# B.Sc. part 1: Paper II: Group-B: Developmental Biology

**Spermatogenesis**

**Definition**: It is the process of maturation of male gametes in the wall of seminiferous tubules.

It involves a series of changes leading to the conversion of spermatogonia into spermatozoa.

**Time**: In the male, the formation of gametes or spermatozoa takes place only during the reproductive period, which begins at the age of puberty (12-16 years) and continue even into old age.

**Duration**: 64-74 days

**Stages**: If we look at one of the seminiferous tubules under a microscope, we find that there are many cells of different size and shapes. Most of these represent stages in the formation of spermatozoa. Some pillar like cells called Sertoli cells have only a supporting function.

The various cell-stages in spermatogenesis are-

Spermatocytosis, meiosis and spermiogenesis

**Spermatocytogenesis or Mitotic division**

- It is the process of conversion of spermatogonia to primary spermatocytes. It takes place by repeated mitotic division. It takes about 16 days.
- Formation of stem cells: The primordial germ cells give rise to spermatogonial stem cells.
- Cell growth: From these stem cells a group of cells are formed at regular interval and are called type A spermatogonia. Production of type A spermatogonia marks the beginning of spermatogenesis.
- Mitotic divisions: Type A spermatogonia (44+x+y) undergo a limited number of mitotic division and form a clone of cells. Some cells become type B spermatogonia. Type A spermatogonia are reserve cells. Type B spermatogonia are precursors of sperms, they enlarge, and undergoes mitosis, to form Primary spermatocyte. The primary spermatocyte is larger and diploid.

**Meiotic Division:**

- It is the process of conversion of primary spermatocytes to secondary spermatocytes.
- The primary spermatocytes now divide so that each of them forms two secondary spermatocytes.
- The daughter cells produced at the end of meiosis 1 are smaller and termed as secondary spermatocyte.
- This is the first meiotic division which reduces the no. of chromosomes to half.
- Each secondary spermatocyte has 22+X or 22+Y chromosomes.
- It divides to form two spermatids. This is the second meiotic division and this time there is no reduction in chromosome no. Second meiotic division is similar to equational division
- In this way, from each of the type B spermatogonium altogether 4 haploid spermatids are produced.
- Each spermatid then differentiate into a mature spermatozoan by the process of spermiogenesis.

**Spermiogenesis**

- It is the process of metamorphosis of spermatids to spermatozoa and takes 24 days.
- The process by which spermatid gradually changes its shape to become a spermatozoan is called spermiogenesis.
- It is the final stage in the maturation of spermatid into mature, motile spermatozoa.
- The spermatid is more or less circular cell containing a nucleus, Golgi apparatus, centriole and mitochondria.

Major events in spermiogenesis

-Nuclear elongation and condensation

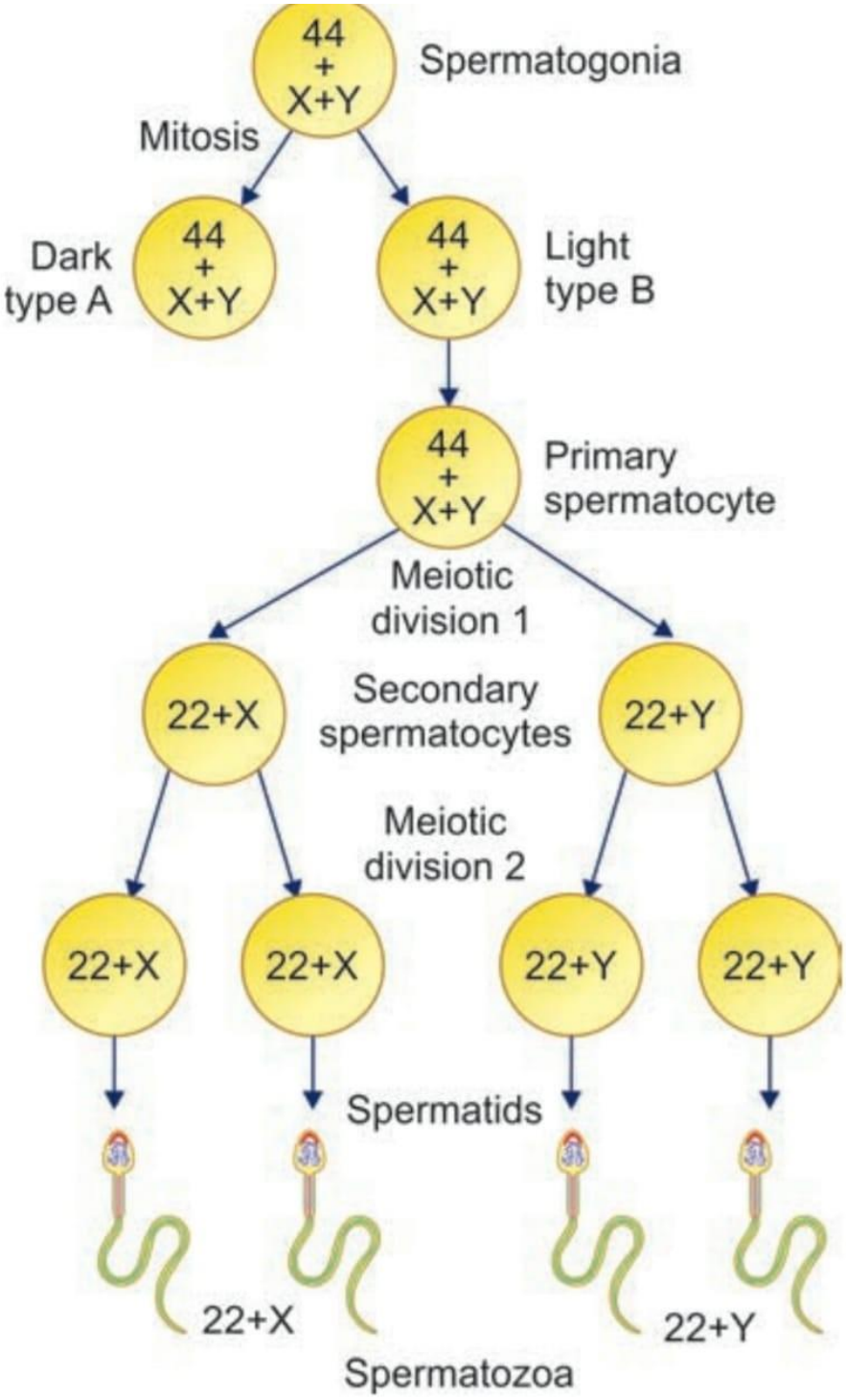
-formation of tail

-formation of acrosome

-Rearrangement of organelles

-Shedding of excess cytoplasm

Ultimately, each spermatid transforms into a spermatozoan.




**Stages in spermatogenesis**

## Hormonal Control of Spermatogenesis:

Spermatogenesis is initiated due to increase in gonadotropin releasing hormone (GnRH) by hypothalamus.

GnRH acts on the anterior lobe of pituitary gland to secrete luteinizing hormone (LH) and follicle stimulating hormone (FSH).

LH acts on Leydig's cells of the testis to secrete testosterone.

Leydig's cells that lie between the seminiferous tubules secrete testosterone.

Testosterone is essential for production of sperm.

Under the control of FSH and testosterone, Sertoli cells secrete androgen binding protein and inhibin.

ABP concentrates testosterone in the seminiferous tubules.

Inhibin suppresses FSH synthesis.

FSH acts directly on spermatogonia to stimulate sperm production.

The level of testosterone is under negative-feedback control.

Source: Book: Inderbir Singh's Human embryology