

Hormonal Control - Human Reproduction

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Abstract: *Hormones from the anterior pituitary and hypothalamus interact with hormones from reproductive tissues and organs to regulate the cycles of reproduction in both male and female humans. The hypothalamus regulates and triggers the pituitary gland's hormone secretion in both sexes. The anterior pituitary receives a gonadotropin-releasing hormone (GnRH) from the hypothalamus when the reproductive hormone is needed. Follicle stimulating hormone (FSH) and luteinizing hormone (LH) are released into the bloodstream as a result of this. Keep in mind that the production of GnRH requires the body to attain puberty. Despite being called for their involvement in female reproduction, both sexes generate FSH and LH, which are crucial hormones that regulate reproduction. In the reproductive systems of both men and women, other hormones have particular purposes.*

Keywords: Hormonal control, Human reproduction, Reproductive hormones, hypothalamus, gonads, Fertility, Contraception, Reproductive disorder

I. INTRODUCTION

Fertility and sexuality are largely dependent on the three primary reproductive hormones: progesterone, oestrogen, and testosterone. Pregnancy, puberty, menstruation, menopause, sex drive, sperm production, and other processes are all under their control. The testes in men and the ovaries in women generate these hormones. Other reproductive hormones including Human Chorionic Gonadotropin (HcG), Prolactin, Luteinizing Hormone (LH), and Follicle-Stimulating Hormone (FSH) are produced, stored, and stimulated by the pituitary gland.

- Birth Control Hormones
- Counter-Inhibitory Hormone
- Progesterone
- oestrogen
- estradiol

By attaching to particular cell-surface or intracellular hormone receptors— molecules embedded in the cell membrane or floating in the cytoplasm with a binding site that matches a binding site on the hormone molecule—hormones trigger changes in the target cells. In this way, hormones only influence cells that have the required receptors, even though they circulate throughout the body and come into touch with a wide variety of cell types. Hormone receptors can be present on or in a wide variety of cells, or they might be restricted to a small number of specialised cells. Thyroid hormones, for instance, stimulate metabolic activity throughout the body by acting on a variety of tissue types. Hormones can also cause diverse reactions in various types of cells.

For instance, the hormone cortisol suppresses immune cell function, but it also induces liver cells to release glucose into the bloodstream, which is an entirely separate effect of cortisol. In addition to having several receptors for the same hormone, cells frequently have receptors for other hormone classes.

II. RESEARCH METHODOLOGY

To comprehensively address the topic of hormonal control in human reproduction, we employed a systematic literature review approach. Our methodology involved the identification and analysis of peer-reviewed research articles, textbooks, and academic publications related to human reproductive endocrinology. The selected sources were critically

evaluated for their relevance and credibility, allowing us to synthesize and present a well-rounded understanding of the subject

What are hormones? And How do hormones work?

Hormones are chemicals that communicate with your organs, skin, muscles, and other tissues through your bloodstream to regulate various bodily activities. Your body receives these messages and knows what to do and when. Your health and life depend on hormones. The human body contains more than 50 hormones that have been discovered thus far. Your endocrine system is made up of hormones and the majority of the tissues (mostly glands) that produce and release them. Hormones regulate a wide range of physiological functions, such as metabolism. • Homeostasis (continuous internal balance), which includes controlling body temperature, blood pressure, blood sugar, and fluid (water) and electrolyte balance.

Which bodily organs produce hormones?

The majority of the hormones in your body are produced and released by specialised glands that make up your endocrine system. An organ that produces hormones, digestive fluids, sweat, or tears is called a gland. Hormones are released into your bloodstream directly by endocrine glands.

The following glands are parts of the endocrine system: The hypothalamus.

- The pituitary.
- The nail gland.
- The thyroid.
- Gland of parathyroid.
- Glandular organs.
- The pancreas.
- The ovary.
- Testis.

However, not every organ or tissue that secretes hormones or compounds that resemble hormones is regarded as a component of the endocrine system. Adipose tissue, or fat tissue, is one of the several bodily tissues that releases hormones.

Which diseases are brought on by problems with hormones?

Hormone problems are the root cause of numerous medical disorders. For most hormones, excess or insufficient amounts result in symptoms and health problems. Treatment is often necessary for these abnormalities. Among the most prevalent disorders linked to hormones are:

- Diabetes, including two types of diabetes and gestational diabetes.
- Thyroid disease, including hypothyroidism (low thyroid hormone levels) and hyperthyroidism (high thyroid hormone levels).
- Irregular menstruation (periods), caused by polycystic ovary syndrome (PCOS), amenorrhea and anovulation.
- Female infertility.
- Male infertility — more specifically, low testosterone levels (hypogonadism).
- Obesity

Human Reproduction

Male and female human reproductive tissues develop in utero in a manner comparable to each other until the male gonads release a small amount of the hormone testosterone. The immature tissues differentiate into male sexual organs as a result of testosterone. The tissues become female sexual tissues in the absence of testosterone. Early gonads develop into the testes or ovaries. In females, the tissues that generate a clitoris make a penis in males. These are homologous structures—tissue that develops into the labia in females and the scrotum in males.

Male Reproductive Anatomy:

The testicles, or testes (singular: testis), are housed in the scrotum, which also serves as a passageway for blood vessels, nerves, and muscles involved in testicular activity in the male reproductive system. The gonads, or testes, are responsible for producing certain reproductive hormones and sperm, or male gametes. Each testis is roughly 2.5 by 3.8 cm in size, and septa, a type of connective tissue, split it into wedge-shaped lobules. Because sperm remain immobile at body temperature, the penis and scrotum are external to the body, in order to maintain the right temperature for movement.

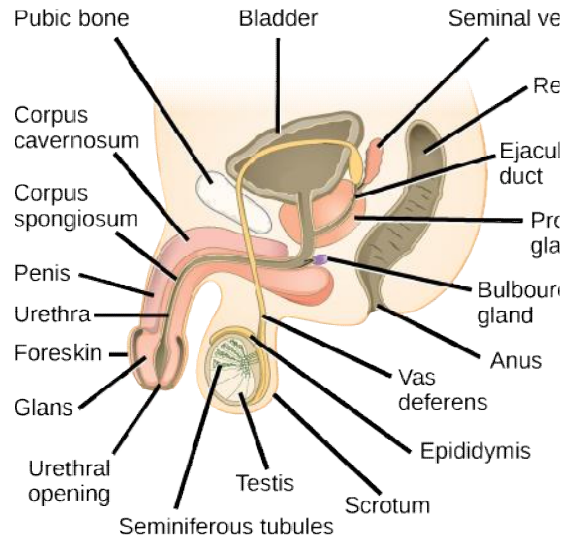
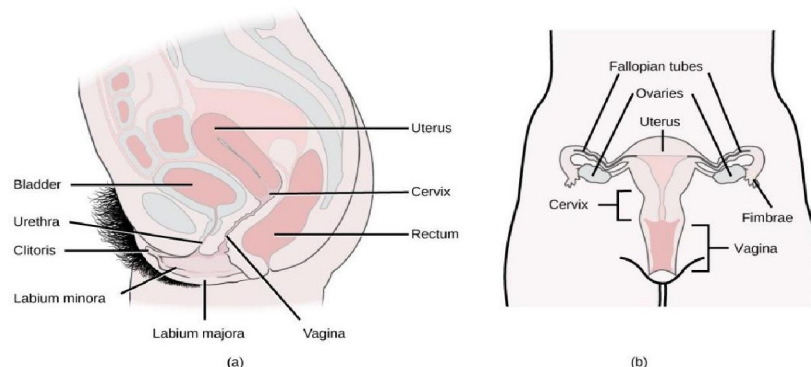


Fig: (wikipedia.com). Male reproductive system is shown in the picture above

Female Reproductive Anatomy:-

The female's body has several reproductive structures on the outside. These include the vulva, which is represented in Figure 3 and consists of the vestibular glands, labia majora, labia minora, clitoris, and mons pubis. Table 2 provides an overview of the location and purposes of the female reproductive organs. Overlying the pubic bone is a rounded, fatty region called the mons pubis. During sexual activity, the clitoris, a structure with erectile tissue, stimulates the clitoris through a multitude of sensory nerves. The other components of the vulva are enclosed by the labia majora, two lengthy tissue folds that extend posteriorly from the mons pubis. The same tissue that gives rise to a man's scrotum also gives rise to the labia majora. The labia minora are little tissue folds that are situated in the middle of the labia majora. The urethral and vaginal apertures are shielded by these labia. During adolescence, the labia minora is hairless, whereas the mons pubis and the anterior part of the labia majora grow hair. During sexual activity, the larger vestibular glands, which are located at the sides of the vaginal entrance, lubricate the area.



Reproductive structures of the human female are shown.

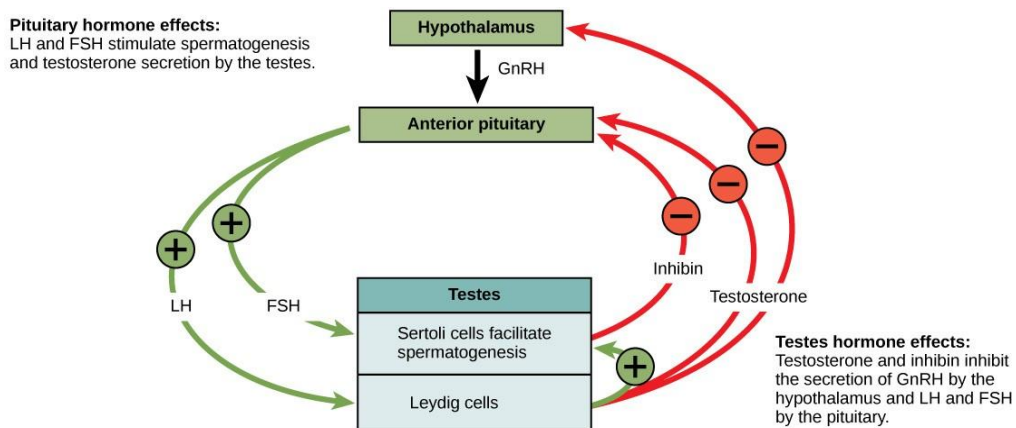
(a: modification of work by Gray's Anatomy; b: modification of work by CDC)

Endocrinologist for Reproduction:-

A doctor who treats a range of hormone abnormalities associated with reproduction and infertility in men and women is known as a reproductive endocrinologist. Menstrual issues, infertility, miscarriage, sexual dysfunction, and menopause are among the disorders. Physicians may treat patients with assisted reproductive technologies (ART), fertility medications, or surgery. In vitro fertilisation is one technique used in assisted reproductive technology (ART) to modify the egg or sperm in order to enhance reproduction. Reproductive endocrinologists complete three years of fellowship training in reproductive endocrinology after completing a four-year obstetrics and gynaecology residency. The doctor needs to pass both the written and oral tests in order to become board certified in this field

Male Reproductive Hormones:-

The hypothalamus releases FSH and LH into the male system for the first time at the commencement of puberty. As seen in Figure 1, FSH enters the testes and activates the Sertoli cells to start promoting spermatogenesis through negative feedback. Additionally, LH enters the testes and triggers the production of testosterone by the Leydig interstitial cells, which is then released into the testes and bloodstream. Spermatogenesis is stimulated by testosterone, the hormone that gives rise to secondary sexual characteristics in males during puberty. The development of facial, axillary, and pubic hair as well as the onset of sex urge are examples of these secondary sex traits.



Hormones control sperm production in a negative feedback system.

Rising testosterone levels in men cause the anterior pituitary and hypothalamus to block the release of GnRH, FSH, and LH, creating a negative feedback loop. This mechanism functions to maintain a reasonably constant blood concentration of testosterone in each male individual following puberty. The hypothalamus will not secrete as much GnRH if testosterone levels rise over their baseline values, also referred to as the set point levels. Lower levels of FSH and LH will then be produced as a result. Reduced LH levels will result in less stimulation for the Leydig cells, which will decrease testosterone production

Female Reproductive Hormones:-

In females, the regulation of reproduction is more intricate. The anterior pituitary gland releases the hormones FSH and LH, same like in men. FSH and LH secretion are regulated by GnRH, however in a more intricate cyclical fashion. Furthermore, progesterone and oestrogens are secreted from the growing follicles. FSH in females promotes the growth of ova, or egg cells, which are developed in follicles. FSH synthesis is inhibited by the hormone inhibin, which is produced by follicle cells.

LH is also involved in the growth of ovaries, the inducement of ovulation, and the stimulation of ovaries' synthesis of progesterone and oestrogen. The steroid hormones progesterone and oestrogen help the body become ready for pregnancy. In females, oestrogen causes the development of the breasts, the maturation of the external genitalia, and the broadening of the hips; in men, progesterone and oestrogen control the menstrual cycle, or periods.

Menstrual Cycle

Pregnancy is made possible by the menstrual cycle, commonly referred to as PERIODS, which is a sequence of physiological changes in hormone production as well as the uterine and ovarian structures in females. The ovarian cycle regulates the cyclic release of progesterone and oestrogen as well as the generation and release of eggs. The uterine cycle controls how the lining of the uterus (womb) gets ready to accept an embryo. These cycles are coordinated and contemporaneous, typically lasting 28 days on average, but they can extend up to 35 days, and they persist for roughly 30 to 45 years. Cycles are driven by naturally occurring hormones; for example, the growth and production of oocytes (immature egg cells) are prompted by the follicle stimulating hormone's periodic rise and fall.

The endometrium, the lining of the uterus, thickens in response to the hormone oestrogen, preparing the uterus for potential fertilization. An embryo that has been implanted successfully receives nutrition from the thicker lining's blood supply. The lining disintegrates and blood leaks out if implantation fails. Menstruation, also known as a "period" in popular culture, is the cyclical shedding of the lining and is an indication that pregnancy has not yet developed. It is caused by a drop in progesterone levels. Premenstrual syndrome, which can include symptoms like fatigue and sensitive breasts, might be brought on by the menstrual cycle in certain women. Premenstrual dysphoric disorder is a category of symptoms that affect daily living and affects 3-8% of women. It is characterized by more severe symptoms. Some women have period discomfort in the early stages of their menstrual cycle, which can radiate from the abdomen to the upper thighs and back. Hormonal birth control has the ability to alter the menstruation cycle

Menopause:-

Women's ovaries become less sensitive to FSH and LH as they get closer to their mid-40s to mid-50s. Menopause is the time when menstruation gradually stops occurring. The ovaries still contain eggs and prospective follicles, but they cannot release a viable egg without the stimulation of FSH and LH. Being unable to conceive is the result of this. Menopause side effects include hot flashes, headaches, excessive perspiration, especially at night, muscle soreness, dry vagina, depression, weight gain, and mood swings. Calcium metabolism depends on oestrogen, and low oestrogen causes low blood calcium levels. Calcium is taken out of the bone to refill the blood, which can lower bone density and cause osteoporosis. Hormone replacement therapy (HRT), which supplements oestrogen, can stop bone loss, but it can also have unfavourable side effects. HRT's negative side effects include an increased risk of stroke or heart attack, blood clots, breast cancer, ovarian cancer, endometrial cancer, gall bladder disease, and possibly dementia. On the other hand, it is believed to offer some protection against colon cancer, osteoporosis, heart disease, macular degeneration, and possibly depression.

III. CONCLUSION

Hormones secreted from the hypothalamus and anterior pituitary as well as hormones from reproductive tissues and organs regulate both male and female reproductive cycles. The anterior pituitary produces and releases the hormones FSH and LH, and the hypothalamus keeps track of how much of each is required. FSH and LH have an impact on reproductive structures, resulting in sperm production and egg preparation for release and potential fertilization. FSH and LH activate Sertoli cells and Leydig interstitial cells in the testes of the male in order to promote sperm generation. The testosterone that is produced by the Leydig cells is also in charge of giving males their secondary sexual traits. FSH and LH stimulate the production of estrogen and progesterone in females. They control the ovarian and menstrual cycles, which make up the female reproductive system. Menopause happens when the female reproductive cycles slow to a standstill and the ovaries lose their sensitivity to FSH and LH

REFERENCES

- [1]. <https://my.clevelandclinic.org/health/articles/22464-hormones>
- [2]. <https://opentextbc.ca/biology/chapter/24-3-human-reproductive-anatomy-and-gametogenesis/>
- [3]. <https://opentextbc.ca/biology/chapter/24-4-hormonal-control-of-human-reproduction/>
- [4]. <https://chat.openai.com/share/502c8e91-2de2-4c69-a390-07dce60bbcd>

- [5]. Abdel-Latif, M., Meyering-Vos, M., Hoffmann, K.H., 2003. Molecular characterisation of cDNAs from the fall armyworm *Spodoptera frugiperda* encoding *Man-duca sexta* allatotropin and allatostatin preprohormone peptides. *Insect. Biochem. Mol. Biol.* 33, 467–476.
- [6]. Abel, T., Bhatt, R., Maniatis, T., 1992. A *Drosophila* CREB/ATF transcriptional activator binds to both fat body- and liver-specific regulatory elements. *Genes Devel.* 6, 466–480.
- [7]. Abrahamsen, N., Martinez, A., Kjaer, T., Sondergaard, L., Bownes, M., 1993. Cis-regulatory sequences leading to female-specific expression of yolk protein genes 1 and 2 in the fat body of *Drosophila melanogaster*. *Mol. Gen. Genet.* 237, 41–48.
- [8]. Abu-Hakima, R., Davey, K.G., 1975. Two actions of juvenile hormone on the follicle cells of *Rhodnius prolixus* Stal. *Can. J. Zool.* 53, 1187–1188.
- [9]. Adams, T.S., 1974. The role of juvenile hormone in house- fly ovarian follicle morphogenesis. *J. Insect Physiol.* 20, 263–276.
- [10]. Adams, T.S., 1980. The role of ovarian hormones in main- taining cyclical egg production in insects. In: Clark, W.H., Jr., Adams, T.S. (Eds.), *Advances in Invertebrate Repro- duction*, vol. 10. Elsevier, New York, pp. 109–125.