

Sex hormones:

Sex or reproductive hormones have multiple functions in both males and females. In general, they are responsible for the development of the **secondary sex characteristics** during puberty. Later in life, during adulthood, they are in charge of regulating the reproductive cycle.

In females, sex hormones are released from the ovary, regulate the *menstrual cycle, and control endometrial growth*.

In males, they are produced in the testes and play a significant role in the *sperm production process (spermatogenesis)*.

Regulation of hormone production

Sex hormones are found in both males and females. However, their levels differ based on your sex.

The endocrine system that regulates sex hormone production in the gonads works equally in both cases.

Gonadotropins, also known as *hypophyseal hormones*, are listed below:

FSH

Follicle-stimulating hormone. It stimulates the gonads to produce gametes, that is, eggs and sperm.

LH

Luteinizing hormone. Also acts over the gonads, but has other functions as well.

Prolactin

It is regulated differently, since its production depends on the dopamine secreted by the pituitary gland. It stimulates the production of milk in the mammary glands.

The pituitary gland is also responsible for the secretion of oxytocin and vasopressin (antidiuretic hormone), which have different functions in males and females.

Male sex hormones

In men, hormones that are synthesized by the pituitary gland have a direct effect on the testes in order to regulate the following main functions:

Spermatogenesis

Sperm production as a response to the effect of FSH. It takes place in the Sertoli cells, which can be found in the seminiferous tubules.

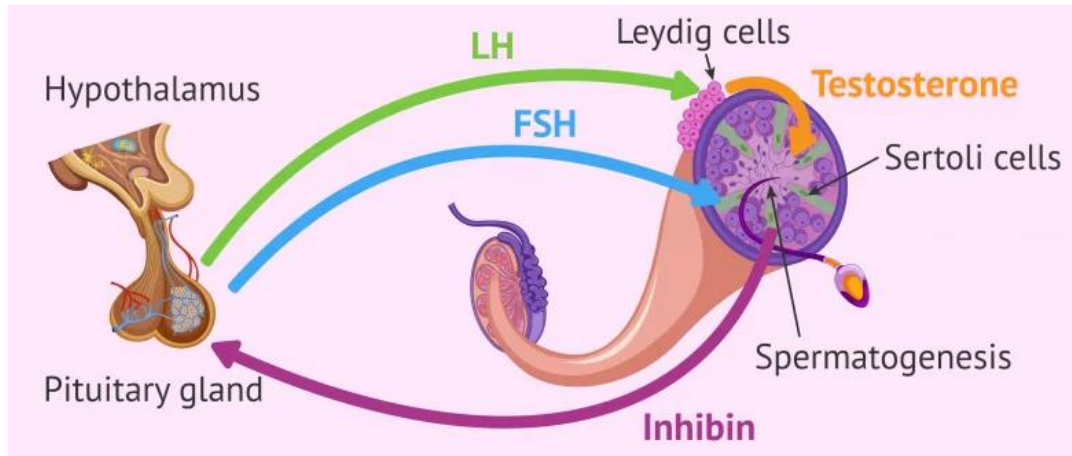
Steroidogenesis

Production of steroid hormones, such as testosterone, as a response to LH. It occurs in the Leydig cells, found in the interstitial tissue of the testicles.

Both processes are perfectly regulated by a positive-negative feedback mechanism that involves testosterone (TST), the main male sex hormone.

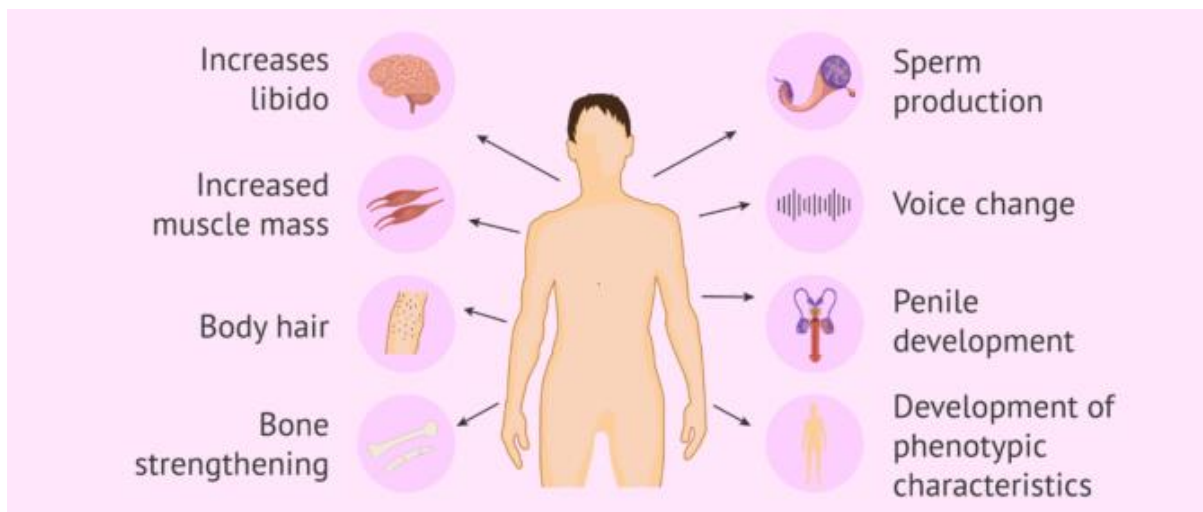
Testosterone and inhibin

TST stimulates the production of sperm. when TST levels in blood rise, a signal is sent to stop the secretion of LH in the brain, and subsequently the release of testosterone.



TST is a type of steroid hormone, which means that it is created from cholesterol. In addition to the regulation function already explained above, it has the following **functions in males as well:**

- To develop the reproductive system (penis and testes) in male fetuses
- To promote the growth of the penis, testicles and hormone secretion during puberty
- To trigger the development of the male sex characteristics: muscle mass, bone density, body hair, increase in sex drive, voice changes...



Female sex hormones

Sex hormone released by the ovaries are androgens, estrogen, and progesterone. As it happens in the testicles, the regulation of steroidogenesis in females depends on FSH and LH. In this case, hormone regulation follows the following steps:

1. LH triggers **androgen production** in the ovarian theca cells.
2. Next, androgen turn into **estrogens** in the granulosa cells, a process that occurs thanks to the action of FSH.
3. The menstrual cycle begins, and subsequently the levels of estrogens rise.
4. Halfway through the menstrual cycle approximately, the so called *LH surge* occurs in order to cause *ovulation in the woman*.
5. Right after ovulation, granulosa cells start synthesizing **progesterone**, and the follicle becomes the corpus luteum.

The production of female sex hormones is regulated by a complex feedback system that regulates the menstrual cycle as well

Estrogen

Estradiol plays a major role when it comes to talking about estrogens. Even though the ovaries are the main source of estradiol production, it takes place in the suprarenal glands too.

The production of estradiol, and subsequently its levels, increase during puberty and remain consistently high during the childbearing age of women until [menopause](#), when they start decreasing. However, it should be noted that estradiol levels vary depending on the day of the menstrual cycle.

The main functions of estradiol throughout a woman's reproductive years include:

- To regulate the development of the female reproductive system: ovaries, womb and vagina.
- To cause the secondary sex characteristics to appear during puberty: breast development, first [menstrual period](#), hair growth, higher-pitched voice, skeletal changes, etc.
- To make sure that a single ovarian follicle per menstrual cycle develops.
- To stimulate the production of LH in order to make ovulation possible.
- To promote endometrial growth during the first half of the menstrual cycle.
- To regulate the consistency of vaginal discharge during the fertile window.

Progesterone

Progesterone is a sex steroid that is key to the overall menstrual cycle, but most importantly during pregnancy.

During pregnancy, the ovaries and placenta are the organs responsible for the secretion of progesterone, although it may be released by the adrenal glands and the liver as well.

As in the case of estradiol, progesterone production starts during puberty, and starts dropping in menopausal women. Progesterone has a role in the development of the secondary sex characteristics to some extent, too.

Nonetheless, these are the most significant functions of progesterone in women:

- To promote endometrial receptivity in order to make *embryo implantation possible*.
- To relax the muscles of the uterus to favor embryo implantation.
- To thicken the *cervical mucus* in order to create the mucus plug during pregnancy.
- To stimulate the production of milk after delivery.
- To promote the start of menstrual periods monthly by decreasing its levels at the ends of each cycle.

