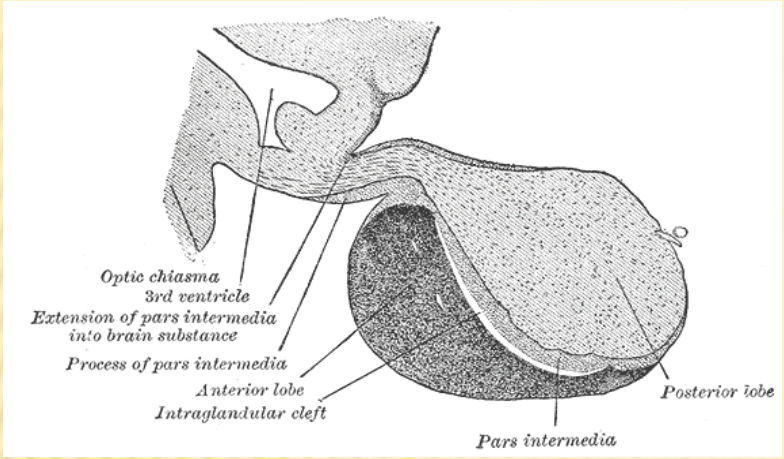
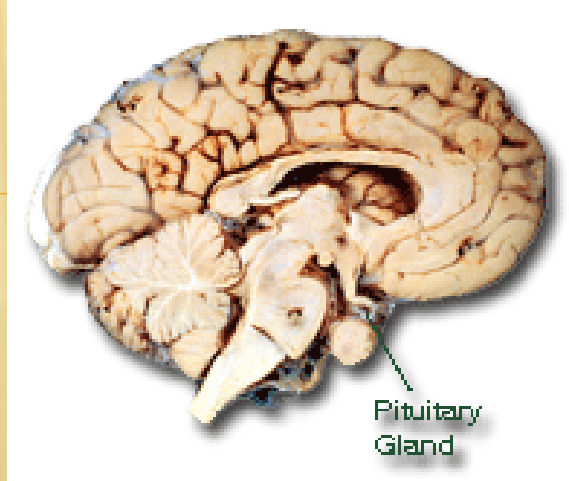


PITUITARY GLAND

SUBMITTED BY-
SAGARIKA MUKHERJEE
DEPARTMENT OF ZOOLOGY
BIDHAN CHANDRA COLLEGE
ASANSOL



Introduction of Pituitary Gland.

•In vertebrate anatomy the **pituitary gland**, or **hypophysis**, is an endocrine gland about the size of a pea and weighing 0.5 g (0.02 oz.).

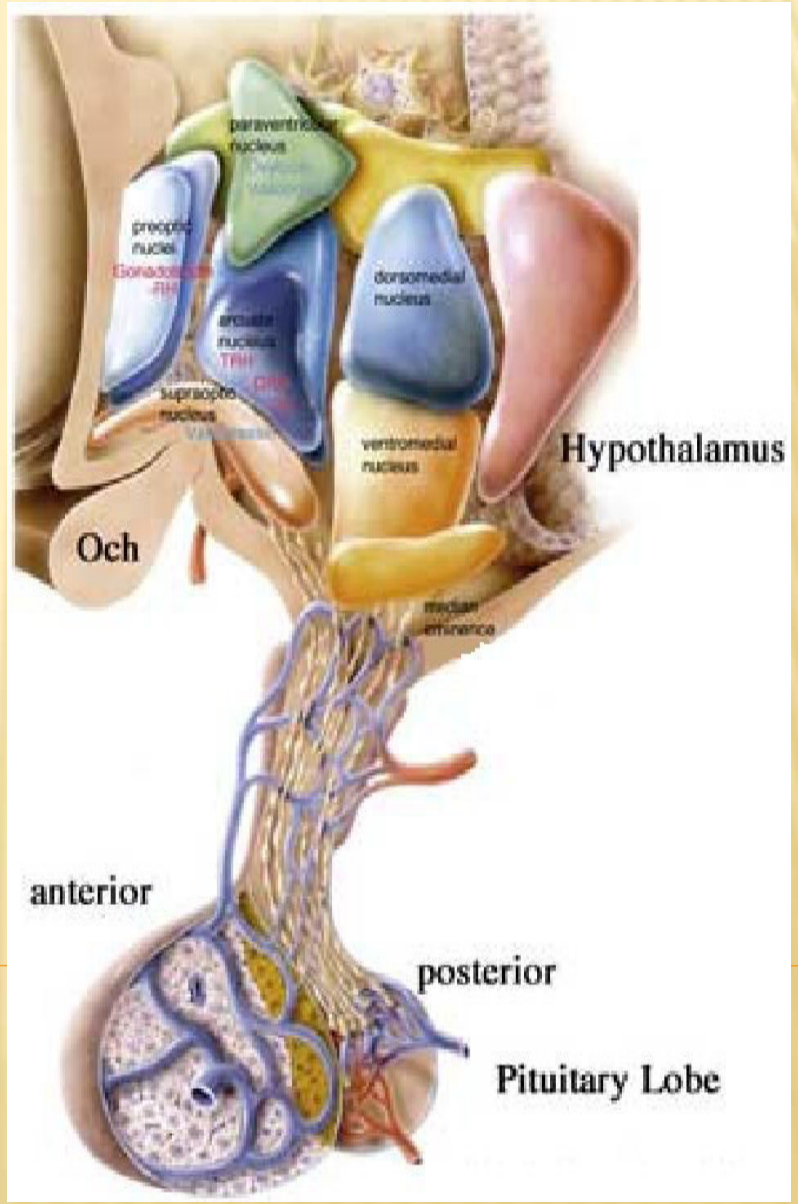
•It is a protrusion off the bottom of the hypothalamus at the base of the brain, and rests in a small, bony cavity **(sella turcica)**

•The pituitary fossa, in which the pituitary gland sits, is situated in the sphenoid bone in the middle cranial fossa at the base of the brain.

•The pituitary gland secretes hormones regulating homeostasis, including tropic hormones that stimulate other endocrine glands.

•It is functionally connected to the hypothalamus by the **median eminence** via a small tube called the **Pituitary Stalk**.

•It is considered to be the **"master gland".**



Pituitary: The Master Gland

The pituitary, a pea-sized gland at the base of the brain, produces a number of hormones, each of which affects a specific part of the body (a target organ or tissue). Because the pituitary controls the function of most other endocrine glands, it is often called the master gland.

Hormone	Target Organ or Tissue
Adrenocorticotropic hormone (ACTH)	Adrenal glands
Antidiuretic hormone	Kidney
Beta-melanocyte–stimulating hormone	Skin
Endorphins	Brain and immune system
Enkephalins	Brain
Follicle-stimulating hormone	Ovaries or testes
Growth hormone	Muscles and bones
Luteinizing hormone	Ovaries or testes
Oxytocin	Uterus and mammary glands
Prolactin	Mammary glands
Thyroid-stimulating hormone	Thyroid gland

Anatomy and physiology of the pituitary gland:

The pituitary gland weighs about 0.5 to 1 g and is divided into anterior and posterior lobes. The pituitary gland sits in the sella turcica immediately behind the sphenoid sinus. Magnetic resonance imaging (MRI) is the best method for the visualization of hypothalamic-pituitary anatomy

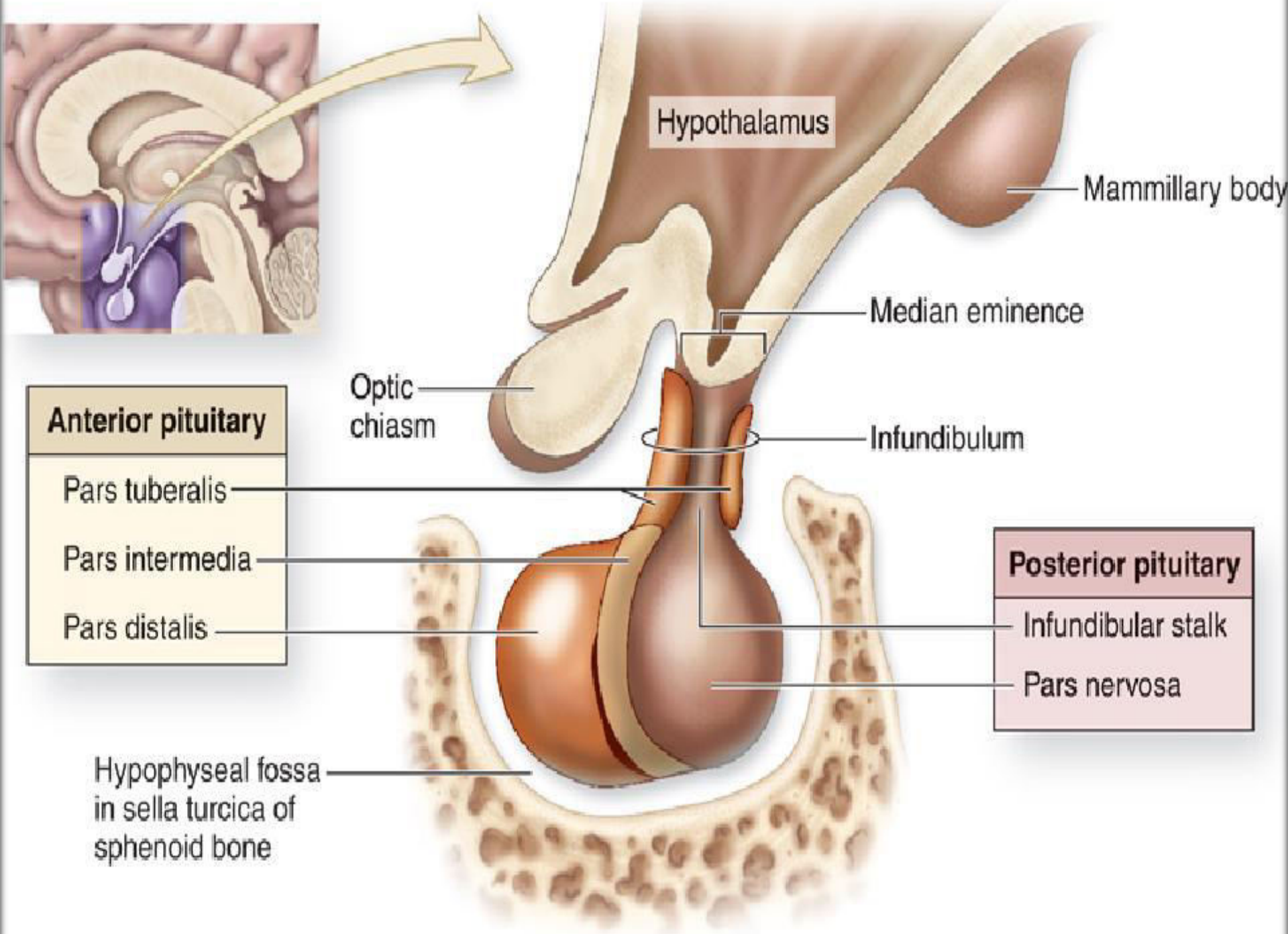
Anterior pituitary hormones are regulated **by hypothalamic releasing and inhibitory hormones and negative feedback action of the target glandular hormones at the pituitary and hypothalamic levels** (Table 1). Among pituitary hormones, only the secretion of **prolacti**n is increased in the absence of hypothalamic influence, because it is mainly under tonic suppression by dopamine, the main prolactin inhibitory factor. All anterior pituitary hormones are secreted in a pulsatile fashion and tend to follow a diurnal pattern.

Table 1: Relationship Among Hypothalamic, Pituitary, and Feedback Hormones and Target Glands

Target Gland	Hypothalamic Regulatory Hormone	Pituitary Hormone	Feedback Hormone
Thyroid gland	TRH	TSH	T_4 T_3
Gonad	LHRH	LH	E_2, T
Gonad	LHRH	FSH	Inhibin, E_2, T
Many organs	GHRH, SMS	GH	IGF-1
Breast	PIF	Prolactin	?
Adrenal	CRH, ADH	ACTH	Cortisol

ACTH, adrenocorticotropic hormone; ADH, antidiuretic hormone; CRH, corticotropin-releasing hormone; E_2, estradiol; GHRH, growth hormone–releasing hormone; IGF-1, interleukin growth factor 1; LHRH, luteinizing hormone–releasing hormone; PIF, prolactin release inhibitory factor; SMS, somatostatin; T, testosterone; T_3, triiodothyronine; T_4, thyroxine; TRH, thyrotropin-releasing hormone.

Antidiuretic hormone (ADH, vasopressin) is produced by the supraoptic and paraventricular nuclei of the hypothalamus and travel in the axons through the pituitary stalk to the posterior pituitary gland. The chief physiologic stimulus of ADH secretion is an increase in serum osmolality and a decrease in plasma volume, resulting in water reabsorption at the level of the distal collecting ducts of the kidneys. Small increments in serum osmolality, more than 290 mOsm/kg, lead to a prompt secretion of ADH.


Hypothalamus
Mammillary body
Median eminence
Optic chiasm
Infundibulum
Anterior pituitary
Pars tuberalis
Pars intermedia
Pars distalis
Posterior pituitary
Infundibular stalk
Pars nervosa
Hypophyseal fossa in sella turcica of sphenoid bone

Origin and location of Pituitary Gland:

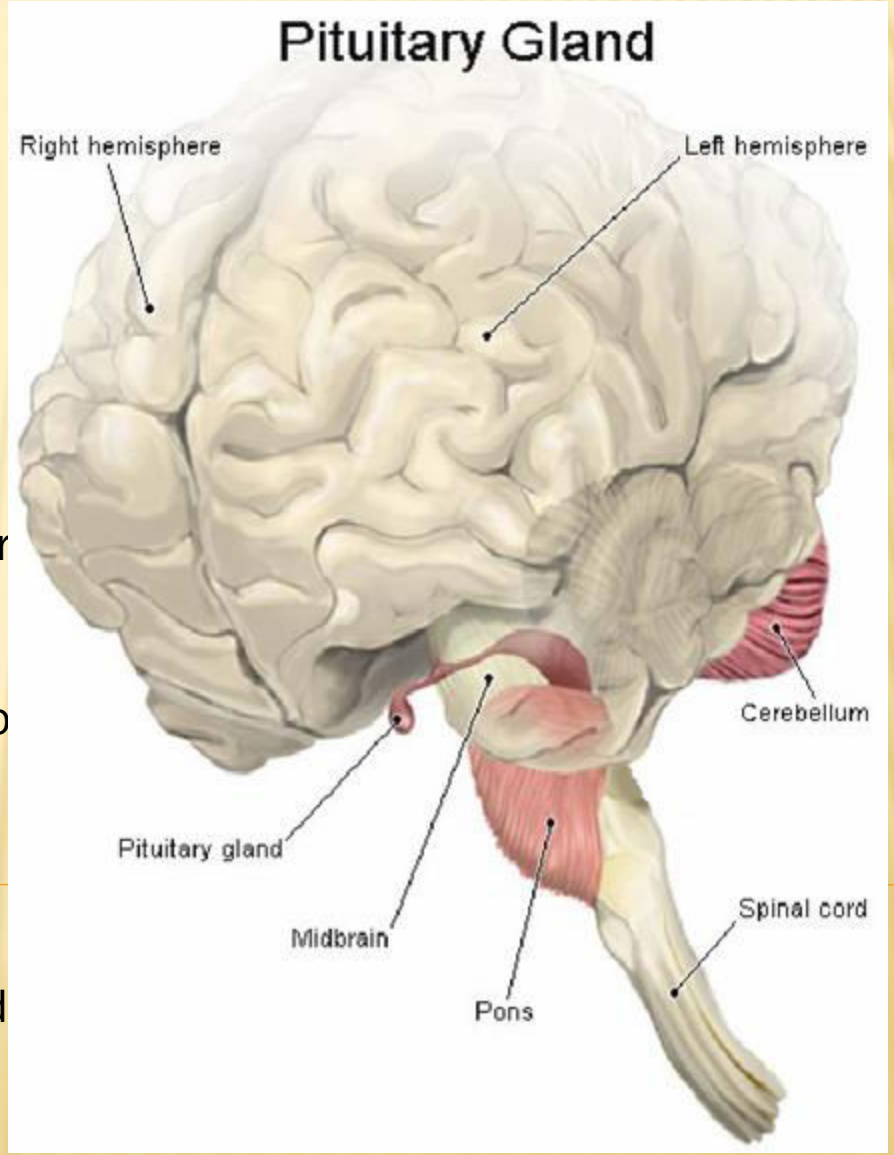
•The pituitary gland is also called The Hypophysis, is the smallest endocrine gland.

•Hypophysis (meaning undergrowth) is so named because of its location below the brain as undergrowth.

•This is an unpaired small ovoid gland and is no longer than the end of the little finger

•It is located at the base of the brain and lies below the diencephalon in a depressio of basis phenoid bone of the skull called Sella Turcica.

•It is a complex structure formed of ectodermic growth of the mouth cavity and down growth of the infandibulum.



Structure of Pituitary Gland:

•Structurally, the pituitary gland is divided into a **larger frontal region (adenohypophysis)** and a **smaller posterior region (neurohypophysis)**.

•The gland is connected to a region of the brain called the hypothalamus by the pituitary stalk. Directly above the pituitary gland and in front of the pituitary stalk are the crossing fibers of the optic nerves, called the optic chiasma.

•Because of the close proximity of the pituitary gland to major intracranial nerves and blood vessels, as well as the vital hormonal control the pituitary gland provides, disorders of the pituitary can cause a wide spectrum of symptoms, both hormonal and neurological.

Parts of Pituitary Gland:

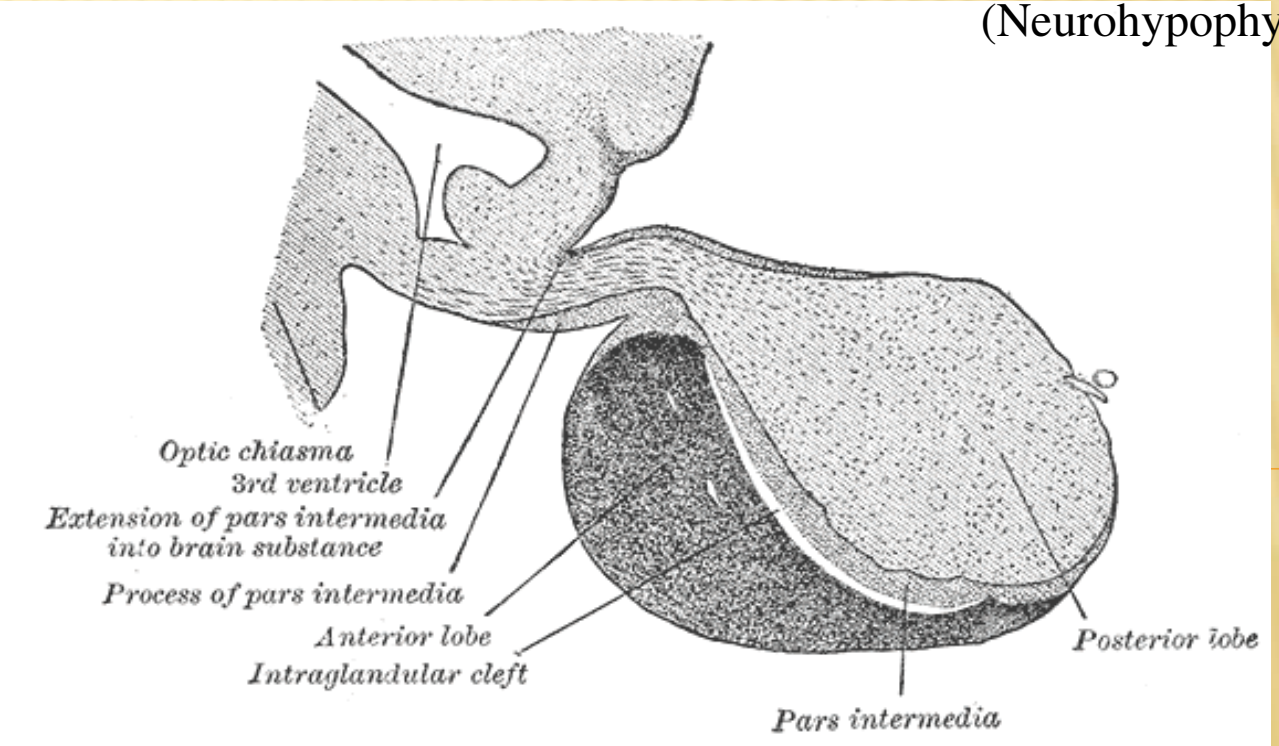
Pituitary gland is divided into 3 parts:

PITUITARY GLAND

Anterior pituitary (Adenohypophysis)

Pars Intermedia

Posterior pituitary (Neurohypophysis)



Anterior pituitary (Adenohypophysis):

•A major organ of the endocrine system, the **anterior pituitary**, also called the **adenohypophysis**, is the **glandular**, anterior lobe of the pituitary gland.

•The anterior pituitary regulates several physiological processes including **stress, growth, and reproduction.**

•Its regulatory functions are achieved through the secretion of **various peptide hormones** that act on target organs including the adrenal gland, liver, bone, thyroid gland, and gonads.

•The anterior pituitary itself is regulated by the hypothalamus and by **negative feedback from these target organs.**

•Disorders of the anterior pituitary are generally classified by the presence of over- or underproduction of pituitary hormones.

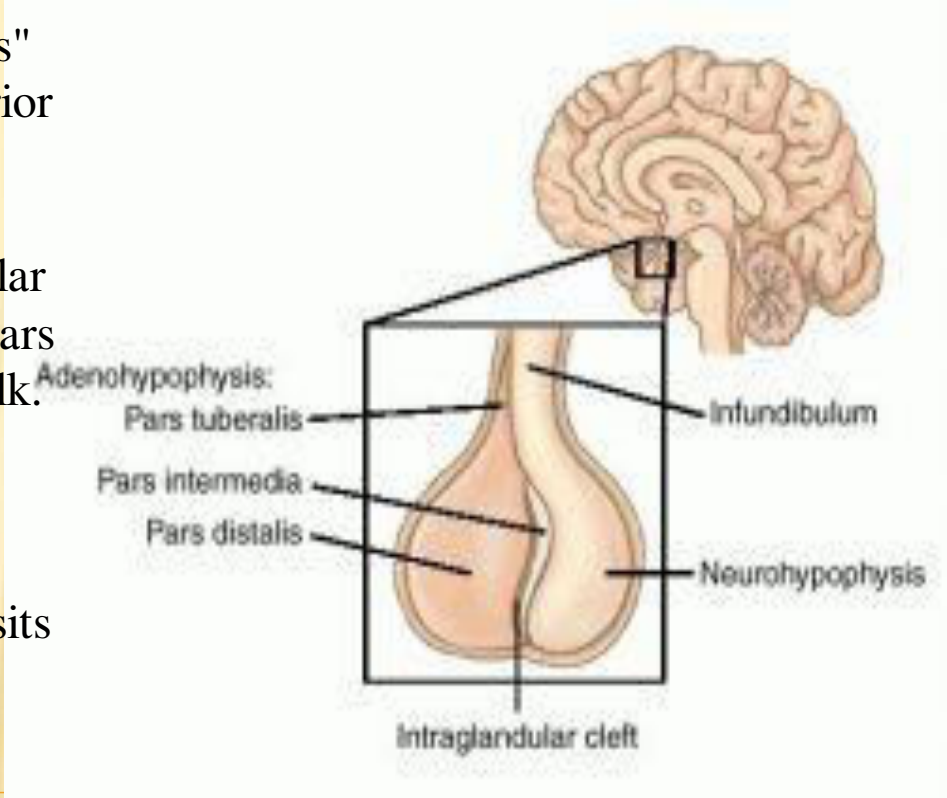
•Proper function of the anterior pituitary and of the organs it regulates can often be ascertained via blood tests that measure hormone levels.

The anterior pituitary is composed of multiple parts:

•**Pars distalis :**The pars distalis, or "distal part", comprises the majority of the anterior pituitary and is where the bulk of pituitary hormone production occurs. Occasionally, "pars distalis" is incorrectly used as a synonym for the anterior pituitary.

•**Pars tuberalis :** The pars tuberalis, or "tubular part", forms a sheath extending up from the pars distalis and wrapping around the pituitary stalk. Its function is poorly understood.

•**Pars intermedia:**
The pars intermedia, or "intermediate part", sits between the pars distalis and the posterior pituitary and is often very small in humans.



Embryology:
The anterior pituitary arises from an invagination of the oral ectoderm and forms Rathke's pouch. This contrasts with the posterior pituitary, which originates from neuroectoderm.

Major hormones secreted:

Hormone	Other names	Symbol(s)	Structure	Secretory cells	Staining	Target	Effect
Adrenocorticotropic hormone	Corticotropin	ACTH	Polypeptide	Corticotrophs	Basophil	Adrenal gland	Secretion of glucocorticoids
Beta-endorphin			Polypeptide	Corticotrophs	Basophil	Opioid receptor	Inhibit perception of pain
Thyroid-stimulating hormone	Thyrotropin	TSH	Glycoprotein	Thyrotrophs	Basophil	Thyroid gland	Secretion of thyroid hormones
Follicle-stimulating hormone	-	FSH	Glycoprotein	Gonadotrophs	Basophil	Gonads	Growth of reproductive system
Luteinizing hormone	Lutropin	LH, ICSH	Glycoprotein	Gonadotrophs	Basophil	Gonads	Sex hormone production
Growth hormone	Somatotropin	GH, STH	Polypeptide	Somatotrophs	Acidophil	Liver, adipose tissue	Promotes growth; lipid and carbohydrate metabolism
Prolactin	Lactogenic hormone	PRL	Polypeptide	Lactotrophs and Mammotrophs	Acidophil	Ovaries, mammary glands	Secretion of estrogens/progesterone; milk production

Pars Intermedia:

•Pars intermedia is the boundary between the anterior and posterior lobes of the pituitary.

•It contains three types of cells - basophils, chromophobes, and colloid-filled cysts.
•
•The cysts are the remainder of Rathke's pouch.

•In human fetal life, this area produces melanocyte stimulating hormone or MSH which causes the release of melanin pigment in skin melanocytes (pigment cells).
•
•However, the pars intermedia is normally either very small or entirely absent in adulthood.
In lower vertebrates (fish, amphibians) MSH from the pars intermedia is responsible for darkening of the skin, often in response to changes in background color.
This color change is due to MSH stimulating the dispersion of melanin pigment in dermal (skin) melanophore cells.

Major hormone secreted:
•Melanocyte Stimulating Hormone or MSH

Posterior pituitary(Neurohypophysis):

The **posterior pituitary** (or **neurohypophysis**) comprises the posterior lobe of the pituitary gland and is part of the endocrine system. Despite its name, the posterior pituitary gland is not a gland, *per se*; rather, it is largely a collection of axonal projections from the hypothalamus that terminate behind the anterior pituitary gland.So it is nervous in origin.

Anatomy:

The posterior pituitary consists mainly of neuronal projections (axons) extending from the supraoptic and paraventricular nuclei of the hypothalamus. These axons release peptide hormones into the capillaries of the hypophyseal circulation. In addition to axons, the posterior pituitaryalso contains pituicytes, specialized glial cells resembling astrocytes. Classification of the posterior pituitary varies, but most sources include the three regions below:

•Pars nervosa Also called the neural lobe or posterior lobe, this region constitutes the majority of the posterior pituitary, and is sometimes (incorrectly) considered synonymous with it. Notable features include Herring bodies and pituicytes.

•Infundibular stalk Also known as the infundibulum or pituitary stalk, the infundibular stalk bridges the hypothalamic and hypophyseal systems.

Hormones secreted:

Hormones known classically as posterior pituitary hormones are synthesized by the hypothalamus. They are then stored and secreted by the posterior pituitary into the bloodstream.

Hormone	Other names	Symbol(s)	Target	Effect	Source
Oxytocin	-	OT	Uterus, mammary glands	Uterine contractions; lactation	supraoptic and paraventricular nuclei
Vasopressin (antidiuretic hormone)	Arginine vasopressin, argipressin, antidiuretic hormone	VP, AVP, ADH	Kidneys or Arterioles	Stimulates water retention; raises blood pressure by contracting arterioles, induces male aggression	supraoptic and paraventricular nuclei

Role in disease:

Insufficient secretion of vasopressin underlies diabetes insipidus, a condition in which the body loses the capacity to concentrate urine. Affected individuals excrete as much as 20 liters of dilute urine per day. Oversecretion of vasopressin causes the syndrome of inappropriate antidiuretic hormone (SIADH).

Hormones secreted from Pituitary Gland:

HORMONES SECRETED FROM PITUITARY GLAND

- **Thyroid Stimulating Hormone (TSH):**
  - Stimulates the thyroid gland to release thyroid hormones.
  - Control basal metabolic rate and play an important role in growth and maturation.
  - Affect almost every organ in the body.

- **Growth Hormone (GH):** Principal hormone that regulates growth.

- **Adrenocorticotropic Hormone (ACTH):** Triggers the adrenal glands, which regulate stress response with the release of hormones such as cortisol and aldosterone.

- **Luteinizing Hormone (LH) and Follicle Stimulating Hormone (FSH):** Control reproduction.

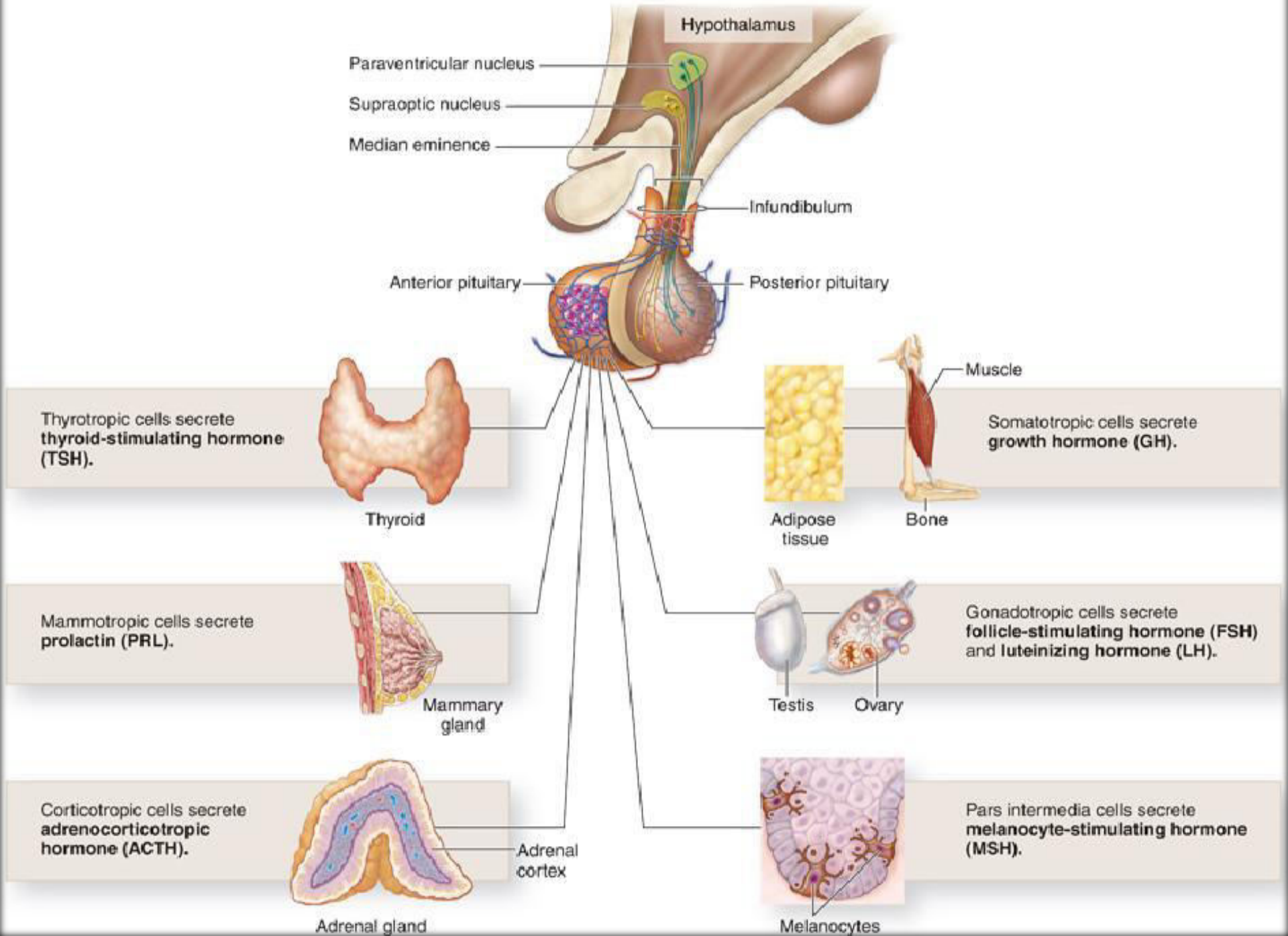
- **Prolactin (PRL):** Stimulates secretion of breast milk.

➢**Melanocyte-stimulating hormone(MSH):**They stimulate the production and release of melanin (melanogenesis) by melanocytes in skin and hair

➢**Oxytocin:**

- it is released in large amounts after distension of the cervix and uterus during labor
- after stimulation of the nipples, facilitating birth and breastfeedingreastfeeding.
- Recent studies have begun to investigate oxytocin's role in various behaviors, including orgasm, social recognition, pair bonding, anxiety, and maternal behaviors

➢**Vasopressin, also called anti-diuretic hormone (ADH):** Promotes water retention.


Hypothalamus
Paraventricular nucleus
Supraoptic nucleus
Median eminence
Infundibulum
Anterior pituitary
Posterior pituitary
Thyrotropic cells secrete thyroid-stimulating hormone (TSH).
Thyroid
Somatotropic cells secrete growth hormone (GH).
Muscle
Adipose tissue
Bone
Mammotropic cells secrete prolactin (PRL).
Mammary gland
Gonadotropic cells secrete follicle-stimulating hormone (FSH) and luteinizing hormone (LH).
Testis
Ovary
Corticotropic cells secrete adrenocorticotropic hormone (ACTH).
Adrenal cortex
Adrenal gland
Pars intermedia cells secrete melanocyte-stimulating hormone (MSH).
Melanocytes

THANK YOU