Name: Oputa Chukwunonso Henrietta

Matric Number: 18/MHS02/165

Assignment Title: Male Reproductive Functions

Course Tile: Physiology

Answer

1. Spermatogenesis

Spermatogenesis is the process by which haploid spermatozoa develop from germ cells in the seminiferous tubules of the testis. This process starts with the mitotic division of the stem cells located close to the basement membrane of the tubules. These cells are called spermatogonial stem cells. Rounded immature sperm cells undergo successive mitotic and meiotic divisions (spermatocytogenesis) and a metamorphic change (spermiogenesis) to produce spermatozoa.

Mitosis and meiosis. Mitosis is the process of cell duplication - two daughter cells are formed with exactly the same DNA and chromosomal content of the original diploid (2N) mother cell. Human cells contain 46 chromosomes - 22 pairs of homologous autosomes and one pair of sex chromosomes.

Mitosis (M) encompasses just one step in the eukaryotic cell cycle: $G_1 > S > G_2 > M > C$. Cells grow during the dominant G_1 phase. Replication of chromosomes occurs in the S phase. Preparation for mitosis takes place during G_2 - replication of organelles and synthesis of microtubules. Interphase includes the combined stages G_1, S, and G_2. During mitosis: chromosomes condense, the nuclear envelope disappears, and spindle fibers begin to form from microtubules (prophase); centromeres of duplicate sister chromatids align along the spindle equator (metaphase); chromatids separate and migrate toward opposite poles (anaphase); the mitotic apparatus is disassembled, autonomous nuclear envelopes are established, and the chromosomes uncoil (telophase). The final stage of the cell cycle, when cell division actually occurs, is called cytokinesis (C).

Meiosis is a special process of reductional cell division; it results in the formation of four gametes containing half (1N) the number of chromosomes found in somatic cells. Haploid gametes unite at fertilization to create a diploid zygote. Remember that in mammals the heterogametic male (XY) determines the sex of the embryo. Approximately one-half of spermatozoa contain either an X or Y chromosome (the sex chromosomal complement of mammalian females is XX, and therefore, ova can only contribute an X chromosome to the offspring). Genes carried on the X chromosome that inhibit spermatogenesis are inactivated in XY somatic cells.

Spermatogenic cycle and wave. If one closely examines serial cross-sections of a seminiferous tubule you will discover that sperm cells differentiate in distinctive associations. Each spermatogenic association has been classified as a stage of the seminiferous epithelial cycle. A spermatogenic cycle is defined as the time it takes for the reappearance of the same stage within a given segment of the tubule. Each stage of the cycle follows in an orderly sequence along the length of the tubule. The distance between the same stages is called the spermatogenic wave. One tubule can contain numerous complete waves. Adjacent segments of the tubule evidently communicate in some unknown manner.

The number of stages within a spermatogenic cycle and the number of cycles required for the completion of spermatogenesis varies between species. There are 12 different stages of the cycle in the bull of about 14 days each; approximately four cycles within a given region of the tubule occur before an A1 spermatogonia is transformed into a spermatozoa. Six stages have been noted in man; four 16-day cycles are needed to complete spermatogenesis. The linear pattern of the spermatogenic cycle is less ordered in man than in farm animals or rodents.

Hormonal regulation. Spermatogonia continue to divide, but in reduced numbers, after hypophysectomy. Spermatocytogenesis is completely arrested at the primary spermatocyte stage in hypophysectomized animals; this step is restored by testosterone. Androgen-binding protein (the testicular counterpart of SHBG) sequesters testosterone within the seminiferous tubule (and caput epididymis). Meiosis II is hormonally-independent. Follicle-stimulating hormone participates in spermiogenesis. Estradiol and DHT are also involved in the spermatogenic process.

Hormonal effects on sperm cells are not direct, but are mediated through Sertoli cells. Biochemical and biophysical facets of sperm-Sertoli interactions in spermatogenesis are largely unknown. Rate of production of spermatozoa is not influenced by endocrine therapy.

Blood-testis barrier. As sperm cells mature they move between Sertoli cells from the basal toward the adluminal compartment of the seminiferous tubule. Because nucleotide recombinations can occur during meiosis I, the genetic code of chromosomes of gametes can differ from that of somatic parent cells (i.e., progeny cells might express cell-surface antigens that are recognized by the host as foreign and thus be eliminated by humeral or cellular immune mechanisms). Occluding junctions that interconnect adjacent Sertoli cells shield secondary spermatocytes, spermatids, and spermatozoa from autoimmune recognition. The blood-testis barrier also acts to conserve certain products of Sertoli cells within the seminiferous tubule, such as ABP. The epithelial syncytium of this barrier extends through the epididymis.

(Vasectomy can lead to a breakdown in the blood-testis barrier in laboratory animals and subhuman primates; as a result, an autoimmune response is mounted against sperm antigens released into the periphery. Immune complexes can lodge within the kidneys and adhere to walls of blood vessels causing renal damage and atherosclerosis; possible complications of this nature, although not detected thus far, need to be monitored closely in long-term vasectomized men.)

Effect of temperature. Sperm cells will not mature at core body temperature in most mammals (spermatogenic DNA polymerase b and recombinase activities exhibit unique temperature optima); to adapt, the testes assume an external position. Testicular descent from the abdomen normally transpires during fetal or neonatal life.

If the testes fail to descend into the scrotum, a condition called cryptorchidism, the male will be sterile; gone uncorrected (by surgery or androgen treatment) spermatogonia will eventually degenerate. The stallion and boar are the most prone to cryptorchidism among the domesticated species (because the condition has a genetic predisposition, it is not advisable to use unilateral/restored animals for breeding purposes). Cryptorchidism does not have a major effect on testicular output of testosterone.

2. Testosterone

Testosterone is a hormone produced by the human body. It's mainly produced in men by the testicles. **Testosterone** affects a man's appearance and sexual development. It stimulates sperm production as well as a man's sex drive. It also helps build muscle and bone mass. In general, the normal range in males is about 270-1070 ng/dL with an average level of 679 ng/dL.

A normal male testosterone level peaks at about age 20, and then it slowly declines. Testosterone levels above or below the normal range are considered by many to be out of balance. If a male has a low level of testosterone, the symptoms can include erectile dysfunction, and reduced bone mass and sex drive. The hormone has many important functions, including: the development of the bones and muscles. The deepening of the voice, hair growth, and other factors related to appearance. Despite being a male sex hormone, testosterone also contributes to sex drive, bone density, and muscle strength in women. However, an excess of testosterone can also cause women to experience male pattern baldness and infertility. The brain and pituitary gland control testosterone levels. Testosterone increases levels of growth hormone. That makes exercise more likely to build muscle.

Testosterone increases bone density and tells the bone marrow to manufacture red blood cells. Men with very low levels of testosterone are more likely to suffer from bone fractures and breaks.

3. Semen

Semen, also known as seminal fluid, is an organic fluid that contains spermatozoa. It is secreted by the gonads (sexual glands) and other sexual organs of male or hermaphroditic animals and can fertilize the female ovum. Semen is a mixture of fluids that contains sperm, but the majority of semen is composed of over 200 separate proteins, as well as vitamins and minerals, including vitamin C, calcium, chlorine, citric acid, fructose, lactic acid, magnesium, nitrogen, phosphorus, potassium, sodium, vitamin B12, and zinc.

Some differences between sperm and semen are one; Sperm is the microscopic male reproductive cell while semen refers to the seminal fluid that contains millions of sperms. Two; Sperm is the genetic bearer and is haploid, while semen has no such characteristic other than nourishing the sperm cells and keeping them motile. How does ejaculation occur?
Ejaculation is controlled by the central nervous system and occurs when there is friction on the genitalia and other forms of sexual stimulation. The stimuli lead to impulses that are sent up the spinal cord and into the brain.

Two phases of ejaculation
Ejaculation has two phases:

Phase 1: emission in which the vas deferens (the tubes that store and transport sperm from the testes) contract to squeeze the sperm toward the base of the penis through the prostate gland and into the urethra. The seminal vesicles release their part of the semen that combine with the sperm. The ejaculation is unstoppable at this stage.

Phase 2: ejaculation in which the muscles at the base of the penis and urethra contract. This leads to forcing the semen out of the penis (ejaculation and orgasm) and this phase also has a bladder neck contraction. The bladder neck contracts to prevent the back flow of the semen into the urinary tract. Dry orgasm can occur even without delivery of semen (ejaculation) from the penis. Erection declines normally following ejaculation.

4. Male Orgasm

Although it seems simple enough, the male orgasm is actually a complex process. Men achieve orgasm through a series of steps involving a number of organs, hormones, blood vessels, and nerves working together. The typical result is ejaculation of fluid that may contain sperm through strong muscle contractions. The fuel for the process leading to orgasm is testosterone, a hormone produced in steady supply by the testicles. The testicles also make millions of sperm each day, which mature and then are mixed with whitish, protein-rich fluids. These fluids nourish and support the sperm so they can live after ejaculation for a limited time. This mixture of fluid and sperm, known as semen, is what is moved through the urethra and out the penis during orgasm.

Some men can have problems reaching orgasm. These most often stem from psychological factors; for example, they are still affected by a traumatic event or a restrictive upbringing, or they have fallen into masturbation patterns that could have conditioned the body to take longer to orgasm. However, the problem also can be caused by certain medications or by a neurological or cardiovascular disease, or by having surgery where nerves are cut, says Beverly Whipple, PhD, RN, professor emerita at Rutgers University in Newark New Jersey, and past president of the American Association of Sex Educators, Counselors and Therapists (AASECT). A short-term way to address problems with orgasm involves stimulation of the penis with a vibrator or some other type of sex toy. However, to really make meaningful changes, a man may need to go through some form of sex therapy. Therapy usually involves "homework" in which a couple engages in sexual activities that reduce performance pressure and focus on pleasure. If you are consistently experiencing problems with orgasm and ejaculation, contact your doctor. A thorough medical exam and history may reveal the reason why.

5. Male Infertility

Male infertility refers to a male's inability to cause pregnancy in a fertile female. In humans it accounts for 40–50% of infertility. It affects approximately 7% of all men. Male infertility is commonly due to deficiencies in the semen, and semen quality is used as a surrogate measure of male fecundity. Causes of male infertility
These may include: Abnormal sperm production or function due to undescended testicles, genetic defects, health problems such as diabetes, or infections such as chlamydia, gonorrhea, mumps or HIV. Enlarged veins in the testes (varicocele) also can affect the quality of sperm.
Treatments for male infertility include: Surgery. For example, a varicocele can often be surgically corrected or an obstructed vas deferens repaired. Prior vasectomies can be reversed. *Signs of Potential Infertility in Men*

- Changes in hair growth.
- Changes in sexual desire.
- Pain, lump, or swelling in the testicles.

- Problems with erections and ejaculation.
- Small, firm testicles.
  Experts differ in their approach, but here are some of the tests you can expect: Sperm and semen analysis. ... Many men with low sperm counts or abnormal semen are still fertile. And about 15% of infertile men have normal semen and plenty of normal sperm.