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**SPERMATOGENESIS**

Spermatogenesis is the biological process of producing matured sperm cells, and occurs in the male gonad of a sexually reproducing organism. In this process, the undifferentiated male germ cells develop into spermatozoa by a series of events. It consists of stages:1-spermatocytogenesis 2- spermatidogenesis, 3- spermiogenesis and spermiation. These stages occur in the seminiferous tubules of the testis except for spermiation that ends up in the epididymis. In humans, spermatogenesis starts at puberty and continues throughout a lifetime. The entire process can take approximately 64 days. Spermatogenesis is the male counterpart of oogenesis in females. The spermatogenesis and oogenesis are the two forms of gametogenesis.

**MALE ANATOMY AND GERM CELLS**

The testis is the male gonad of animals, including humans. It is where mature sperm cells are produced and from where androgen hormones (mainly testosterone) are released. In humans, it consists of testicular septa, testicular lobules, efferent ductules, rete testis, and seminiferous tubules. The seminiferous tubules may be convoluted or straight.

**HORMONAL REGULATION**

The pituitary gland in the brain regulates the production of sperm cells and testosterone in the testes. In particular, the anterior pituitary releases luteinizing hormone (LH) that controls the release of testosterone. It is also the one releasing the follicle-stimulating hormone (FSH). These pituitary hormones, together with the testosterone from the testes, regulates spermatogenesis. Testosterone is the primary male sex hormone and is responsible for the activation of the genes that are involved in spermatogenesis.

**BIOLOGICAL IMPORTANCE**

Spermatogenesis is a vital biological process. It is the means by which male gametes are produced. Through meiosis, it permits genetic recombination to increase genetic variations and thereby improve the gene pool. Any disturbance or interference in this process could lead to reduced fertility among males.

Some of the factors that could affect efficiency are temperature and nutrition. In humans, the normal scrotal temperature is approximately at 34 degree celcius, which is lower than the core body temperature (37 degree celcius). There should also be sufficient vitamins like B, E, A. Spermatogenesis must be well regulated and kept within optimal conditions to make sure that the sperm cells will be devoid of lesions and abnormalities.

**TESTOSTERONE**

Testosterone is a steroid hormone that has a chemical formula of C19 H28O2. It is the primary male sex hormone. In males, it is produced and secreted mainly by the Leydig cells of the testes. A small percentage of testosterone is produced by the adrenal glands. In females, testosterone is produced (although in relatively very small quantities) in the adrenal glands and thecal cells of the ovaries. During pregnancy, it is also synthesized in the placenta.

Testosterone is biosynthesized from cholesterol by the process steroidogenesis, where the cholesterol undergoes series of enzymatic processes to yield testosterone. When testosterone levels are low, the hypothalamus releases gonadotropin-releasing hormone that stimulates the pituitary gland to release luteinizing hormone (LH) and follicle stimulating hormone (FSH). In males. LH and FSH stimulate the testes to produce testosterone. The testosterone is released into the blood stream to reach target tissues. In the blood, it is bound to sex hormone-binding globulin (SHBG). The metabolism of testosterone occurs in the liver as well as in extrahepatic tissues. Testosterone metabolism occurs via the hepatic 17-ketosteroid pathway, the cytochrome P450-mediated testosterone metabolism, e.t.c. Two important metabolites from testosterone metabolism are 5alpha-DHT and estradiol. 5alpha-DHT, for instance, is a stronger agonist of androgen receptors than testosterone. The activation of testosterone occurs when it releases the SHBG and then binds to the androgen receptor on the nucleus of the target cell. The binding causes structural changes in the receptor that allows the testosterone to move inside the nucleus of the cell so that it could bind to specific nucleotide sequences of the DNA of the chromosome. This leads to the transcription of certain genes producing androgen effect, e.g. stimulation of the development of male sex organs (e.g. testes and prostrate) and of secondary sexual characteristics (e.g. increased muscle and bone mass and body hair growth). Testosterone is also involved in certain neurosteroid activities.

Deficiency of testosterone in males is associated with bone loss and frailty. Thus, testosterone is also produced synthetically so that it can be used as a medication for such conditions. Testosterone is also used in breast cancer treatments.