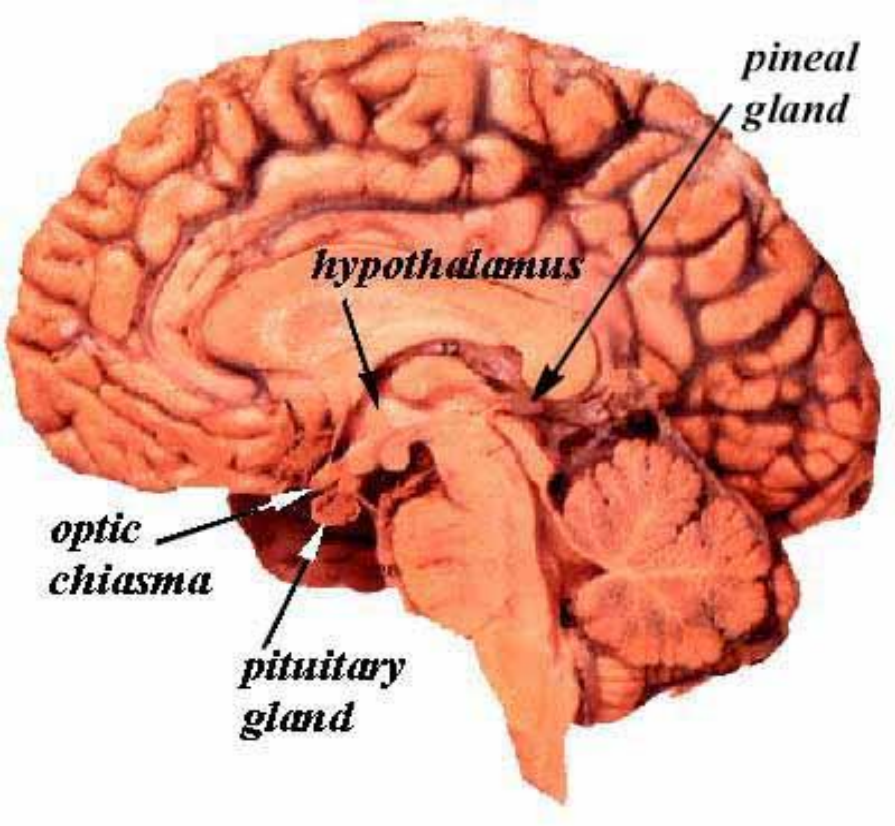
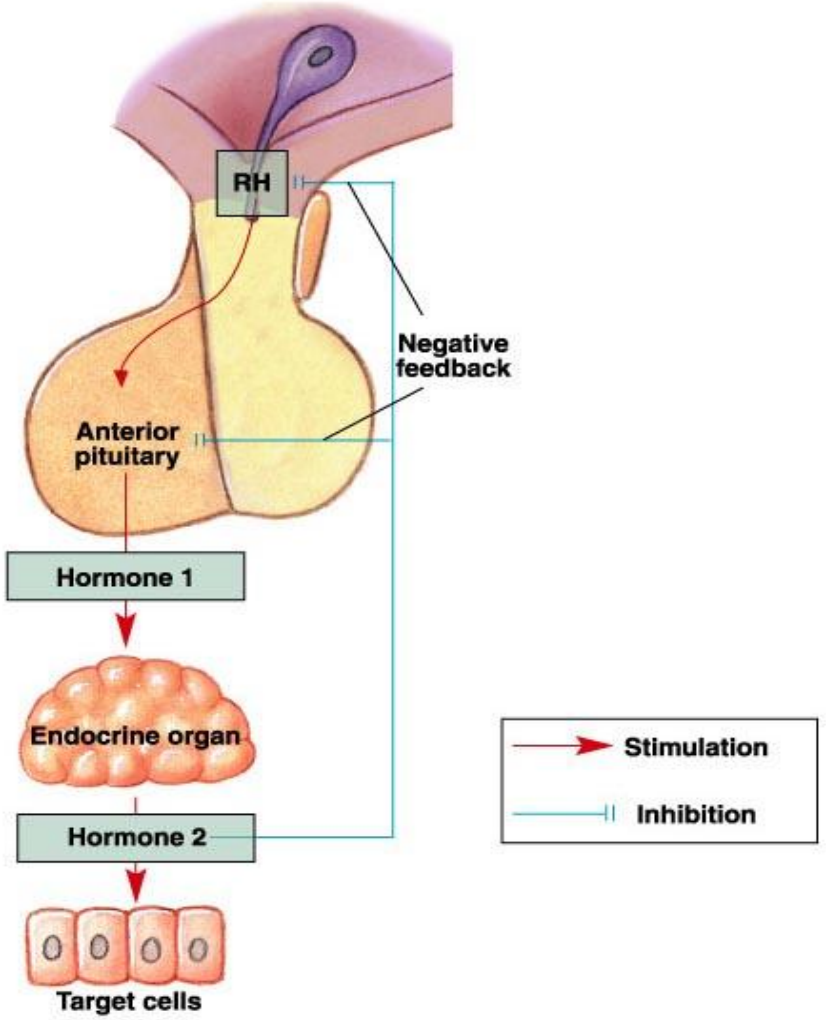
Pituitary Physiology and Deficiencies



Ipsita Maity.
Department of Zoology

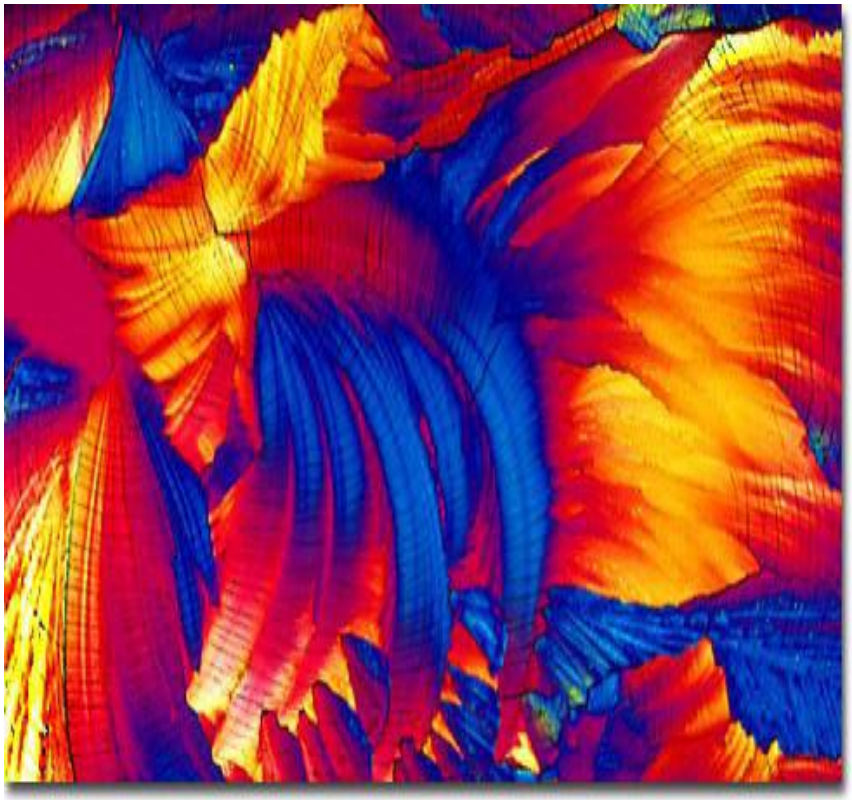
Pituitary

- Pituitary
  - "Master" gland
  - Most of the pituitary hormones control other endocrine glands



Goals of Discussion

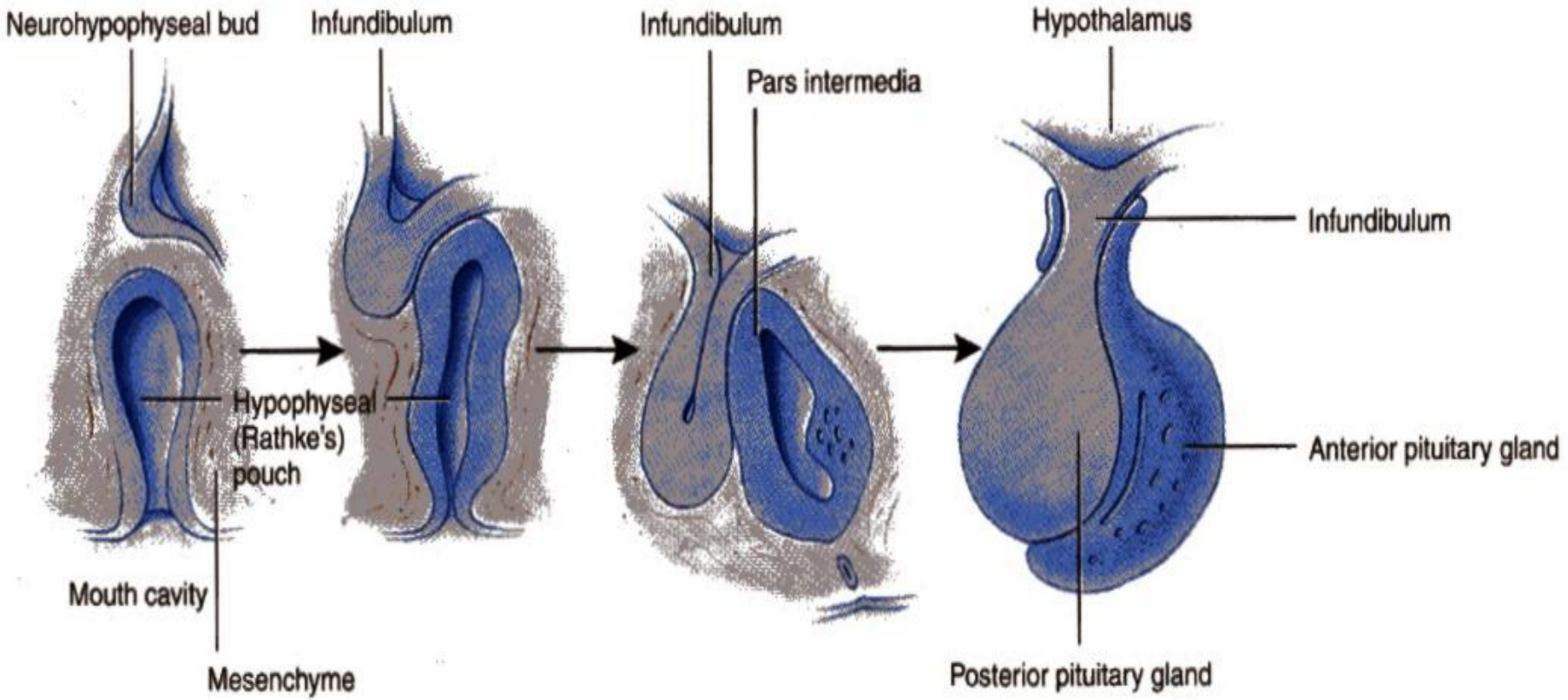
- Review pituitary anatomy
- Understand pituitary physiology
- Discuss pituitary hormone deficiencies



Nomenclature

- Pituitary
  - Greek
    - *ptuo* (to spit)
  - Latin
    - *Pituita* (mucus)
  - Mucus was produced by the brain and was excreted through the nose by the pituitary

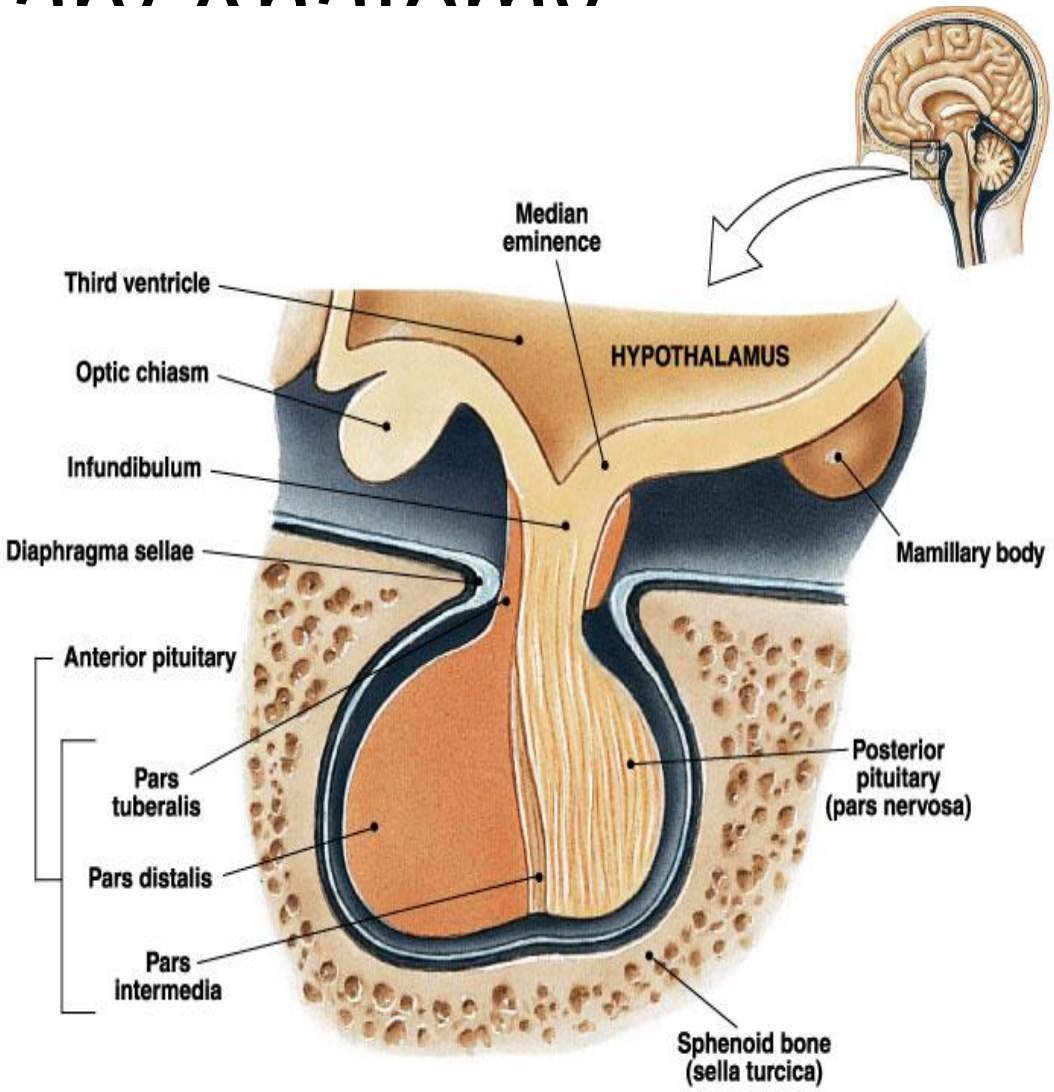
Pituitary Development



- Evagination of the stromodeal ectoderm from buccal cavity
- Infundibulum, neural stalk and posterior lobe from diencephalon
- Development 3rd to the 15th week gestation

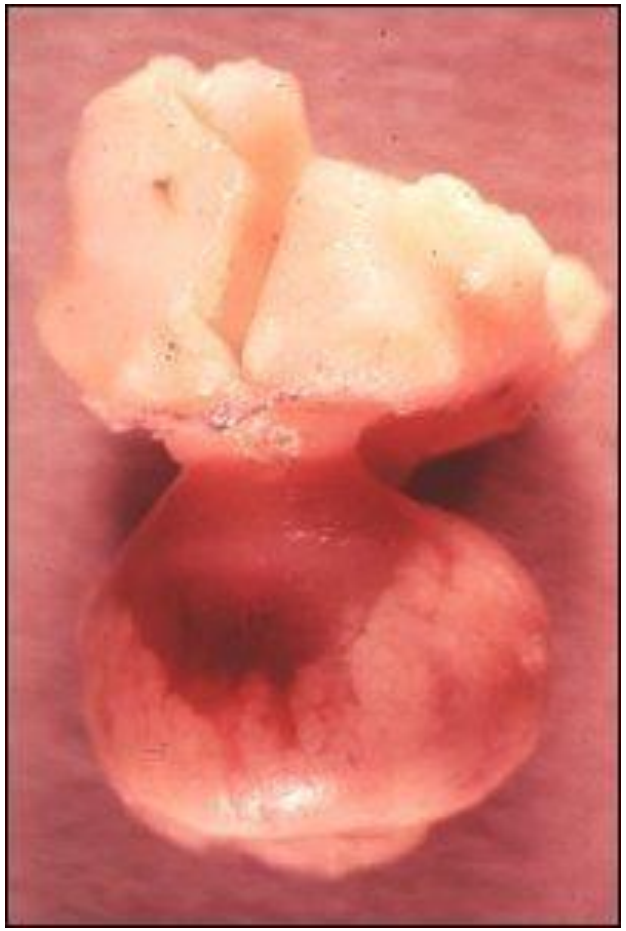
Pituitary Anatomy

- Sits in sella turcica
- Surrounded by dura
- Sphenoid
  - Lateral and inferior
- Lateral
  - Cavernous sinus
    - Internal carotid artery
    - CN III, IV, VI, V1 and V2

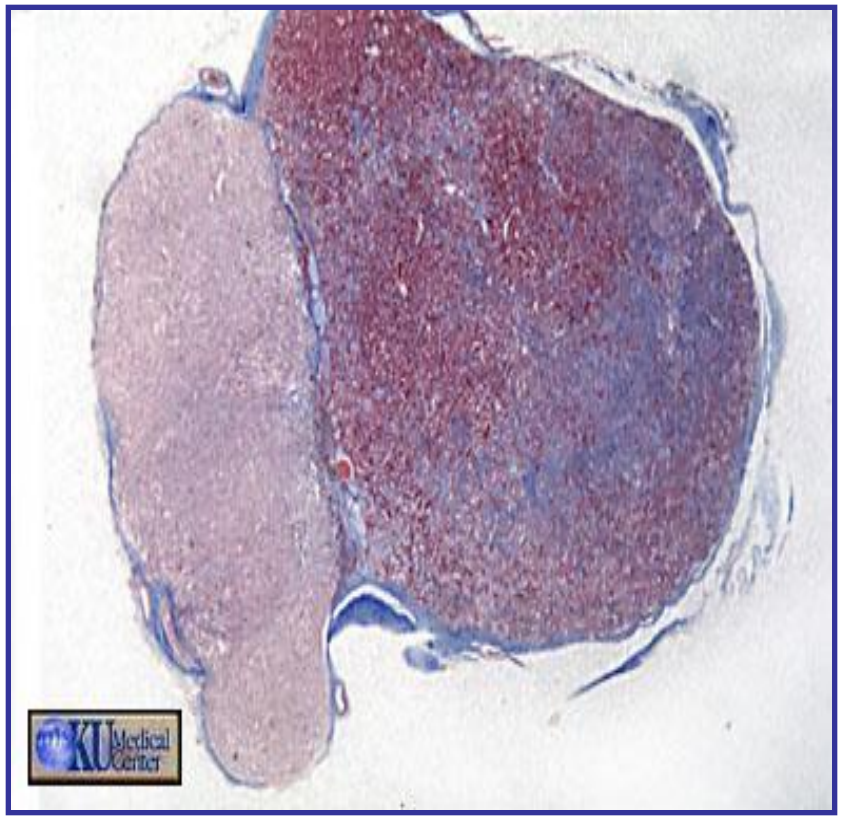


Pituitary Anatomy
Gross

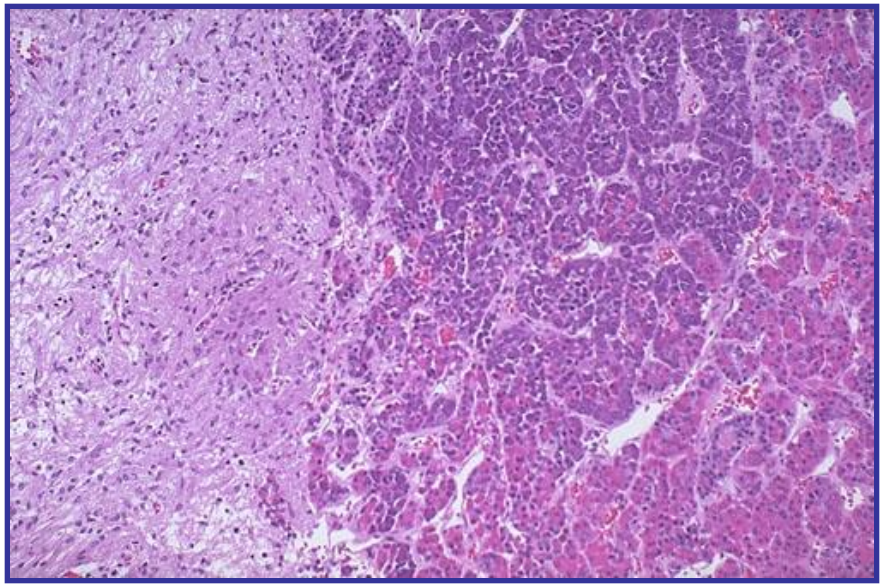
- Symmetrical bean shaped
  - Brownish red
- 13 mm transverse
- 9 mm AP
- 6 mm height
- Adult
  - 0.4-0.9 grams
  - Larger in women
  - Larger in multiparous women
  - During pregnancy increases to 0.9-1 grams



Pituitary Anatomy
Microscopic

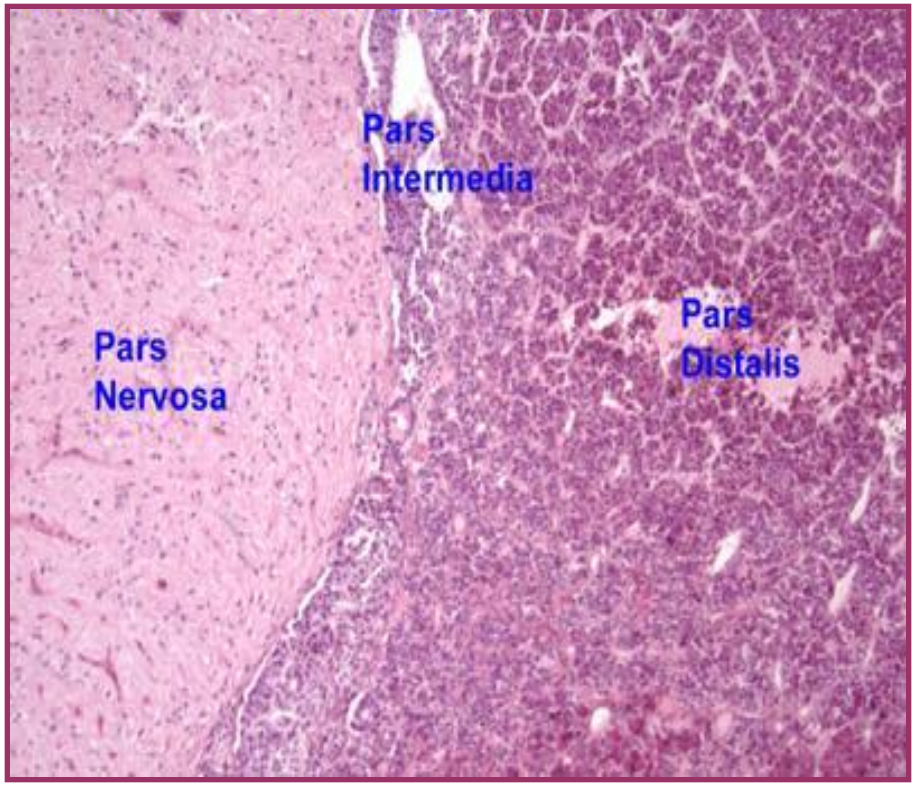


- Anterior lobe
  - 80% of gland
  - Brown color
- Posterior lobe
  - Gray/brown color



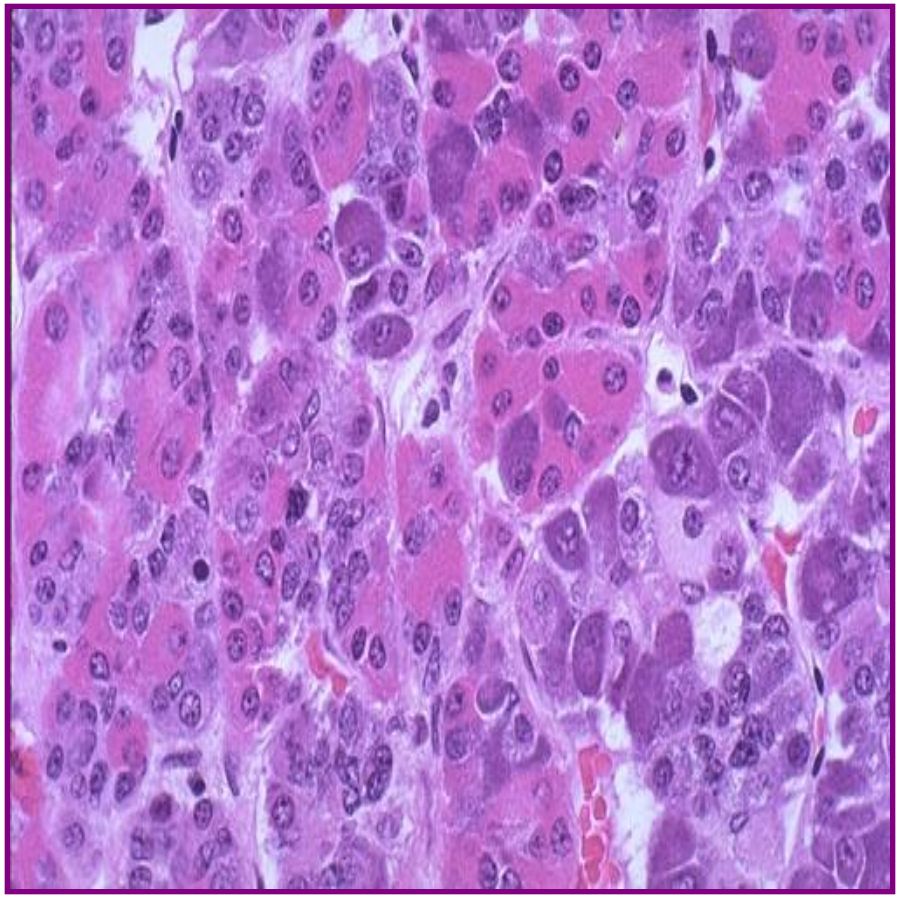
Pituitary Anatomy
Microscopic

- Anterior lobe 3 divisions
  - Pars distalis
    - Largest
    - Hormone producing cells
  - Pars intermedia
    - Poorly defined in the human
  - Pars tuberalis
    - Upward extension to the anterior lobe and attached to pituitary stalk
- Posterior lobe
  - Pars nervosa



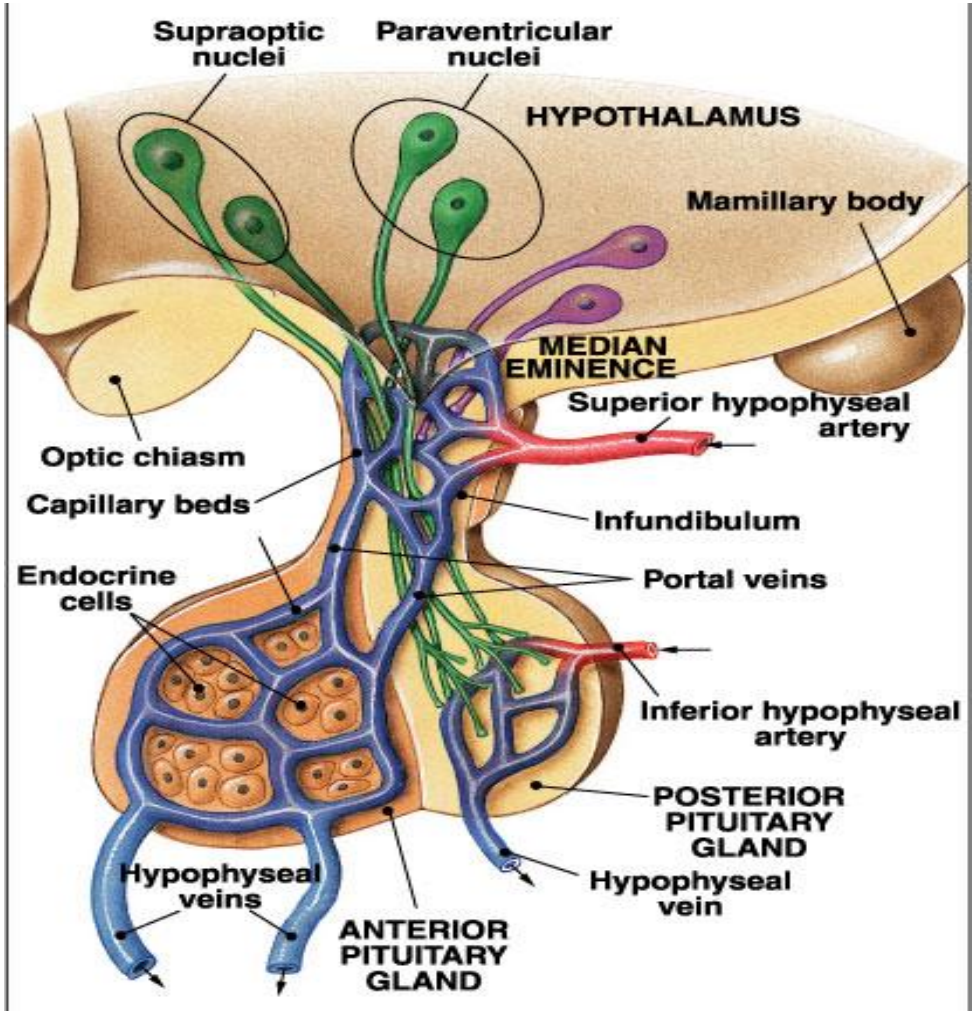
Pituitary Gland
Microscopic

- Pars distalis
  - Pink acidophils
    - Growth hormone
    - Prolactin
  - Dark purple basophils
    - Corticotropin (ACTH)
    - Thyroid stimulating hormone (TSH)
    - Follicle stimulating hormone (FSH)
    - Luteinizing hormone (LH)



Pituitary
Portal System

- Hypophyseal arteries
  - From carotid
  - Superior
    - 80-90% to adenophysis
  - Inferior
    - Posterior pituitary
- Posterior lobe
  - Rich nerve supply
  - Unmyelinated nerves



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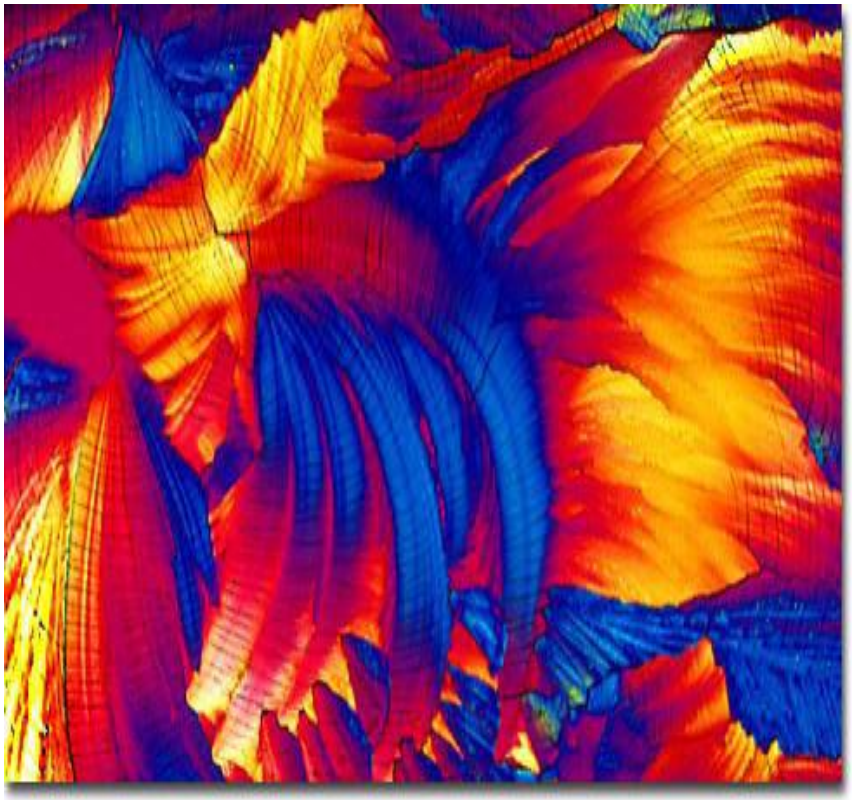
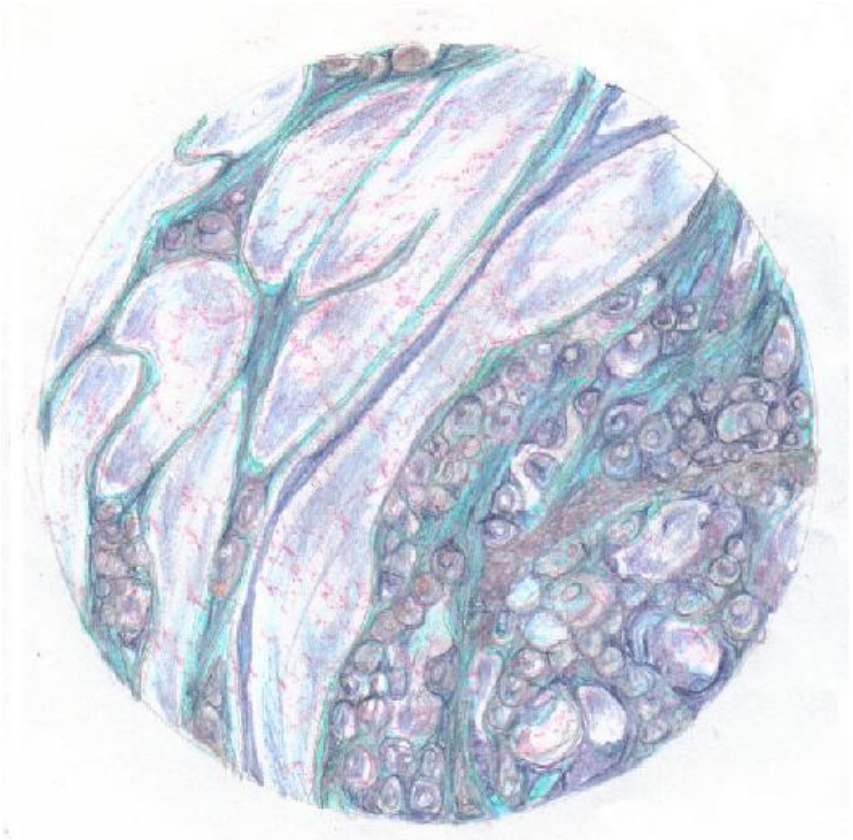


Hormones Of The Anterior Pituitary



- 6 main hormones secreted by the adenohypophysis:
  - Growth hormone
    - Somatotropin
  - Thyroid-stimulating hormone
    - Thyrotropin
  - Adrenocorticotropic hormone
    - Corticotropin
  - Prolactin
  - Follicle-stimulating hormone
  - Luteinizing hormone

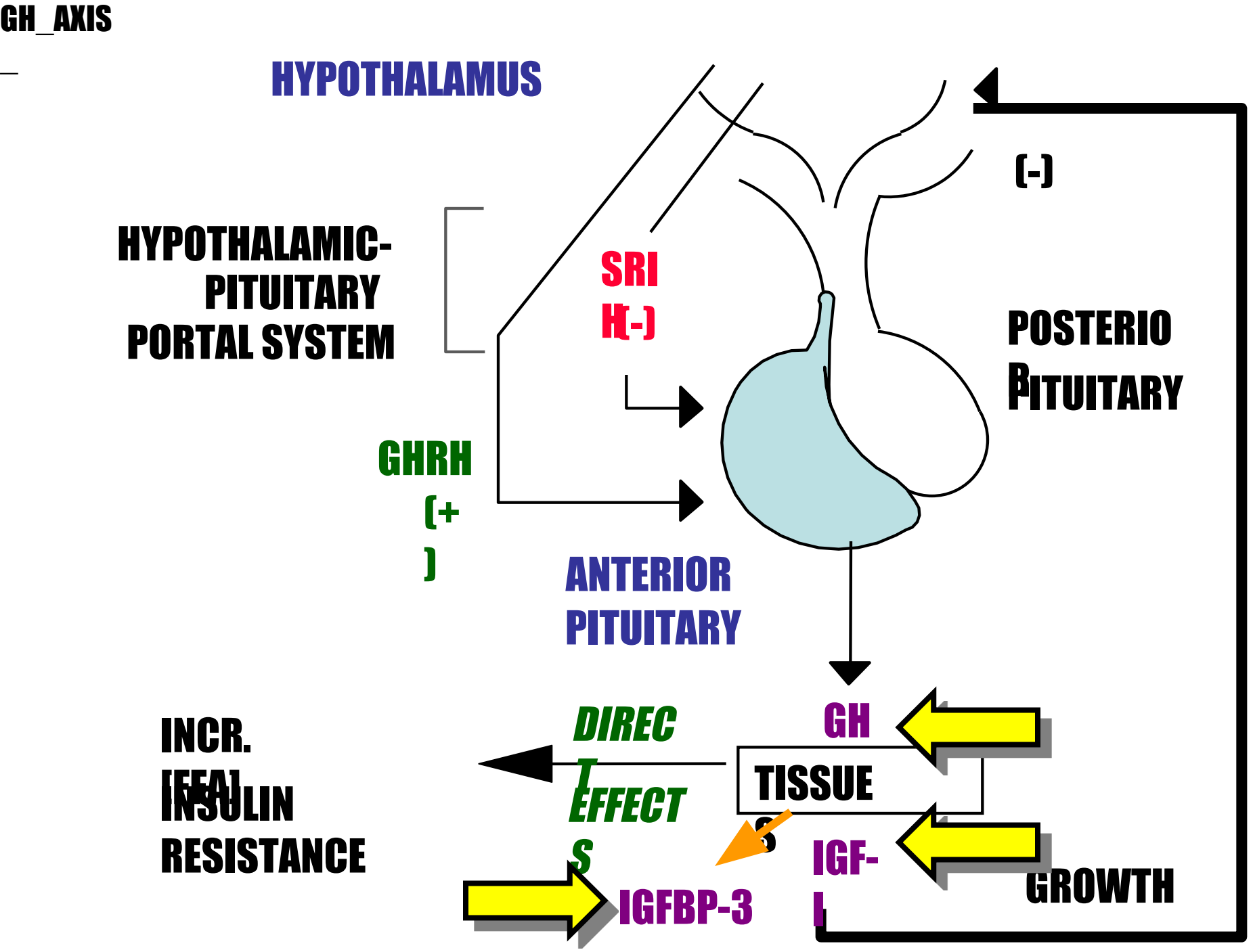
Anterior pituitary

Hypothalamic product	Pituitary product	Target organ	Hormone product
CRH	ACTH	Adrenal cortex	Cortisol
TRH	TSH	Thyroid	T4, T3
GHRH (+) SRIH (-)	GH	Liver; Tissues	IGF-I (systemic) IGF-I (local)
PRIH (dopamine)	PRL	Breast	[Lactation]
GnRH (LHRH)	LH, FSH	Gonad	Sex hormones

Hormone	Structure	Amino acids/Source	
Polypeptide/proteins			
ACTH	Polypeptide	39	Corticotroph
GH	Protein	191	Somatotroph
PRL	Protein	199	Lactotroph
Glycoproteins			
TSH	Alpha* / TSH-beta	110	Thyrotroph
LH	Alpha / LH-beta	115	Gonadotroph
FSH	Alpha / FSH-beta	115	Gonadotroph
[hCG	Alpha / beta-hCG]	147	[Placenta]

* 92 amino acids

GH_AXIS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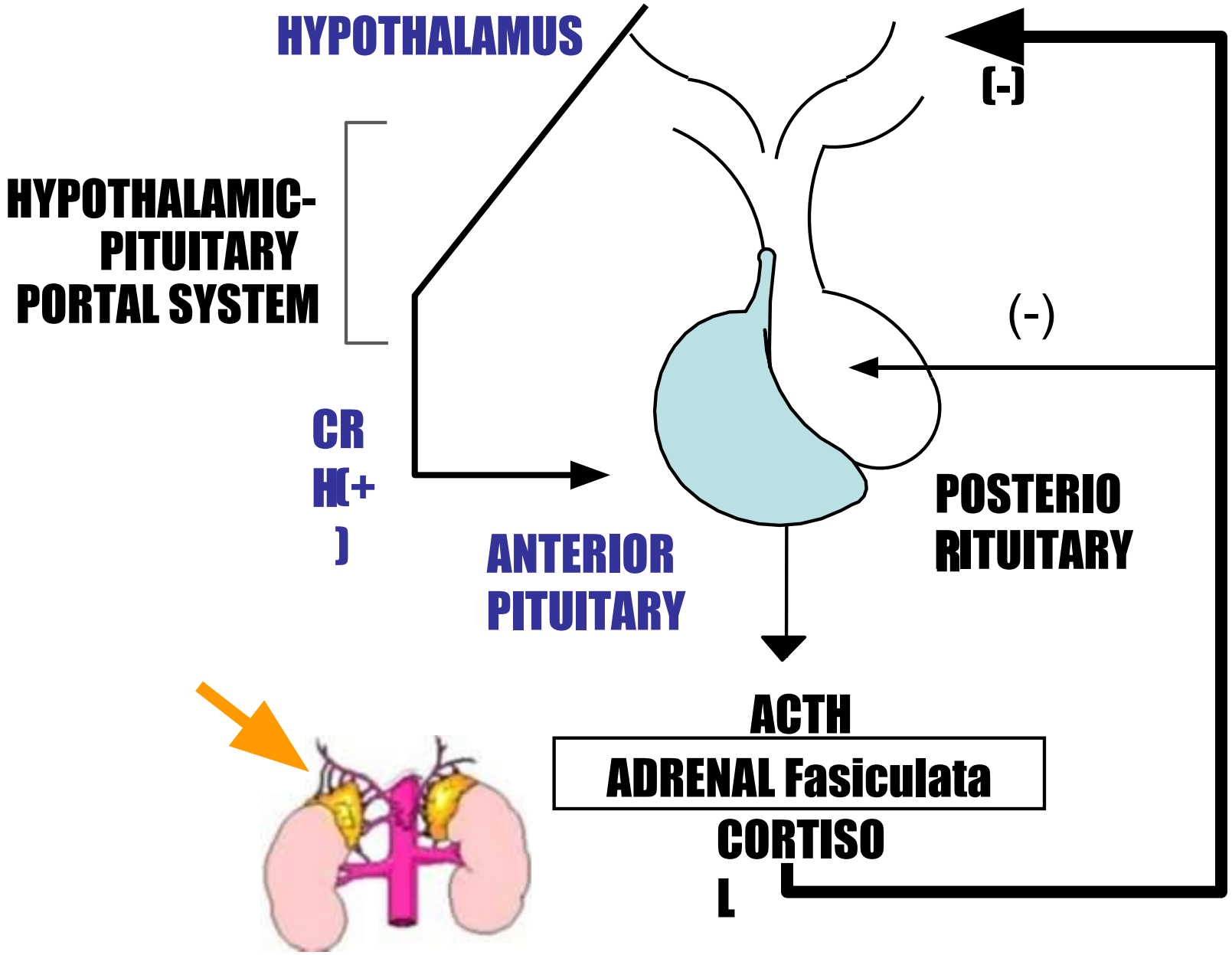
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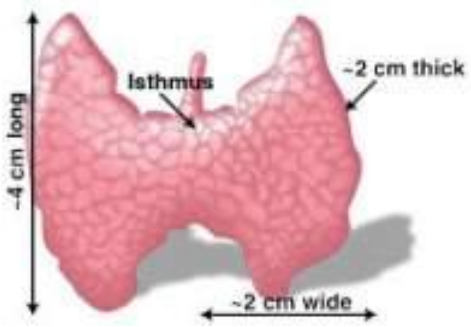
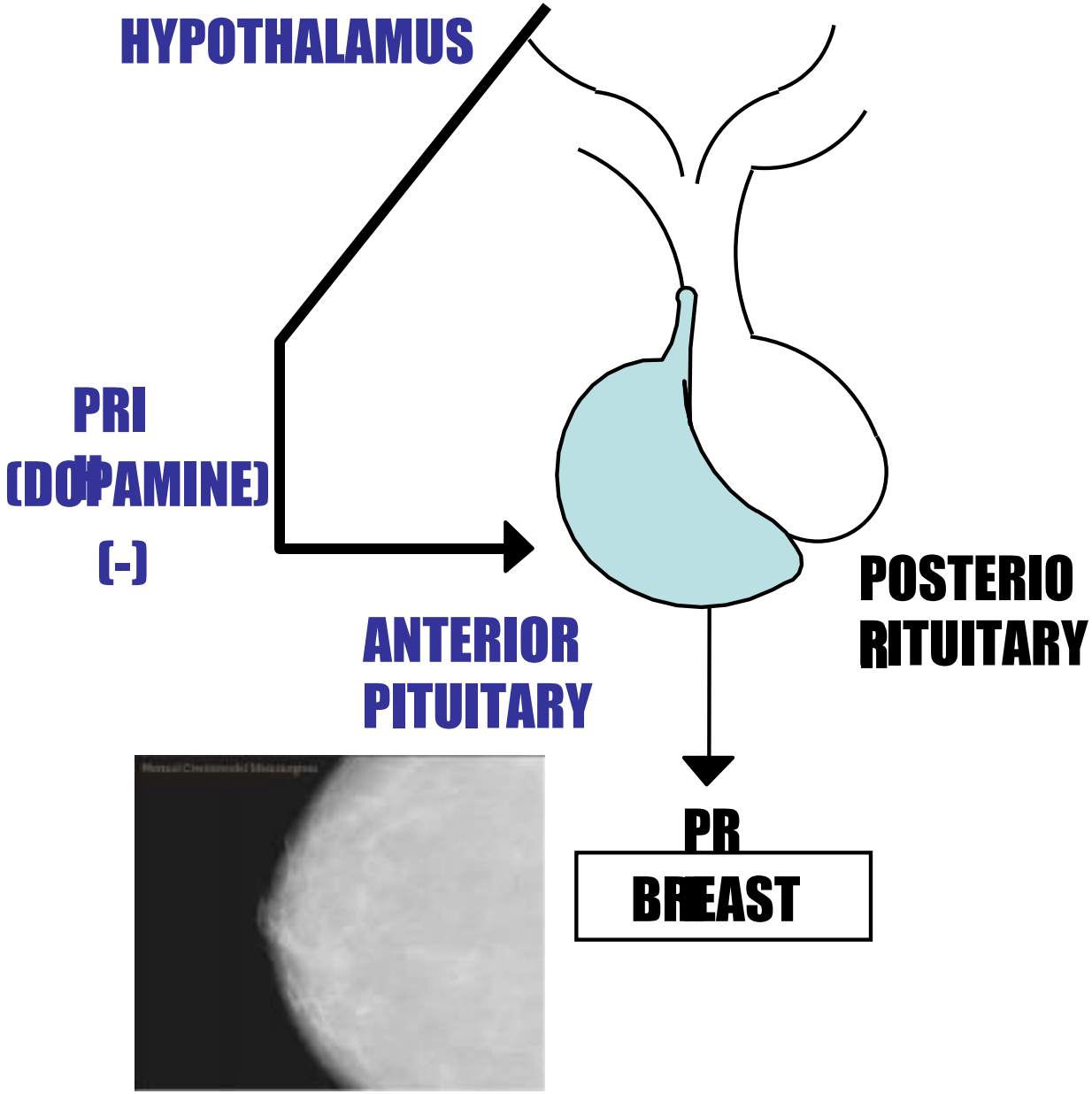
TSH

THYROID GLAND

T4, T3 (T4 --> T3)

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POSTERIO
RITUITARY
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BREAST

HYPOTHALAMUS

(-)

HYPOTHALAMIC-
PITUITARY
PORTAL SYSTEM

GnRH
(LHRH)

(+)

(-)

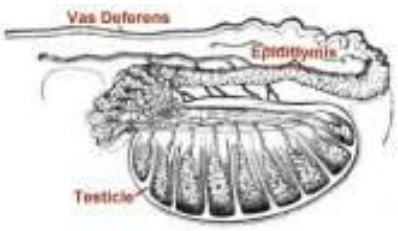
ANTERIOR
PITUITARY

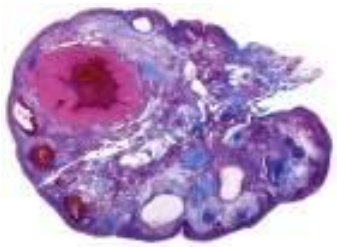
POSTERIO
RITUITARY

LH, FSH

GONAD

SEX HORMONES, INHIBIN





Posterior pituitary

Hypothalamic source (cell body)	Target	Effect
ADH	Collecting duct	H_2O retention
Oxytocin	Breast	Milk let down
	Uterus	Smooth muscle Contraction

Differential Diagnosis
Hypopituitarism

- Isolated hormone deficiencies
  - Acquired or congenital
- Tumors
  - Pituitary adenomas
  - Pituitary apoplexy
  - Hypothalamic tumors
  - Metastatic carcinoma
- Inflammatory
  - Granulomatous disease
    - Sarcoidosis, TB and syphilis
  - Eosinophilic granuloma
  - Lymphocytic hypophysitis

Differential Diagnosis
Hypopituitarism

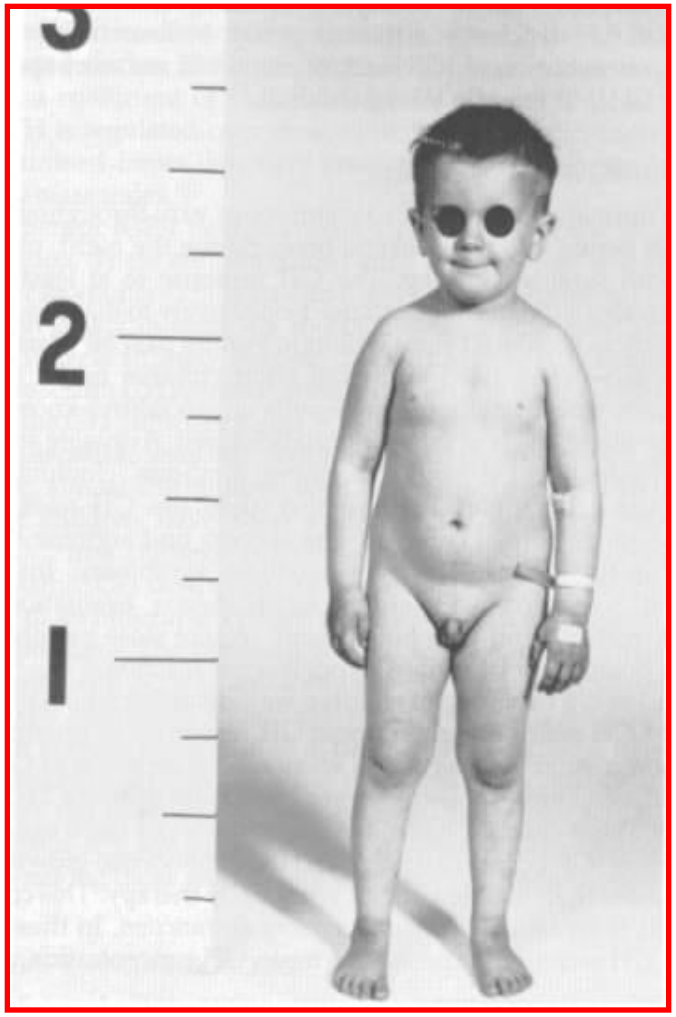
- Vascular disease
  - Sheehan's postpartum necrosis
  - Carotid aneurysm
- Destructive
  - Surgery
  - Radiation
  - Trauma
- Infiltration
  - Hemochromatosis
  - Amyloidosis

Hypopituitary
Presentation

- Growth hormone production
  - First hormone to be disrupted
- Gonadotropin deficiency
  - Easily disrupted
- Corticotropin
  - Less frequently affected
- Thyrotropin
  - Rarely affected
- Anti-diuretic hormone
  - Deficiency usually due to tumor
  - Craniopharyngioma

Hypopituitary
Presentation

- Growth hormone deficiency
  - Children
    - Short stature
  - Adults
    - Non specific
    - Fine wrinkling around the face
    - Improved insulin sensitivity



Hypopituitary
Presentation

- Gonadotropin deficiency
  - Women
    - Amenorrhea
      - Primary or secondary
    - Infertility
  - Men
    - Decreased libido
    - Decreased beard and body hair

Hypopituitary
Presentation

- Corticotropin deficiency
  - Fatigue
  - Decreased appetite
  - Weight loss
  - Decreased pigmentation
  - Abnormal response to stress
    - Hypotension
    - Hyponatremia
    - Fever
- Primary Adrenal Insufficiency
  - Addison's disease
  - Fatigue
  - Decreased appetite
  - Weight loss
  - Increased pigmentation
  - Hyperkalemia
  - Abnormal response to stress
    - Hypotension
    - Hyponatremia
    - Fever

Hypopituitary
Presentation

- Hypothryoidism
  - Fatigue
  - Cold intolerance
  - Puffy skin
  - Absence of goiter
- Diabetes Insipidus
  - Polyuria
  - Polydipsia

- Thank you