SPERMATOGONIUM

Spermatogonial Stem Cell

An undifferentiated male germ cell with self-renewing capacity representing the first stage of spermatogenesis.

♀ Reproductive cells ♂ Male

About Spermatogonium

Function

The ability of a male to produce sperm cell is a basic condition for conceiving an offspring. The development of male gametes starts after birth at the seminiferous tubules, when a basal reservoir of male germ cell is created. These reserve male germ cells are called spermatogonia (sg.: spermatogonium). They represent the foundation of sperm cell production in the testis by balancing self-renewal and differentiation activity. When a man reaches the age of puberty, spermatogonia resume their division and start the process of spermatogenesis. Spermatogonia also replicate themselves to maintain their counts to supply the spermatogenesis during whole life of a man.

Characterization

Spermatogonia are the least mature cells in the process of spermatogenesis and can be found connected to Sertoli cells at the basement membrane of a seminiferous tubule (Pic. 1). Spermatogonia are diploid cells meaning that they contain full copy of man’s genetic information. Complete genetic information of any human is represented by 46 chromosomes, cell with 46 chromosomes are referred as diploid cells (2n). When spermatogonia resume mitotic division, the result is the gain of two identical diploid cells. One of these cells remains a spermatogonium, and the other one becomes a primary spermatocyte. Based upon a specific destiny of each spermatogonium (Pic. 2), there can be found 3 types.

1. Type Ad spermatogonia ("dark")
   - Type Ad spermatogonia have the self-renewal capacity. These cells do not directly participate in producing sperm, instead they serve to maintain the supply of stem cells for spermatogenesis. Each type Ad spermatogonium divides to produce another type Ad spermatogonium, which can further carry on spermatogenesis, and one type Ap spermatogonium, which differentiates further.

2. Type Ap spermatogonia ("pale")
   - Type Ap spermatogonia mitotically divide to produce identical cells linked by cytoplasmic bridges. The connections between cells allow the cell development to be synchronised. When mitotic division stops, the cells differentiate into type B spermatogonia.

3. Type B spermatogonia
   - Type B spermatogonia undergo another mitotic division to produce next stage of male germ cells called primary spermatocytes.

Medical relevance

Undifferentiated spermatogonia can be also referred as unipotent spermatogonial stem cells (SSCs) due to some very specific qualities they possess. In particular, type A spermatogonia possess some special aspects of great medical importance in solving male cancer-induced infertility. When type A spermatogonia are transplanted into the seminiferous tubules of an infertile male, they can establish donor-derived...
spermatogenesis and produce sperm cells that transmit the donor haplotype to progeny. Additionally, when they are cultured in appropriate conditions, they can acquire pluripotency and differentiate into derivatives of the three embryonic germ layers.

Find more about related issues

### Diagnoses

**Varicocele**
An abnormal enlargement of the pampiniform venous plexus in the scrotum.
Learn more at: [www.fertilitypedia.org/therapy/diag/varicocele](http://www.fertilitypedia.org/therapy/diag/varicocele)

**Azoospermia**
Complete absence of sperm in the ejaculate of a man.
Learn more at: [www.fertilitypedia.org/therapy/diag/azoospermia](http://www.fertilitypedia.org/therapy/diag/azoospermia)

**Erectile dysfunction**
The inability (that lasts more than 6 months) to develop or maintain an erection of the penis during sexual activity.
Learn more at: [www.fertilitypedia.org/therapy/diag/erectile-dysfunction](http://www.fertilitypedia.org/therapy/diag/erectile-dysfunction)

**Undescended testes**
In the case of cryptorchidism one or both testes are absent from the scrotum. It is is the most common etiologic factor of azoospermy in the adult.
Learn more at: [www.fertilitypedia.org/therapy/diag/undescended-testes](http://www.fertilitypedia.org/therapy/diag/undescended-testes)

**Anejaculation**
The pathological inability to ejaculate in males, with (orgasmic) or without (anorgasmic) orgasm.
Learn more at: [www.fertilitypedia.org/therapy/diag/anejaculation](http://www.fertilitypedia.org/therapy/diag/anejaculation)

**Ejaculatory disorders**
A class of sexual disorders defined as the subjective lack of normal ejaculation.
Learn more at: [www.fertilitypedia.org/therapy/diag/ejaculatory-disorders](http://www.fertilitypedia.org/therapy/diag/ejaculatory-disorders)

**Thyroid disorders**
A medical condition impairing the function of the thyroid.
Learn more at: [www.fertilitypedia.org/therapy/diag/thyroid-disorders](http://www.fertilitypedia.org/therapy/diag/thyroid-disorders)

**Klinefelter syndrome**
The set of symptoms that result from two or more X chromosome in males.
Learn more at: [www.fertilitypedia.org/therapy/diag/klinefelter-syndrome](http://www.fertilitypedia.org/therapy/diag/klinefelter-syndrome)

**Kallmann syndrome**
A genetic condition where the primary symptom is a failure to start puberty or a failure to fully complete puberty.
Learn more at: [www.fertilitypedia.org/therapy/diag/kallmann-syndrome](http://www.fertilitypedia.org/therapy/diag/kallmann-syndrome)

**Non-obstructive azoospermia**
Complete absence of sperm in the ejaculate due to testicular failure.
Learn more at: [www.fertilitypedia.org/therapy/diag/non-obstructive-azoospermia](http://www.fertilitypedia.org/therapy/diag/non-obstructive-azoospermia)

**XX male syndrome**
The male sex chromosomal disorder characterized by a spectrum of clinical presentations, ranging from ambiguous to normal male genitalia.
Learn more at: [www.fertilitypedia.org/therapy/diag/xx-male-syndrome](http://www.fertilitypedia.org/therapy/diag/xx-male-syndrome)
Oligozoospermia
Seminal fluid with a low concentration of sperm and is a common finding in male infertility.
Learn more at: www.fertilypedia.org/therapydiag/oligozoospermia

Hypogonadism
A medical term which describes a diminished functional activity of the gonads – the testes and ovaries.
Learn more at: www.fertilypedia.org/therapydiag/hypogonadism

Sperm autoantibodies
Antibodies that bind to sperm, inhibiting their movement, stopping recognition and entry into the egg.
Learn more at: www.fertilypedia.org/therapydiag/sperm-autoantibodies

Testicular cancer
Cancer that develops in the testicles.
Learn more at: www.fertilypedia.org/therapydiag/testicular-cancer

Prostatitis
An inflammation of the prostate gland.
Learn more at: www.fertilypedia.org/therapydiag/prostatitis

Hypospermia
A condition in which a man has an unusually low ejaculate (or semen) volume.
Learn more at: www.fertilypedia.org/therapydiag/hypospermia

Obstructive azoospermia
Absence of sperm in the ejaculate despite normal spermatogenesis, caused by an obstruction of the genital tract.
Learn more at: www.fertilypedia.org/therapydiag/obstructive-azoospermia

Orchitis
An inflammation of the testes, involving swelling and heavy pains.
Learn more at: www.fertilypedia.org/therapydiag/orchitis

Testicular torsion
Emergency medical condition occurring when the spermatic cord twists and cuts off the testicle’s blood supply.
Learn more at: www.fertilypedia.org/therapydiag/testicular-torsion

Teratospermia
Teratospermia is a condition characterized by the presence of sperm with abnormal morphology that affects fertility in males.
Learn more at: www.fertilypedia.org/therapydiag/teratospermia

Cryptozoospermia
Male infertility diagnosis characterized by extremely low concentration of sperm in semen.
Learn more at: www.fertilypedia.org/therapydiag/cryptozoospermia

Heart

Testes
Male gonads which produce both sperm and androgens, such as testosterone, and are active throughout the reproductive lifespan of the male.
Learn more at: www.fertilypedia.org/edu/organs/testes

Reproductive functions
Spermatogenesis
Process in which spermatozoa are produced from male primordial germ cells in testicles by way of mitosis and meiosis.
Learn more at: www.fertilitypedia.org/edu/reproductive-functions/spermatogenesis

Gallery

Pic. 2: The development of spermatogonia during the spermatogenesis
A scheme of spermatogonia advancement showing the function of different types of spermatogonia in the process of spermatogenesis.

Pic. 1: Spermatogonia in seminiferous tubules
A photography of spermatogonia positioned on the basement membrane of seminiferous tubules (marked by number 4).

Sources

“Anatomy and Physiology of the Female Reproductive System” —sourced from OpenStax College licensed under CC BY 4.0 Download for free at http://cnx.org/content/col11496/latest/

“The Use of Spermatogonial Stem Cells in cancer-Induced Infertility” —by Sá et al. licensed under CC BY 4.0

“Human Testis–Derived Pluripotent Cells and Induced Pluripotent Stem Cells” —by Kobayashi et al. licensed under CC BY 3.0

“Enrichment of Undifferentiated Type A Spermatogonia from Goat Testis Using Discontinuous Percoll Density Gradient and Differential Plating” —by Heidari et al. licensed under CC BY-NC 3.0

“Isolation and Culture of Human Spermatogonial Stem Cells Derived from Testis Biopsy” —by Goharbaksh et al. licensed under CC BY-NC 3.0

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