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Spermatogenesis.

The vast majority of the testosterone produced within the testes remains there, and/or within the male reproductive system. This testosterone acts on the Sertoli cells that compose the lining of the seminiferous tubules to stimulate the synthesis of several proteins. The interrelation between testosterone and FSH in the promotion of spermatogenesis is complex. In short, testosterone is required for qualitatively normal spermatogenesis, while FSH is required for the initiation of the process at puberty (or reinitiation in adults) and for quantitatively normal spermatogenesis. This is accomplished by structural alterations in the cytoskeleton of the Sertoli cell and the production of binding proteins and trophic factors by the Sertoli cells.

In the adult mammal's spermatogenesis is a continuous process, which can be divided into two distinct phases and each, characterized by specific morphological and biochemical changes of nuclear and cytoplasm components.

The two phases include:

(i) Formation of spermatids (mitosis and meiosis) and

(ii) Spermiogenesis.

Formation of spermatids:

This phase of spermatogenesis is further subdivided into three phases.

1. Multiplication phase:

This phase is also known as proliferation and renewal of spermatogonia. During this phase the diploid spermatogonia which are situated at the periphery of the seminiferous tubule, multiply mitotically to form spermatocytes and also to give rise to new spermatogonia stem cells and enter the phase of growth.

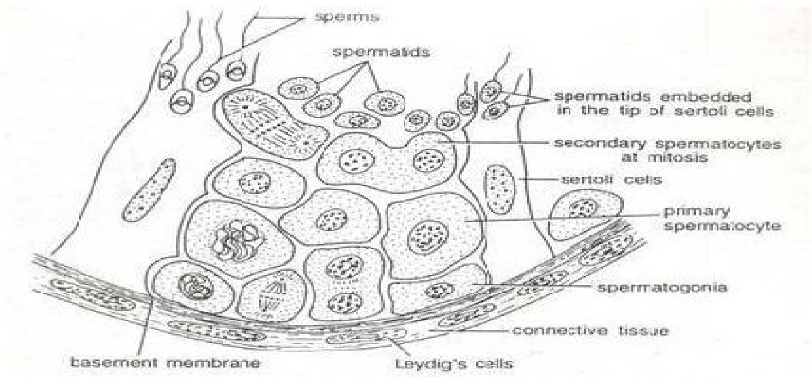

Fig. T. S. of a part of a seminiferous tubule of human testis showing production of sperms.

2. Growth phase:

During this phase, a limited growth of spermatogonia takes place; their volume becomes double and they are now called primary spermatocytes which are still diploid in number. Now these primary spermatocytes enter into the next phase namely, maturation phase.

3. Maturation phase:

The primary spermatocyte enter into the prophase of meiotic or maturation division. Meiotic prophase is a very complex process characterised by an ordered series of chromosal rearrangements which are accompanied by molecular changes. During meiosis, first nuclear DNA duplicates, each homologous chromosome starts pairing (synapsis) and longitudinally spilts up into two chromatids, both of which remain joined by a common centromere.

By chiasma formation mutual exchange of some chromosome material between two non-sister chromatids of each homologous pair (tetrad) occurs (crossing over) to provide an almost indefinite variety of combinations of paternal and maternal genes in any gamete.

Lastly, two chromosomes of each homologous pair (tetrad) migrate towards opposite poles of the primary spermatocyte. Now each pole of primary spermatocyte has haploid set of chromosomes. Each set of chromosome is surrounded by the nuclear membrane developed from the endoplasmic reticulum. The first meiotic division, as a rule, is followed by the division of cytoplasm (cytokinesis) which divides each primary spermatocyte into two haploid, secondary spermatocyte.

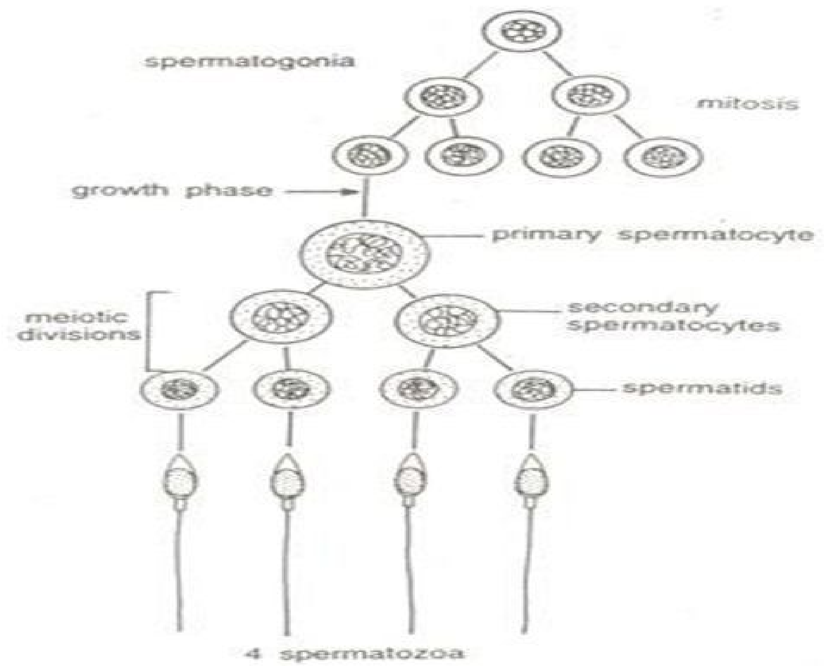

Fig. Gametogenesis in male.

Each secondary spermatocyte undergoes second meiotic or maturation division which is a simple mitosis and produces four haploid spermatids. These are non-functional male gametes. To become functional spermatozoa, they have to undergo a complex process of cytological and chemical transformations; a process usually referred to as spermiogenesis.

Spermiogenesis:

The changes in the spermatids leading to the formation of spertmatozoa constitute the process of spermiogenesis. Because a spermatozoon is a very active and mobile cell, in order to provide real mobility to it, all the superfluous materials of the developing spermatozoa are to be discarded and a high degree of specialization takes place in the sperm cell through a number of steps.

During spermiogenesis two major parts of the sperm, the head and tail are formed by the following process.

1. Formation of the tail of the spermatozoon:

The Centrosome of a spermatid after the second meiotic division consists of two Centrioles which have the structure of two cylindrical bodies, lying at right angle to each other. During early stages of sperm metamorphosis, the two Centrioles move to a position just behind the sperm, nucleus in the future neck region. A depression is formed in the posterior surface of the nucleus and one of the two Centrioles becomes placed in the depression with its axis approximately at right angles to the main axis of the spermatozoon.

This is the proximal Centriole and the other centriol i.e. the distal Centriole takes up a position behind the proximal one with its axis coinciding with the longitudinal axis of the spermatozoon. The distal

Biochemical Changes in Spermatogensis:

A number of biochemical events occur during spermatogenesis (Monesi, 1970). These are:

(1) The RNA synthesized during meiosis is eliminated from the nucleus during the two meiotic divisions and remains in the cytoplasm. The fully formed spermatozoon does not contain any detectable amounts of RNA. The meiotic RNA is probably associated with the synthesis of acrosomal proteins and flagellum.