

HUMAN ANATOMY AND PHYSIOLOGY-II

UNIT-IV

Endocrine system

Structure and functions of pituitary gland



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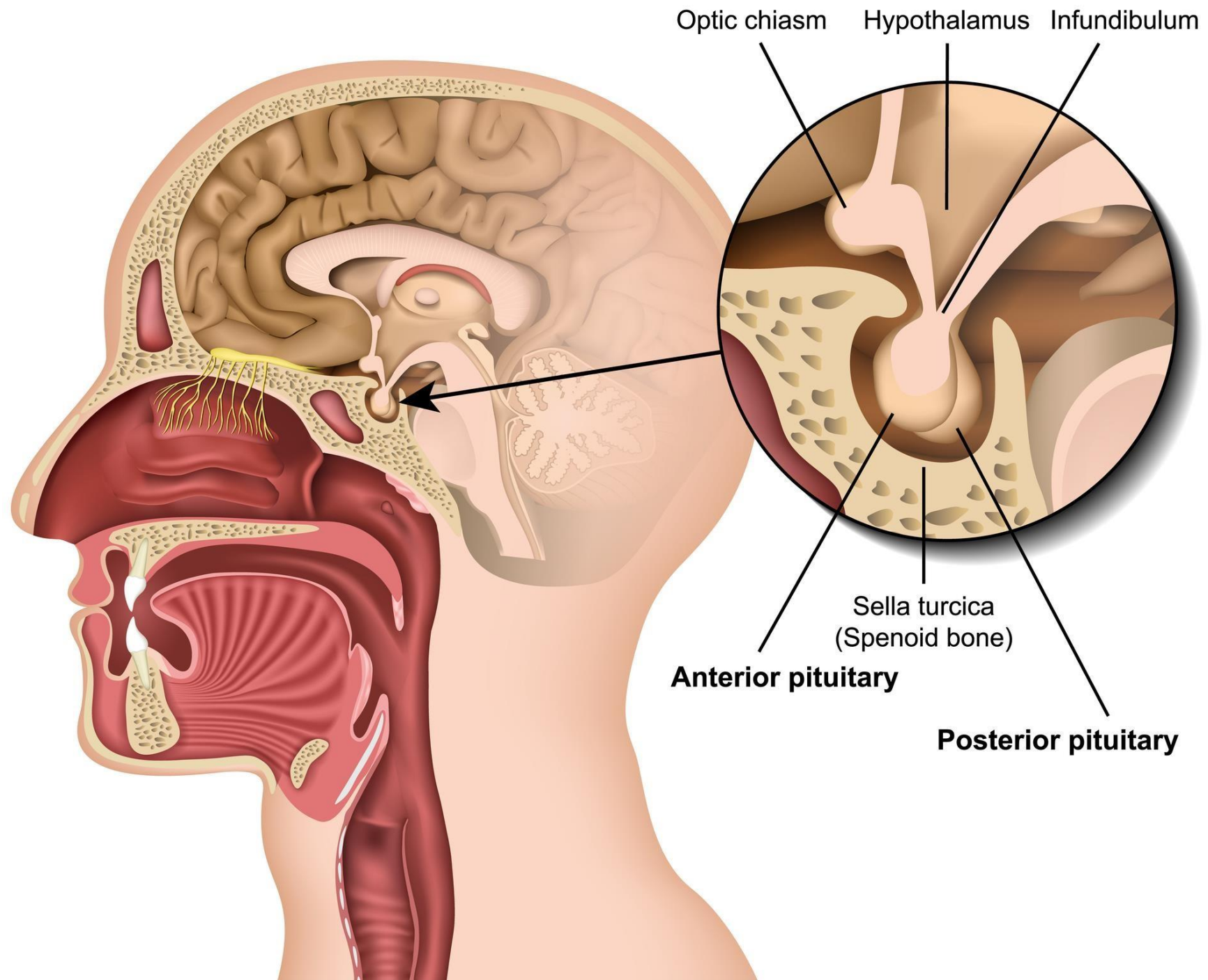
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Pituitary Gland

- Pituitary gland or hypophysis is a small endocrine gland with a diameter of 1 cm and weight of 0.5 to 1 g.
- Present in the sphenoid bone at the base of skull. It is connected with the hypothalamus by the pituitary stalk or hypophyseal stalk.

Pituitary gland is divided into two divisions:

1. Anterior pituitary or adenohypophysis
2. Posterior pituitary or neurohypophysis.



ANTERIOR PITUITARY OR ADENOHYPOPHYSIS

Anterior pituitary is also known as the master gland because it regulates many other endocrine glands through its hormones.

PARTS

Anterior pituitary consists of three parts ;

1. Pars distalis
2. Pars tuberalis
3. Pars intermedia

HORMONES SECRETED BY ANTERIOR PITUITARY

Six hormones are secreted by the anterior pituitary:

1. Growth hormone (GH) or somatotrophic hormone (STH)
2. Thyroid-stimulating hormone (TSH) or thyrotropic hormone
3. Adrenocorticotrophic hormone (ACTH)
4. Follicle-stimulating hormone (FSH)
5. Luteinizing hormone (LH) in females or interstitial cell-stimulating hormone (ICSH) in males
6. Prolactin.

Recently, the hormone β -lipotropin is found to be secreted by anterior pituitary.

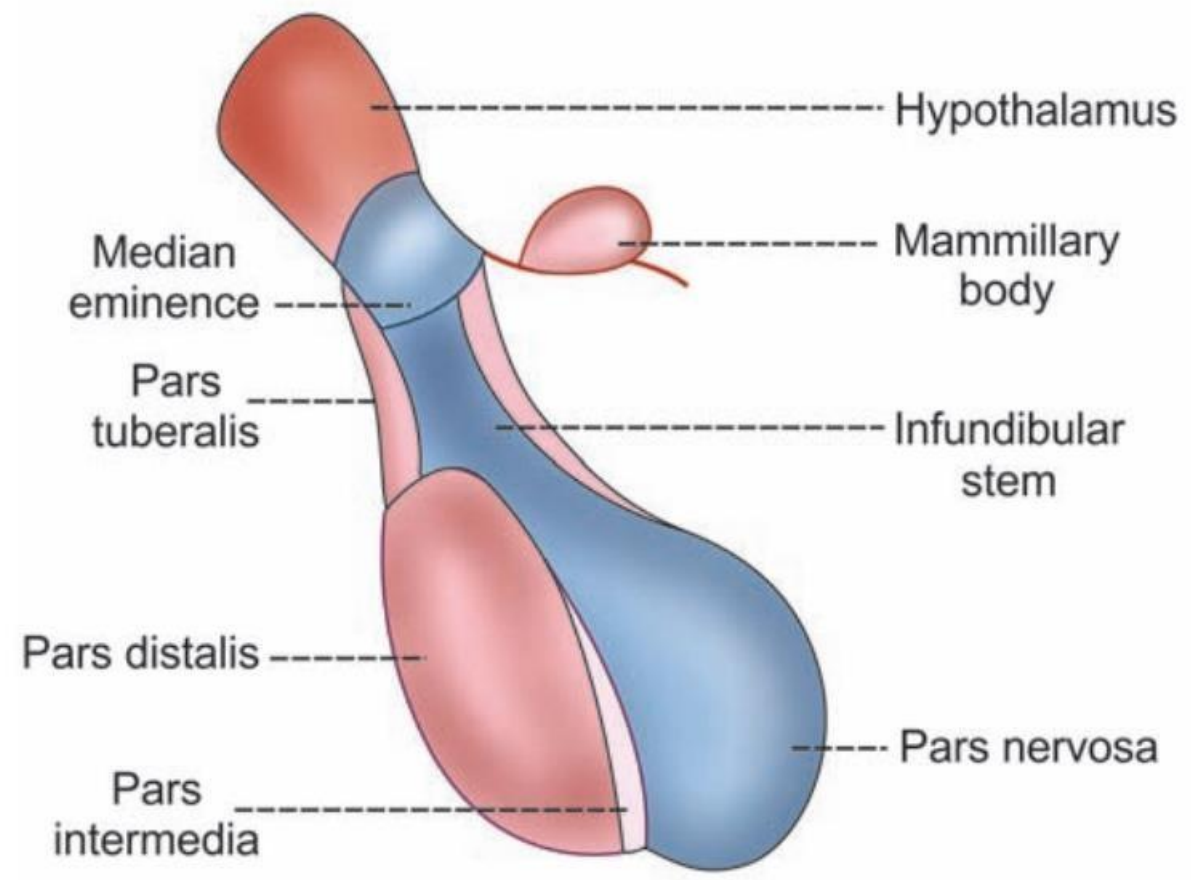


FIGURE 66.1: Parts of pituitary gland
■ Adenohypophysis ■ Neurohypophysis

POSTERIOR PITUITARY OR NEUROHYPOPHYSIS PARTS

Posterior pituitary consists of three parts:

1. Pars nervosa or infundibular process
2. Neural stalk or infundibular stem
3. Median eminence.

Pars tuberalis of anterior pituitary and the neural stalk of posterior pituitary together form the hypophyseal stalk.

HORMONES OF POSTERIOR PITUITARY

Posterior pituitary hormones are:

1. Antidiuretic hormone (ADH) or vasopressin
2. Oxytocin.

Thyroid stimulating hormone (TSH)

- This hormone is synthesised by the anterior pituitary and its release is stimulated by TRH from the hypothalamus. It stimulates growth and activity of the thyroid gland, which secretes the hormones thyroxine (T4) and triiodothyronine (T3). Release is lowest in the early evening and highest during the night.
- When the blood level of thyroid hormones is high, secretion of TSH is reduced, and vice versa.

Adrenocorticotrophic hormone (corticotrophin, ACTH)

- Corticotrophin releasing hormone (CRH) from the hypothalamus promotes the synthesis and release of ACTH by the anterior pituitary.
- This increases the concentration of cholesterol and steroids within the adrenal cortex and the output of steroid hormones, especially cortisol.
- ACTH levels are highest at about 8 a.m. and fall to their lowest about midnight, although high levels sometimes occur at midday and 6 p.m. This circadian rhythm is maintained throughout life.
- It is associated with the sleep pattern and adjustment to changes takes several days, following, e.g., shift work changes, travel to a different time zone (jet lag).

Growth hormone (GH)

- This is the most abundant hormone synthesized by the anterior pituitary. It stimulates growth and division of most body cells but especially those in the bones and skeletal muscles.
- It also regulates aspects of metabolism in many organs, e.g. liver, intestines and pancreas; stimulates protein synthesis; promotes breakdown of fats; and increases blood glucose levels.
- Its release is stimulated by growth hormone releasing hormone (GHRH) and suppressed by growth hormone release inhibiting hormone (GHRIH) both of which are secreted by the hypothalamus. Secretion of GH is greater at night during sleep although hypoglycaemia, exercise and anxiety also stimulate release.

Prolactin

- This hormone stimulates lactation (milk production) and has a direct effect on the breasts immediately after parturition (childbirth).
- The blood level of prolactin is stimulated by prolactin releasing hormone (PRH) released from the hypothalamus and it is lowered by prolactin inhibiting hormone (PIH, dopamine) and by an increased blood level of prolactin.
- After birth, suckling stimulates prolactin secretion and lactation. The resultant high blood level is a factor in reducing the incidence of conception during lactation.
- Prolactin together with oestrogens, corticosteroids, insulin and thyroxine is involved in initiating and maintaining lactation.
- Prolactin secretion is related to sleep, i.e. it is raised during any period of sleep, night or day.
- Emotional stress increases production.

Gonadotrophins

After puberty two gonadotrophins (sex hormones) are secreted by the anterior pituitary in response to luteinising hormone releasing hormone (LHRH), also known as gonadotrophin releasing hormone (GnRH).

In both males and females these are:

- follicle stimulating hormone (FSH)
- luteinising hormone (LH).

- **In both sexes.** FSH stimulates production of gametes (ova or spermatozoa).
- **In females.** LH and FSH are involved in secretion of the hormones oestrogen and progesterone during the menstrual cycle. As the levels of oestrogen and progesterone rise secretion of LH and FSH is suppressed.
- **In males.** LH, also called interstitial cell stimulating hormone (ICSH) stimulates the interstitial cells of the testes to secrete the hormone testosterone

Table 9.2 Summary of the hormones secreted by the anterior pituitary gland and their functions

Hormone	Function
Growth hormone (GH)	Regulates metabolism, promotes tissue growth especially of bones and muscles
Thyroid stimulating hormone (TSH)	Stimulates growth and activity of thyroid gland and secretion of T_3 and T_4
Adrenocorticotrophic hormone (ACTH)	Stimulates the adrenal cortex to secrete glucocorticoids
Prolactin (PRL)	Stimulates milk production in the breasts
Follicle stimulating hormone (FSH)	Stimulates production of sperm in the testes, stimulates secretion of oestrogen by the ovaries, maturation of ovarian follicles, ovulation
Luteinising hormone (LH)	Stimulates secretion of testosterone by the testes, stimulates secretion of progesterone by the corpus luteum

Posterior pituitary

- Oxytocin and antidiuretic hormone (ADH or vasopressin) are the hormones synthesized in the hypothalamus and then released from the axon terminals within the posterior pituitary gland.
- These hormones act directly on non-endocrine tissue and their release by exocytosis is stimulated by nerve impulses from the hypothalamus.

Oxytocin

- Oxytocin stimulates two target tissues during and after parturition (childbirth): uterine smooth muscle and the muscle cells of the lactating breast.

Antidiuretic hormone (ADH) or vasopressin

- The main effect of antidiuretic hormone is to reduce urine output (diuresis is the production of a large volume of urine). ADH increases the permeability to water of the distal convoluted and collecting tubules of the nephrons of the kidneys

Hypothalamic Factor	Corresponding Anterior Pituitary Hormone
Thyrotropin releasing hormone (TRH)	TSH
Corticotropin releasing hormone (CRH)	ACTH
Gonadotropin releasing hormone (GnRH)	LH and FSH
Growth hormone releasing hormone (GHRH)	GH
Prolactin releasing hormone (PRLH)	PRL