methods are not used or fail to prevent an unwanted pregnancy, induced abortion may be performed. Induced abortions may involve vacuum aspiration (suction), infusion of a saline solution, or surgical evacuation (scraping). Certain drugs, most notable the French drug RU-486, can induce abortion, a so-called nonsurgical abortion. **RU-486 (mifepristone)** is an antiprogestin; it blocks the action of progesterone. Progesterone prepares the uterine endometrium for implantation and then maintains the uterine lining after implantation. If progesterone levels fall during pregnancy or if the action of the hormone is blocked, menstruation occurs, and the embryo is sloughed off along with the uterine lining. RU-486 occupies the endometrial receptor sites for progesterone. In effect, it blocks the action of progesterone on the endometrium. Within 12 hours the endometrium starts to degenerate and then begins to slough off within 72 hours. Prostaglandin, which stimulates uterine contractions is given after RU-486 to aid in expulsion of the endometrium. RU-486 can be taken up to 5 weeks after conception. One side effect of the drug is uterine bleeding. RU-486 is being tested in clinical trials in the United States and has been used for several years in France, Sweden, the United Kingdom, and China.

**Female Disorders:**

**Menstrual Abnormalities:** Because menstruation reflects not only the health of the uterus but also the health of the endocrine glands that control it, the ovaries, anterior pituitary, and hypothalamus, disorders of the female reproductive system often involve menstrual disorders.

**Amenorrhea** is the absence of menstruation. If a woman has never menstruated, the condition is called primary amenorrhea. Primary amenorrhea can be caused by endocrine disorders, most often in the pituitary gland and hypothalamus, or by a genetically caused abnormal development of the ovaries or uterus. Secondary amenorrhea, the skipping of one or more periods, is commonly experienced by women at some time during their lives. Changes in body weight often cause amenorrhea. Either obesity or extreme weight loss, such as occurs in anorexia nervosa, can disturb ovarian function and cause amenorrhea. Amenorrhea may also be associated with very low body fat level, as sometimes occurs during rigorous athletic training. When amenorrhea is unrelated to weight, analysis of levels of estrogens often reveals deficiencies of pituitary and ovarian hormones.

**Dysmenorrhea** refers to pain associated with menstruation and is usually reserved to describe an individual with menstrual symptoms that are severe enough to prevent her from functioning normally for one or more days each month. Primary dysmenorrhea is painful menstruation with no detectable organic disease. Besides pain, other signs and symptoms may include headache, nausea, diarrhea or constipation, and urinary frequency. The pain of primary dysmenorrhea is thought to result from uterine contractions, probably associated with uterine muscle ischemia and prostaglandins produced by the uterus. Primary dysmenorrhea is less of a problem after pregnancy and vaginal delivery, perhaps because of enlargement of the cervical canal. Drugs that inhibit prostaglandin synthesis (naproxen and ibuprofen) are used to treat primary dysmenorrhea.

Secondary dysmenorrhea is painful menstruation that is frequently associated with a pelvic pathology. Some cases are caused by uterine tumors, ovarian cysts, pelvic inflammatory disease, endometriosis, and intrauterine devices (IUDs). Treatment is aimed at correcting the underlying cause.

Abnormal uterine bleeding includes menstruation of excessive duration or excessive amount, diminished menstrual flow, too frequent menstruation, intermenstrual bleeding, and postmenopausal bleeding. These abnormalities may be caused by disordered hormonal regulation, emotional factors, fibroid tumors of the uterus, and systemic diseases.
**Endometriosis**: Endometriosis is characterized by the growth of endometrial tissue outside the uterus. The tissue enters the pelvic cavity via the open uterine tubes and may be found in any of several sites – on the ovaries, rectouterine pouch, outer surface of the uterus, sigmoid colon, pelvic and abdominal lymph nodes, cervix, abdominal wall, kidneys, and urinary bladder. One theory for the development of endometriosis is that there is regurgitation of menstrual flow through the uterine tubes. Endometriosis is common in women 25-40 years of age who have not had children. Symptoms include premenstrual pain or unusual menstrual pain. The unusual pain is caused by the displaced tissue sloughing off at the same time the normal uterine endometrium is being shed during menstruation. Infertility can be a consequence. Treatment usually consists of hormone therapy, modified GnRH (nafarelin), videolaseroscopy (laparoscope with camera and laser), or conventional surgery. Endometriosis disappears at menopause or when the ovaries are removed.

**Sexually Transmitted Diseases**: The general term sexually transmitted disease (STD) is applied to any of the large group of diseases that can be spread by sexual contact. The group includes conditions traditionally specified as venereal diseases (VD), such as chlamydia, gonorrhea, syphilis, and genital herpes. In most developed countries of the world, such as those of the European community, Japan, Australia, and New Zealand, the incidence of STDs has declined markedly during the past 20 years. In the United States by contrast, STDs have been rising to near epidemic proportions, especially among urban populations. AIDS and hepatitis are sexually transmitted diseases that also may be contracted in other ways.

**Chlamydia**: Chlamydia is a sexually transmitted disease caused by the bacterium Chlamydia trachomatis. This unusual bacterium cannot reproduce outside body cells; it ‘cloaks’ itself inside cells to divide. At present, chlamydia is the most prevalent sexually transmitted disease, affecting 3-5 million persons annually in the United States in all socioeconomic groups. For example, it is found in up to 5% of female college students and 10% of young men in the military. On an annual basis, more than 20,000 young men and women in the United States are rendered sterile by chlamydia. In males, urethritis is the principal result. Symptoms of urethritis include a thick discharge, burning on urination, frequent urination, and painful urination. Without treatment, the epididymides may also become inflamed, leading to sterility. In females, the most common site of infection is the cervix, resulting in cervicitis and production of a thick mucus and pus discharge. Symptoms include pelvic soreness, lower back pain, and abdominal pain. Due to its proximity to the vagina, the female urethra may also become infected, leading to urethritis and symptoms similar to those that occur in males. Moreover, the uterine tubes may also become inflamed, which increases the risk of ectopic pregnancy (implantation of a fertilized ovum outside the uterus) and sterility die to formation of scar tissue in the tubes. Chlamydia may be passed from mother to infant during childbirth, infecting the eyes. Treatment consists of the administration of tetracycline or doxycycline.

**Genital Herpes**: Another sexually transmitted disease, genital herpes, is common in the United States. Each year, 400,000 – 600,000 new cases join an estimated 30 million who are already infected. Type II herpes simplex virus (HSV-2) causes genital infections, such as painful genital blisters on the prepuce, glans penis, and penile shaft in males and on the vulva or sometimes high up in the vagina in females. The blisters disappear and reappear in most patients, but the virus itself remains in the body. A related virus, type I herpes simplex virus (HSV-1), causes cold sores on the mouth and lips. Infected persons typically experience recurrences of symptoms several times a year. Treatment of the symptoms involves pain medication, saline compresses, sexual abstinence for the duration of the eruption, and use of a salve or oral drug called acyclovir (Zovirax). This drug interferes with viral DNA replication but not with host cell DNA replication. Acyclovir speeds the healing and sometimes reduces the pain of initial genital herpes infections. It also shortens the duration of lesions in patients with recurrent genital herpes and reduces the number of flare-ups. A topically applied ointment that contains Inter Vir-A (Immuvir), an antiviral substance, is another drug used to treat genital herpes. Inter Vir-A provides rapid relief for the pain, itching, and burning associated with genital herpes. An experimental genital herpes vaccine is being tested.
**Gonorrhea**: Gonorrhea or ‘clap’ is an infectious sexually transmitted disease caused by the bacterium Neisseria gonorrhoeae. In the United States 1-2 million new cases of gonorrhea appear each year. Most cases occur in those aged 15-24 years. Discharges from infected mucous membranes are the source of transmission of the bacteria during sexual contact or during passage of a newborn through the birth canal. The site of infection relates to the type of sexual contact, occurring in the mouth and throat after oral-genital contact, vagina and penis after genital intercourse, or rectum after recto-genital contact. Males usually suffer inflammation of the urethra with pus and painful urination. The prostate gland and epididymis may also become infected. In females, infection typically occurs in the vagina, often with a discharge of pus. Both infected males and females may harbor the disease without any symptoms, however, until it has progressed to a more advanced stage. In females the infection and consequent inflammation can proceed from the vagina into the uterus, uterine tubes, and pelvic cavity. Peritonitis, or inflammation of the peritoneum, is a life-threatening disorder. Although antibiotics have greatly reduced the mortality rate of acute peritonitis, it is estimated that 50,000 – 80,000 women in the United States are made sterile by gonorrhea every year as a result of scar tissue formation that closes the uterine tubes. If the bacteria are transmitted to the eyes of a newborn in the birth canal, blindness can result. Administration of a 1% silver nitrate solution in the infant’s eyes prevents infection. For many years, penicillin and tetracycline were the drugs of choice for the treatment of gonorrhea in adults. However, bacterial strains resistant to these antibiotics have become very prevalent since the mid-1980’s. Currently, ceftriaxone is the antibiotic that most effectively attacks the majority of gonorrhea bacteria.

**Syphilis**: Syphilis is a sexually transmitted disease caused by the bacterium Treponema pallidum. It is transmitted through sexual contact or exchange of blood, or through the placenta to a fetus. The disease progresses through several stages. During the primary stage, the chief symptom is a painless open sore, called a chancre, at the point of contact. The chancre heals within 1-5 weeks. From 6 – 24 weeks later, symptoms such as a skin rash, fever, and aches in the joints and muscles usher in the secondary stage. These symptoms also eventually disappear (in about 4 – 12 weeks), and the disease ceases to be infectious, but a blood test for the presence of the bacteria generally remains positive. During this ‘symptom-less’ period, called the latent stage, which may last up to 20 years, the bacteria may invade body organs. When signs of organ degeneration appear, the disease is said to be in the tertiary stage. If the organs of the nervous system become involved, the tertiary stage is called neurosyphilis. Neurosyphilis may take different forms, depending on the tissue involved. Cerebellar damage is manifested by uncoordinated movements in such activities as writing. As the motor areas become extensively damaged, victims may be unable to control urine and bowel movements. Eventually, they may become bedridden, unable even to feed themselves. Damage to the cerebral cortex produces memory loss and personality changes that range from irritability to hallucinations. AIDS and other disorders that compromise the immune system may speed the progression of neurosyphilis, possibly by impairing macrophages and antibody production. Syphilis can be treated with antibiotics (penicillin) during the primary, secondary, and latent periods. Certain forms of neurosyphilis may also be successfully treated, but the prognosis for others is very poor.