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The male reproductive system functions in the production and maturation of sperm. Additionally, special cells also produce and release the sex steroid, testosterone.

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The scrotum is an external pouch that contains the testes, the male primary sex organs. It also houses two spermatic cords which include the ductus deferentia as well as blood vessels, nerves and lymph vessels. Each cord travels from a testis through the abdominal wall into the abdominal cavity. The dartos muscles attach on the bottom portion of each testis. They are made of smooth muscle and they help reduce surface area and potential heat loss, when cold, by pulling the testes closer to the body. The cremaster muscles surround the spermatic cords and also pull the testes closer to the body.

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Each testis contains many internal compartments called lobules. Each lobule contains many microscopic tubes known as seminiferous tubules. Each tube is lined with special cells known as the germinal epithelium. The germinal epithelium gives rise to the cells that ultimately become sperm cells. Additionally, special cells in the seminiferous tubules, called sustentacular cells, help protect and support the cells of the germinal epithelium. A hollow space called the lumen, runs through the center of each tubule.

As the cells in the germinal epithelium develop into sperm cells (spermatogenesis), the sustentacular cells promote their growth by providing nutrients and growth factors and removing wastes. Sustentacular cells also create a blood-testis barrier which prevents proteins and other cells in blood and interstitial fluid from attacking the genetically different germ cells. Remember that as germ cells undergo meiosis, their chromosome composition becomes different from that of the surrounding cells.

All of the seminiferous tubules in a testis merge to form a network called the rete testis. Sperm cells partially mature in a rete testis before moving out of the testis into a spermatic duct called the epididymis.

In the lobules of the testes, interstitial cells are found in the spaces between the seminiferous tubules. Interstitial cells are the primary sources of testosterone in the male body.

During fetal development, the testes develop near the kidneys and eventually descend out of the body. As testosterone levels increase during the 7th month of development, the testes are pulled through the abdominal wall and into the scrotum.

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The spermatic ducts are the hollow pathways through which sperm travel as they move from the testes into the urethra. There are three components that comprise the ducts.

Sperm travel from a rete testis into the first portion of the duct system, the epididymis. The epididymis is a highly coiled structure on the surface of a testis. It is the site of sperm maturation and storage. It takes about 20 days for sperm to travel through an epididymis to the distal end where they are stored.

Stored sperm will remain viable for 40-60 days. After which they begin to disintegrate.

The ductus deferens, the next portion of the pathway, carries sperm from an epididymis into the abdominopelvic cavity through the wall of the torso. Inside the body, it passes behind the bladder and unites with a duct from the seminal vesicle. Both ductus deferentia meet near the base of the bladder.

The final portion of the pathway is formed when the ducts from the seminal vesicles and the ductus deferentia merge and is known as the ejaculatory duct. The ejaculatory duct carries sperm and other components of semen through the prostate gland and into the urethra. The urethra is shared by the urinary system and reproductive system.

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The penis is an external organ that functions in the transfer of semen into the female reproductive system. It consists of 3 cylindrical columns of erectile tissue which are capable filling with blood during sexual arousal to cause an erection. The ventral column of erectile tissue is called the corpus spongiosum. The corpus spongiosum encloses the urethra, through which semen and urine leave the body. The two dorsal erectile bodies are called the corpora cavernosa (corpus cavernosum, singular). The tip of the penis is known as the glans.

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The process of sperm production is known as spermatogenesis. Sperm production occurs in the germinal epithelial tissue of the seminiferous tubules of the testes. Sperm production starts during puberty and continues until death. Each individual sperm cell reaches maturity over several months.

During fetal development, primordial germ cells (2N) in the germinal epithelium of the seminiferous tubules develop to become spermatogonia. Spermatogonia remain dormant until puberty.

Hormonal changes during puberty cause spermatogonia to divide by mitosis to make additional spermatogonia.

Some spermatogonia from the germinal epithelium move between sustentacular cells and cross the blood-testis barrier to become primary spermatocytes (2N).

Hormones cause primary spermatocytes to undergo Meiosis I. Two daughter cells, called secondary spermatocytes, are produced when a single primary spermatocyte divides. During the division, the

nucleus of the primary spermatocyte splits and each secondary spermatocyte receives half of the original chromosomes to become haploid (N).

Each secondary spermatocyte will then automatically go through Meiosis II to become two haploid spermatids (N). Unlike the in the female system, Meiosis II in males isn't dependent upon other events or conditions. In summary, the overall process starts with one diploid cell which ultimately produces four haploid cells.

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Sperm cells mature in a process known as spermiogenesis. During development, spermatids grow flagella. Each fully mature sperm cell has several basic parts.

The head of the sperm consists of a haploid nucleus and a cap digestive enzymes known as the acrosome. The enzymes in the acrosome are essential to help penetrate the outer portion of a secondary oocyte during fertilization.

The midpiece of a sperm cell contains numerous mitochondria that provide the energy required for the sperm cell to move.

The tail of a sperm cell (flagellum) uses energy produced in the midpiece and propels the sperm in the female reproductive tract.

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Semen is the fluid expelled through the urethra during ejaculation. It contains sperm and secretions produced by several accessory glands.

The seminal vesicles produce seminal fluid. Seminal fluid makes up the majority of semen (60%). It contains fructose that can be used by the mitochondria in the midpiece of a sperm cell to help power the flagellum. Seminal fluid contains an alkaline substance called citrate that helps to neutralize acid in the male urethra and the vagina. Seminal fluid also contains chemicals called prostaglandins which stimulate the smooth muscle in the uterus to help facilitate of movement of sperm into the uterine tubes.

Prostate fluid makes up 30% of semen and is produced by the prostate gland. It contains calcium ions, citrate, phosphate ions that elevate pH and help sperm survive in the acidic environment of the female reproductive tract. Prostate fluid also contains enzymes which help sperm adhere to the walls of the reproductive tract, increasing the possibility of fertilization.

Finally, a small amount of bulbourethral fluid is produced by the bulbourethral glands. This fluid serves to lubricate the urethra and helps the penis enter the vagina.

