The Anatomy and Physiology: The Male Reproductive System

CHAPTER 1

Reproduction is a fundamental aspect of living organisms, vital for the perpetuation of species. Although it may not be crucial for individual survival, it ensures the continuation of life through the creation of new offspring.

Reproduction entails a multifaceted process that involves a sequence of interrelated anatomical and physiological functions. While the anatomical and physiological aspects of the reproductive system are central to procreation, it is essential to recognise the significant roles played by psychological and social factors in reproduction. Additionally, the enjoyment that is typically associated with reproductive organs highlights the holistic nature of the reproductive experience.

Gonads, such as testes in males and ovaries in females, produce gametes and hormones indispensable for reproductive function and sexual characteristics.

In contrast to the female reproductive system, the male reproductive system is more visibly external, with the majority of its organs being located outside the body (see Figure 1.1).

In collaboration with other bodily systems, the male reproductive system produces vital hormones that are crucial for biological development, sexual behaviour and performance. These systems include the neuroendocrine and musculoskeletal systems. Additionally, the male reproductive system plays a central role in the efficient operation of the urinary system.

Comprising the scrotum, testes, spermatic ducts, sex glands and penis, the male reproductive system collectively functions to produce sperm – the male gamete – and other components of semen. Furthermore, these organs collaborate in ejaculating semen from the body through the penis, facilitating its delivery into the vagina for the fertilisation of egg cells, typically occurring within the female body, leading to the formation of a zygote, subsequently developing into an embryo and then a fetus.

The primary functions of the male reproductive system are discussed.

PRODUCTION, MAINTENANCE AND TRANSPORTATION OF MALE SPERM AND SEMINAL FLUID

- The testes serve as the primary site for sperm production.
- Sperm cells undergo maturation and are nourished within the epididymis, which is located on the surface of each testis.
- Sperm cells are transported through the vas deferens.
- Secretions from various accessory glands, including the seminal vesicles and prostate gland, are added to the sperm to form semen.

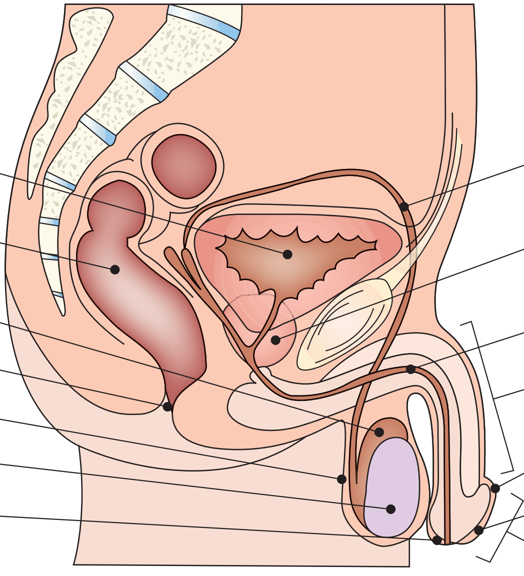

FIGURE 1.1 The male reproductive system. *Source:* Peate (2012). With permission of John Wiley & Sons.

EJACULATION OF SEMEN FROM THE PENIS

- During sexual arousal, the male reproductive system prepares for ejaculation. This involves the contraction of muscles surrounding the reproductive organs, including the muscles of the pelvic floor and the smooth muscles of the vas deferens.
- Rhythmic contractions of these muscles propel semen through the urethra and out of the body via the penis, known as ejaculation.
- The penis becomes engorged with blood during sexual arousal, facilitating rigidity for penetration during intercourse.

PRODUCTION AND SECRETION OF MALE SEX HORMONES

- Producing and secreting hormones known as androgens; testosterone is the primary androgen.
- Testosterone plays a crucial role in regulating various aspects of male physiology and behaviour.
- Functions of testosterone include the development and maintenance of secondary sexual characteristics. It also influences libido, mood and bone density.

INTEGRATION WITH OTHER BODY SYSTEMS

- The male reproductive system collaborates closely with the neuroendocrine system, which includes the hypothalamus and pituitary gland, regulating hormone production and maintaining reproductive function.

- The musculoskeletal system plays a role in supporting and facilitating reproductive activities, particularly during sexual intercourse.

This chapter outlines the anatomy and physiology of the male reproductive system, encompassing gonads and various accessory organs. In males, these include the testes, accessory ducts, accessory glands and the penis.

THE SCROTUM

The scrotum, an anatomical feature that is unique to male mammals, is a specialised pouch of skin and tissue. It is suspended from the base of the penis. It serves as protective housing for the testes, which are the primary organs responsible for sperm production and hormone secretion.

Externally, the scrotum appears as a singular sac, visually divided into two halves by a distinct ridge that is known as the raphe. This external division results from the underlying scrotal septum, a fibrous partition that separates the scrotum into two compartments, each contains one testicle. This arrangement helps to prevent physical contact between the testes, reducing the risk of injury and facilitating independent movement (Figure 1.2).

The scrotum is highly vascularised internally, ensuring adequate blood flow to the testes for their metabolic needs. Additionally, the scrotal skin is rich in sweat glands, which help with thermoregulation by facilitating evaporative cooling when necessary.

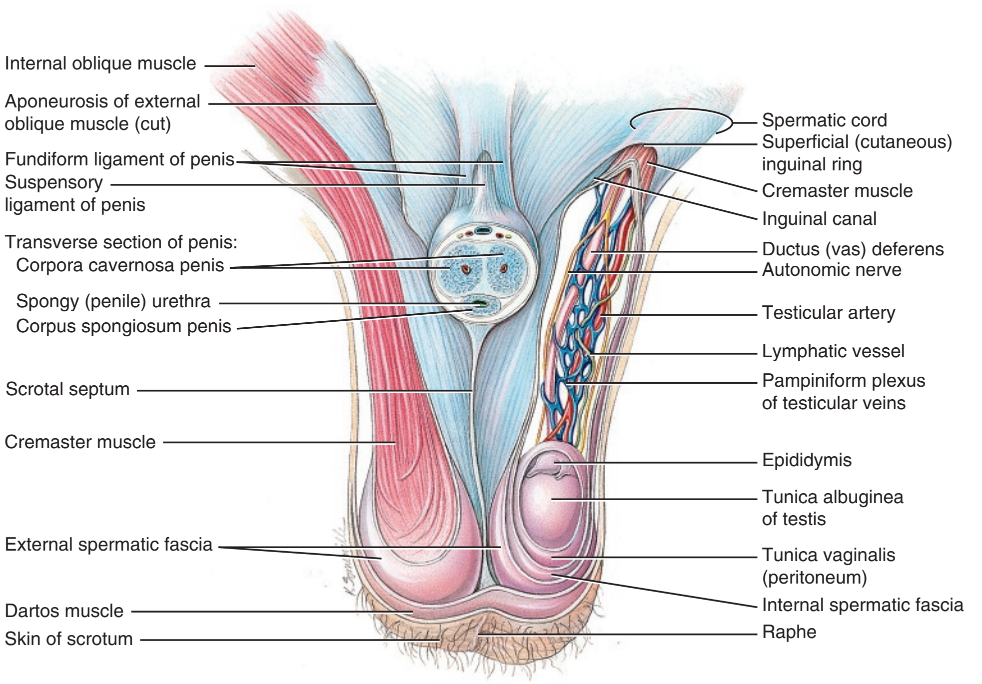

FIGURE 1.2 The scrotal sac and testes. *Source:* Peate (2020). With permission of John Wiley & Sons.

The location of the scrotum, located outside the pelvic cavity, is essential for maintaining the optimal temperature for sperm production, which is approximately 2–3 °C below the body's core temperature. This lower temperature is necessary for spermatogenesis (the process of sperm production) to occur efficiently, as high temperatures can impair sperm production and their viability.

Temperature regulation in the scrotum is primarily mediated by two sets of muscles: the cremaster muscle and the dartos muscle. The cremaster muscle, which is an extension of the internal abdominal oblique muscle, responds to changes in ambient temperature by contracting or relaxing. When it is cold, the cremaster muscle contracts, pulling the testes closer to the body to absorb more heat. Conversely, in warm conditions, the cremaster muscle relaxes, allowing the testes to descend away from the body to cool down. Simultaneously, the dartos muscle, a layer of smooth muscle within the scrotal wall, adjusts the surface area and tension of the scrotal skin. In cold temperatures, the dartos muscle contracts, causing the scrotum to wrinkle and become tighter, which reduces heat loss. Conversely, in warm conditions, the dartos muscle relaxes, allowing the scrotal skin to become smoother and more relaxed, facilitating heat dissipation through increased surface area.

The complex structure and dynamic function of the scrotum play a critical role in supporting spermatogenesis and ensuring the production of healthy sperm. Temperature regulation mechanisms mediated by the cremaster and dartos muscles help maintain the optimal conditions for sperm development and contribute to male fertility and reproductive health.

THE TESTES

The reproductive glands of the male are the testes, which are analogous to the female ovaries.

During the prenatal development of the male fetus, the testes initially emerge within the abdominal cavity. Before birth, they usually migrate through the inguinal canal, and they settle into the scrotal sac. Suspended within this sac, they hang on either side of the penis, typically with one positioned lower than the other. This external positioning is essential for the production of viable sperm. The primary functions of the testes include:

- Producing sperm (spermatozoa)
- Producing male sex hormones, such as testosterone

The testes are small, oval-shaped organs. They measure approximately 5 cm in length and 2.5 cm in width, enveloped by a layer of serous fibrous connective tissue (Mate 2020). The testes are covered by three layers:

1. Tunica vaginalis
2. Tunica albuginea
3. Tunica vasculosa

See Figure 1.3.

Internally, the testes are divided into approximately 250–300 compartments or lobules. Each of the compartments contains tightly coiled hollow tubes that are known as seminiferous tubules, which serve as the site of sperm production. Interspersed between the tubules are spaces that house interstitial or Leydig cells. These cells are responsible for synthesising and secreting the hormone testosterone, along with other androgens that are essential for male development and reproductive function.

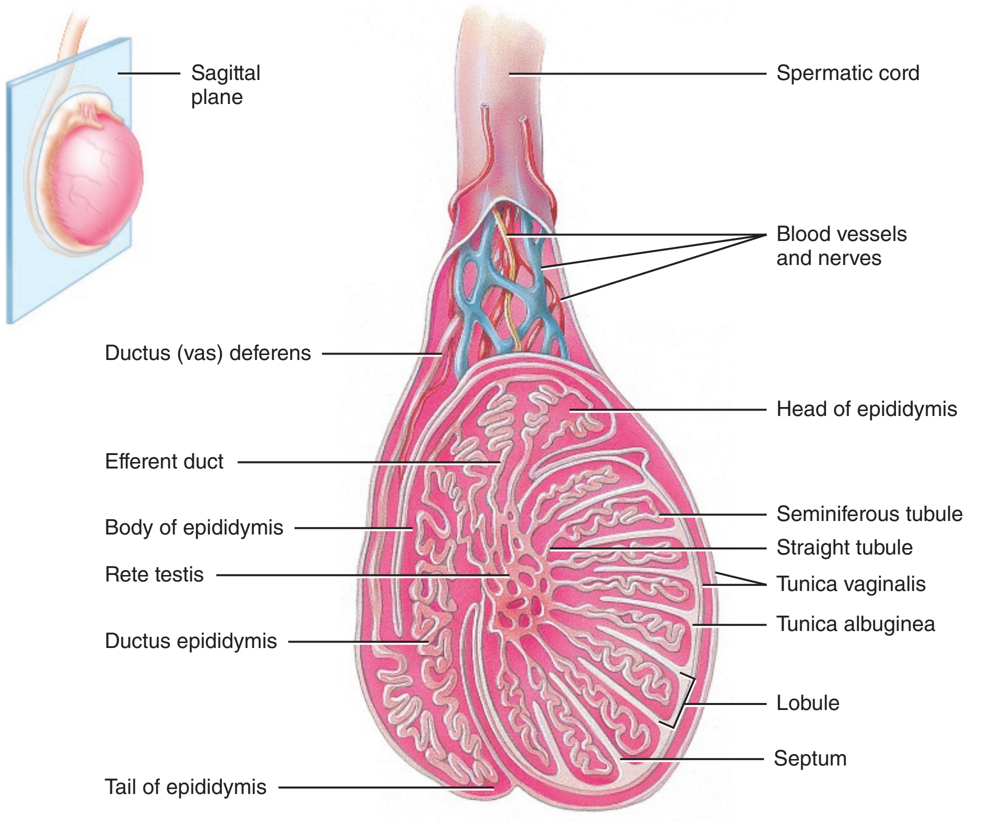

FIGURE 1.3 A testicle, seminiferous tubules. *Source:* Peate (2020). With permission of John Wiley & Sons.

The seminiferous tubules are lined with an outer layer of smooth muscle and an inner layer that is composed of Sertoli cells and developing sperm cells. Sperm cells, in various stages of development, gradually move through the spaces between the adjacent Sertoli cells until they are released into the lumen of the seminiferous tubule. Sertoli cells play a crucial role in nurturing and controlling the development of sperm; they are often referred to as nurse cells or mother cells. Some key functions of Sertoli cells include stimulating sperm proliferation and differentiation, providing nutrients for developing sperm, phagocytosing defective sperm and secreting fluid and proteins into the lumen of the seminiferous tubule.

SPERMATOGENESIS

Spermatogenesis is a complex process. Its aim is to produce mature sperm cells (Ridgers 2012). Sperm production takes place within the seminiferous tubules of the testes, in a process that is known as spermatogenesis (see Figure 1.4). This begins typically during puberty, and it persists throughout a man's life, with the average daily production ranging from 50 to 200 million sperm. Spermatogenesis takes approximately 74 days in humans (Mate 2020).

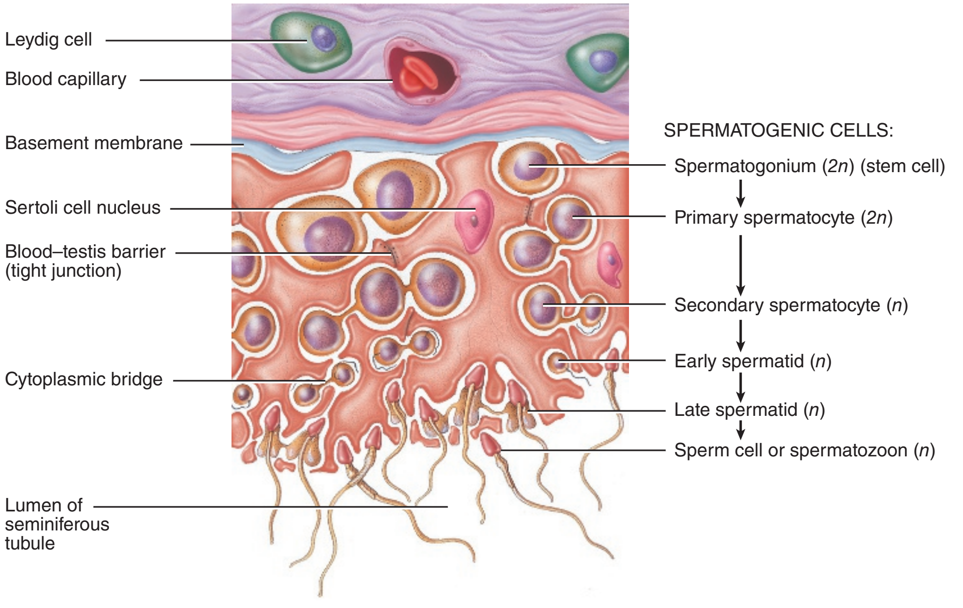

FIGURE 1.4 Spermatogenesis. *Source:* Peate (2020). With permission of John Wiley & Sons.

The initial step of spermatogenesis begins with the division of spermatogonia, which are stem cells located near the basement membrane of the seminiferous tubules in the testes. These spermatogonia undergo mitotic division, meaning they replicate their DNA and divide into two identical daughter cells. This process is crucial for replenishing the population of spermatogonia and initiating the production of sperm cells. Spermatogonia have a full set of chromosomes, referred to as diploid $2n$ with a count of 46 chromosomes. These spermatogonia cells continuously divide through a process called mitosis. During mitosis, they produce primary spermatocytes, which also have the same diploid number of chromosomes, 46. As such, both spermatogonia and primary spermatocytes contain the full set of chromosomes, which is necessary for maintaining the correct genetic information during sperm production. Some spermatogonia remain anchored near the basement membrane, serving as a reservoir of undifferentiated stem cells for future sperm generation.

Primary spermatocytes, which initially contain 46 chromosomes (a diploid number), undergo the first division of a process called meiosis. During this division, the primary spermatocytes split into two cells called secondary spermatocytes, each containing half the number of chromosomes as the original cell, which is 23 chromosomes (a haploid number). These secondary spermatocytes then undergo a second division of meiosis. As a result, each secondary spermatocyte divides again to produce spermatids, which are also haploid cells that contain 23 chromosomes. This process is key for reducing the chromosome number in sperm cells and ensuring that they have the correct number of chromosomes for fertilisation.

During the process of spermatogenesis, which involves the production of sperm cells in the testes, each primary spermatocyte (a cell with 46 chromosomes) undergoes meiotic divisions to produce four spermatids. These spermatids each contain 23 chromosomes, which is half the number found in other body cells.

In the final phase of spermatogenesis, the round spermatids undergo further changes to become elongated sperm cells. These mature sperm cells are then released into the central cavity (lumen) of the seminiferous tubules within the testes, where they can eventually travel through the male reproductive system to fertilise an egg cell.

These sperm cells carry only 23 chromosomes each, similarly, ovum (egg) cells also contain 23 chromosomes. During fertilisation, when a sperm cell merges with an egg cell, the resulting embryo (conceptus) will have a total of 46 chromosomes, which is the normal human chromosome count. This combination of genetic material from both the sperm and egg is essential for the development of a healthy embryo with the correct number of chromosomes, 46.

Figure 1.5 outlines the sequential steps involved in spermatogenesis, from the production of spermatogonia to the formation of mature sperm cells capable of fertilising an egg cell.

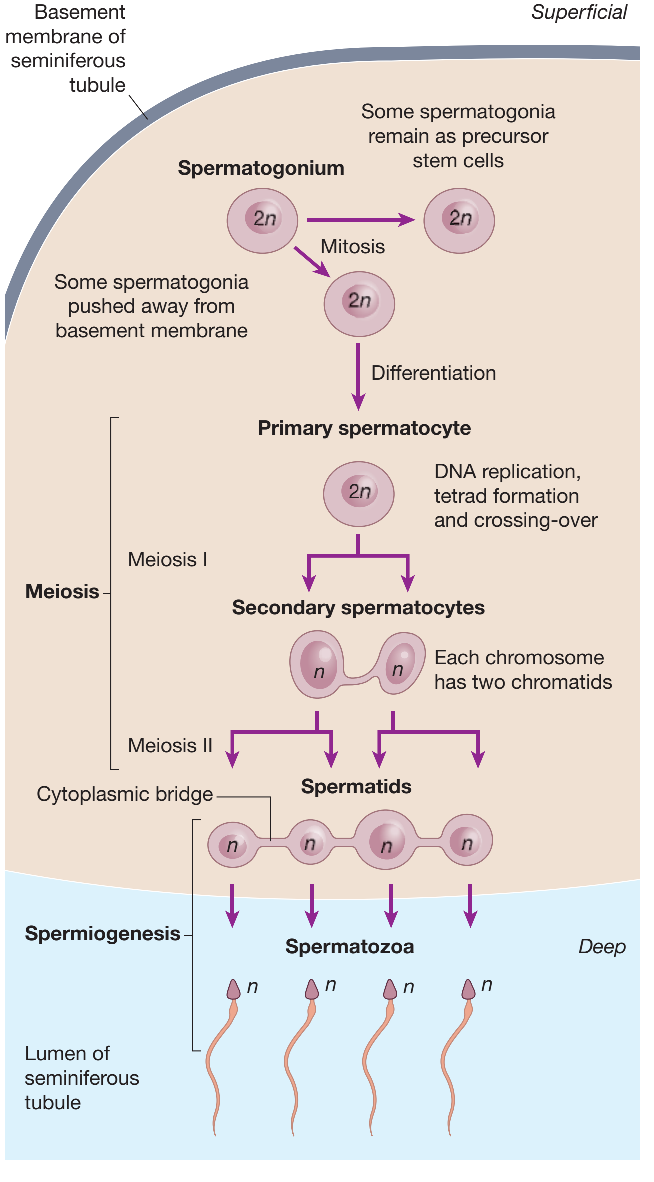

FIGURE 1.5 The sequential steps involved in spermatogenesis. *Source:* Peate (2022). With permission of John Wiley & Sons.

SPERM

Each day, the male reproductive system produces around 200 million sperm cells (Tortora and Derrickson 2012). These sperm cells are intricately designed with specialised structures to fulfil their ultimate mission of fertilising an egg.

The anatomy of a sperm cell is depicted in Figure 1.6. The elongated tail, a whip-like structure propels the sperm forward with extraordinary agility and precision. This tail, powered by the energy generated from the mitochondria that is housed within the midpiece, ensures the sperm's swift journey towards its destination.

The head of the sperm (the acrosome) contains the nucleus, where the genetic material essential for fertilisation is located. The acrosomal cap is a specialised structure that is located at the head of the sperm, it contains enzymes essential for penetrating the protective barriers surrounding the egg during fertilisation. These barriers include both cellular and non-cellular coverings, which act as formidable obstacles that the sperm must overcome to successfully fertilise the egg. The enzymes contained within the acrosomal cap facilitate the breakdown of these barriers, allowing the sperm to reach and fuse with the egg, initiating the process of fertilisation.

Once matured, sperm are released into the seminiferous tubules, embarking on their voyage towards their ultimate destination. The journey takes the sperm through the intricate network of the rete testes, where they converge into a single conduit that is called the epididymis. In the epididymis, the sperm undergo further maturation and acquire the motility necessary for the fertilisation of an egg.

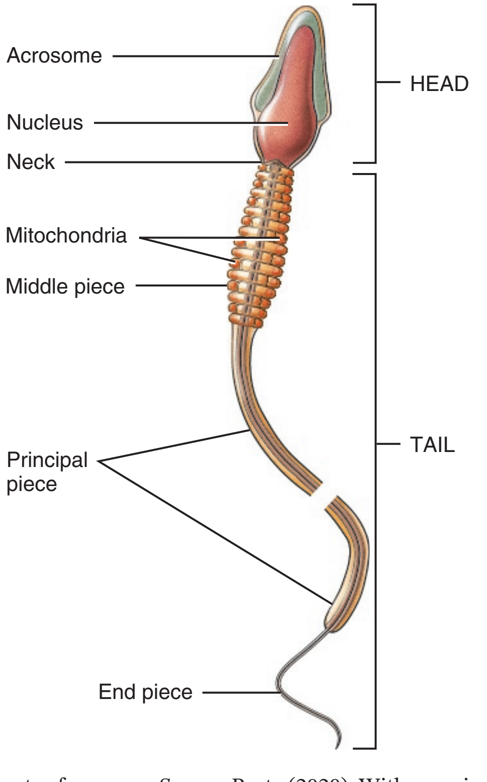

FIGURE 1.6 The components of a sperm. *Source:* Peate (2020). With permission of John Wiley & Sons.

EPIDIDYMIS

The epididymis is a long and highly coiled duct that is loosely attached to the testis; it is lined with pseudostratified columnar epithelium and is surrounded by a layer of smooth muscle. If it were fully uncoiled, each human epididymis would stretch to approximately 5 m in length (Mate 2020). As sperm travel through this highly coiled duct that constitutes the epididymis, they develop the ability to move spontaneously and actively (motility).

Transport of sperm through the epididymis usually takes around one to two weeks and is required in order for sperm to develop motility and the ability to fertilise an ovum. Sperm can also be stored in the epididymis and then released via peristaltic activity as the smooth muscle contracts during sexual arousal, moving the sperm along the epididymis into the vas deferens. Sperm stored in the epididymis can remain there for several weeks. However, sperm that are not ejaculated are eventually reabsorbed.

The epididymis leads to the larger and more muscular duct called the vas deferens.

THE VAS DEFERENS, SPERMATIC CORD AND EJACULATORY DUCT

The vas deferens is also known as the ductus deferens. It exhibits a straighter and wider structure compared to the convoluted epididymis, with an approximate length of 45 cm (Tortora and Derrickson 2012). This duct comprises ciliated epithelial cells and is ensheathed by a robust layer of muscle. The primary function of the vas deferens is to transport sperm from the scrotum, traversing the inguinal canal, a narrow passage in the abdominal wall, to reach the abdominal cavity. Situated between the scrotal sac and the inguinal canal lies the spermatic cord, a supportive structure that houses the vas deferens as it ascends through the scrotum, alongside blood vessels and nerves (Colbert, Ankney, and Lee 2020).

Originating from each testicle, the two vas deferens converge at the base of the urinary bladder. Each vas deferens then joins with a seminal vesicle to form ejaculatory ducts. These ducts will subsequently connect to the urethra, through which sperm are expelled during ejaculation induced by sexual intercourse, masturbation or other stimuli. Following ejaculation, sperm typically maintains viability for up to 48 hours within the female reproductive tract.

THE SEMINAL VESICLES

The seminal vesicles along with the prostate gland are responsible for secreting the majority of the fluids present in the ejaculate. This fluid, characterised by its milky alkalinity, creates a conducive environment for sperm survival, aiding them in navigating the acidic conditions of the vagina.

Situated at the base of the urinary bladder, there are two seminal vesicles, each measuring approximately 5 cm in length. These vesicles discharge their secretions into the ejaculatory duct, contributing to about two-thirds of the semen volume. Their secretions contain fructose as an energy source for sperm and a clotting protein facilitating semen coagulation post-ejaculation.

THE PROSTATE GLAND

Not all the functions of the prostate gland are fully understood. The prostate is an exocrine gland and is part of the male reproductive system, which is the largest accessory gland in the male reproductive system. A layer of fibrous tissue called the prostatic capsule covers the prostate gland. A thin layer of connective tissue separates the prostate and seminal vesicles from the rectum posteriorly. The prostate gland is made up of a number of different types of cells:

- Gland cells that produce the fluid portion of semen.
- Muscle cells that control urine flow and ejaculation.
- Fibrous cells that provide the supportive structure of the gland.

The prostate is a firm gland; it is partly glandular and has a partly muscular body, located immediately below the internal urethral orifice and around the beginning aspect of the urethra. It is located in the pelvic cavity, below the lower part of the symphysis pubis, above the superior fascia of the urogenital diaphragm and in front of the rectum. It is about the size of a chestnut and somewhat conical in shape with three zones (see Figure 1.7):

- Peripheral
- Transition
- Central

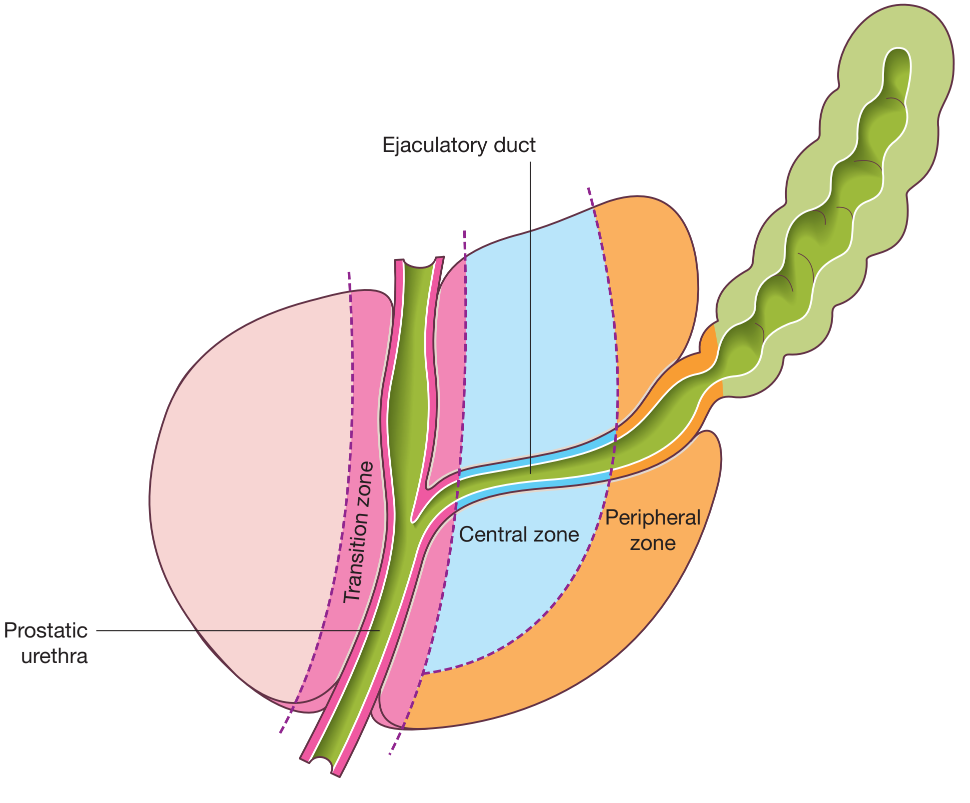

FIGURE 1.7 The prostate gland. *Source:* Peate (2022). With permission of John Wiley & Sons.

The arterial blood supply to the prostate gland is derived from branches of the internal iliac artery. Venous blood collects in the periprostatic venous plexus from where it is returned to the internal iliac vein by the inferior vesical vein.

The lymphatic vessels originating from the prostate gland usually drain into the internal iliac lymph nodes. Additionally, some of these lymphatic vessels may also reach the anterior group of obturator lymph nodes. In the context of anatomy, lymphatic vessels serve to transport lymph, a fluid containing white blood cells and waste products, away from tissues and organs towards lymph nodes, where it is filtered, and immune responses may be initiated. The internal iliac nodes and obturator nodes are specific groups of lymph nodes located in the pelvic region.

The prostate receives an autonomic nerve supply from the inferior hypogastric plexus, which lies along the internal iliac artery.

THE ZONES OF THE PROSTATE GLAND

PERIPHERAL ZONE

The peripheral zone of the prostate gland is the region that is closest to the rectum. It constitutes the largest portion of the prostate gland, making up approximately 70% of its total mass.

TRANSITION ZONE

The transition zone occupies the middle position within the prostate, lying between the peripheral and central zones. It encompasses the urethra as it traverses through the prostate. Initially, up to around the age of 40 years, this zone represents approximately 20% of the prostate gland's volume. However, with ageing, the transition zone undergoes enlargement, eventually becoming the most expansive region of the prostate. This enlargement displaces the peripheral zone towards the rectum.

CENTRAL ZONE

Positioned anteriorly to the transition zone, the central zone is farthest from the rectum. It houses approximately one-third of the ducts responsible for secreting fluid that aids in the formation of semen.

SURFACES OF THE PROSTATE GLAND

The prostate gland has several surfaces:

BASE

The base, when palpated, is oriented upward and inferior to the bladder surface. The urethra passes through it, closer to its anterior edge than its posterior edge.

APEX

The apex is relatively small and points downward, coming into contact with the urogenital diaphragm. It is through the apex that the urethra exits.

ANTERIOR, INFEROLATERAL AND POSTERIOR SURFACES

The anterior surface is slender and attaches to the puboprostatic ligament. The paired inferolateral surfaces are separated from the levator ani muscle by the prostatic venous plexus, curved inward both anteriorly and inferiorly. The posterior surface is broad, narrowing towards the bottom and distinguished by a shallow longitudinal depression dividing it into right and left sides. Near the top of this ridge, the ejaculatory ducts join the prostate.

PROSTATE GLAND FUNCTION

PROSTATIC FLUID PRODUCTION

The primary function of the prostate gland, regulated by testosterone hormone levels, is to generate the fluid component of semen. This fluid supports sperm motility and viability by creating a protective and fluid environment for semen passage through the vagina during fertilisation. Glandular cells within the prostate produce a thin alkaline fluid abundant in proteins and minerals, sustaining and nourishing the sperm. While this fluid is continually produced, its production escalates during sexual arousal, resulting in larger volumes of prostatic fluid. Upon ejaculation, this fluid mixes with sperm, forming semen.

URINARY FLOW REGULATION

Additionally, the prostate gland plays a role in controlling urine flow. The muscle fibres of the gland encompass the urethra under the control of the involuntary nervous system. These fibres contract to regulate and halt the flow of urine.

STRUCTURES LOCATED AROUND THE PROSTATE GLAND

- Seminal vesicles: these glands produce semen and are located on both sides of the prostate.
- Vas deferens: these tubes carry sperm from the testicles to the seminal vesicles.
- Nerve bundles: these control bladder and erectile function and are located on both sides of the prostate.
- Muscles: they control urination.

PROSTATE-SPECIFIC ANTIGEN

Prostate-specific antigen (PSA) is a protein produced by the prostate gland; it plays a crucial role in male reproductive physiology. Although its primary function was originally believed to be solely related to the liquefaction of semen (this refers to the process by which semen, initially thick and gel-like upon ejaculation, transforms into a more liquid state) after ejaculation, it is believed that PSA has a more complex and multifaceted role.

One important aspect of PSA's function is its involvement in fertility. PSA has been found to assist sperm in penetrating cervical mucus, which is crucial for successful fertilisation. By breaking down the cervical mucus barrier, PSA helps sperm navigate through the female reproductive tract more effectively, increasing the likelihood of reaching and fertilising the egg.

Prostate-specific antigen has been implicated in various pathological conditions affecting the prostate gland, particularly prostate cancer. Although elevated levels of PSA in the blood are often used as a marker for prostate cancer, the exact relationship between PSA levels and prostate cancer risk is complex.

THE PENIS

The penis serves as the primary male copulatory organ, encompassing the urethra and possessing a rich vascular supply. It functions as the conduit for both urine excretion and the ejaculation of semen. Structurally, it consists of a shaft and a glans tip, with the glans typically covered by the prepuce in uncircumcised males. The glans penis in males is analogous to the clitoris in females. Both structures are highly sensitive and play a key role in sexual arousal and pleasure. The attached section of the penis is referred to as the root, while the more mobile portion is known as the shaft or body.

Anatomically, the penis is cylindrical in shape, comprised of three cylindrical tissue masses enveloped by fibrous tissue called the tunica albuginea. These masses include two corpora cavernosa and the corpus spongiosum, housing the spongy urethra (see Figure 1.8).

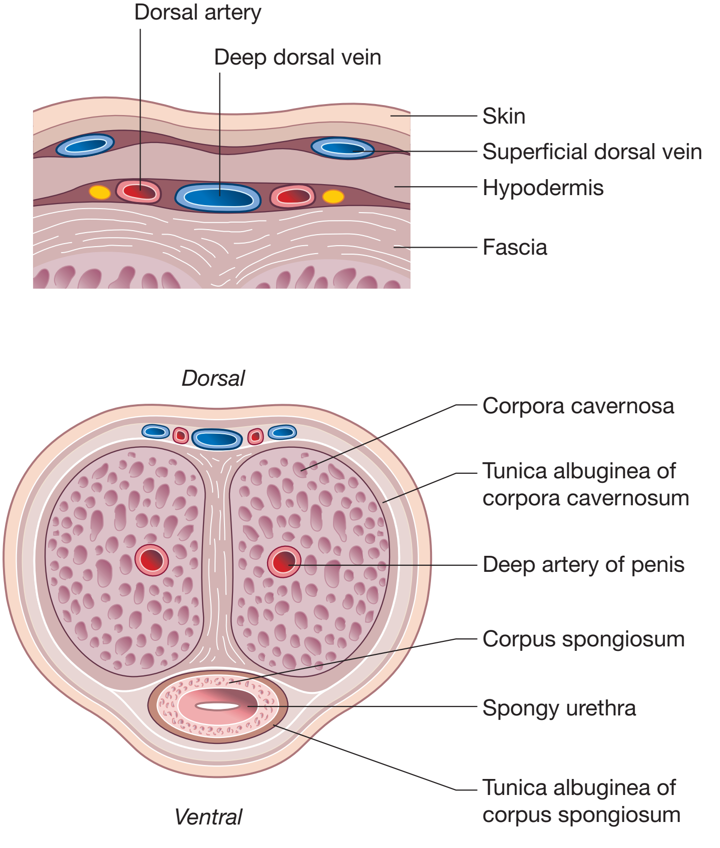

FIGURE 1.8 The anatomy of the penis. *Source:* Peate (2022). With permission of John Wiley & Sons.

Under normal circumstances, the penis is usually flaccid and hangs downward. However, during sexual arousal, it undergoes erection, an enlargement characterised by swelling, engorgement with blood, increased firmness and straightening. This erection reflex relies on stimulation of the parasympathetic nervous system, triggered by various sensory stimuli associated with sexual encounters.

Upon parasympathetic stimulation, the penis becomes erect as blood fills the erectile tissue within the corpora cavernosa and corpus spongiosum. This allows the penis to penetrate the vagina and deposit sperm (ejaculation) as close to the fertilisation site as possible. Following ejaculation, arterioles constrict, causing the penis to return to a flaccid state.

HORMONAL CONTROL OF MALE REPRODUCTION

The primary hormones in both males and females can be classed as either oestrogens or androgens. Both classes of male and female hormones are present in both males and females alike, but they differ vastly in their amounts.

Testosterone, the primary male sex hormone, acts as a steroid that regulates growth and development. Its production undergoes a substantial increase (approximately 18-fold) during puberty. Following puberty, interstitial cells typically maintain a continuous production of testosterone, amounting to around 6 mg per day. However, testosterone production can be disrupted for a number of reasons and by the age of 40 years, men will usually experience a decline in production, decreasing by about 1% annually (Peate 2022).

Testosterone plays a crucial role in developing both primary and secondary male sex characteristics (see Figure 1.9). Primary characteristics include the size of the penis and testes, spermatogenesis and libido regulation. Erectile function is also influenced by testosterone, which enhances the activity of nitric oxide synthase, thereby improving smooth muscle movement in the penis, facilitating erections.

Secondary male sex characteristics, such as pubic, body and facial hair growth, deepening of the voice and increased bone density, are also influenced by testosterone. Greater testosterone levels lead to a higher proportion of lean body mass and lower body fat compared to females.

During puberty, there is an increase in gonadotropin-releasing hormone (GnRH) secretion from the hypothalamus triggering elevated secretion of luteinising hormone (LH) and follicle-stimulating hormone (FSH) from the anterior pituitary gland. This negative feedback mechanism regulates testosterone secretion and spermatogenesis (see Figure 1.10).

Leydig cells, located between seminiferous tubules, are stimulated by LH to produce testosterone, synthesised from cholesterol in the testes. These cells generate the majority (95%) of a man's testosterone. Through negative feedback, LH secretion is suppressed by the anterior pituitary and GnRH secretion is inhibited by the hypothalamus. Testosterone can also be converted to dihydrotestosterone in target cells such as the prostate gland.

Follicle-stimulating hormone indirectly promotes spermatogenesis by stimulating Sertoli cells, which release androgen-binding protein (ABP) into the seminiferous tubules' lumen and interstitial fluid surrounding spermatogenic cells. ABP binds to testosterone, maintaining its concentration. Testosterone is responsible for stimulating the final stages of spermatogenesis in the seminiferous tubules.

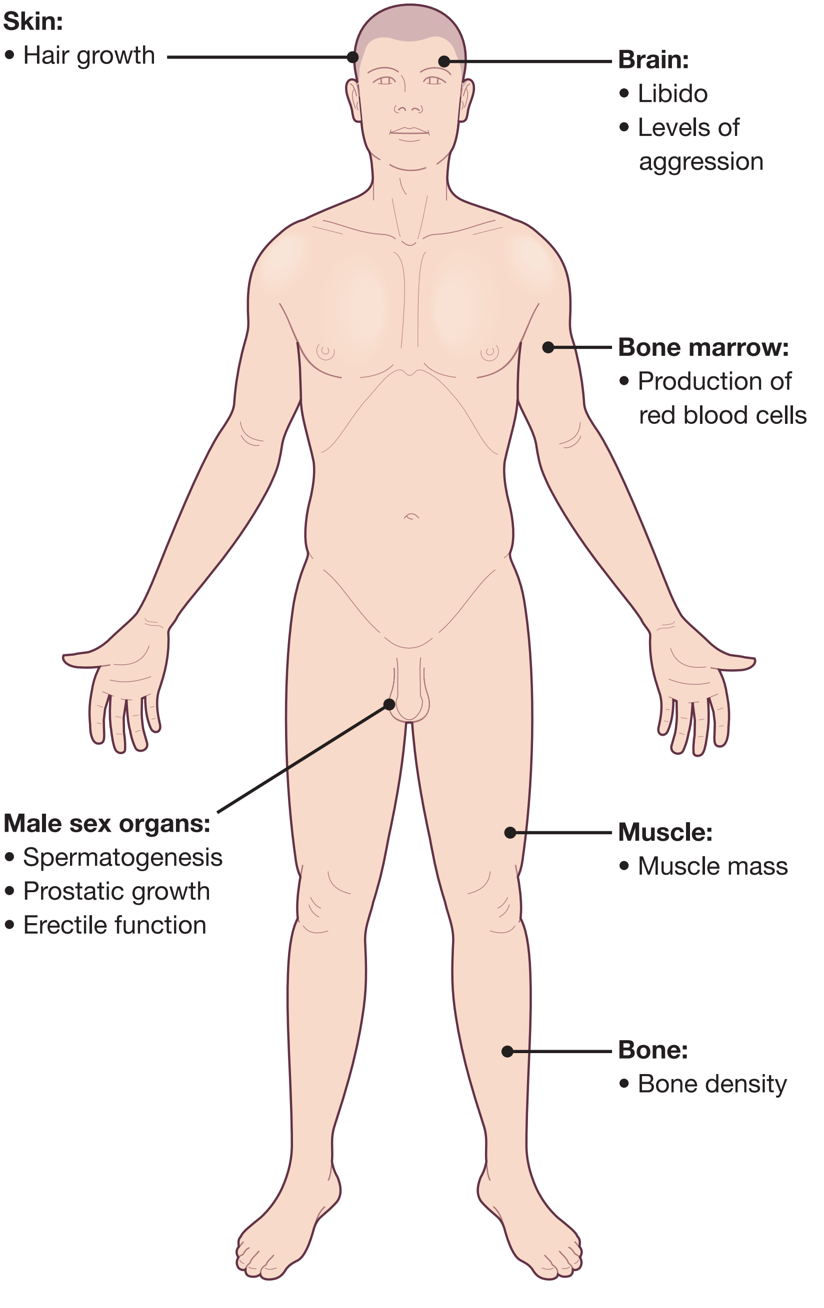

FIGURE 1.9 Primary and secondary sex characteristics. *Source:* Peate (2022). With permission of John Wiley & Sons.

Inhibin, released by Sertoli cells, regulates FSH secretion by inhibiting the anterior pituitary gland when the required degree of spermatogenesis for male reproductive function is attained. Conversely, decreased inhibin levels result in increased FSH production, accelerating spermatogenesis when it occurs too slowly.

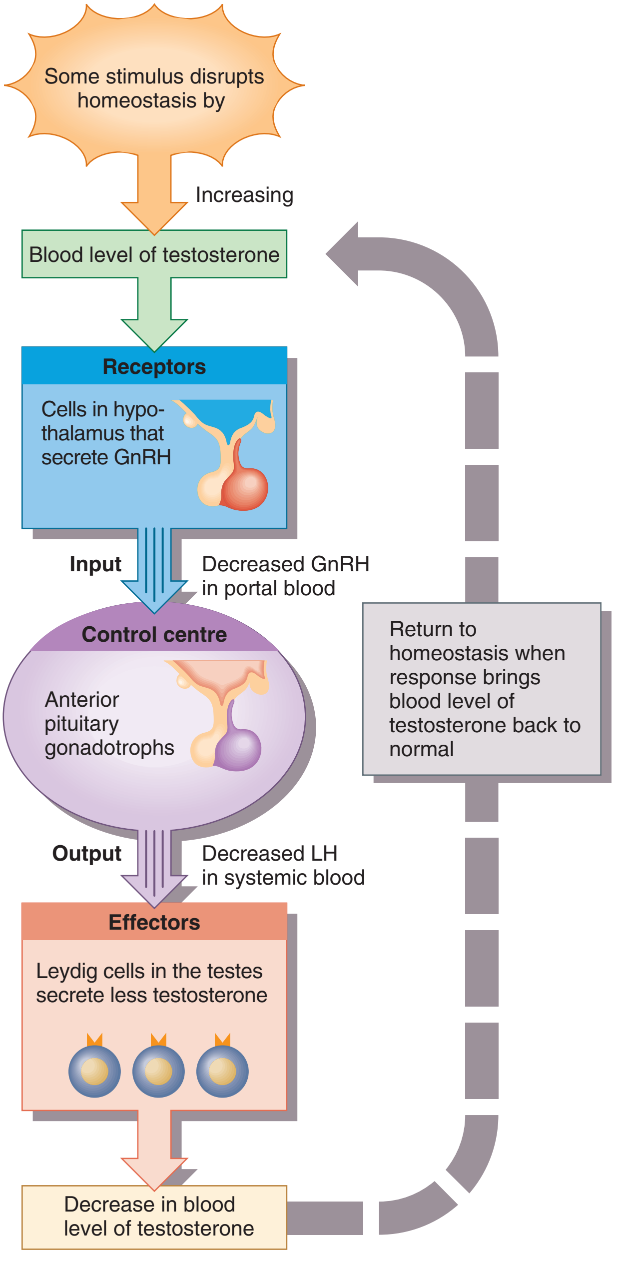

FIGURE 1.10 Negative feedback system associated with the control of testosterone in the blood. *Source:* Peate (2020). With permission of John Wiley & Sons.

CONCLUSION

A comprehensive understanding of the anatomy and physiology of the male reproductive system is fundamental for the provision of holistic care to male patients across various healthcare settings. This chapter has delved into the intricate structures and functions that comprise the male reproductive system, providing essential knowledge to enable the delivery of competent and compassionate care.

The primary organs of the male reproductive system have been explored, including the testes, epididymis, vas deferens, prostate gland, seminal vesicles and penis, understanding their roles in sperm production, storage and ejaculation. Hormonal regulation and the intricate interplay of hormones such as testosterone, LH and FSH in orchestrating male sexual development and function have been outlined.

The male reproductive system is complex. It should also be noted that the system provides pleasure, sexual excitement and intimacy. For many individuals, this is an important aspect of their well-being.

GLOSSARY OF TERMS

Androgens: Male sex hormones responsible for the development and maintenance of male reproductive organs and secondary sexual characteristics.

Corpora cavernosa: Two cylindrical masses of erectile tissue in the penis that fill with blood during erection, contributing to penile rigidity.

Corpus spongiosum: Cylindrical mass of erectile tissue in the penis that surrounds the urethra and aids in maintaining urethral patency during erection.

Epididymis: Coiled tubular structure located on the posterior aspect of the testis where sperm mature and are stored before ejaculation.

Follicle-stimulating hormone (FSH): Hormone produced by the anterior pituitary gland that stimulates spermatogenesis and regulates sperm production in the testes.

Glans: Sensitive tip of the penis, rich in nerve endings and involved in sexual stimulation and arousal.

Gonadotropin-releasing hormone (GnRH): Hormone produced by the hypothalamus that stimulates the release of LH and FSH from the anterior pituitary gland, regulating testosterone production and spermatogenesis.

Leydig cells: Cells located in the interstitial tissue of the testes that produce testosterone in response to LH stimulation.

Luteinising hormone (LH): Hormone produced by the anterior pituitary gland that stimulates testosterone production by the Leydig cells in the testes.

Penis: Male external genital organ involved in sexual intercourse, urination and ejaculation.

Prepuce (foreskin): Fold of skin that covers the glans penis in uncircumcised males.

Prostate gland: Glandular organ located below the bladder that produces seminal fluid, aiding in sperm viability and ejaculation.

Semen: Fluid containing sperm and seminal fluid, ejaculated during sexual intercourse.

Seminal vesicles: Paired glands located near the base of the bladder that produce seminal fluid, contributing to semen volume and sperm motility.

Sertoli cells: Cells located in the seminiferous tubules of the testes that support and nourish developing sperm cells.

Sperm: Male reproductive cells produced in the testes through the process of spermatogenesis.

Spermatogenesis: Process of sperm cell production within the seminiferous tubules of the testes.

Testes: Male reproductive organs responsible for producing sperm and testosterone.

Testosterone: Primary male sex hormone responsible for the development and maintenance of male reproductive organs, secondary sexual characteristics and libido.

Tunica albuginea: Dense fibrous tissue surrounding the testes and penile erectile tissue, providing structural support and protection.

Vas deferens: Duct that transports mature sperm from the epididymis to the urethra during ejaculation.

MULTIPLE CHOICE QUESTIONS

1. What is the primary male sex hormone responsible for the development and maintenance of male reproductive organs?
   a) Oestrogen
   b) Testosterone
   c) Progesterone
   d) LH
2. Where does sperm maturation primarily occur?
   a) Testes
   b) Epididymis
   c) Prostate gland
   d) Vas deferens
3. Which part of the male reproductive system encloses the urethra and contains erectile tissue?
   a) Scrotum
   b) Testes
   c) Seminal vesicles
   d) Penis
4. What is the function of the epididymis?
   a) Production of sperm
   b) Storage and maturation of sperm
   c) Production of testosterone
   d) Secretion of seminal fluid
5. Which cells in the testes produce testosterone?
   a) Leydig cells
   b) Sertoli cells
   c) Germ cells
   d) Interstitial cells
6. What is the function of the vas deferens?
   a) Produce sperm
   b) Store sperm
   c) Transport sperm from the epididymis to the urethra
   d) Produce seminal fluid

7. Which part of the male reproductive system is responsible for the production of sperm?
   a) Seminal vesicles
   b) Vas deferens
   c) Prostate gland
   d) Seminiferous tubules in the testes

8. What is the function of the prostate gland in the male reproductive system?
   a) Production of testosterone
   b) Storage of sperm
   c) Production of seminal fluid
   d) Maturation of sperm

9. Which structure in the male reproductive system carries both urine and semen?
   a) Vas deferens
   b) Penis
   c) Urethra
   d) Seminal vesicles

10. What is the purpose of the tunica albuginea in the testes?
   a) Produce sperm
   b) Provide structural support and protection
   c) Store sperm
   d) Produce testosterone

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