Male Sexual Anatomy and Physiology

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  - Reflect
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Which of the following statements are the truth, and which are fiction? Look for the Truth-or-Fiction icons on the pages that follow to find the answers.

1. The penis contains bone and muscle.  
2. The father determines the baby’s sex.  
3. Semen is a synonym for sperm.  
4. Morning erections reflect the need to urinate.  
5. Men can will themselves to have erections.  
6. The penis has a mind of its own.  
7. Many men who are paralyzed below the waist can attain erection, engage in sexual intercourse, and ejaculate.  
8. Men can have orgasms without ejaculating.
A 34-year-old Chinese man, H. K. F., felt the need to urinate while at the movies. In the bathroom, he suddenly lost feeling in his genital region and developed fear that his penis was going to retract into his body. He went into a panic and his legs gave way. He sat on the floor, holding onto his penis to prevent it from retracting and waited a half hour, until the attack was over. He visited a health professional who assured him that his penis would not retract into his body, and H. K. F. has not suffered another attack since.

H. K. F. had experienced Koro, otherwise known as genital retraction syndrome, a syndrome found in Malaysia, Indonesia, and China, in which men mistakenly believe that their penises will shrink and retract into their bodies (Dzokoto & Adams, 2005; Freudenmann & Schönfeldt-Lecuona, 2005). The anxiety they experience during an attack does cause the penis to shrink somewhat, but it does not retract into the body—an anatomical impossibility. Koro is most likely to occur when a man attempts to urinate in the cold, is guilty over masturbating or visiting prostitutes, is worried about his sexual performance, or has argued with his wife.

The man will typically grab his genitals to prevent them from retracting. He may use mechanical devices like cords, chopsticks, clamps, or small weights to prevent retraction until he can find help. Koro is not all that common, but an “epidemic” of the problem, a sort of mass hysteria, occurred among men in Singapore a few years back.

Many men who experience Koro attacks, like H. K. F., profit from anatomical information and reassurance, as given by a health professional. In a couple of recent cases, men with attacks have also been treated effectively with anti-depressant medications (Kennedy & McDonough, 2002; Nakaya, 2002). The reason for the effectiveness of these medications is not quite clear. Given that these were uncontrolled case studies, it is possible that the anti-depressants worked like placebos—that is, “sugar pills”—and that the patients’ belief that they would work was the “curative” agent.

Koro is a Chinese “culture-bound syndrome” that is believed to reflect loss (or fear of loss) of yang, a form of positive male energy that is balanced in nature by yin, or female energy. Nevertheless, there are some cases of Koro spreading to other cultures (Kennedy & McDonough, 2002). However, as contemporary health information becomes more widely spread, we will probably have fewer rather than more cases of Koro overall.

The experience of H. K. F. informs us about the perceived importance of the size of the male genitalia in the eyes of men, and of the folklore that has grown around it. In the murky predawn light of Western civilization, people engaged in phallic worship. Phallic symbols became glorified in art in the form of plows, axes, and swords. The ancient Greeks carried oversized images of fish as phallic symbols in their Dionysian processions, which celebrated the wilder and more frenzied aspects of human sexuality. The Greeks also adorned themselves with phallic rings and necklaces.

The ancient Romans honored Venus by outfitting a float in the shape of a large phallus and parading it through the streets. Men in Roman courts often swore to tell the truth with their hands on their genitals—as we swear to tell the truth by placing our hands on the Bible. The words testes and testicles derive from the same Latin word as “testify.” The Latin testis means “a witness.”

Even today, men with large genitals are accorded respect from male peers and sometimes adoration from admirers. Given these cultural attitudes, it is not surprising that young men (and some not-so-young men) belittle themselves if they feel they do not measure up. Boys who mature late may be ridiculed by their peers. Adult men, too, may wonder whether their penises are large enough to satisfy lovers. Or they may fear that their partners’ earlier lovers had larger genitals.
In this chapter we examine male sexual anatomy and physiology, and we attempt to sort out truth from fiction. As in our exploration of female sexual physiology and anatomy, we begin with the external genitalia and then move inward. Once inside, we focus on the route of sperm through the male reproductive system.

Real Students, Real Questions

Q Are men really that obsessed with their penises? Why?

A Not necessarily. There are individual differences. A large penis is generally considered a plus in our culture. But males with average or somewhat smaller penises tend to become less concerned with size so long as their sex partner or partners are adequately aroused by them.

External Sex Organs

The Penis

The penis mightier than the sword.
—Mark Twain

Is that a gun in your pocket, or are you just glad to see me?
—Mae West

At first glance the penis may seem simple and obvious in its structures, particularly when compared to women's organs. Yet, as Figure 4.1 shows, the apparent simplicity of the penis is misleading. Much goes on below the surface.

The penis, like the vagina, is the sex organ used in sexual intercourse. But unlike the vagina, the penis serves as a conduit for urine. Both semen and urine pass through...
The Male Reproductive System. The external male sex organs include the penis and the scrotum.

**Corpora cavernosa**  Cylinders of spongy tissue in the penis that become congested with blood and stiffen during sexual arousal.

**Corpus spongiosum**  The spongy body that runs along the bottom of the penis, contains the penile urethra, and enlarges at the tip of the penis to form the glans.

**Corona**  The ridge that separates the glans from the body of the penis.

**Frenulum**  The sensitive strip of tissue that connects the underside of the penile glans to the shaft.

**Root**  The base of the penis, which extends into the pelvis.

**Shaft**  The body of the penis, which expands as a result of vasocongestion.

the urethral opening, or urethral *meatus* (pronounced me-ATE-us). The urethra is connected to the bladder, which is unrelated to reproduction, and to those parts of the reproductive system that transport semen.

**Truth or Fiction Revisited:** Many mammals, including dogs, have penile bones that stiffen the penis to facilitate copulation. But despite the slang term “boner,” the human penis has no bones. Nor, despite another slang term, “muscle,” does the penis contain muscle tissue. However, muscles at the base of the penis, like the muscles surrounding the vaginal and urethral openings in women, are involved in urination and ejaculation.

Rather than bones or muscles, the penis contains three cylinders of spongy material that run its length and swell (become “engorged”) with blood during sexual arousal, causing erection. The larger two, the *corpora cavernosa* (see Figure 4.1), lie side by side and function like the cavernous bodies in the clitoris. They fill with blood and stiffen when the male is aroused. In addition, a *corpus spongiosum* (spongy body) runs along the bottom, or ventral, surface of the penis. It contains the penile urethra that conducts urine to the urinary opening (urethral meatus) at the tip. Also at the tip, the spongy body enlarges into the glans, or head, of the penis.

The penile glans, like the clitoral glans, is highly sensitive to sexual stimulation, but direct, prolonged stimulation can become irritating. Most men prefer to masturbate by stroking the penile shaft rather than the glans. The *corona*, or coronal ridge, separates the glans from the body of the penis. It is also quite sensitive to sexual stimulation. The *frenulum*, a thin strip of tissue that connects the underside of the glans to the shaft, is also very sensitive. Most men find the top of the penis to be least sensitive.

The base of the penis, or *root*, extends into the pelvis. It is attached to the pelvic bone by leglike structures, called *crura*, similar to those that anchor the female’s clitoris. The body of the penis is called the penile *shaft*. Unlike the clitoral shaft, it is free-swinging. Thus, the result of engorgement, erection, is obvious.
The skin of the penis is hairless and loose, allowing expansion during erection. It is fixed to the penile shaft just behind the glans. Some of it, however, like the labia minora in the female, folds over to partially cover the glans. This covering is the prepuce, or foreskin. It covers part or all of the penile glans just as the clitoral prepuce (hood) covers the clitoral shaft. The prepuce consists of loose skin that freely moves over the glans. However, smegma—a cheeselike, foul-smelling secretion—may accumulate below the foreskin, causing it to adhere to the glans.

**Real Students, Real Questions**

**Q** My penis curves to the right. Is this normal?

**A** Sure. Penises do not tend to hang straight. As noted in the text, one testicle—usually the left testicle—tends to hang lower than the other because of the differential lengths of the spermatic cords.

**CIRCUMCISION** Male circumcision is surgical removal of the prepuce (see Figure 4.3). It has a long history as a religious rite. Jews traditionally carry out male circumcision shortly after a baby is born. Circumcision is performed as a sign of the covenant between God and the people of Abraham. Muslims also circumcise for religious reasons, although they do so some years later. Circumcision rates in hospitals vary widely in the United States, from about 75% in the Midwest to 31% in the West (*Medical News Today*, 2008). The rate is about 56% across the United States. Circumcision is uncommon elsewhere, and is rare in Latin America. Latin American immigration accounts for some of the disparity in circumcision rates across the United States (*Medical News Today*, 2008). The rate is about 17% in Canada and 5% in England. Figure 4.4 shows that the world’s highest circumcision rates are found in countries where the population is largely or exclusively Muslim.

According to the National Health and Social Life Survey (NHSLS), of 1,410 men aged 18 to 59, circumcision is most common among European American men (81%) and men whose mothers graduated from college (87%) (Laumann et al., 1997). Figure 4.5 compares the circumcision rates among various ethnic groups in the United States.
Ethnic group

European American men (including Jewish American men)
African American men
Latino American men

Percentage circumcised males

United States. The groups have some overlap; the great majority of Jews—for whom circumcision is a religious rite—are also European Americans.

Circumcision became widespread in the United States because medical research suggests that it lessens the risk of infections from the urinary tract (Muckherjee et al., 2009), HPV, HIV/AIDS (Tobian et al., 2009), and cancer of the penis. One study compared the incidence of HIV infection in two African cities with high rates and two with low rates (White et al., 2008). In Yaoundé, Cameroon, and Cotonou, Benin, the prevalence of HIV among sexually active men was about 4 to 5%, and 99% of the men were circumcised. In Kisumu, Kenya, and Ndola, Zambia, where circumcision rates were much lower, the rates of HIV infection among sexually active men were about 26 to 27%. The protective effects of circumcision are likely to reflect a lower incidence of local inflammation and genital ulcers, both of which provide ports of entry for HIV, and the removal of cells in the foreskin—Langerhans cells—that are receptive to infection by HIV (Gray et al., 2009).

Some negatives are that circumcision lessens sexual sensations (Liptak, 2003) and is painful if not carried out with adequate anesthesia. In 1999, the American Academy of Pediatrics stated that the relatively higher risks of penis of the cancer and STIs were not sufficient to recommend that circumcision be carried out universally. Critics of circumcision also argue that it is not carried out with the informed consent of the person being operated on (who is usually only a few days old) (Liptak, 2003).

**Figure 4.4** Prevalence of Circumcision around the Globe.

Circumcision is most prevalent in Islamic countries, where it is a religious rite, as well as in Israel, where it is also a religious rite.

**Figure 4.5** Who Is Circumcised?

Circumcision was most common among Jewish American men in the NHSLS study, for whom it is a religious rite, and among European American men in general, compared with African American men and Latino Americans. Elsewhere in the world, circumcision is relatively rare, except among Muslims, who also circumcise males for religious reasons.

Physicians once agreed that circumcision is the treatment of choice for phimosis, a condition in which it is difficult to retract the foreskin from the glans. But today, only a small minority of males with phimosis are circumcised for that reason (Rickwood et al., 2000).

**Penis Size**

IRAS: *Am I not an inch of fortune better than she?*

CHARMIAN: *Well, if you were but an inch of fortune better than I, where would you choose it?*

IRAS: *Not in my husband’s nose.*

—William Shakespeare, *Antony and Cleopatra*

In our culture, the size of the penis is often seen as a measure of a man’s masculinity and his ability to please his sex partner (Lever et al., 2006). Shakespeare and other writers inform us that men have looked down at themselves for centuries, sometimes in delight but more often in chagrin. Men who are heralded for their sexual or reproductive feats are presumed to have more prominent “testaments” to their manhood. Clinical experience with dysfunctional couples suggests that women are more likely to complain about their partner’s communication ability or the feeling or tone of their relationship rather than the size of his penis (Zilbergeld, 1999). Nevertheless, surveys show that a minority of women are dissatisfied with the size of their partner’s penis (Lever et al., 2006; Stulhofer, 2006).

An Internet survey of some 52,000 heterosexual men and women found that two-thirds of the men (66%) rated their penises as average in size, 22% rated them as large, and 12% rated them as small (Lever et al., 2006). Self-reported penis size was correlated negatively with the amount of body fat, consistent with other studies, reported in Chapter 15, that connect male sexual functioning negatively with levels of low density (“bad”) cholesterol. Most women (85%) were content with the size of their partner’s penis, as compared with only 55% of the men. Forty-five percent of the men desired larger penises, and hardly any (only 0.2%) wanted smaller penises.

Penises generally range in length from 3 inches to a little more than 4 inches when flaccid, or soft (Masters & Johnson, 1966). The average erection ranges from 5 to 7 inches in length. Erect penises differ less in size than flaccid penises do. Penises that are small when soft tend to gain more size when they become erect.

Even when flaccid, the same penis can vary in size. Factors such as cold air or water, or emotions of fear or anxiety can cause the penis (along with the scrotum and testicles) to draw closer to the body, reducing its size. These factors can trigger Koro syndrome in Chinese culture, as we saw at the beginning of the chapter. The flaccid penis may expand in warm water or when the man is relaxed.

**The Scrotum**

The scrotum is a pouch of loose skin below the base of the penis that becomes covered lightly with hair at puberty. It has two compartments that hold the testes. Each testicle is held in place by a spermatic cord, a structure that contains the vas deferens, blood vessels and nerves, and the cremaster muscle. The cremaster muscle raises and lowers the testicle within the scrotum in response to temperature changes and sexual stimulation. (Sexual arousal draws the testes closer to the body.)

Sperm production is optimal at slightly below the 98.6°F that is normal for most of the body. Scrotal temperature tends to be from 5 to 6°F lower than body

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**CRITICAL THINKING**

What are the similarities and differences between male circumcision and female circumcision (clitoridectomy), as described in Chapter 3? Can one logically favor one of these practices but oppose the other?
**A WORLD OF Diversity**

### Chinese Hunger for Sons Fuels Boys’ Abductions

“If you have only girls, you don’t feel right inside. You feel your status is lower than everyone else.”

“It doesn’t matter how much money you have. If you don’t have a son, you are not as good as other people who have one.”

Shenzhen, China—The thieves often strike at dusk, when children are playing outside and their parents are distracted by exhaustion. Deng Huidong lost her 9-month-old son in the blink of an eye as a man yanked him from the grip of his 7-year-old sister near the doorway of their home. The car did not even stop as a pair of arms reached out the window and grabbed the boy.

Sun Zuo, a gregarious 3 1/2-year-old, was lured off by someone with a slice of mango and a toy car, an abduction that was captured by police surveillance cameras.

Peng Gaofeng was busy with customers when a man snatched his 4-year-old son from the plaza in front of his shop as throngs of factory workers enjoyed a spring evening. “I turned away for a minute, and when I called out for him he was gone,” Mr. Peng said.

These and thousands of other children stolen from the teeming industrial hubs of China’s Pearl River Delta have never been recovered by their parents or by the police. But anecdotal evidence suggests the children do not travel far. Although some are sold to buyers in Singapore, Malaysia, and Vietnam, most of the boys are purchased domestically by families desperate for a male heir.

The demand is especially strong in rural areas of south China, where a tradition of favoring boys over girls and the country’s strict family planning policies have turned the sale of stolen children into a thriving business.

Su Qingcai, a tea farmer from the mountainous coast of Fujian Province, explained why he spent $3,500 last year on a 5-year-old boy. “A girl is just not as good as a son,” said Mr. Su, 38, who has a 14-year-old daughter but whose biological son died at 3 months. “It doesn’t matter how much money you have. If you don’t have a son, you are not as good as other people who have one.”

The centuries-old tradition of cherishing boys—and a custom that dictates that a married woman moves in with her husband’s family—is reinforced by a modern reality: Without a real social safety net in China, many parents fear they will be left to fend for themselves in old age.

The extent of the problem is a matter of dispute. The Chinese government insists there are fewer than 2,500 cases of human trafficking each year, a figure that includes both women and children. But advocates for abducted children say there may be hundreds of thousands.


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**Dartos muscle** The muscle in the middle layer of the scrotum that contracts and relaxes in response to temperature changes. Temperature. The scrotum is loose-hanging and flexible. It permits the testes and nearby structures to escape the higher body heat, especially in warm weather. In the middle layer of the scrotum is the dartos muscle, which, like the cremaster, contracts and relaxes reflexively in response to temperature changes. In cold weather, or when a man jumps into a body of cold water, the dartos muscle contracts and brings the testes closer to the body. In warm weather, it relaxes, allowing the testes to hang farther from the body. The dartos muscle also increases or decreases the surface area of the scrotum in response to temperature changes. Smoothing allows greater dissipation of heat in hot weather. Constricting the skin surface helps retain heat and wrinkles the scrotum in the cold.
The scrotum is developed from the same embryonic tissue that becomes the labia majora of the female. Thus, like the labia majora, it is quite sensitive to sexual stimulation.

**Internal Sex Organs**

**THE MALE INTERNAL SEX ORGANS** include the testes, the organs that manufacture sperm and testosterone; the system of tubes and ducts that conduct sperm through the male reproductive system; and the organs that help nourish and activate sperm and neutralize some of the acidity that sperm encounter in the vagina (see Figure 4.2).

**The Testes**

The testes are the male gonads (*gonad* derives from the Greek *gone*, meaning “seed”). In slang, the testes are frequently referred to as “balls” or “nuts.” These terms are considered vulgar, but they are reasonably descriptive.

The testes serve two functions analogous to those of the ovaries. They secrete sex hormones and produce mature germ cells. In the case of the testes, the germ cells are sperm and the sex hormones are androgens. The most important androgen is testosterone.

**TESTOSTERONE** Testosterone is secreted by interstitial cells, which are also known as Leydig’s cells. Interstitial cells lie between the seminiferous tubules and release testosterone into the bloodstream (see Figure 4.6). Testosterone stimulates prenatal differentiation of male sex organs, sperm production, and development of secondary sex characteristics, such as the beard, a deep voice, and muscle mass.

In men, several endocrine glands—a feedback loop among the hypothalamus, pituitary gland, and testes (see Figure 4.7)—keep blood testosterone levels at a more or less even level, although there are slight variations with stress, time of day or month, and other factors. This contrasts with the peaks and valleys in levels of female sex hormones during the phases of the menstrual cycle.

The pituitary hormones, FSH and LH, which regulate the activity of the ovaries, also regulate the activity of the testes. FSH regulates the production of sperm. LH stimulates secretion of testosterone by interstitial cells. Low testosterone levels signal the hypothalamus to secrete the hormone, LH-releasing hormone (LH–RH). Like dominoes falling in a line, LH–RH causes the pituitary gland to secrete LH, which in turn stimulates the testes to secrete testosterone. LH is also known as *interstitial-cell-stimulating-hormone*, or ICSH.

When the level of testosterone in the blood system reaches a peak, the hypothalamus directs the pituitary gland not to secrete LH. This system for circling information around these three endocrine glands is called a feedback loop. This feedback loop is negative. That is, increases in hormone levels in one part of the system trigger another part to shut down and vice versa.

The testes usually range between 1 and 1 ¾ inches in length. They are about half as wide and deep. The left testicle usually hangs lower, because the left spermatic cord tends to be somewhat longer.

**SPERM** Each testicle is divided into many lobes, which are filled with winding seminiferous tubules (see Figure 4.2). Although packed into a tiny space, these...
The testes churn out about 1,000 sperm per second or 30 \textit{billion} per year. Mathematically speaking, 10 to 20 ejaculations hold enough sperm to populate the Earth. (Men are always so taken with themselves, notes the third author.)

Researchers have discovered that sperm cells possess the same kind of receptors that the nose uses to sense odors (Baum & Kelliher, 2009). Sperm may thus find their way to an egg cell by detecting its scent. In the future we may have contraceptives...
that prevent fertilization by blocking these receptors from sensing the odors of egg cells.

Sperm proceed from the seminiferous tubules through a maze of ducts that converge in a tube called the epididymis. The epididymis lies against the back wall of the testicle and stores sperm. It is some 2 inches in length and it consists of twisted passages that would extend 10 to 20 feet if straightened. Sperm are inactive when they enter the epididymis. They continue to mature as they make their way through the epididymis for another two to four weeks.

**Real Students, Real Answers**

**Q** What does ejaculate taste like, and is it harmful to ingest?

**A** In a word, salty. Some people like the taste, others find it unpleasant, and still others are simply indifferent to it. Some find the taste to be sexually arousing. It is not clear as to how much of the response reflects natural individual differences and how much reflects what people expect as a result of cultural reasons and tales from friends.

The substances in the ejaculate are absolutely harmless. It is vaguely conceivable (no pun intended) that the fluid of the ejaculate could go down “the wrong pipe” and cause choking, but this possibility exists with the ingestion of any fluid, even water. By the way, the ejaculate is a low-calorie food—largely protein—when ingested.

**The Vas Deferens**

Each epididymis empties into a vas deferens (also called ductus deferens). The vas is a thin, cylindrical tube about 16 inches long that serves as a conduit for mature sperm. In the scrotum, the vas deferens lies near the skin surface within the spermatic cord. Therefore, a vasectomy, an operation in which the right and left vas deferens are severed, is a convenient means of sterilization. The tube leaves the scrotum and follows a circuitous path up into the abdominal cavity. Then it loops back along the rear surface of the bladder (see Figure 4.10 on page 114).

**The Seminal Vesicles**

The two seminal vesicles are small glands, each about 2 inches long. They lie behind the bladder and open into the ejaculatory ducts, where the fluids they secrete combine with sperm (see Figure 4.10). The seminal vesicles were so named because they were mistakenly believed to be reservoirs for semen, rather than glands.

The fluid produced by the seminal vesicles is rich in fructose, a form of sugar, which nourishes sperm and helps them become active, or motile. Sperm motility is a major factor in male fertility. Before reaching the ejaculatory ducts, sperm are propelled along by contractions of the epididymis and vas deferens and by cilia that line the walls of the vas deferens. Once they become motile, they propel themselves by whipping their tails.

At the base of the bladder, each vas deferens joins a seminal vesicle to form a short ejaculatory duct that runs through the middle of the prostate gland (see Figure 4.10 on page 114).
Andropause: When Hormones Rage No More

Most of us are familiar enough with the phrase “raging hormones” when it comes to the alleged irritability shown by some women prior to menstruation and apparently related to the fluctuations of sex hormones. Yet men, too, can be said to be prey to “raging hormones.” The male sex hormone testosterone is related to tendencies to dominate other people. There is research evidence that aggressive boys, college students, and men have higher testosterone levels than their peers (Chance et al., 2000; Giotakos et al., 2005; McAndrew, 2009). High levels of testosterone also appear to reduce fear of the consequences of aggression (King et al., 2005). For reasons such as these, social commentator Anna Quindlen wrote an article, “Is Testosterone Toxic?” We will see that the answer to Anna Quindlen’s question might be yes—that is, testosterone might well be toxic—but not for reasons that she was writing about.

Historically speaking, more research has been done with men’s health problems than women’s. Yet the problems related to low levels of sex hormones in men do not yet even have an agreed-upon name. Andropause suggests a falloff in androgens (male sex hormones). Viropause suggests a decline in virility, which is not a scientific term and suggests a general loss of ability. Manopause is a widely used but unscientific knockoff of the scientific term menopause.

For women, menopause is a time of relatively distinct age-related declines in sex hormones and fertility. In men, the decline in the production of male sex hormones and fertility is more gradual (Harvey & Berry, 2009). It therefore is not surprising to find a man in his 70s or older fathering a child. However, many men in their 50s and 60s experience problems in achieving and maintaining erections (Corona et al., 2009), which may reflect circulatory problems or hormone deficiencies. Figure 4.8 indicates the ages at which one group of researchers found symptoms of andropause to begin.

Sexual performance is one part of the story. Figure 4.9 shows the frequencies of a number of problems. Between the ages of 40 and 70, the typical American male loses 12 to 20 pounds of muscle, about 2 inches in height, and 15% of his bone mass. (Men as well as women are at risk for osteoporosis [Yeap, 2009].) The percent of fat in the body nearly doubles. There is some loss in hearing and vision. There is loss of endurance as the cardiovascular system and lungs become less capable of adapting to exertion. Figure 4.9 indicates the frequency of some symptoms among a group of more than 300 men who were diagnosed with andropause.

Some of these changes can be slowed or reversed. Exercise helps maintain muscle tone, keeps the growth of fatty tissue in check, and helps combat osteoporosis (Tan, 2002). A diet rich in calcium and vitamin D also wards off bone loss. Hormone replacement therapy may help but is controversial.

PROSTATIC FLUID

Prostate gland

The gland that lies beneath the bladder and secretes prostatic fluid, which gives semen its characteristic odor and texture.

In the prostate, the ejaculatory duct opens into the urethra, which carries sperm and urine out through the tip of the penis.

The Prostate Gland

The prostate gland lies beneath the bladder and approximates a chestnut in shape and size (about 3/4 inch in diameter). It contains muscle fibers and glandular tissue that secrete prostatic fluid. Prostatic fluid is milky and alkaline. It provides the characteristic texture and odor of the seminal fluid. The alkalinity neutralizes some of the acidity of the vaginal tract, prolonging the life span of sperm as seminal fluid spreads through the female reproductive system. The prostate is continually active...
U.S. physicians write more than one million prescriptions for testosterone and related drugs for men each year, but the benefits are not fully proven, and the risks should make the caution lights blink (Emmelot-Vonk et al., 2009). Testosterone replacement may boost strength, energy, and the sex drive, but it also increases the risks of prostate cancer and cardiovascular disease (American Cancer Society, 2009). In fact, in 2002, the government decided not to proceed with a study of the effects of testosterone on aging men just because of these concerns (Kolata, 2002).

**Figure 4.8 ● Age of Onset of Andropause.**
According to one study, andropause is most likely initially to affect men in the 50- to 60-year-old age range.

**Figure 4.9 ● Frequency of Some Symptoms of Andropause.** Andropause is most likely to be characterized by problems in attaining and maintaining an erection, weakness, and memory problems. The researchers' label of intimacy problems refers to increased dependence of the man of his spouse and family. As testosterone goes down, men appear to be less likely to roam.

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**Real Students, Real Questions**

**Q** Is it possible to urinate with a full erection?

**A** No and yes. The ductwork of the male is constructed such that urination and ejaculation tend to be mutually exclusive. On the other hand, if a male with an erection makes an effort to relax his bladder fully (that is, to allow himself to urinate), he may well be able to do so, even if the flow of urine is delayed.
in mature males, but sexual arousal further stimulates secretions. Secretions are conveyed into the urethra by a sieve-like duct system. There the secretions combine with sperm and fluid from the seminal vesicles.

A vasectomy prevents sperm from reaching the urethra but does not cut off fluids from the seminal vesicles or prostate gland. A man who has had a vasectomy thus emits an ejaculate that appears normal but contains no sperm.

**Cowper’s Glands**

The two **Cowper’s glands** are also known as the **bulbourethral glands**, in recognition of their shape and location. They lie below the prostate and empty their secretions into the urethra. During sexual arousal they secrete a drop or so of clear, slippery fluid that appears at the tip of the penis. The fluid may help buffer the acidity of the male’s urethra and lubricate the urethral passageway, but not enough is produced to lubricate the vagina during intercourse.

Fluid from the Cowper’s glands precedes the ejaculate and often contains sperm. Thus, male–female coitus may lead to pregnancy even if the penis is withdrawn before ejaculation. For this reason, people who practice the “withdrawal method” of birth control are often called “parents.”

**Semen**

**Truth or Fiction Revisited:** semen is not a synonym for sperm. Sperm and the fluids contributed by the seminal vesicles, the prostate gland, and the Cowper’s glands make up semen, or whitish seminal fluid, which is expelled through the tip of the penis during ejaculation. The seminal vesicles secrete about 70% of the fluid that constitutes the ejaculate. The remaining 30% of seminal fluid consists of sperm and fluids produced by the prostate gland and the Cowper’s gland. Sperm themselves account for only about 1% of the volume of semen. This is why men with vasectomies ejaculate nearly as much semen as before the operation.

Semen carries sperm through the male’s reproductive system and the reproductive tract of the female. Semen contains water, mucus, sugar (fructose), acids, and bases. It activates and nourishes sperm, and the bases help shield sperm from vaginal acidity. The typical ejaculate contains between 200 and 400 million sperm and ranges between 3 and 5 milliliters in volume. (Five milliliters is equal to about 1 tablespoon.)

The quantity of semen decreases with age and frequency of ejaculation. On the other hand, there appears to be a relationship between the quality of semen and intelligence. Arand Pierce and his colleagues (2009) used standardized intelligence tests to assess the intelligence of several hundred U.S. army veterans and found that intelligence was related to the concentration of sperm in semen \( r = +0.15 \), the sperm count \( r = +.19 \), and the motility of the sperm \( r = +0.14 \). No correlation equals a correlation of 0.00, and a perfect correlation equals +1.00. The correlations found in the study are too small to make meaningful predictions about intelligence and semen quality, but they are large enough to be unlikely due to chance fluctuation. The authors suggest that biological factors might be at work such that the overall
long-term trend could be toward greater intelligence, but this interpretation of the findings might be a “reach.”

Health Problems of the Urogenital System

BECAUSE THE ORGANS THAT COMPRIZE the urinary and reproductive systems are near each other and share some “piping,” they are referred to as the urinogenital or urogenital system. A number of health problems affect the urogenital system. The type of physician who specializes in their diagnosis and treatment is a urologist.

Urethritis

Men, like women, are subject to bladder and urethral inflammations, which are generally referred to as urethritis. The symptoms include frequent urination (urinary frequency), a strong need to urinate (urinary urgency), burning during urination, and a penile discharge. People with symptoms of urinary frequency and urinary urgency feel the pressing need to urinate repeatedly, even though they may have just done so and may have but another drop or two to expel. The discharge may dry on the urethral opening, in which case it may have to be peeled off or wiped away before it is possible to urinate. The urethra also may become constricted when it is inflamed, slowing or halting urination.

Preventive measures for urethritis parallel those suggested for cystitis (bladder infection): drinking more water, drinking cranberry juice (4 ounces, two or three times a day), and lowering intake of alcohol and caffeine. Cranberry juice is highly acidic, and acid tends to eliminate many of the bacteria that can give rise to urethritis. Urethritis is usually treated with antibiotics.

Cancer of the Testes

Cancer of the testicles remains a relatively rare form of cancer, accounting for about 8,400 new cases annually, and about 380 men will die from it every year (American Cancer Society, 2009). It is the most common form of solid-tumor cancer to strike men between the ages of 20 and 34, accounting for nearly 10% of all deaths from cancer among men in that age group.

There is no evidence that testicular cancer results from sexual overactivity or masturbation. About 14% of men with testicular cancer had cryptorchidism as children, a condition in which one or both testicles fail to descend from the abdomen into the scrotum (American Cancer Society, 2009). Family history also increases the risk. European Americans are 5 to 10 times more likely than African Americans to develop cancer of the testes, and more than twice as likely as Asian Americans (American Cancer Society, 2009).

Although testicular cancer was generally fatal in earlier years, the prognosis today is quite favorable, especially when detected early. Treatments include surgical removal of the diseased testis, radiation, and chemotherapy. The survival rate among cases that are detected before the cancer has spread beyond the testes is about 99% (American Cancer Society, 2009).

The surgical removal of a testicle may have profound psychological implications. Some men who have lost a testicle feel less “manly.” Also, fears related to sexual

Urethritis An inflammation of the bladder or urethra.
Cryptorchidism A condition in which one or two testicles fails to descend from the abdomen into the scrotum.
performance can engender sexual dysfunctions. From a physiological standpoint, sexual functioning should remain unimpaired, as adequate testosterone is produced by the remaining testis.

The early stages of testicular cancer usually produce no symptoms, other than the mass itself. Because early detection is crucial to survival, men are advised to examine themselves monthly following puberty and to have regular medical checkups. Self-examination may also reveal evidence of sexually transmitted infections (STIs) and other problems.

**SELF-EXAMINATION OF THE TESTES** Self-examination (see Figure 4.11) is best performed shortly after a warm shower or bath, when the skin of the scrotum is most relaxed. The man should exam the scrotum for evidence of pea-sized lumps. Each testicle can be rolled gently between the thumb and the fingers. Lumps are generally found on the side or front of the testicle. The presence of a lump is not necessarily a sign of cancer, but it should be promptly reported to a physician for further evaluation. The American Cancer Society (2009) lists these warning signals:

- A lump on a testicle
- Enlargement or swelling of a testicle
- Change in the consistency of a testicle
- Dull ache in the lower abdomen or groin (pain may be absent in cancer of the testes, however)
- Sensation of dragging and heaviness in a testicle

Less common symptoms are:

- Growth of breast tissue; tender or swollen breasts
- Loss of the sex drive
- Premature (prior to puberty) growth of hair on the face and body

**Disorders of the Prostate**

The prostate gland is tiny at birth and grows rapidly at puberty. It may shrink during adulthood, but usually becomes enlarged past the age of 50.

**BENIGN PROSTATIC HYPERPLASIA (BPH)** The prostate gland becomes enlarged in about half the men past the age of 50 and 80% of men by age 80 (www.prostatecare.com, 2006). Benign prostatic hyperplasia (BPH) is noncancerous enlargement of the prostate gland due to hormonal changes associated with aging rather than other causes, such as inflammation from sexually transmitted infections. Because the prostate surrounds the upper part of the urethra (see Figure 4.2), enlargement constricts the urethra, causing urinary frequency (including increased frequency of nocturnal urination), urinary urgency, and difficulty starting the flow of urine. Several treatments are available to relieve the pressure on the urethra and increase the flow of urine. Two types of drugs help men with BPH. The first type, 5-ARIs (5-alpha reductase inhibitors), inhibits the production of the hormone DHT (a form of testosterone), which causes enlargement of the prostate. The 5-ARIs shrink the prostate, provide long-term improvement of symptoms, and reduce the risk of severe urinary retention and the need for surgery. The second type is alpha-blockers, which act by relaxing the muscles of the bladder to improve the flow of urine, pro-
viding symptom relief. Part of the prostate is also sometimes surgically removed (www.prostatecare.com, 2006).

**PROSTATITIS** Prostatitis is inflammation of the prostate, which can be caused by various infectious agents. The chief symptoms are an ache or pain between the scrotum and anal opening and painful ejaculation. Prostatitis is usually treated with antibiotics. Although aspirin and ibuprofen may relieve the pain, men with these symptoms should consult a physician. Painful ejaculation may discourage masturbation or coitus, which is ironic, because regular flushing of the prostate through ejaculation may be helpful in the treatment of the inflammation. Prostatitis is usually treated with antibiotics, most commonly ciprofloxin.

**CANCER OF THE PROSTATE** Prostate cancer is a serious and life-threatening problem. About one man in six in the United States will develop prostate cancer (American Cancer Society, 2009). It is the second most common form of cancer among men, after skin cancer, and the second leading cause of cancer deaths in men, after lung cancer. There are about 192,280 new cases of prostate cancer in the United States each year, and about 27,360 deaths (American Cancer Society, 2009).

Prostate cancer involves the growth of malignant prostate tumors that can metastasize to bones and lymph nodes if not detected and treated early. African American men are 50 to 60% more likely than European American men to develop prostate cancer (Cancer Statistics, 2008). In general, African American men have less access to health care than European American men do, so prostate cancer is diagnosed later among them, and they are twice as likely to die from it (American Cancer Society, 2009).

Researchers have identified intake of animal fat as a risk factor. Men whose diets are rich in animal fats, especially fats from red meat, have a substantially higher chance of developing advanced prostate cancer than do men with a low intake of animal fat. The incidence of prostate cancer also increases with age, with more than 80% of cases diagnosed in men aged 65 and above (American Cancer Society, 2009). Genetic factors are apparently involved (American Cancer Society, 2009). Moreover, testosterone spurs the development of prostate cancer as well as BPH (American Cancer Society, 2009).

The early symptoms of cancer of the prostate may mimic those of benign prostate enlargement: urinary frequency and difficulty in urinating. Later symptoms include blood in the urine, pain or burning when urinating, and pain in the lower back, pelvis, or upper thighs (American Cancer Society, 2009). Most cases occur without noticeable symptoms in the early stages.

Health professionals detect and assess prostate cancer by a combination of tests. These include a PSA test, which is a blood test for prostate specific antigen, recommended once a year for men aged 50 and over, and beginning at a younger age for men at greater risk. African American men are advised to begin at age 45. Results under 4 nanograms per milliliter are normal. More than 10 are high; those between 4 and 10 are borderline. PSA is a protein that helps transform a gel-like substance in the prostate gland to a liquid that transports sperm during ejaculation. In the diseased or enlarged prostate, PSA seeps into the blood at higher levels, yielding higher test scores. Early detection permits treatment before the cancer has metastasized, after which the survival rate drops dramatically if the cancer has metastasized. Still, the overall survival rate has improved from 50% in the 1960s to above 80% (American Cancer Society, 2009). Yet, as we see in “A Closer Look” on page 118, the value of PSA screening has been questioned.
The American Cancer Society (2009) recommends that men receive annual digital rectal examinations (DREs) beginning at the same age as PSA tests (see Figure 4.12). The physician inserts a finger into the rectum and feels for bumps or hard spots in the prostate gland. Unfortunately, many men are reluctant to have a rectal examination, even though it is only mildly uncomfortable and may save their lives. Some are embarrassed or reluctant to discuss urinary problems with their physicians. Some may resist the rectal examination because they associate rectal insertion with male–male sex. Some, of course, fear they may have cancer and choose to remain ignorant. Failure to have regular exams is a major contributor to the death rate from prostate cancer. Ultrasound may also be used. If cancer is suspected, a biopsy is performed, in which the doctor uses a needle to take a sample of prostate tissue and rate them from 1 to 5 on the so-called Gleason scale, to provide a measure of the cancer’s aggressiveness.

Two results of two major studies on the effectiveness of PSA screening for prostate cancer were reported in the New England Journal of Medicine in 2009. The American study found no statistically significant difference in the death rates due to prostate cancer in men from the experimental group who were screened annually and men in the control group, who were left to their own judgment as to whether or not to obtain PSA tests (Andriole et al., 2009). The European study found that screening every four years as opposed to screening at the individual’s discretion was associated with a 20% lower risk of dying from prostate cancer (Schröder et al., 2009). But if we place the European results in perspective, we find that the average risk of dying from prostate cancer for an unscreened man is about 3%, and the reduced rate for screened men is about 2.4%.

Prostate cancer is not necessarily lethal, and men over age 75 are usually advised not to be screened for PSA. Therefore, in both the United States and Europe, a positive PSA result (one that is indicative of prostate cancer) exposes many men to “aggressive and unnecessary treatments” (Parker-Pope, 2009a) that can cause erectile dysfunction (difficulty achieving an erection) and incontinence. According to Otis Brawley (2009) of the American Cancer Society, the European results suggest that “the [PSA] test is about 50 times more likely to ruin your life than it is to save your life.”

These studies are not perfect, however. Each has its problems. For example, the U.S. study found no benefit for PSA testing over a period of 7 to 10 years. But 10 years out, only some 170 men of 77,000 studied have died from prostate cancer. Because prostate cancer grows slowly, group differences in mortality could emerge over the next several years. Another problem is “contamination” in the control group. Because of ethical considerations, men in the control group were not asked to avoid PSA screening, and it seems that some 40 to 50% of them were tested for PSA, although not as regularly as men in the experimental group. Therefore, the studies didn’t truly compare testing with no testing; instead, it compared regular testing with unknown or haphazard testing. Nor did the research sort out results with African Americans or with men whose families have a history of prostate cancer, groups at higher risk for prostate cancer.

Do the results of these studies mean that men should no longer be tested for PSA levels? Not necessarily. Most medical groups suggest that screening is a “personal choice” made by a man in consultation with his doctor. Surgeon Gerald L. Andriole (2009), the lead author of the U.S. study, believes that middle-aged or older men whose life expectancy is ten years or more “need to be informed about the potential pros and harms of screening. If they want to embark on it, that’s fine. I’m still open to accepting that we learn a lot about a man’s prostate and about the probability of him getting or having prostate cancer by measuring PSA.”

Figure 4.12  ● Digital Rectal Examination for Prostate Cancer
Source: Reprinted by the permission of the American Cancer Society, Inc. All rights reserved.
Male Sexual Functions

THE MALE SEXUAL FUNCTIONS of erection and ejaculation provide the means for sperm to travel from the male’s reproductive tract to the female’s. There the sperm cell and ovum unite to conceive a new human being. Of course, the natural endowment of reproduction with sensations of pleasure helps ensure that it will take place with or without knowledge of these biological facts.

Erection

Erection is caused by the engorgement of the penis with blood, such that the penis expands and stiffens. The erect penis is an efficient funnel for depositing sperm deep within the vagina.

Erection is a hydraulic event. The spongy, cavernous masses of the penis fill with blood, causing the penis to enlarge, much like a sponge swells when it absorbs water. Erection involves both the vascular (circulatory) system and the nervous system.

In a few moments—10 or 15 seconds—the penis can double in length and firmness, and will shift from a funnel for passing urine to one that expels semen. Muscles close off the bladder when the male becomes sexually aroused, preventing the mixture of semen and urine.

The corpora cavernosa are surrounded by a tough, fibrous covering. Just as the rubber of a balloon resists the pressure of pumped-in air, this covering resists expansion, stiffening the penis. The corpus spongiosum, which contains the urethra, also engorges with blood during erection. It does not become hard, however, because it lacks the fibrous casing. The penile glans, which is formed by the crowning of the spongiosum at the tip of the penis, turns a dark purplish hue as it becomes engorged, but it too does not stiffen.

Erection is reversed when more blood flows out of erectile tissue than flows in, restoring the pre-arousal circulatory balance and shrinking the spongy masses. Loss of erection occurs when sexual stimulation ceases, or when the body returns to a (sexual) resting state following orgasm. Loss of erection can also occur in response
to anxiety or perceived threats (Janssen, 2006; Janssen et al., 2006). Such loss can be abrupt, as when a man in the “throes of passion” suddenly hears a noise suggestive of an intruder. A man who fears that he will be unable to perform successfully may experience performance anxiety, which can prevent him from obtaining or maintaining an erection.

Men have nocturnal erections every 90 minutes or so as they sleep. They generally occur during REM (rapid eye movement) sleep, which is associated with

Other findings:
- All treatments have side effects such as urinary incontinence, bowel problems, and erectile dysfunction. The chances of sexual dysfunction and bowel problems are similar for surgery and radiation, but urine leakage is much more likely among surgery patients than patients treated with external radiation.
- External-beam radiation therapy and androgen deprivation each led to a higher frequency of bowel urgency (3%) than prostate removal (1%).
- Erectile dysfunction was more likely to be associated with androgen deprivation (86%) and radical prostatectomy (58%) than with watchful waiting (33%).
- One study concluded that men who were treated with surgery were less likely to have their cancer metastasize or to die than those who waited watchfully, but another study reported no difference in survival between the two.
- Hormone therapy before prostatectomy did not enhance survival rates or decrease recurrence rates.
- Combining radiation with hormone treatments may decrease mortality, but when compared to radiation alone, the combination appears to increase the rates of impotence and abnormal breast development.

New treatments come along. One is a therapeutic prostate cancer vaccine, Provenge (Pollack, 2009). Therapeutic vaccines do not prevent a disease as childhood vaccines do. Instead, they are meant to trigger the body’s immune system to attack a disease that is already in progress.

Check with your doctor about the latest findings for the various treatments.

Performance anxiety
Feelings of dread and foreboding experienced in connection with sexual activity (or any other activity that might be judged by another person).
dreaming. It is so named because the sleeper’s eyes dart about rapidly under the closed eyelids during this stage.

The mechanism of nocturnal erection is physiological. That is, dreams may not have erotic content. Morning erections are actually nocturnal erections. They occur when the man awakens during REM sleep. **Truth or Fiction Revisited:** Morning erections do not reflect the need to urinate.

### Spinal Reflexes and Sexual Response

Men may become sexually aroused by a range of stimuli, including tactile stimulation provided by their partners, visual stimulation (as from scanning photos of nudes on the Internet), or sexual fantasies. Regardless of the source of stimulation, the man’s sexual responses, erection, and ejaculation occur by reflex.

Sexual reflexes are automatic, unlearned responses to sexual stimulation. Examples in women include vaginal lubrication and orgasm. We need not try to become aroused. We need only expose ourselves to sexual stimulation and allow reflexes to do the job for us.

**Truth or Fiction Revisited:** Men cannot will themselves to have erections. People do not control sexual reflexes voluntarily, as they might lift an arm, but they can set the stage for them to occur by seeking sexual stimulation. Efforts to control sexual responses consciously by “force of will” can backfire and make it more difficult to become aroused (for example, to attain erection or vaginal lubrication).

The reflexes governing erection and ejaculation are controlled in the spinal cord. They are thus called *spinal reflexes*. Erectile responses to direct stimulation such as touching or licking involve a simple spinal reflex that does not require the direct participation of the brain (see Figure 4.13). Erections can also be initiated by the brain, as when a man has sexual fantasies or catches a glimpse of an attractive person. In such cases, stimulation from the brain travels to the spinal cord, where the erectile reflex is triggered.

Tactile stimulation (touching) of the penis or nearby areas (lower abdomen, scrotum, inner thighs) causes sensory neurons to transmit nerve messages (signals) to an erection center in the lower back, in an area of the spinal cord called the *sacrum*. The sacral erection center controls reflexive erections—that is, erections

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**Figure 4.13** - **Reflexes.** Reflexes need not involve the brain, although messages to the brain may make us aware when reflexes are occurring. Reflexes are the product of “local government” in the spine.
occurring in response to direct stimulation of the penis and nearby areas. When direct penile stimulation occurs, messages in the form of nerve impulses are received by this erection center, which in turn sends impulses to the genitalia via nerves that serve the penis. These impulses cause arteries carrying blood to the corpora cavernosa and corpus spongiosum to dilate, so that more blood flows into them, causing erection.

The sacral erection center makes it possible for men whose spinal cords have been injured or severed above the center to achieve erections (and ejaculate) in response to direct tactile stimulation of the penis. Erection occurs even though their injuries prevent nerve signals from reaching their brains. Because of the lack of communication between the genital organs and the brain, there are no sensations, but many spinal-injured men report that sex remains psychologically pleasurable because they can observe the responses of their partners.

THE ROLE OF THE BRAIN If direct penile stimulation triggers erection at the spinal level, what is the role of the brain? Although it may seem that the penis sometimes has “a mind of its own,” the brain plays an important role in regulating sexual responses.

Tactile (touch) stimulation of the penis may trigger erection through the spinal cord, but sexual sensations are then normally relayed to the brain, which generally results in pleasure and perhaps in a decision to focus on erotic stimulation. The sight of one’s partner, erotic fantasies, memories, and so forth can result in messages being sent by the brain through the spinal cord to the arteries servicing the penis, maintaining or strengthening the erection.

When the brain originates messages that trigger the erectile reflex, it transmits nerve impulses to a second and higher erection center located in the upper back in the lumbar region of the spinal cord. This higher spinal erection center serves as a “switch board” between the brain and the penis, allowing perceptual, cognitive, and emotional responses to make their contributions. When the nerve pathways between the brain and the upper spinal cord are blocked or severed, men cannot achieve erections in response to mental stimulation alone.

The brain can also stifle sexual response. A man who is highly anxious about his sexual abilities may be unable to achieve an erection even with intense penile stimulation. Or a man who believes that sexual pleasure is sinful or dirty may be filled with anxiety and guilt and be unable to achieve erection with a partner.

In some males, especially adolescents, the erectile reflex is so easily tripped that incidental rubbing of the genitals against his own undergarments, the sight of an attractive passer-by, or a fleeting sexual fantasy produces erection. Spontaneous erections may occur under embarrassing circumstances, such as before classes change in middle or high school or on a beach. In an effort to distract himself from erotic fantasies and to allow an erection to subside, many a male adolescent desperately renews his interest in his algebra or language textbook in class before the bell rings. (A well-placed towel may serve in a pinch on the beach.)

As men mature, they need more penile stimulation to achieve full erection. Partners of men in their 30s and 40s should not feel that their attractiveness has waned if their lovers no longer have instant “no-hands” erections when they disrobe. It takes men longer to obtain erection as they age, and direct stimulation becomes more important.

THE ROLE OF THE AUTONOMIC NERVOUS SYSTEM (ANS) Stimulation that brings about an erection can originate in the brain, but erection is not a volun-
Automatic responses, such as erection, involve the division of the nervous system called the **autonomic nervous system (ANS)**. Autonomic means “automatic.” The ANS controls automatic bodily processes such as heartbeat, pupil dilation, respiration, and digestion. In contrast, voluntary movement (like raising an arm) is under the control of the somatic division of the nervous system.

The ANS has two branches: the sympathetic and the parasympathetic. These branches have largely opposing effects; when they are activated at the same time, their effects become balanced out to some degree. In general, the sympathetic branch is in command during processes that involve a release of bodily energy from stored reserves, such as during running, performing some other athletic task, or being gripped by fear or anxiety. The sympathetic branch also governs the general mobilization of the body, such as by increasing the heart rate and respiration rate in response to threat.

The parasympathetic branch is most active during processes that restore reserves of energy, such as digestion. When we experience fear or anxiety, the sympathetic branch of the ANS quickens the heart rate. When we relax, the parasympathetic branch curbs the heart rate. The parasympathetic branch activates digestive processes but inhibits digestive activity. Because the sympathetic branch is in command when we feel fear or anxiety, such stimuli can inhibit the activity of the parasympathetic system, possibly causing indigestion.

The divisions of the ANS play different roles in sexual arousal and response. The nerves that cause penile arteries to dilate during erection belong to the parasympathetic branch of the ANS. The parasympathetic system largely governs erection. The nerves governing ejaculation belong to the sympathetic branch, however. One implication of this division of neural responsibility is that intense fear or anxiety, which involves sympathetic nervous system activity, may inhibit erection by counteracting the activity of the parasympathetic nervous system. Since sympathetic arousal helps trigger ejaculation, anxiety or fear may also accelerate ejaculation, causing premature ejaculation (see Chapter 15).

The connection between emotions, sympathetic activity, and ejaculation can set up a vicious cycle. Anxiety in a sexual encounter may trigger premature ejaculation. During a subsequent sexual encounter, the man might fear recurrence of premature ejaculation. The fear may bring on the reality. He may face further sexual encounters with yet greater fear, perhaps further hastening ejaculation—but possibly inhibiting erection. Methods for helping men with erectile dysfunction and premature ejaculation aim at reducing their levels of anxiety and thereby lessening sympathetic activity.

**Truth or Fiction Revisited:** Because erections seem spontaneous at times and often occur when the man would rather not have them, it may seem to men that the penis has a mind of its own. But despite this common folk belief, the penis possesses no guiding intelligence. It consists of spongy masses of erectile tissue, not the lovely dense gray matter that renders your thought processes so incisive.

**ERECTILE ABNORMALITIES** Some men find that their erect penises are slightly curved or bent. Some degree of curvature is normal, but men with Peyronie’s disease have excessive curvature that can make erections painful. The condition is caused by buildup of fibrous tissue in the penile shaft. Although some cases of Peyronie’s disease appear to clear up on their own, most require medical attention.
Some men experience erections that persist for hours or days. This condition is called priapism, after Priapus of Greek myth, the son of Dionysus and Aphrodite who personified male procreative power. Priapism is often caused by leukemia, sickle cell anemia, or diseases of the spinal cord, although in some cases the cause remains unknown. Priapism occurs when the mechanisms that drain the blood that erects the penis are damaged and cannot readily return the blood to the circulatory system. Priapism may become a medical emergency, because erection prolonged beyond six hours can starve penile tissues of oxygen, leading to tissue deterioration. Medical intervention in the form of drugs or surgery may be required to reverse the condition.

Ejaculation

Ejaculation, like erection, is a spinal reflex. It is triggered when sexual stimulation reaches a critical point or threshold. Ejaculation generally occurs together with orgasm, the sudden muscle contractions that occur at the peak of sexual excitement and result in the abrupt release of sexual tension that had built up during sexual arousal. Orgasm is generally pleasurable. Ejaculation, however, refers only to the expulsion of semen from the tip of the penis. Orgasm and ejaculation are not synonymous, however. For example, paraplegics can ejaculate if the area of the lower spinal cord that controls ejaculation is intact. They do not experience the subjective aspects of orgasm, however, since the sensations of orgasm do not reach the brain.

Truth or Fiction Revisited: Many men who are paralyzed below the waist can attain erection, engage in sexual intercourse, and ejaculate, if the spinal centers controlling erection and ejaculation remain intact.

Truth or Fiction Revisited: Prepubertal boys may also experience orgasms even though they emit no ejaculate (so-called dry orgasms). Boys do not begin to produce seminal fluid (and sperm) until puberty. Mature men can also experience dry orgasms. These take the form of “little orgasms” preceding a larger orgasm, or they can follow “wet orgasms” when sexual stimulation is continued but seminal fluids have not been replenished.

Ejaculation occurs in two stages (Levin, 2005a). The first phase, often called the emission stage, involves contractions of the prostate gland, seminal vesicles, and the upper part of the vas deferens (the ampulla). The force of these contractions propels seminal fluid into the prostatic part of the urethral tract—a small tube called the urethral bulb—which balloons as muscles close at either end, trapping the semen. It is at this point that the man perceives orgasm as inevitable. The man feels that nothing can prevent ejaculation.

In the second or expulsion stage, seminal fluid is propelled through the urethra and out of the urethral opening at the tip of the penis. In this stage, muscles at the base of the penis and elsewhere contract rhythmically, expelling semen. The second stage is generally accompanied by the sensations of orgasm.

In ejaculation, seminal fluid is released from the urethral bulb and expelled by contractions of the pelvic muscles that surround the urethral channel and the crura of the penis. The first few contractions are most intense and occur at 0.8-second intervals. Subsequent contractions weaken. The interval between them increases. Seminal fluid is expelled in spurts during the first few contractions. In young men, seminal fluid may be propelled 12 to 24 inches. But in some men, semen travels but a few inches or oozes from the penile opening. The force of the expulsion varies with the condition of the man’s prostate, his general health, and his age. More intense orgasms tend to accompany more forceful ejaculations.

**Truth or Fiction Revisited:***

**7**

**8**

**Orgasm** The climax of sexual excitement.

**Paraplegic** A person with sensory and motor paralysis of the lower half of the body.

**Emission stage** The first phase of ejaculation, which involves contractions of the prostate gland, seminal vesicles, and the upper part of the vas deferens.

**Ampulla** A sac or dilated part of a tube or canal.

**Urethral bulb** The small tube that makes up the prostatic part of the urethral tract and that balloons out as muscles close at either end, trapping semen prior to ejaculation.

**Expulsion stage** The second phase of ejaculation, during which muscles at the base of the penis and elsewhere contract rhythmically, forcefully expelling semen and providing pleasurable sensations.
Like erection, ejaculation is regulated by two centers in the spinal cord, one in the sacral region and one in the higher lumbar region. When sexual arousal reaches the point of ejaculatory inevitability, the lumbar ejaculatory center triggers the first stage of ejaculation, seminal emission. The lower, or sacral, ejaculatory center triggers the second stage of orgasm.

Although ejaculation occurs by reflex, a man can delay ejaculation by maintaining the level of sexual stimulation below the critical threshold, or “the point of no return.” Men who ejaculate prematurely have been successfully treated in programs that train them to learn to recognize their “point of no return” and maintain sexual stimulation below it. (Issues concerning the definition and treatment of premature ejaculation are explored in Chapter 11 on sexual dysfunction.) Recognizing the point of no return and keeping stimulation beneath the critical level can also prolong coitus and enhance sexual pleasure for couples even when the man does not experience premature ejaculation.

**RETOGRADE EJACULATION** In retrograde ejaculation, the ejaculate empties into the bladder rather than being expelled from the body. During normal ejaculation an external sphincter opens, allowing seminal fluid to pass out of the body. Another sphincter, this one internal, closes off the opening to the bladder, preventing the seminal fluid from backing up into the bladder. In retrograde ejaculation, the actions of these sphincters are reversed. The external sphincter remains closed, preventing the expulsion of the seminal fluid, while the internal sphincter opens, allowing the ejaculate to empty into the bladder. The result is an apparently dry orgasm. Retrograde ejaculation may be caused by prostate surgery (much less so now than in former years), drugs such as tranquilizers, certain illnesses, and accidents. Retrograde ejaculation is usually harmless in itself, because the seminal fluid is later discharged with urine. But infertility can result, and there may be changes in the sensations associated with orgasm. Persistent dry orgasms should be medically evaluated.

Male sexual functions, like female sexual functions, are complex. They involve the cooperation of the nervous system, the endocrine system, the cardiovascular system, and the musculoskeletal system. In Chapter 5 we learn more about how the female and male sex organs respond to sexual stimulation. In Chapter 6 we examine the similarities and differences between females and males with respect to sexual differentiation, behavior, and personality.

Retrograde ejaculation

Ejaculation in which the ejaculate empties into the bladder.
Male Sexual Anatomy and Physiology

The 3 R’s: Reflect, Recite, and Review

Your text uses the PQ4R method. Congratulations on completing the first R—reading the chapter. The remaining 3 R’s—reflect, recite, and review—will help you understand and recall the material in the chapter, as well as test your mastery.

Reflect

- Does your ethnic group have any particular attitudes or beliefs surrounding the practice of male circumcision? Do you share them? Explain.
- Considering the evidence, would you take testosterone to increase your prowess in athletics? Why or why not?
- Is any man you know reluctant to undergo regular screening (DRE and PSA testing) for cancer of the prostate? What are the sources of the reluctance? What arguments might you use to convince him to undergo screening?

CRITICAL THINKING: How has the material on male anatomy and physiology changed your views of the male sex organs? If your views have not changed, explain why.

Recite

1. What are the external male sex organs?
   - The external male sex organs include the penis and the scrotum, both of which are sensitive to sexual stimulation. Semen and urine pass out of the penis through the urethral opening. Circumcision has been carried out for religious and hygienic reasons. Research shows that circumcision makes a male less vulnerable to certain health problems but decreases sexual sensations. The scrotum is the pouch that contains the testes.

2. What are the internal male sex organs?
   - The internal male sex organs consist of the testes, tubes and ducts that conduct sperm, and organs that nourish and activate sperm. Testes secrete male sex hormones and produce sperm. The hypothalamus, pituitary gland, and testes keep blood testosterone levels at more or less even levels through a negative feedback loop. Each epididymis empties into a vas deferens that conducts sperm over the bladder. The seminal vesicles open into the ejaculatory ducts where their fluids nourish sperm. Semen is made up of sperm and fluids contributed by the seminal vesicles, prostate gland, and Cowper’s glands.

3. What health problems affect the urogenital system?
   - Men, like women, are subject to bladder and urethral inflammations, which are generally referred to as urethritis.

Unlike women, men can experience prostatitis. Cancer of the testes is the most common form of solid-tumor cancer to strike young men between the ages of 20 and 34. Benign prostate hyperplasia (BPH) is noncancerous enlargement of the prostate, which is caused by testosterone and connected with aging. Risk factors for prostate cancer include genetics, aging, and eating animal fats. Testosterone spurs growth of prostate cancer cells.

4. How do erection and ejaculation occur?
   - The penis erects when caverns within it become engorged with blood, expanding and stiffening it. Erection occurs in response to sexual stimulation but is also common during REM sleep. There are two erection centers in the spinal cord. Although erection is a reflex, penile sensations are relayed to the brain, where they generally result in pleasure. The parasympathetic branch of the autonomic nervous system largely governs erection, whereas the sympathetic branch largely controls ejaculation. Ejaculation, like erection, is a reflex. It is triggered when sexual stimulation reaches a threshold. The emission phase of ejaculation involves contractions of the prostate, seminal vesicles, and the upper part of the vas deferens. In the expulsion stage, muscles propel semen out of the penis.
Review

1. ________ is characterized by prolonged erection.
   (a) Phimosis
   (b) Peyronie's disease
   (c) Ejaculation
   (d) Priapism

2. During the emission stage of ejaculation, semen is propelled into the
   (a) urethral bulb.
   (b) prostate gland.
   (c) sacrum.
   (d) bladder.

3. Both males and females have
   (a) sperm.
   (b) semen.
   (c) vas deferens.
   (d) corpora cavernosa.

4. Male circumcision removes the
   (a) frenulum.
   (b) prepuce.
   (c) glans.
   (d) corona.

5. Scrotal temperature tends to be ________ body temperature.
   (a) 5 to 6º F higher than
   (b) 5 to 6º F lower than
   (c) the same as
   (d) an unpredictable

6. ________ stimulates secretion of testosterone by interstitial cells.
   (a) Progestin
   (b) Prolactin
   (c) Luteinizing hormone
   (d) Follicle-stimulating hormone

7. ________ nanograms of prostate specific antigen per milliliter of blood are considered normal.
   (a) Under 4
   (b) 4–10
   (c) 10–20
   (d) Over 20

8. Both semen and urine pass through the
   (a) vas deferens.
   (b) bladder.
   (c) urethral meatus.
   (d) intestines.

9. Men have erections every _____ minutes or so while they sleep.
   (a) 30
   (b) 60
   (c) 90
   (d) 120

10. The human penis contains
    (a) corpora cavernosa.
    (b) bone.
    (c) muscle.
    (d) interstitial tissue.