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ASSIGNMENT

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. The mitotic division of these produces two types of cells. Type A cells replenish the stem cells, and type B cells differentiate into primary spermatocytes. The primary spermatocyte divides meiotically (Meiosis I) into two secondary spermatocytes; each secondary spermatocyte divides into two equal haploid spermatids by Meiosis II. The spermatids are transformed into spermatozoa (sperm) by the process of spermiogenesis. These develop into mature spermatozoa, also known as sperm cells. Thus, the primary spermatocyte gives rise to two cells, the secondary spermatocytes, and the two secondary spermatocytes by their subdivision produce four permatozoa and four haploid cells. Spermatogenesis produces mature male gametes, commonly called sperm but more specifically known as spermatozoa, which are able to fertilize the counterpart female gamete, the oocyte, during conception to produce a single-celled individual known as a zygote. This is the cornerstone of sexual reproduction and involves the two gametes both contributing half the normal set of chromosomes (haploid) to result in a chromosomally normal (diploid) zygote.

Spermatogenesis takes place within several structures of the male reproductive system. The initial stages occur within the testes and progress to the epididymis where the developing gametes mature and are stored until ejaculation. The seminiferous tubules of the testes are the starting point for the process, where spermatogonial stem cells adjacent to the inner tubule wall divide in a centripetal direction—beginning at the walls and proceeding into the innermost part, or lumen—to produce immature sperm. Maturation occurs in the epididymis. The location [Testes/Scrotum] is specifically important as the process of spermatogenesis requires a lower temperature to produce viable sperm, specifically 1°-8 °C lower than normal body temperature of 37 °C (98.6 °F).[6] Clinically, small fluctuations in temperature such as from an athletic support strap, causes no impairment in sperm viability or count.

For humans, the entire process of spermatogenesis is variously estimated as taking 74 days[8][9] (according to tritiumlabelled biopsies) and approximately 120 days[10] (according to DNA clock measurements). Including the transport on Duration

ductal system, it takes 3 months. Testes produce 200 to 300 million spermatozoa daily.[11] However, only about half or 100 million of these become viable sperm.

2: TESTOSTERONE

Testosterone is the primary male sex hormone and anabolic steroid. In male humans, testosterone plays a key role in the development of male reproductive tissues such as testes and prostate, as well as promoting secondary sexual characteristics such as increased muscle and bone mass, and the growth of body hair. In addition, testosterone is involved in health and well-being, and the prevention of osteoporosis. Insufficient levels of testosterone in men may lead to abnormalities including frailty and bone loss. Testosterone is a steroid from the androstane class containing a keto and hydroxyl groups at positions three and seventeen respectively. It is biosynthesized in several steps from cholesterol and is converted in the liver to inactive metabolites. It exerts its action through binding to and activation of the androgen receptor. In humans and most other vertebrates, testosterone is secreted primarily by the testicles of males and, to a lesser extent, the ovaries of females. On average, in adult males, levels of testosterone are about 7 to 8 times as great as in adult females. As the metabolism of testosterone in males is more pronounced, the daily production is about 20 times greater in men. Females are also more sensitive to the hormone.

In addition to its role as a natural hormone, testosterone is used as a medication in the treatment of low testosterone levels in men, transgender hormone therapy for transgender men, and breast cancer in women. Since testosterone levels decrease as men age, testosterone is sometimes used in older men to counteract this deficiency. It is also used illicitly to enhance physique and performance, for instance in athletes.

BIOLOGICAL EFFECT

In general, androgens such as testosterone promote protein synthesis and thus growth of tissues with androgen receptors. Anabolic effects include growth of muscle mass and strength, increased bone density and strength, and stimulation of linear growth and bone maturation. Androgenic effects include maturation of the sex organs, particularly the penis and the formation of the scrotum in the fetus, and after birth (usually at puberty) a deepening of the voice, growth of facial hair (such as the beard) and axillary (underarm) hair. Many of these

BEFORE BIRTH

Effects before birth are divided into two categories, classified in relation to the stages of development.

The first period occurs between 4 and 6 weeks of the gestation. Examples include genital virilisation such as midline fusion, phallic urethra, scrotal thinning and rugation, and phallic enlargement; although the role of testosterone is far smaller than that of dihydrotestosterone. There is also development of the prostate gland and seminal vesicles.

During the second trimester, androgen level is associated with sex formation. Specifically, testosterone, along with antiMüllerian hormone (AMH) promote growth of the Wolffian duct and degeneration of the Müllerian duct respectively.

EARLY INFANCY

Early infancy androgen effects are the least understood. In the first weeks of life for male infants, testosterone levels rise. The levels remain in a pubertal range for a few months, but usually reach the barely detectable levels of childhood by 4–7 months of age.

BEFORE PUBERTY

Before puberty effects of rising androgen levels occur in both boys and girls. These include adult-type body odor, increased oiliness of skin and hair, acne, pubarche (appearance of pubic hair), axillary hair (armpit hair), growth spurt, accelerated bone maturation, and facial hair.

PUBERTAL

Pubertal effects begin to occur when androgen has been higher than normal adult female levels for months or years. In males, these are usual late pubertal effects, and occur in women after prolonged periods of heightened levels of free testosterone in the blood. The effects include:

Growth of spermatogenic tissue in testicles, male fertility, penis or clitoris enlargement, increased libido and frequency of erection or clitoral engorgement occurs. Growth of jaw, brow, chin, and nose and remodeling of facial bone contours, in conjunction with human growth hormone occurs.

ADULT

Testosterone is necessary for normal sperm development. It activates genes in Sertoli cells, which promote differentiation of spermatogonia. It regulates acute HPA (hypothalamic–pituitary–adrenal axis) response under dominance challenge. Androgen including testosterone enhances muscle growth. Adult testosterone effects are more clearly demonstrable in males than in females, but are likely important to both sexes. Some of these effects may decline as testosterone levels might decrease in the later decades of adult life.

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. In humans, seminal fluid contains several components besides spermatozoa: proteolytic and other enzymes as well as fructose are elements of seminal fluid which promote the survival of spermatozoa, and provide a medium through which they can move or "swim". Semen is produced and originates from the seminal vesicle, which is located in the pelvis. The process that results in the discharge of semen is called ejaculation.

Semen is also a form of genetic material. In animals, semen has been collected for cryoconservation. Cryoconservation of animal genetic resources is a practice that calls for the collection of genetic material in efforts for conservation of a particular breed.

HUMAN SEMEN COMPOSITION

During the process of ejaculation, sperm passes through the ejaculatory ducts and mixes with fluids from the seminal vesicles, the prostate, and the bulbourethral glands to form the semen. The seminal vesicles produce a yellowish viscous fluid rich in fructose and other substances that makes up about 70% of human semen.[3] The prostatic secretion,

influenced by dihydrotestosterone, is a whitish (sometimes clear), thin fluid containing proteolytic enzymes, citric acid, acid phosphatase and lipids. The bulbourethral glands secrete a clear secretion into the lumen of the urethra to lubricate it.

Sertoli cells, which nurture and support developing spermatocytes, secrete a fluid into seminiferous tubules that helps transport sperm to the genital ducts. The ductuli efferentes possess cuboidal cells with microvilli and lysosomal granules that modify the ductal fluid by reabsorbing some fluid. Once the semen enters the ductus epididymis the principal cells, which contain pinocytotic vessels indicating fluid reabsorption, secrete glycerophosphocholine which most likely inhibits premature capacitation. The accessory genital ducts, the seminal vesicle, prostate glands, and the bulbourethral glands, produce most of the seminal fluid. Seminal plasma of humans contains a complex range of organic and inorganic constituents.

Quality

Semen quality is a measure of the ability of semen to accomplish fertilization. Thus, it is a measure of fertility in a man. It is the sperm in the semen that is the fertile component, and therefore semen quality involves both sperm quantity and sperm quality.

Quantity

The volume of semen ejaculate varies but is generally about 1 teaspoonful or less. A review of 30 studies concluded that the average was around 3.4 milliliters (mL), with some studies finding amounts as high as 5.0 mL or as low as 2.3 mL. In a study with Swedish and Danish men, a prolonged interval between ejaculations caused an increase of the sperm count in the semen but not an increase of its amount.

4: MALE ORGASM

Ejaculation is the discharge of semen (normally containing sperm) from the male reproductory tract as a result of an orgasm. It is the final stage and natural objective of male sexual stimulation, and an essential component of natural conception. In rare cases, ejaculation occurs because of prostatic disease. Ejaculation may also occur spontaneously during sleep (a nocturnal emission or "wet dream").

Anejaculation is the condition of being unable to ejaculate. Ejaculation is usually very pleasurable for men; dysejaculation is an ejaculation that is painful or uncomfortable. Retrograde ejaculation is the condition where semen travels backwards into the bladder rather than out the urethra.

STIMULATION

A usual precursor to ejaculation is the sexual arousal of the male, leading to the erection of the penis, though not every arousal nor erection leads to ejaculation. Penile sexual stimulation during masturbation or vaginal, anal, oral, or nonpenetrative sexual activity may provide the necessary stimulus for a man to achieve orgasm and ejaculation. With regard to intravaginal ejaculation latency time, men typically reach orgasm 5–7 minutes after the start of penile-vaginal intercourse, taking into account their desires and those of their partners, but 10 minutes is also a common intravaginal ejaculation latency time. A prolonged stimulation either through foreplay (kissing, petting and direct stimulation of erogenous zones before penetration during intercourse) or stroking (during masturbation) leads to an adequate amount of arousal and production of pre-ejaculatory fluid. While the presence of sperm in pre-ejaculatory fluid is thought to be rare, sperm from an earlier ejaculation, still present in the urethra, may be picked up by preejaculatory fluid. In addition, infectious agents (including HIV) can often be present in pre-ejaculate.

Premature ejaculation is when ejaculation occurs before the desired time. If a man is unable to ejaculate in a timely manner after prolonged sexual stimulation, in spite of his desire to do so, it is called delayed ejaculation or anorgasmia. An orgasm that is not accompanied by ejaculation is known as a dry orgasm.

When a man has achieved a sufficient level of stimulation, the orgasm and ejaculation begins. At that point, under the control of the sympathetic nervous system, semen containing sperm is produced (emission). The semen is ejected through the urethra with rhythmic contractions. These rhythmic contractions are part of the male orgasm. They are generated by the bulbospongiosus and pubococcygeus muscles under the control of a spinal reflex at the level of the spinal nerves S2–4 via the pudendal nerve. The typical male orgasm lasts several seconds.

After the start of orgasm, pulses of semen begin to flow from the urethra, reach a peak discharge and then diminish in flow. The typical orgasm consists of 10 to 15 contractions, although the man is unlikely to be consciously aware of that many. Once the first contraction has taken place, ejaculation will continue to completion as an involuntary process. At this stage, ejaculation cannot be stopped. Ejaculation usually begins during the first or second contraction of orgasm. For most men, the first ejection of semen occurs during the second contraction, while the second is typically the largest expelling 40% or more of total semen discharge. After this peak, the magnitude of semen the penis emits diminishes as the contractions begin to lessen in intensity. The muscle contractions of the orgasm can continue after ejaculation with no additional semen discharge occurring. A small sample study of seven men showed an average of 7 spurts of semen followed by an average of 10 more contractions with no semen expelled. This study also found a high correlation between number of spurts of semen and total ejaculate volume, i.e., larger semen volumes resulted from additional pulses of semen rather than larger individual spurts.

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.

Factors relating to male infertility include:

IMMUNE INFERTILITY

Antisperm antibodies (ASA) have been considered as infertility cause in around 10–30% of infertile couples. ASA production are directed against surface antigens on sperm, which can interfere with sperm motility and transport through the female reproductive tract, inhibiting capacitation and acrosome reaction, impaired fertilization, influence on the implantation process, and impaired growth and development of the embryo. Risk factors for the formation of antisperm antibodies in men include the breakdown of the blood-testis barrier, trauma and surgery, orchitis, varicocele, infections, prostatitis, testicular cancer, failure of immunosuppression and unprotected receptive anal or oral sex with men.

GENETICS

Chromosomal anomalies and genetic mutations account for nearly 10–15% of all male infertility cases.

Klinefelter Syndrome

One of the most commonly known causes of infertility is Klinefelter Syndrome, affecting 1 out of 500–1000 newborn males Klinefelter Syndrome is a chromosomal defect that occurs during gamete formation due to a non-disjunction error during cell division. Resulting in males having smaller testes, reducing the amount of testosterone and sperm production. Males with this syndrome carry an extra X chromosome (XXY), meaning they have 47 chromosomes compared to the normal 46 in each cell. This extra chromosome directly affects sexual development before birth and during puberty (links to learning disabilities and speech development have also been shown to be affected). There are varieties in Klinefelter Syndrome, where some cases may have the extra X chromosome in some cells but not others, referred to as Mosaic Klinefelter Syndrome, or where individuals have the extra X chromosome in all cells. The reduction of testosterone in the male body normally results in an overall decrease in the production of viable sperm for these individuals thereby forcing them to turn to fertility treatments to father children.[10]

Y chromosome deletions

Y chromosomal infertility is a direct cause of male infertility due to its effects on sperm production, occurring in 1 out of every 2000 males. Usually affected men show no sign of symptoms other than at times can exhibit smaller teste size.