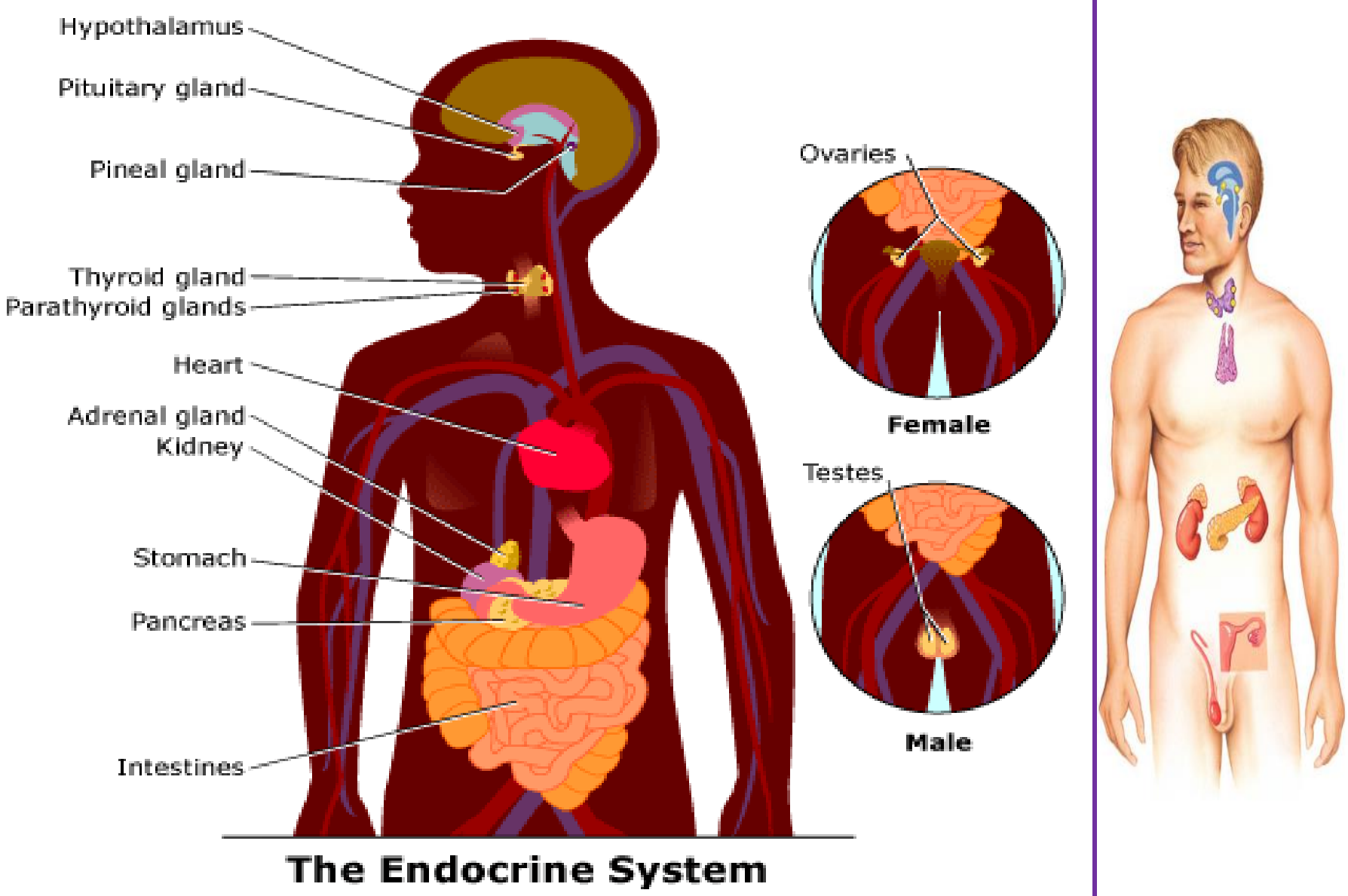
Endocrine System

Objectives

The students should be able to:

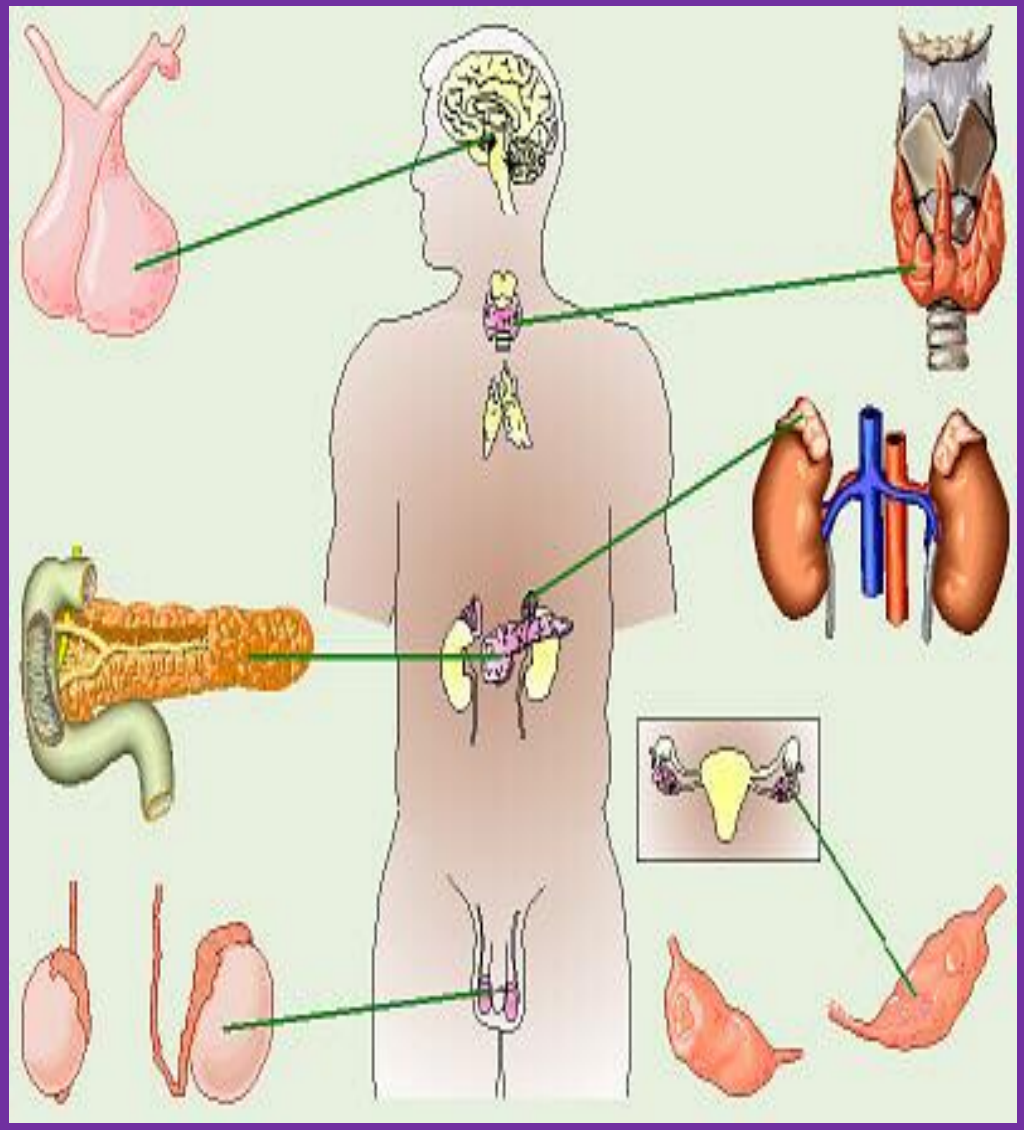
1. recall the two control system of the body.
2. define hormones.
3. Describe the endocrine glands,their hormones and respective functions.



The Endocrine System

Endocrine glands of vertebrate

1. Pituitary
2. Thyroid
3. Parathyroids
4. Islets of Langerhans
5. Gastric and intestinal mucosa
6. Thymus
7. Adrenals
8. Gonads
9. Pineal



Hormones and nerves

In multicellular animals
- Integration
- Control

Two communication system
- Chemical control (Hormones)
- Electrical control (Nerves)

Hormones ——— Long- term responses and control.

Eg. metabolism,growth,reproduction.

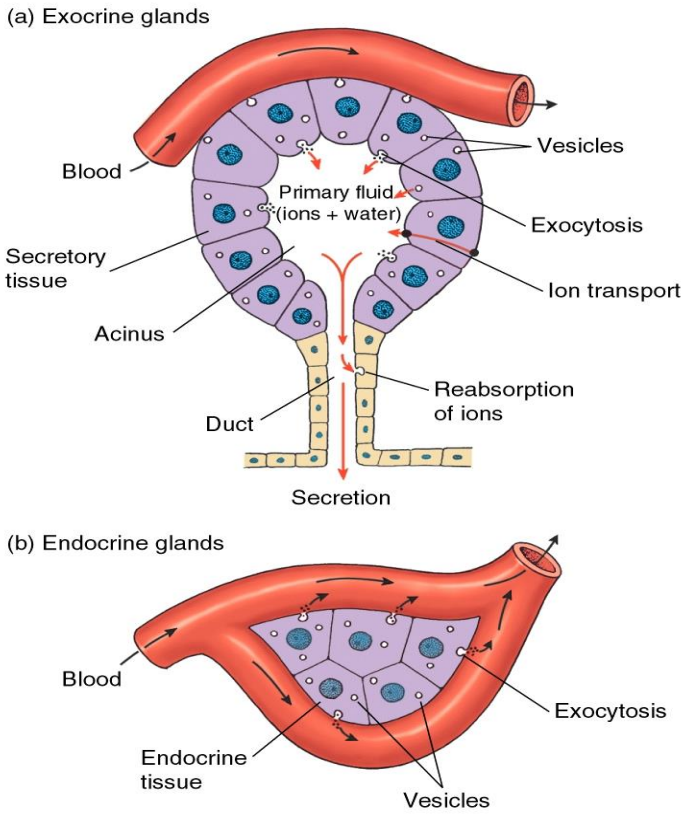
Nerves ——— Short -term responses and control.

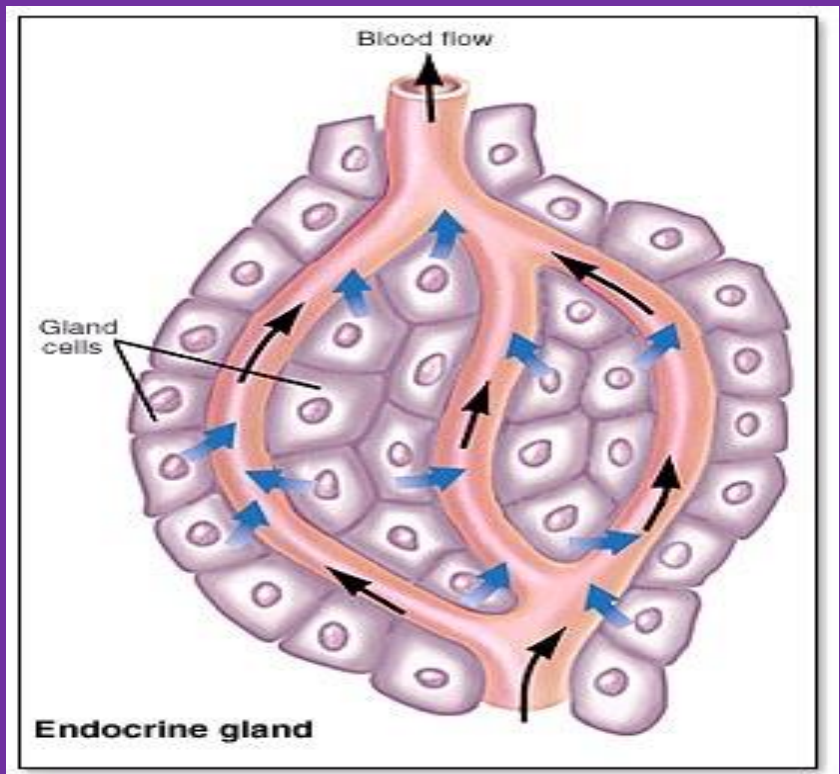
A. Exocrine gland

- Ducts
- Lumen and surfaces

B. Endocrine gland (**Ductless glands**)

- Chemical messengers
- Blood stream





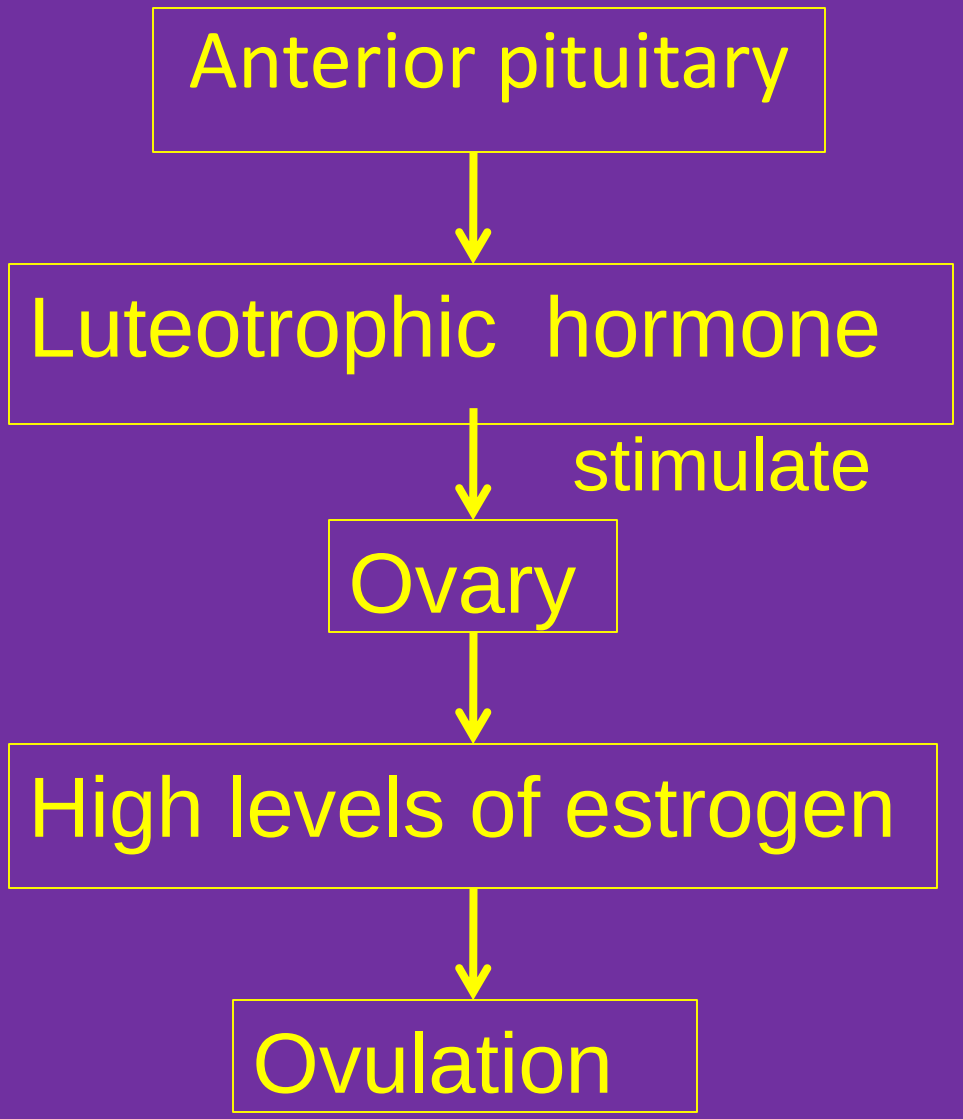
Hormones

Hormones can be defined as chemical messenger.They are produced by endocrine glands of epithelial origin and are released directly into body fluids such as lymph or blood.

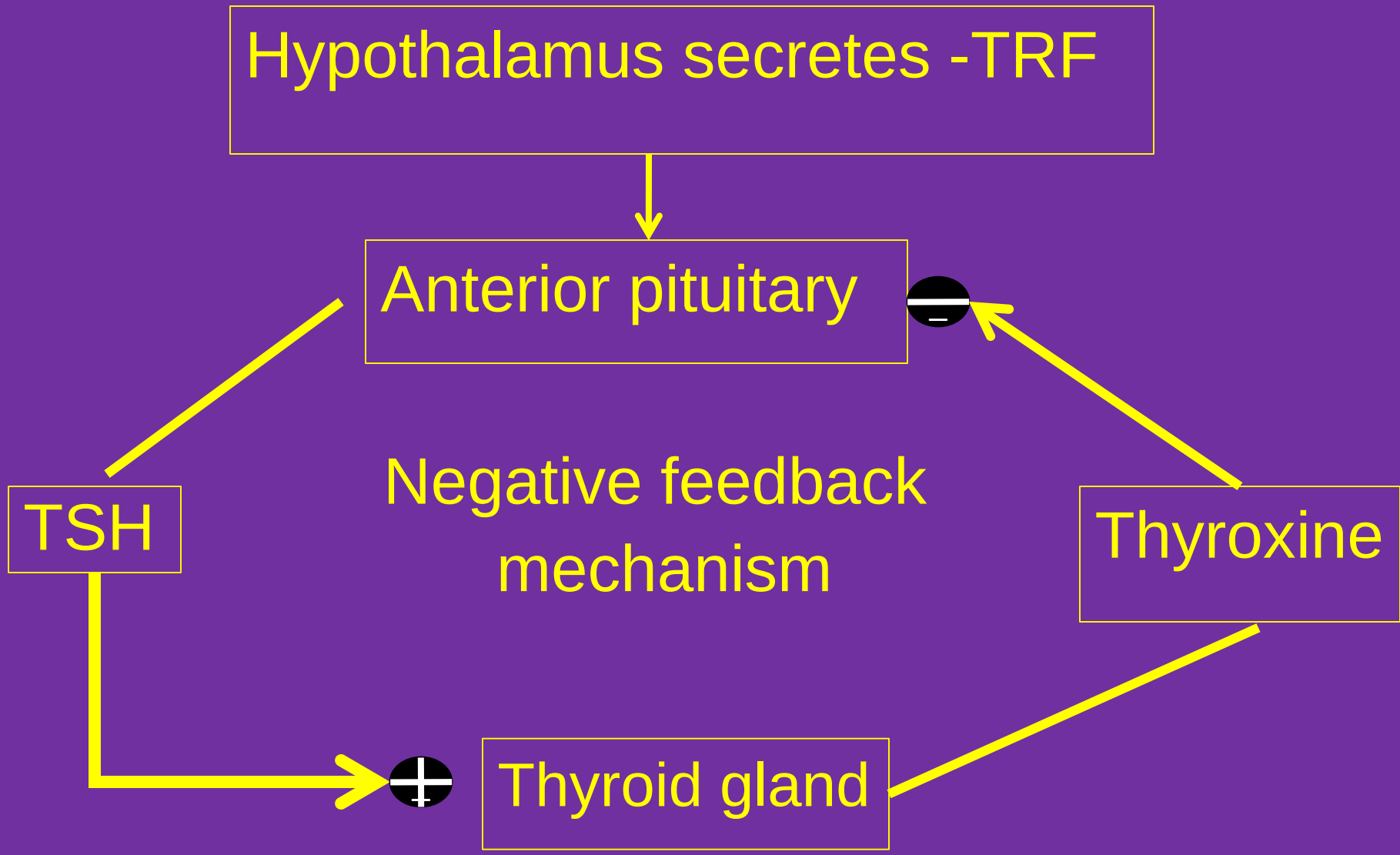
1.Negative Feedback Processes

Concentrations of hormones in body fluids are low and are normally under the control of negative feedback processes.

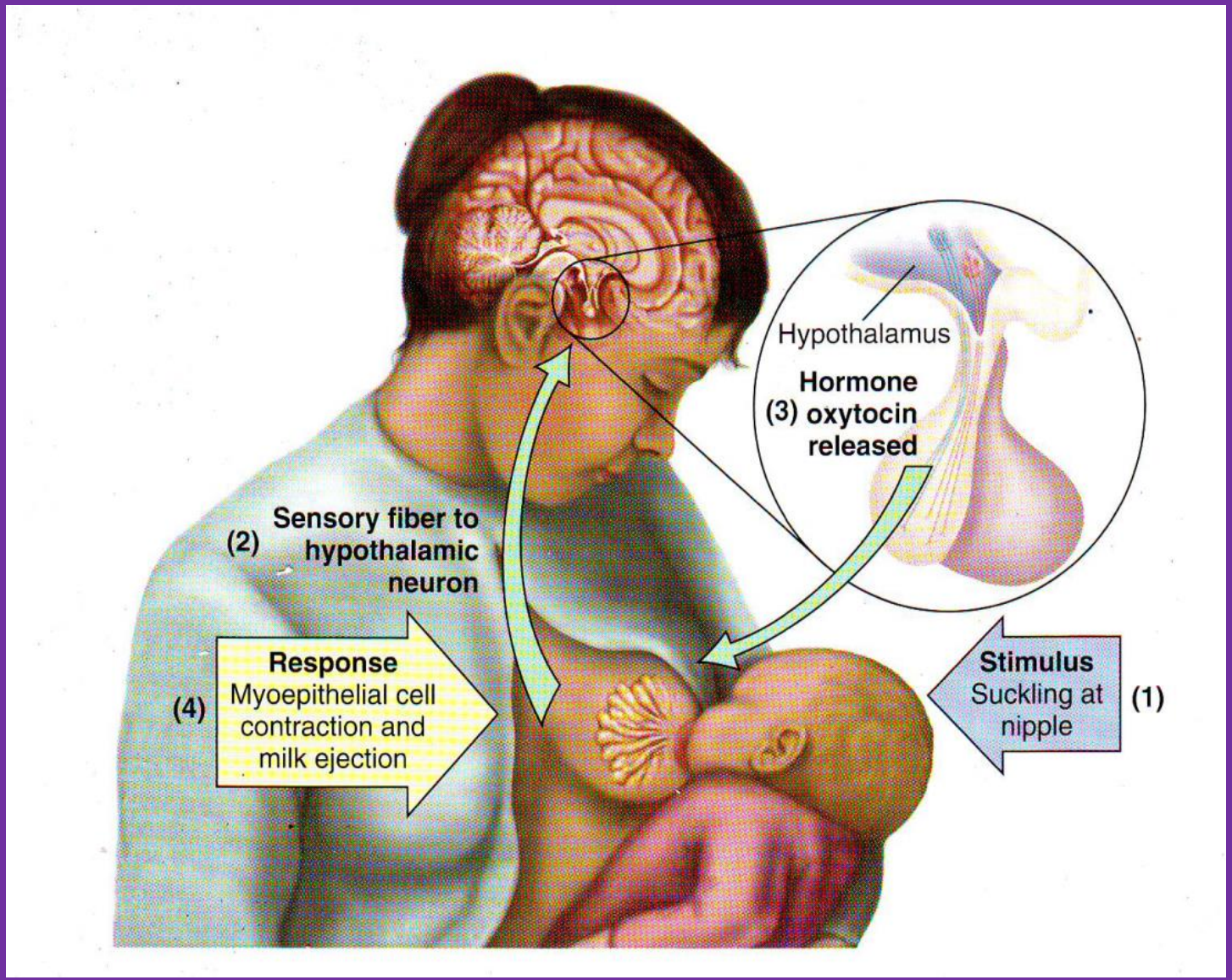
2. Positive Feedback Processes



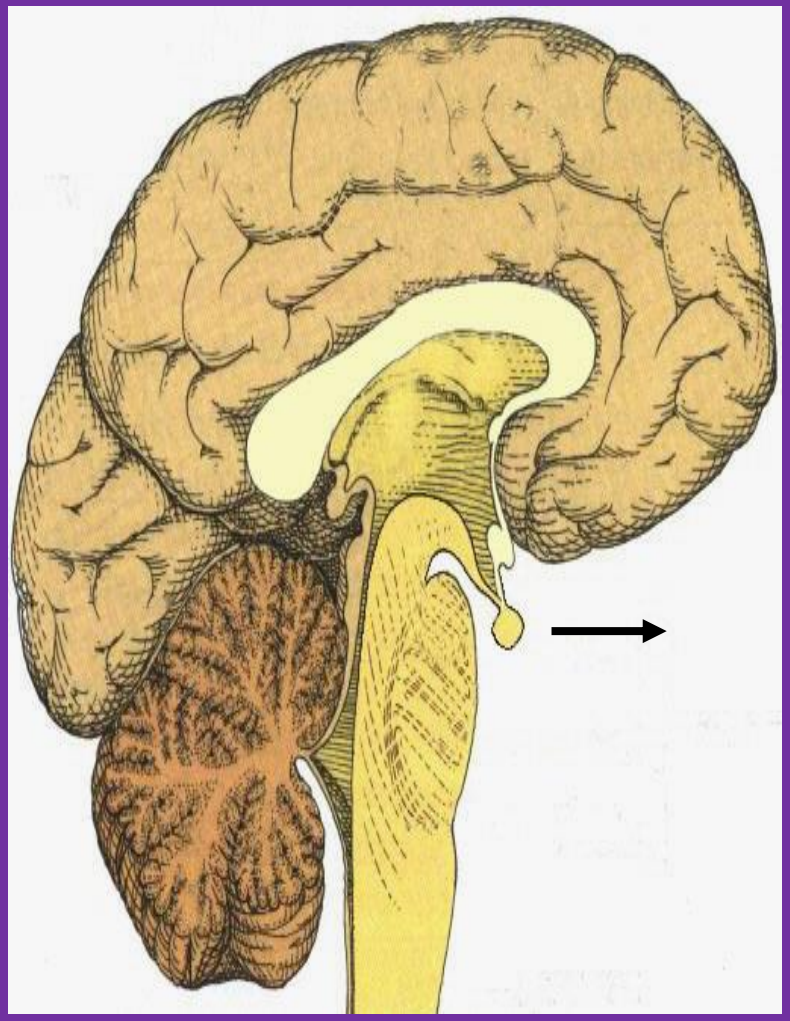
Hierarchy of endocrine control

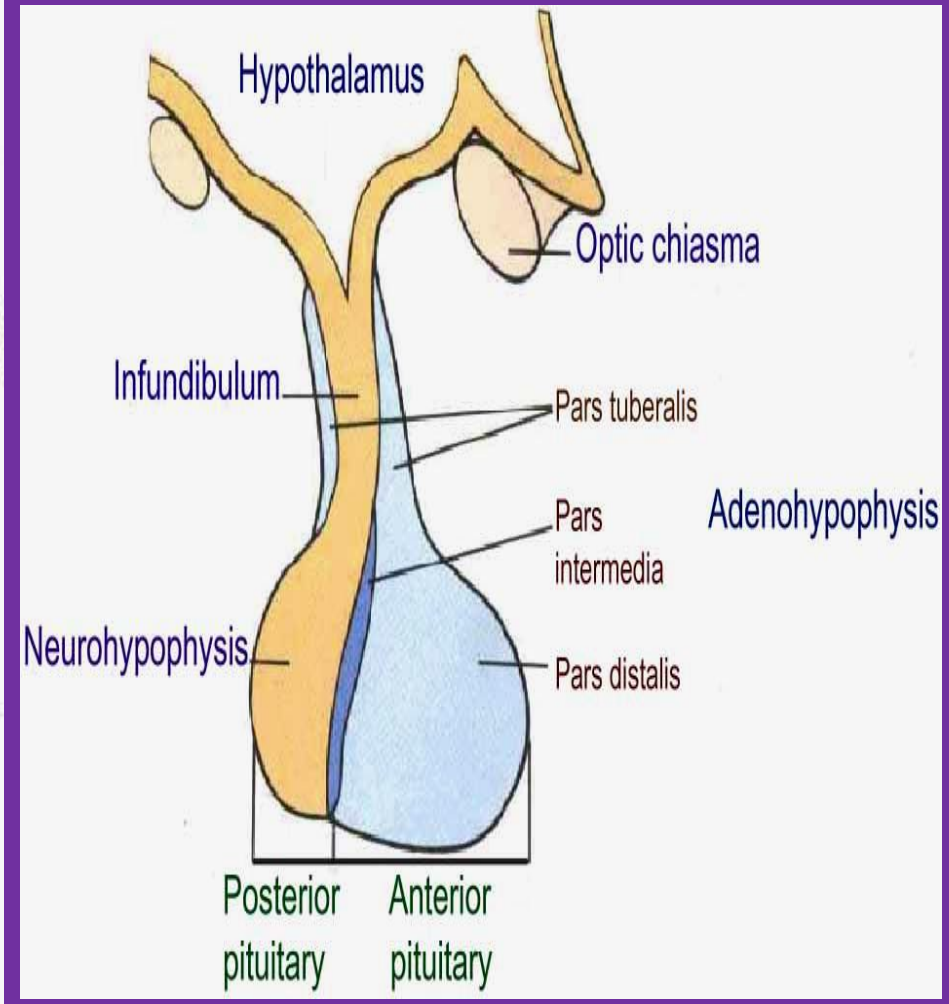


Nervous-endocrine co-operation

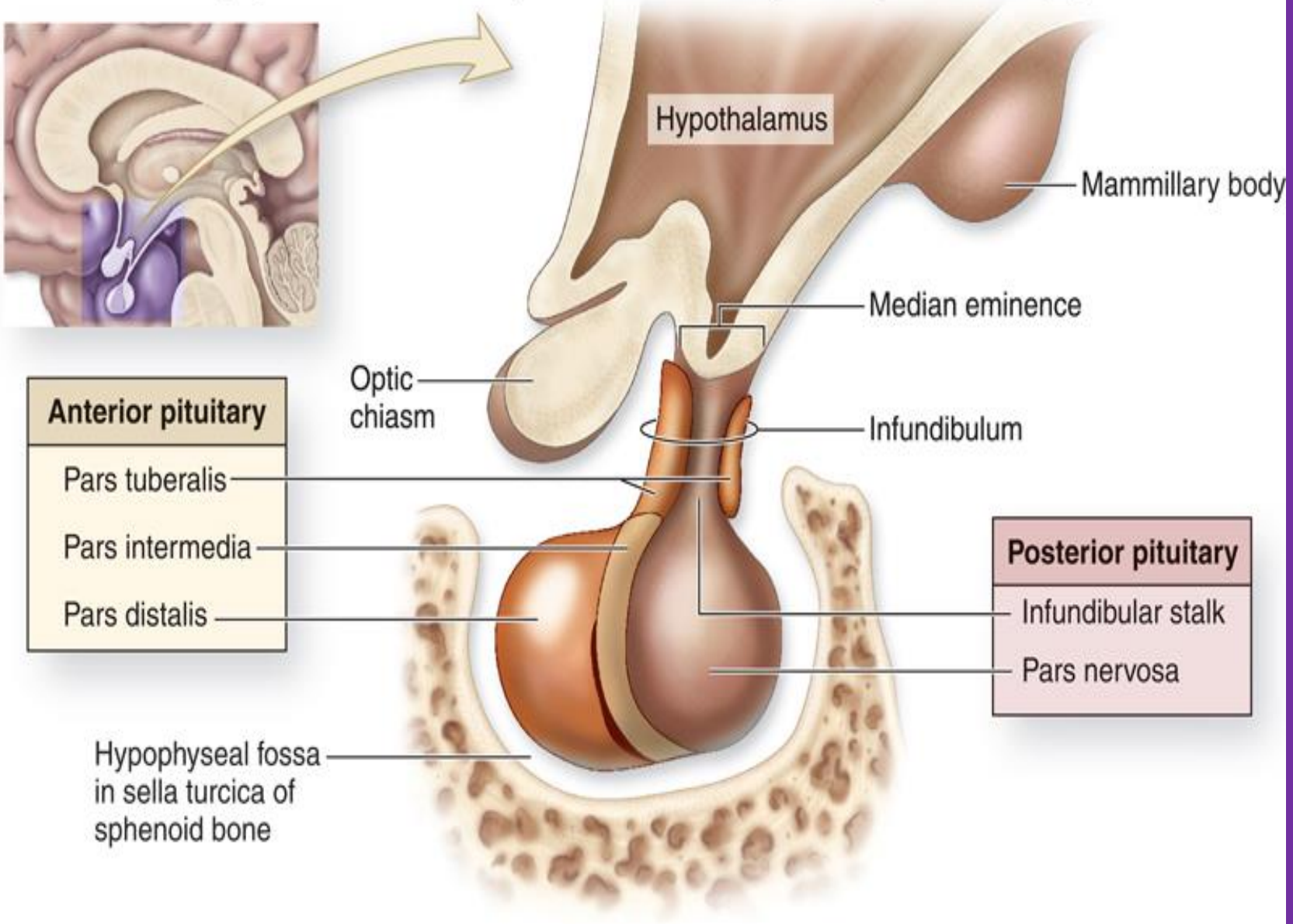


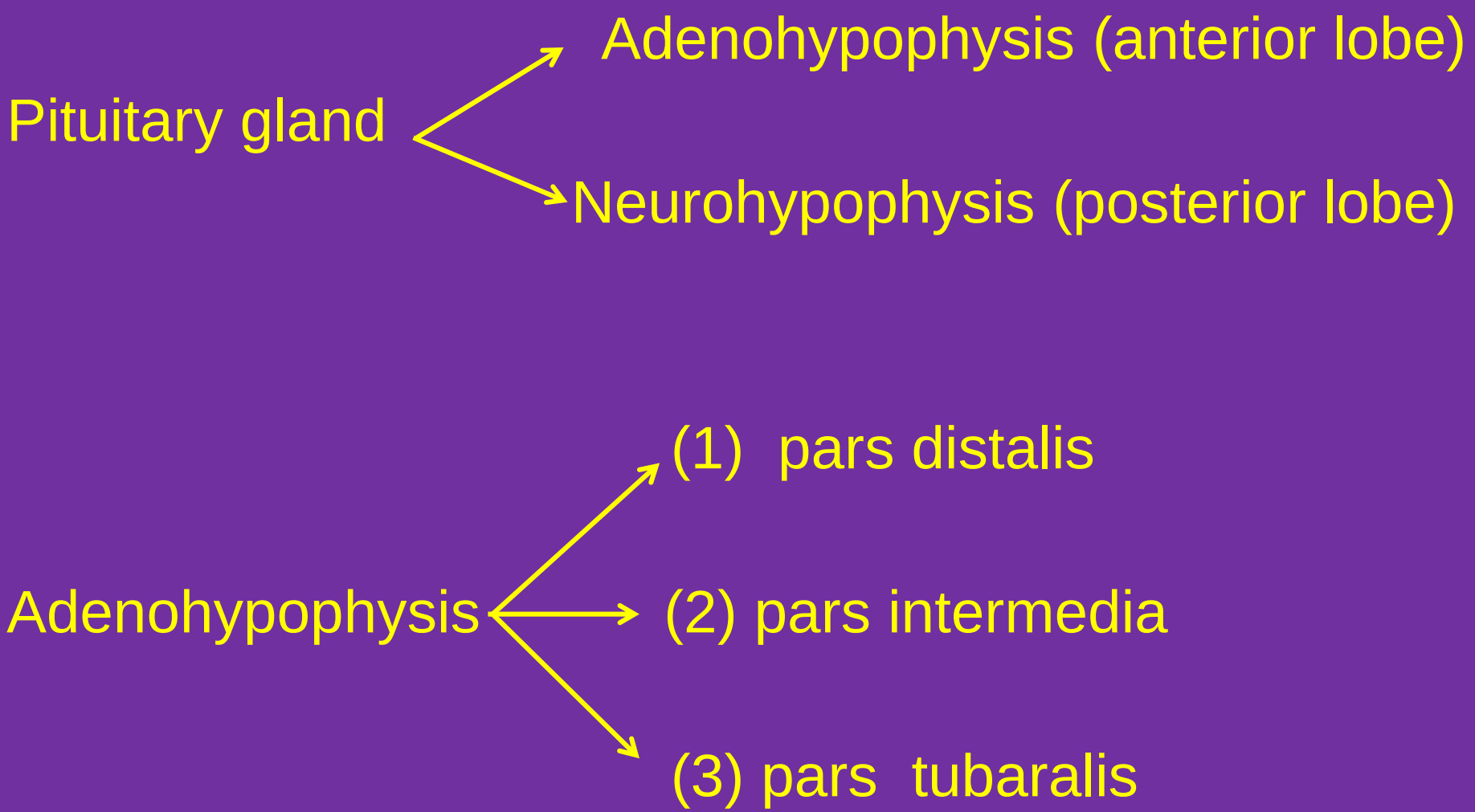
Pituitary gland





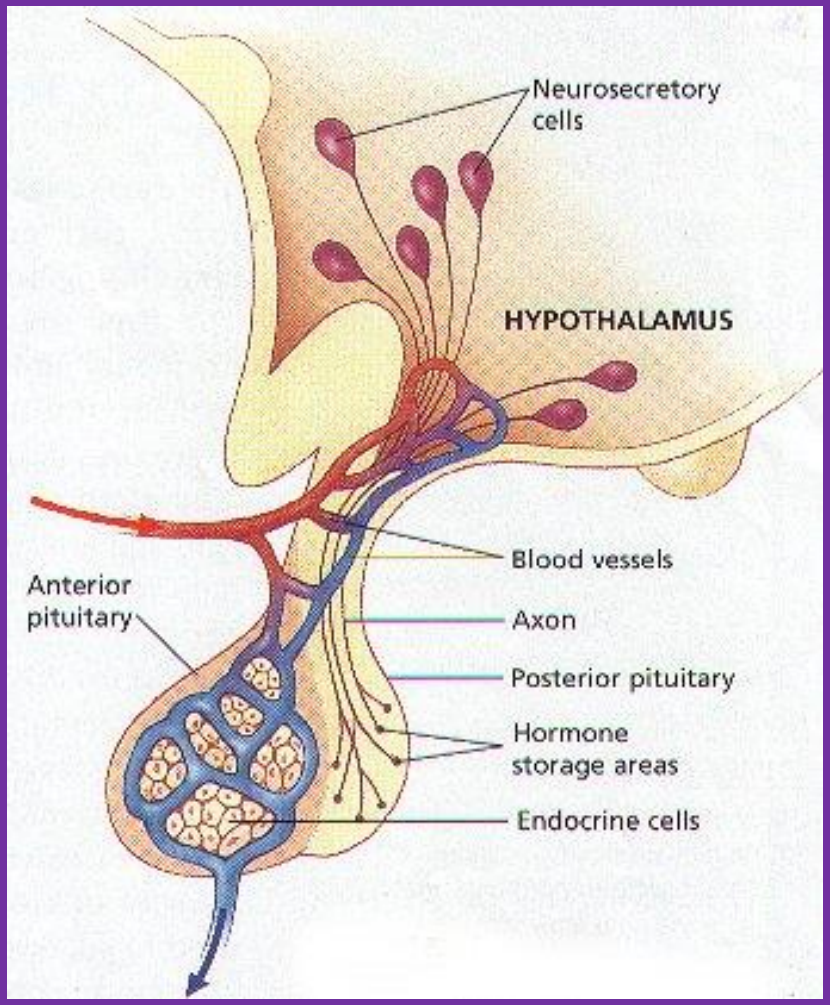
At the base of the brain




Pituitary gland
Adenohypophysis (anterior lobe)
Neurohypophysis (posterior lobe)
Adenohypophysis
(1) pars distalis
(2) pars intermedia
(3) pars tubaralis

Neurosecretory Cells

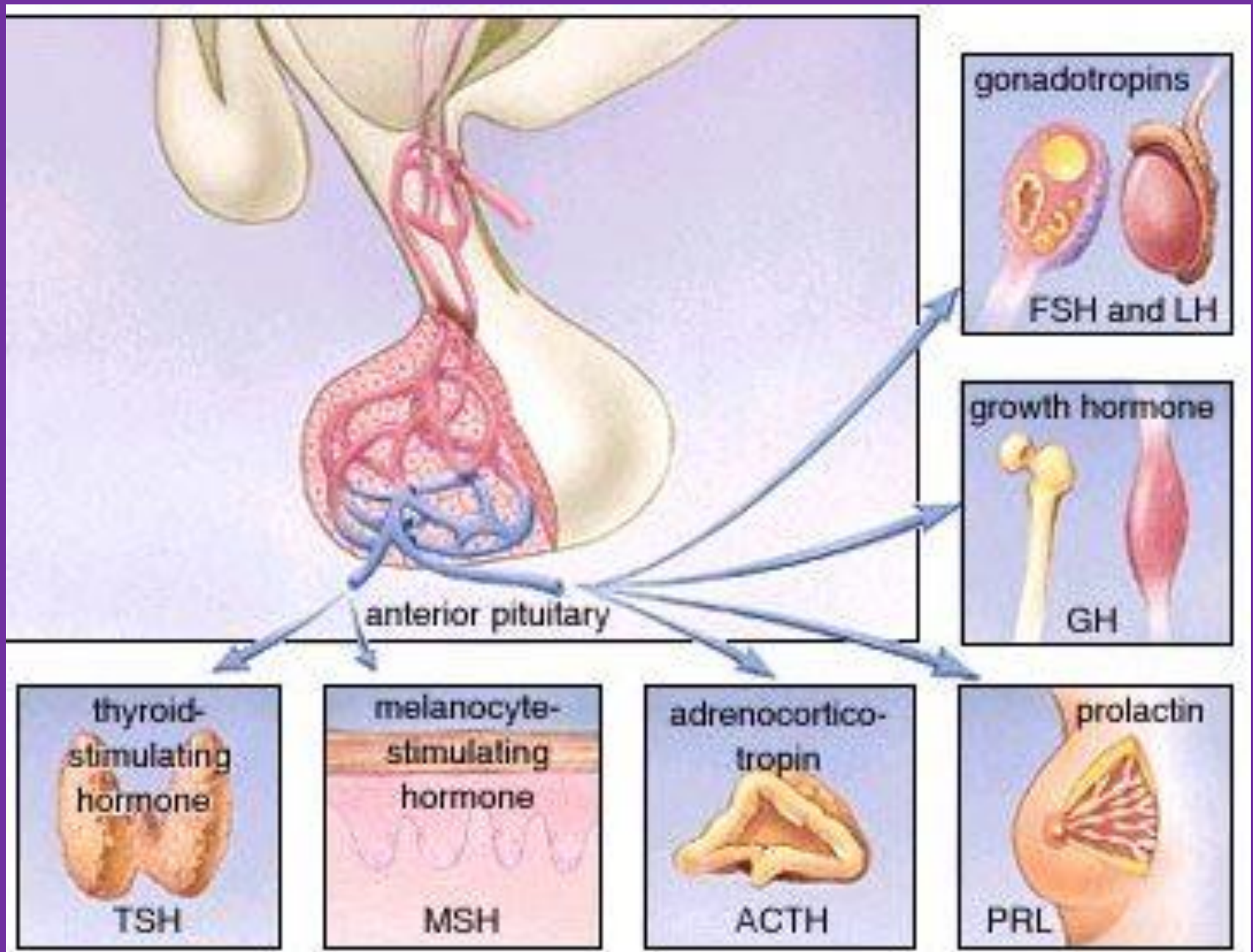
1. Specialized neurons
   Synthesize and secrete hormones
2. Extend from hypothalmus to posterior pituitary



Pituitary hormones(master gland)

- PRL: prolactin
- GH: growth hormone
- FSH: follicle-stimulating hormone
- LH: luteinizing hormone
- TSH: thyroid-stimulating hormone
- ACTH: adrenocorticotropic hormone
- MSH: melanophore-stimulating hormone
- ADH : antidiuretic hormone or Vasopressin
- Oxytocin

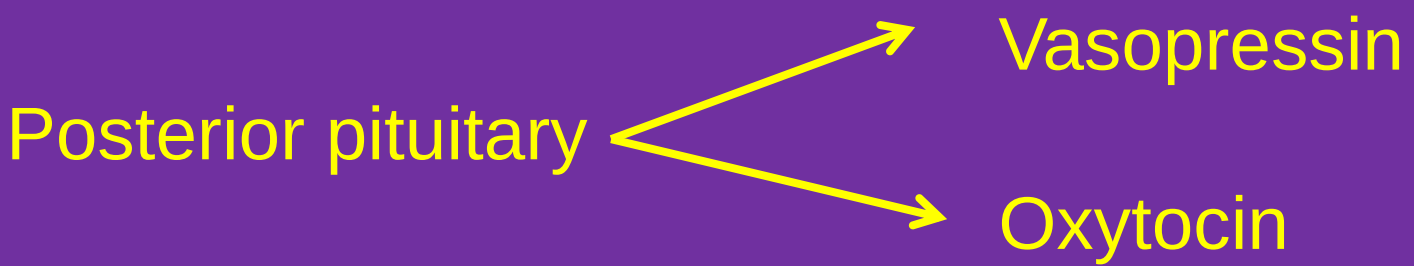
Pituitary gland (Anterior pituitary)



Anterior Pituitary Hormones

HORMONE	TARGET	FUNCTION
Thyroid (TSH) Stimulating	Thyroid gland	TH synthesis & release
Growth (GH)	Many tissues	growth
Adrenocortico-Tropin (ACTH)	Adrenal cortex	Cortisol release (androgens)
Prolactin (PRL)	Breast	Milk production
Follicle (FSH)	Gonads	Egg/sperm prod.
Luteinizing (LH)	Gonads	Sex hormones

Posterior pituitary hormone

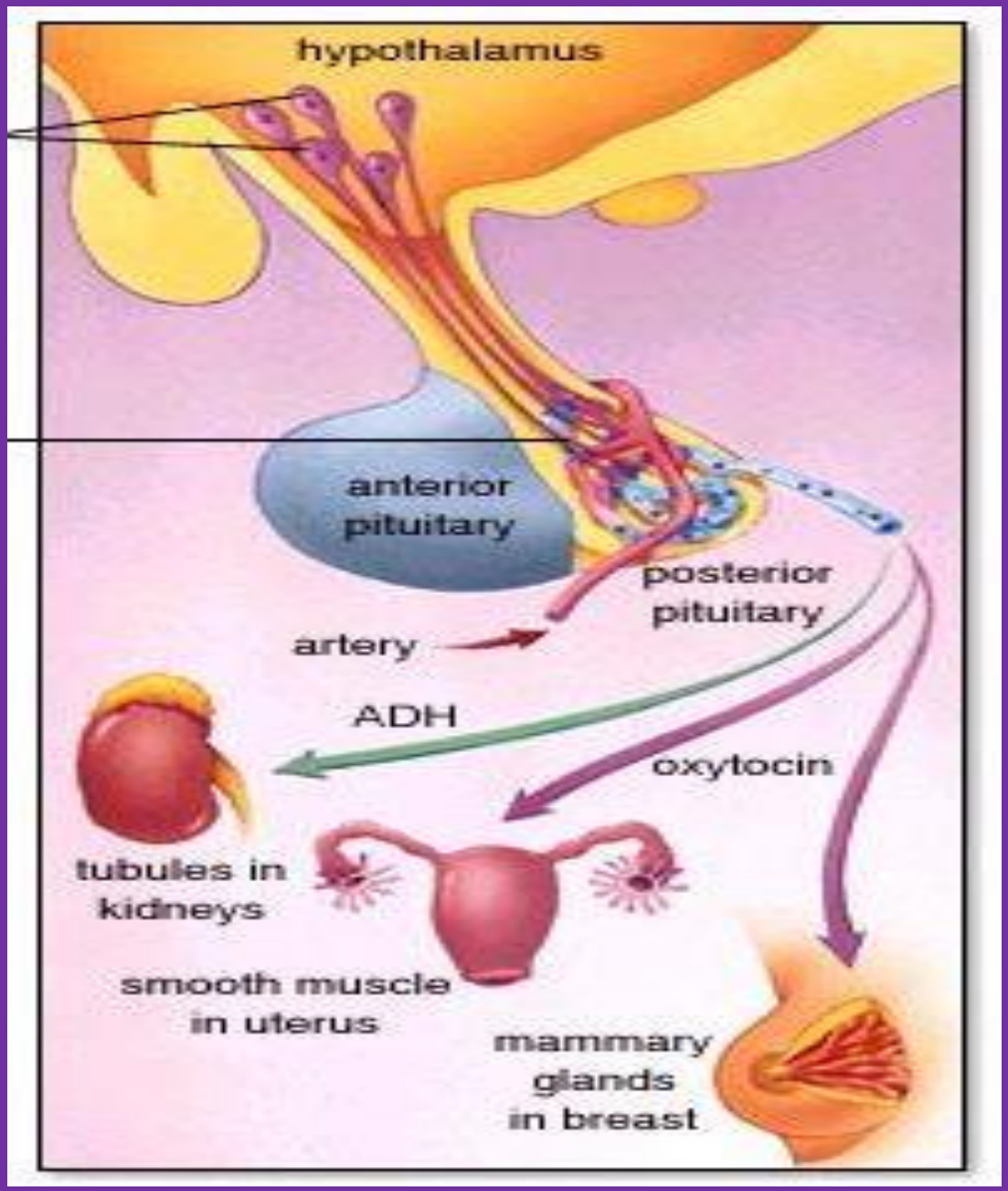


Vasopressin ___ increases absorption of water in the kidney tubules and causes constriction of the smooth muscle of the arterioles.

Oxytocin ___ contraction of smooth muscle in the uterus during birth.

___ ejection of milk from mammary glands.

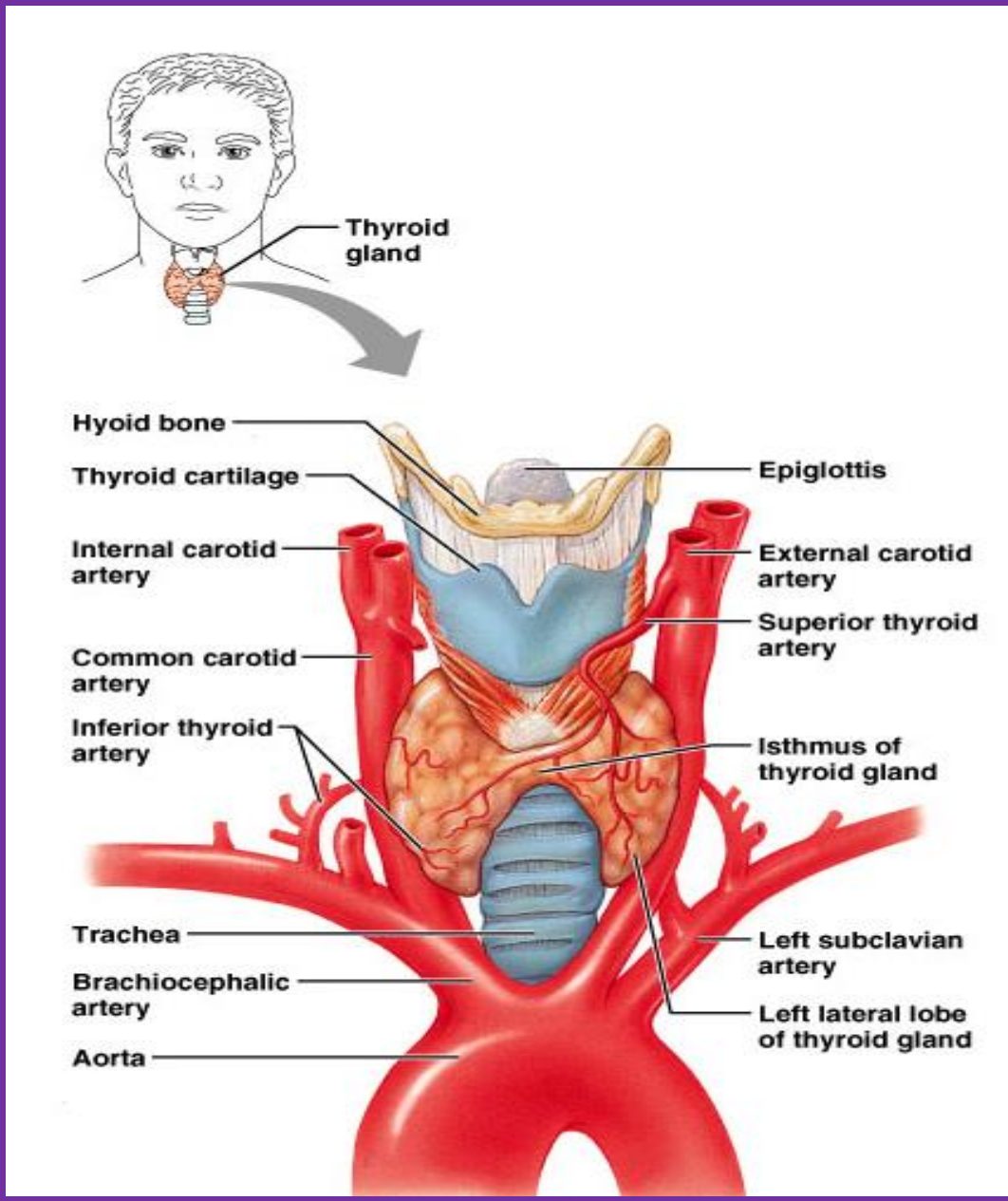
Pituitary gland (posterior pituitary)



The Thyroid Gland

-Anterior neck on trachea just inferior to larynx

-Two lateral lobes and an isthmus

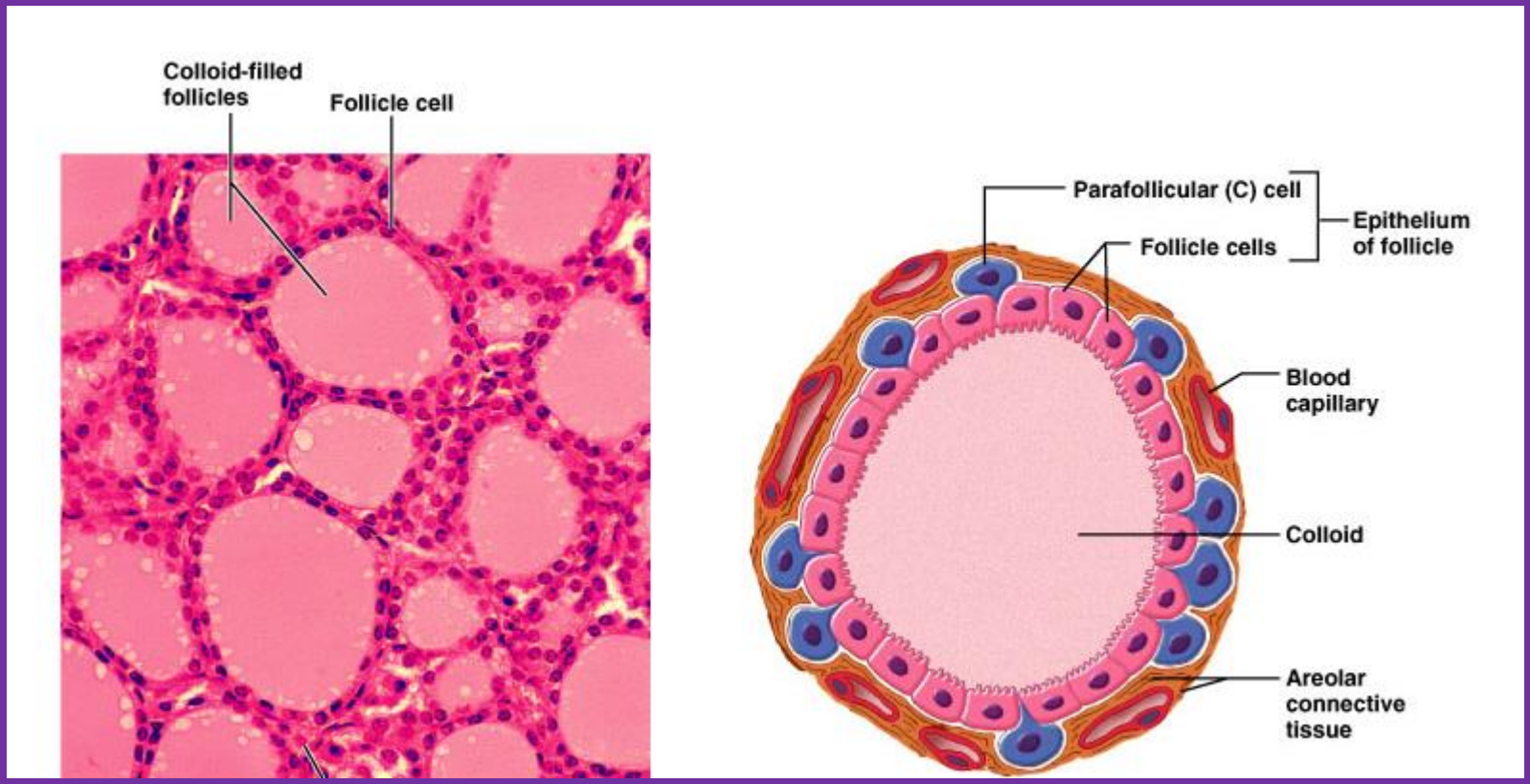


The Thyroid Gland

Produces two hormones

- Thyroid hormone: tyrosine based with 3 or 4 iodine molecules
  - T4 (thyroxine) and T3
- Calcitonin involved with calcium and phosphorus metabolism

- Thyroid is composed of spherical follicles
  - Follicle cells: produce thyroglobulin, the precursor of thryoid hormone (thyroxin)
  - Colloid lumen is of thyroglobulin
  - Parafollicular “C” cells: produce calcitonin

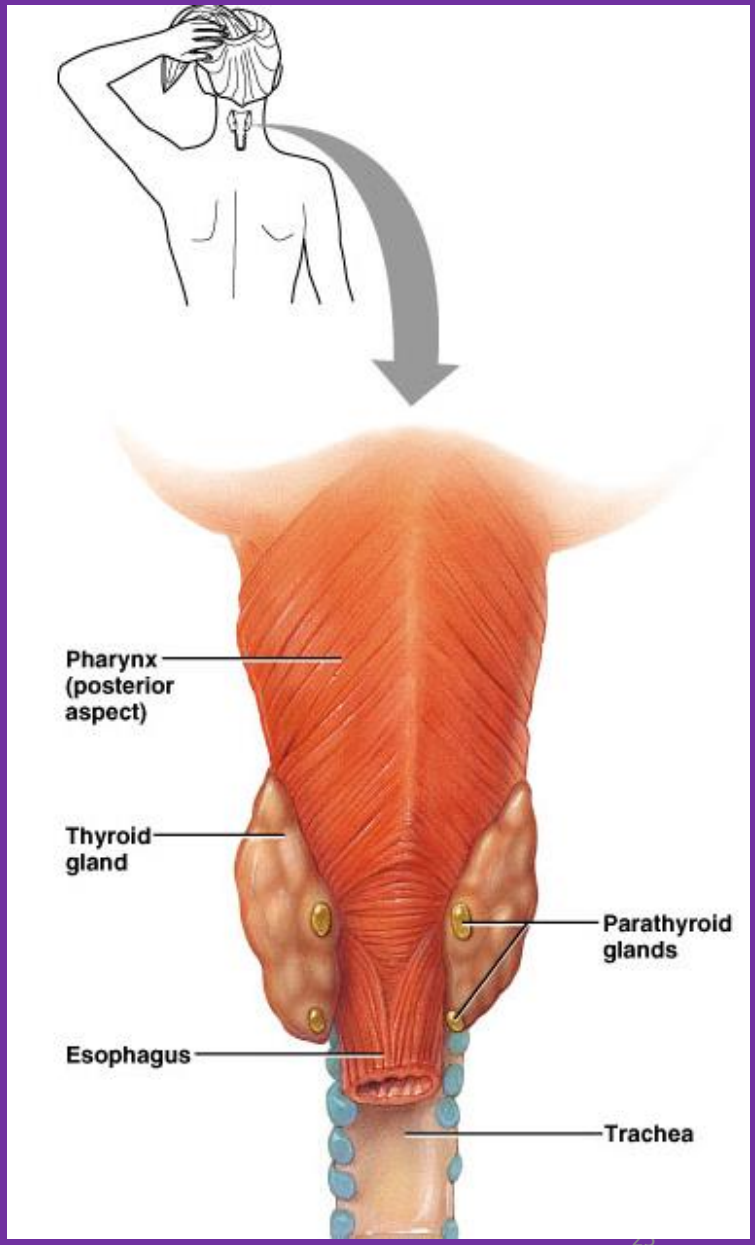


Thyroid hormone promote metamorphosis.

The Parathyroid Glands

- Most people have four
- On posterior surface of thyroid gland

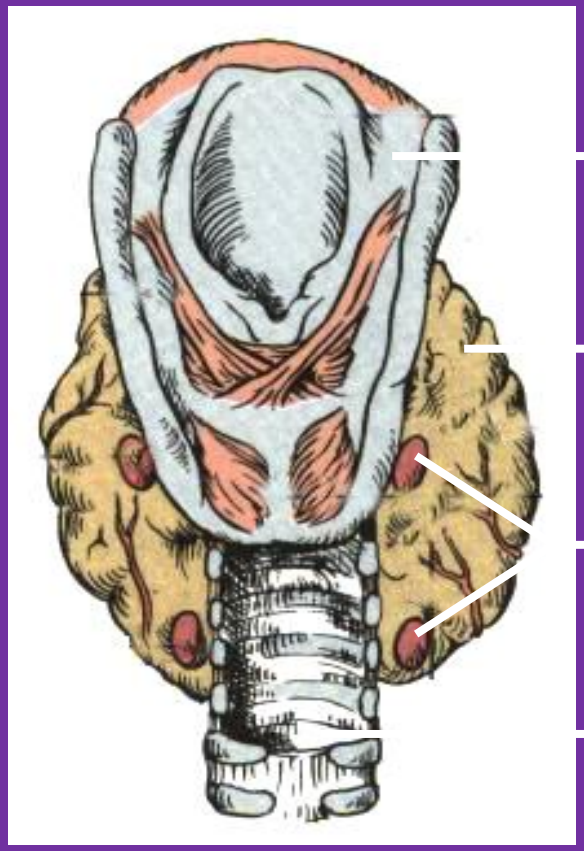
(partly embedded)



Parathyroid

Parathormone

Regulates the concentration of calcium and phosphate in the blood and affects the metabolism of the body.



(Posterior view)

Function of PTH (parathyroid hormone or "parathormone")

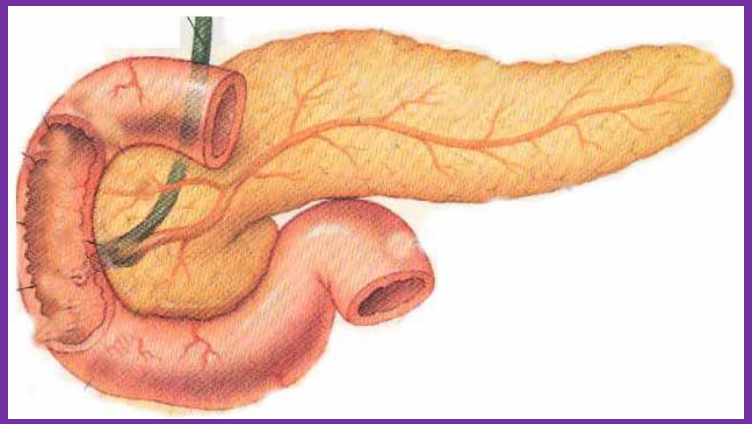
- Increases blood Ca++ (calcium) concentration when it gets too low
- Mechanism of raising blood calcium
  1. Stimulates osteoclasts to release more Ca++ from bone
  2. Decreases secretion of Ca++ by kidney
  3. Activates Vitamin D, which stimulates the uptake of Ca++ from the intestine

The Pancreas

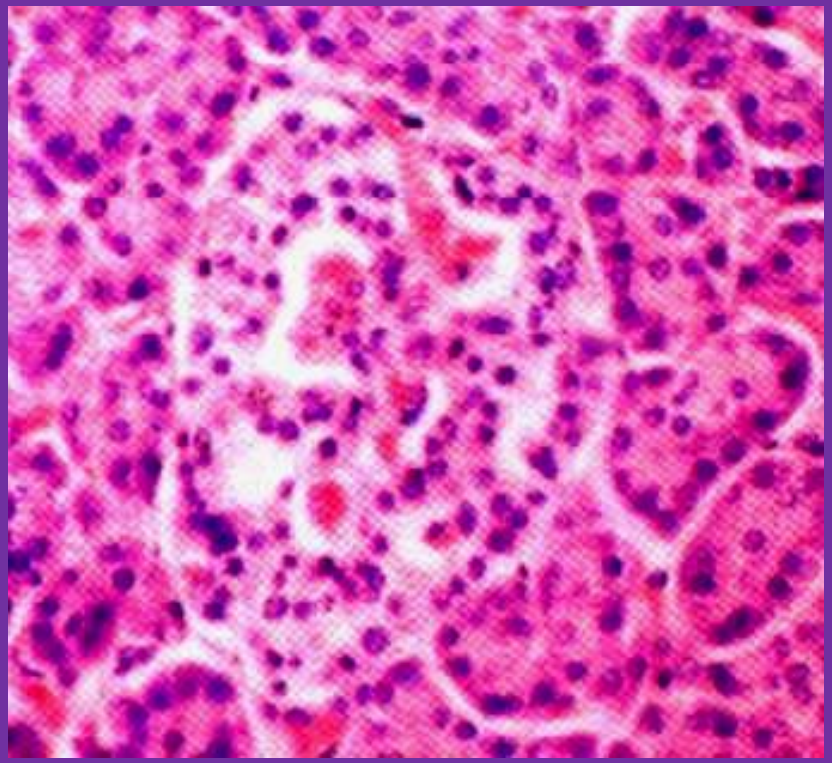
Exocrine and endocrine cells

- Acinar cells (forming most of the pancreas)
  - Exocrine function
  - Secrete digestive enzymes

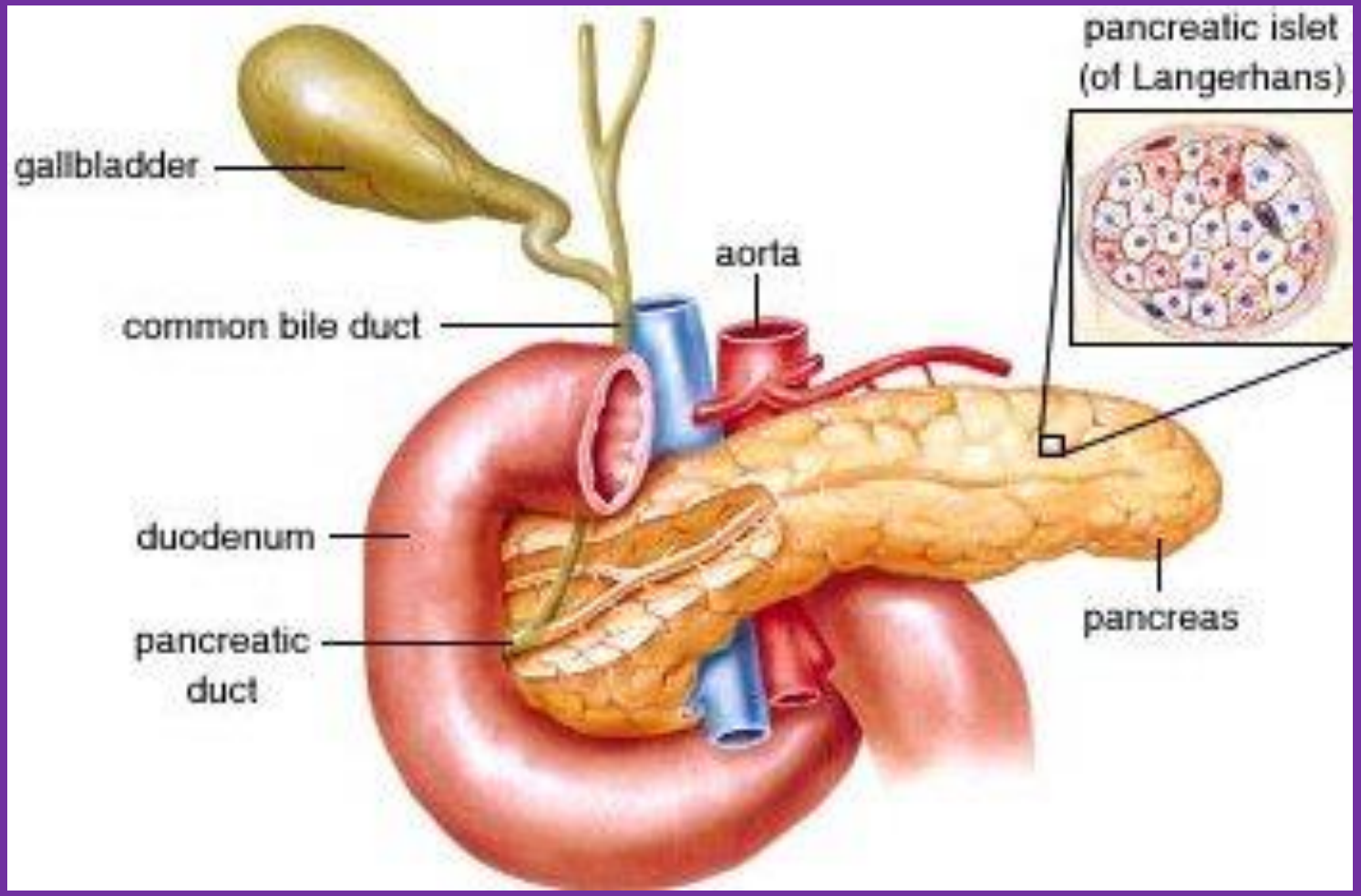
Islets of Langerhans

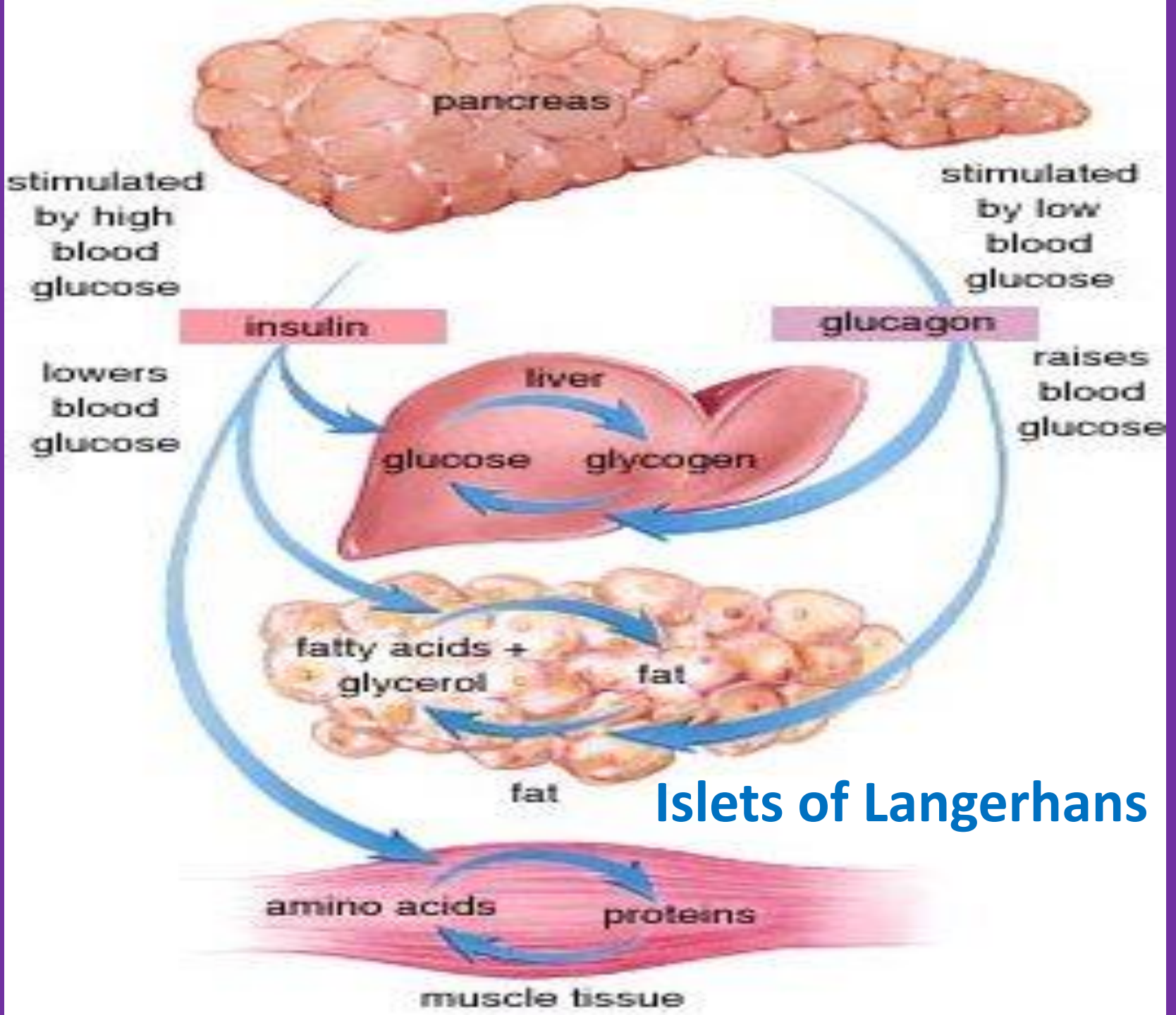


Pancreas



Islets of Langerhans





Islets of Langerhans

Islet cells of Langerhans Endocrine function

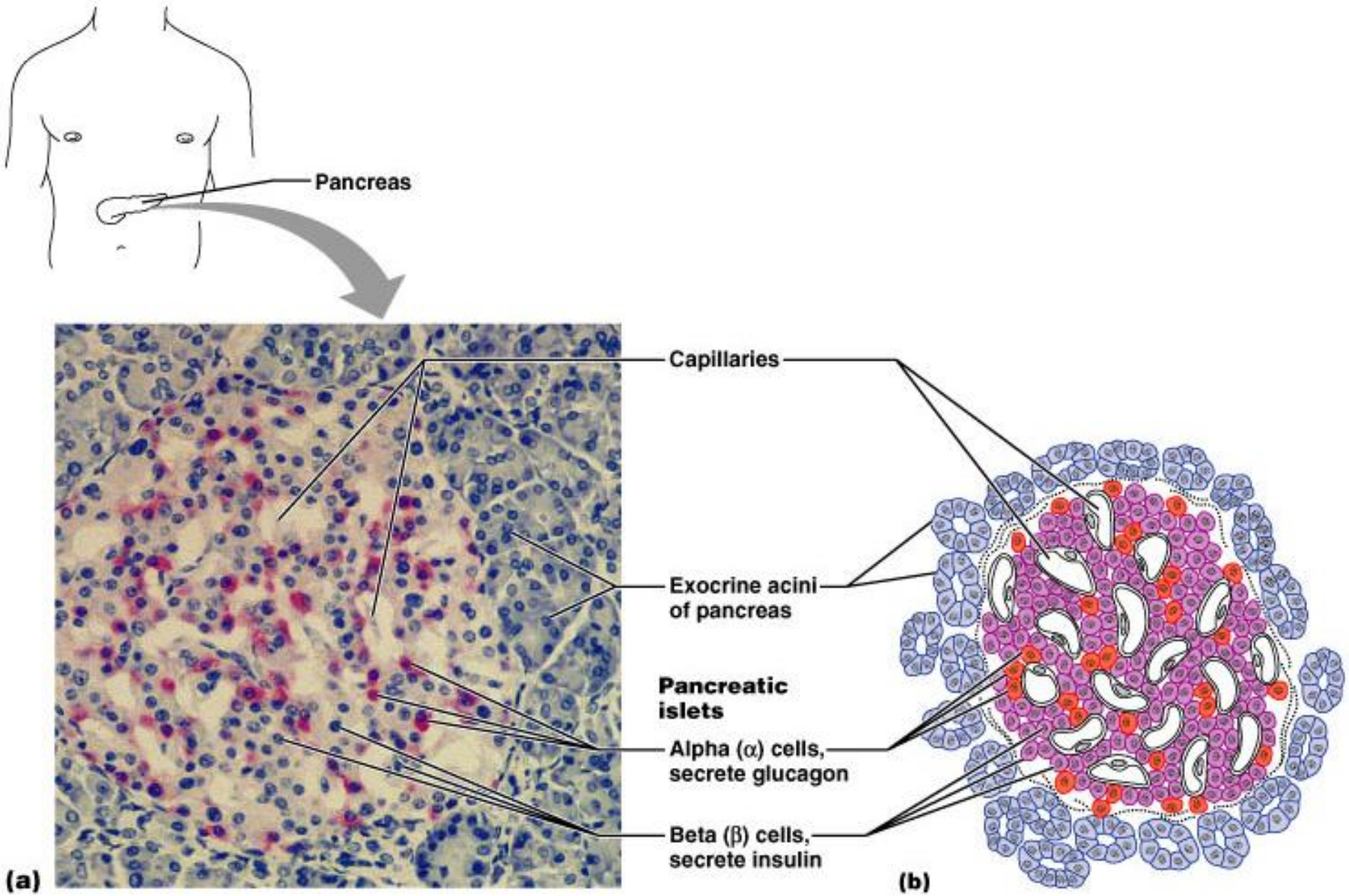
Three kinds of cells are

(1).Alpha cells: secrete glucagon raises blood sugar mostly in periphery

(2).Beta cells: secrete insulin lowers blood sugar central part (are more abundant)

(3).Delta cells:secrete somatostatin inhibits glucagon

Pancreatic islet endocrine cells



Gastric and intestinal mucosa

Stomach
Small intestine
} produce digestive enzymes

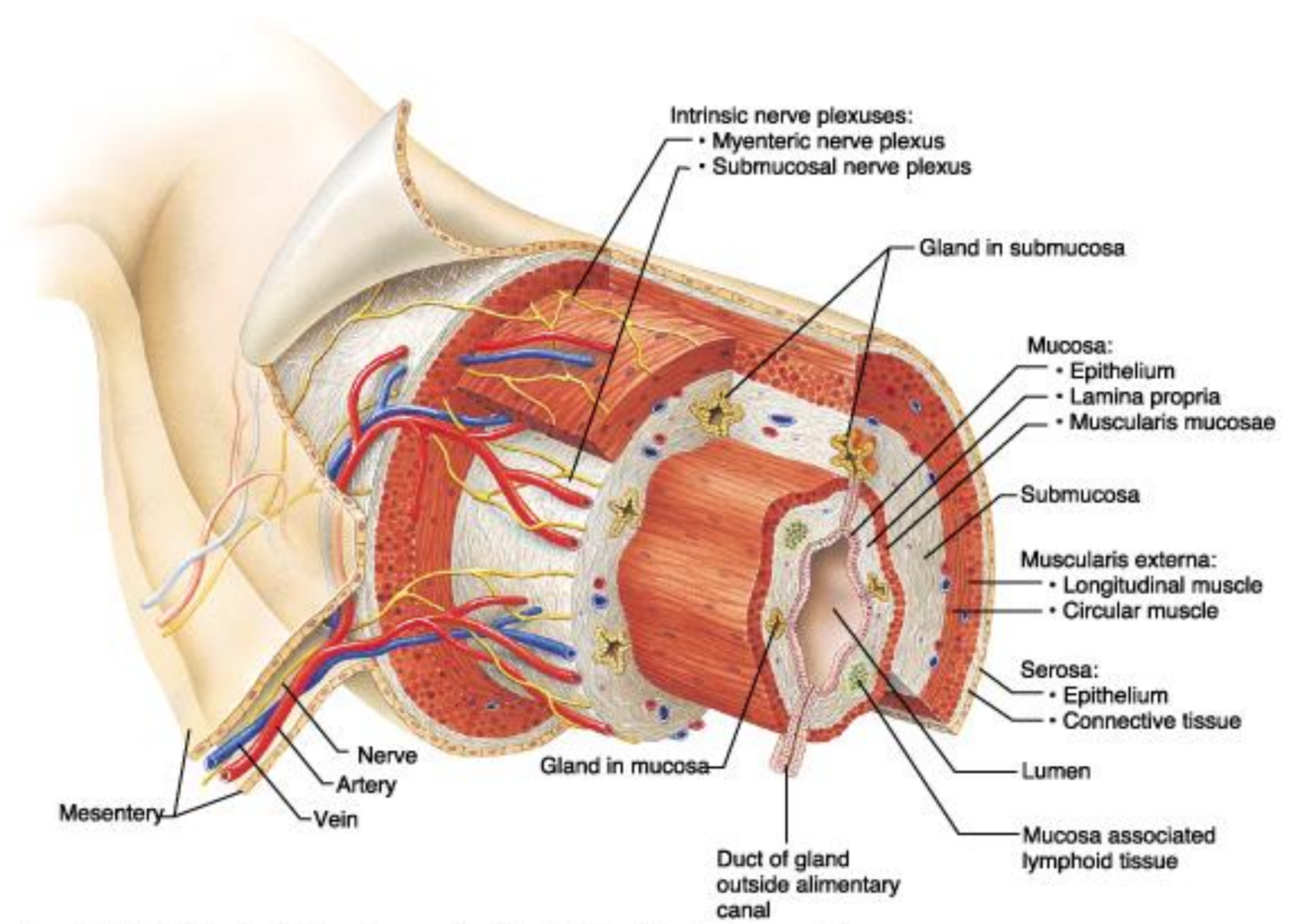
Wall of duodenum → secretin

→ CCKPZ

↓

stimulate secretion of pancreation juice.

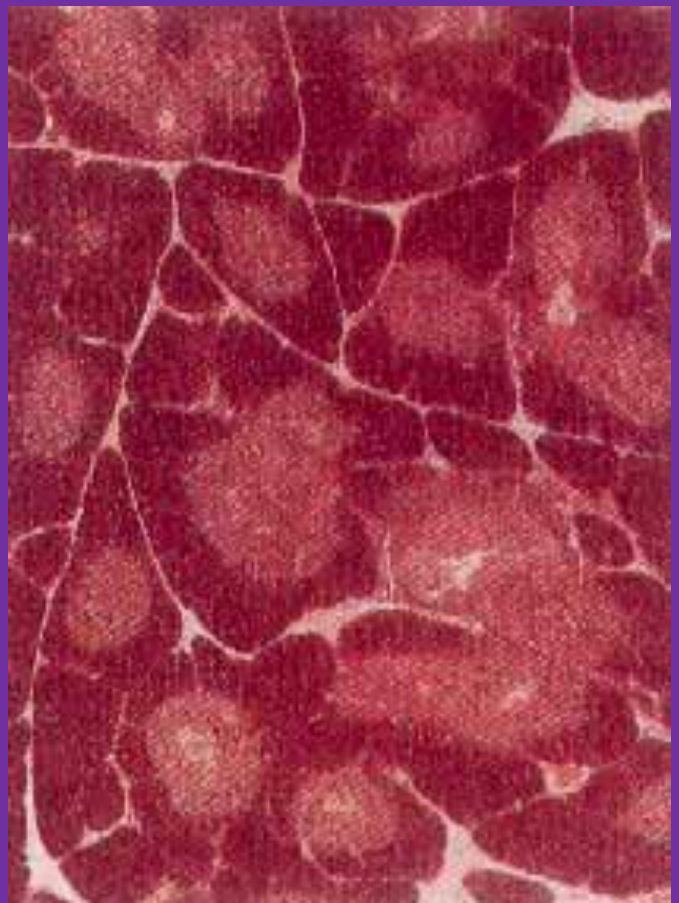
Stomach mucosa → gastrin secretion of gastric juice.



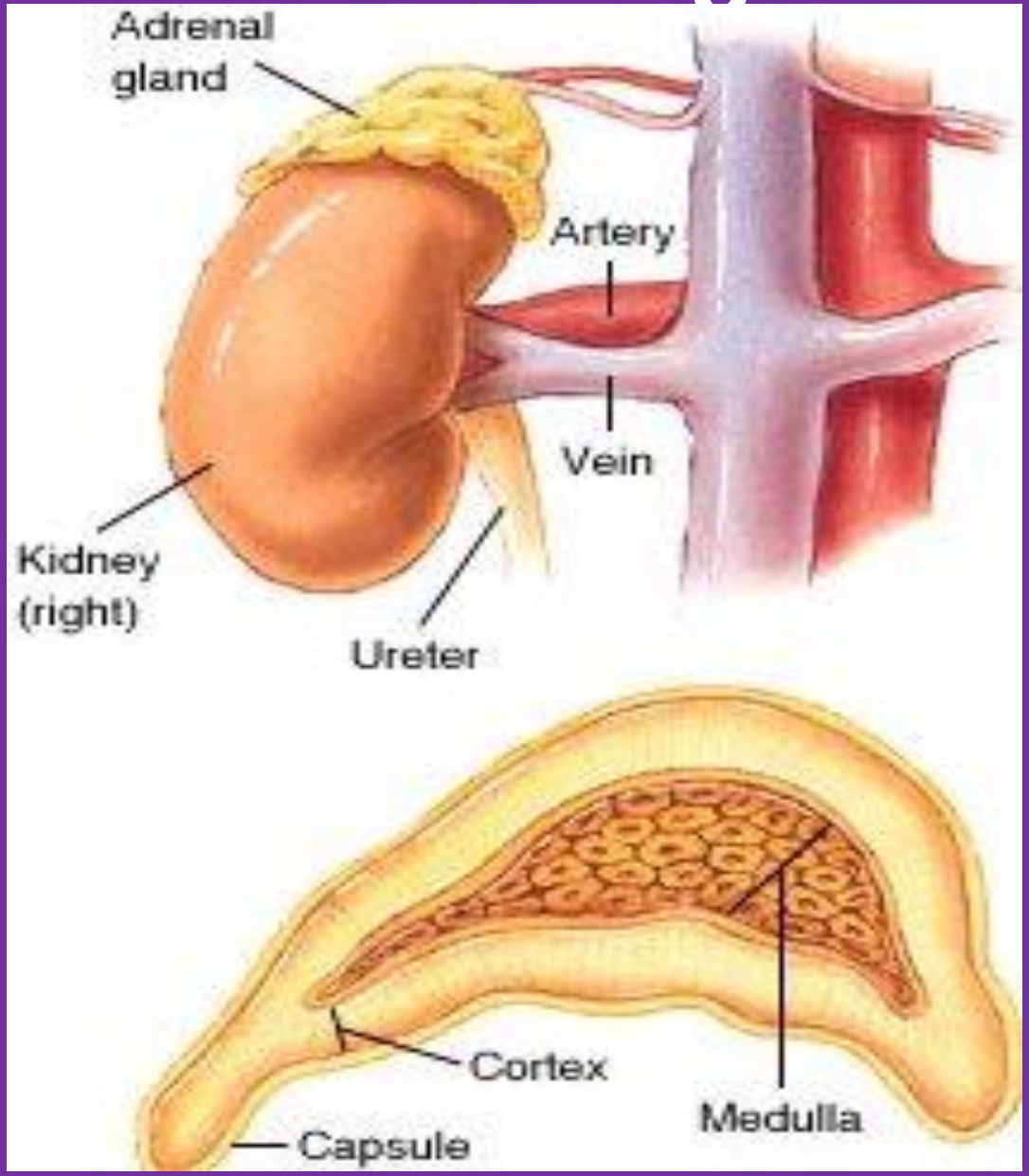
Thymus gland

Thymus beneath the sternum in the upper part of the chest.

Thymosin __ acts upon lymphocytes.



Adrenal gland



Adrenal Gland

- Adrenal gland located at a top kidney
- Outer cortex
  - Secretes Cortisol (stress), Androgens, Aldosterone (electrolytes)
- Inner medulla
  - SNS control
  - Secretes EPI & NEPI (fight or flight)

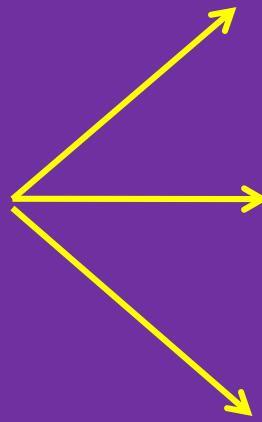
Epinephrine __ to support sudden metabolic needs of the body under condition of emergency.

Norepinephrine __ vasoconstriction and confers muscle tone throughout the circulatory system.

Adrenal cortex - responds to endocrine signals of stress

- synthesize and secrete corticosteroid

Group of steroid hormone



glucocorticoids

mineralocorticoids

androgens

I.Glucocorticoids

(a) cortisol __ promote synthesis of glucose

__ increase energy supply during stress

__ aid regulation of carbohydrate metabolism and electrolyte balance

(b) cortisone __ use to treat serious inflammatory condition (such as arthritis)

high dose of cortisone suppress the body's immune system

II.Mineralocorticoids

Aldosterone - affect salt and water balance

- stimulates kidney cells to reabsorb sodium iron from the filtrate
- regulated by hormone produced in the liver and kidney response to plasma iron concentration

Cortical androgens -affect sexual development

III.Androgens__ important in women for some

muscle and body hair

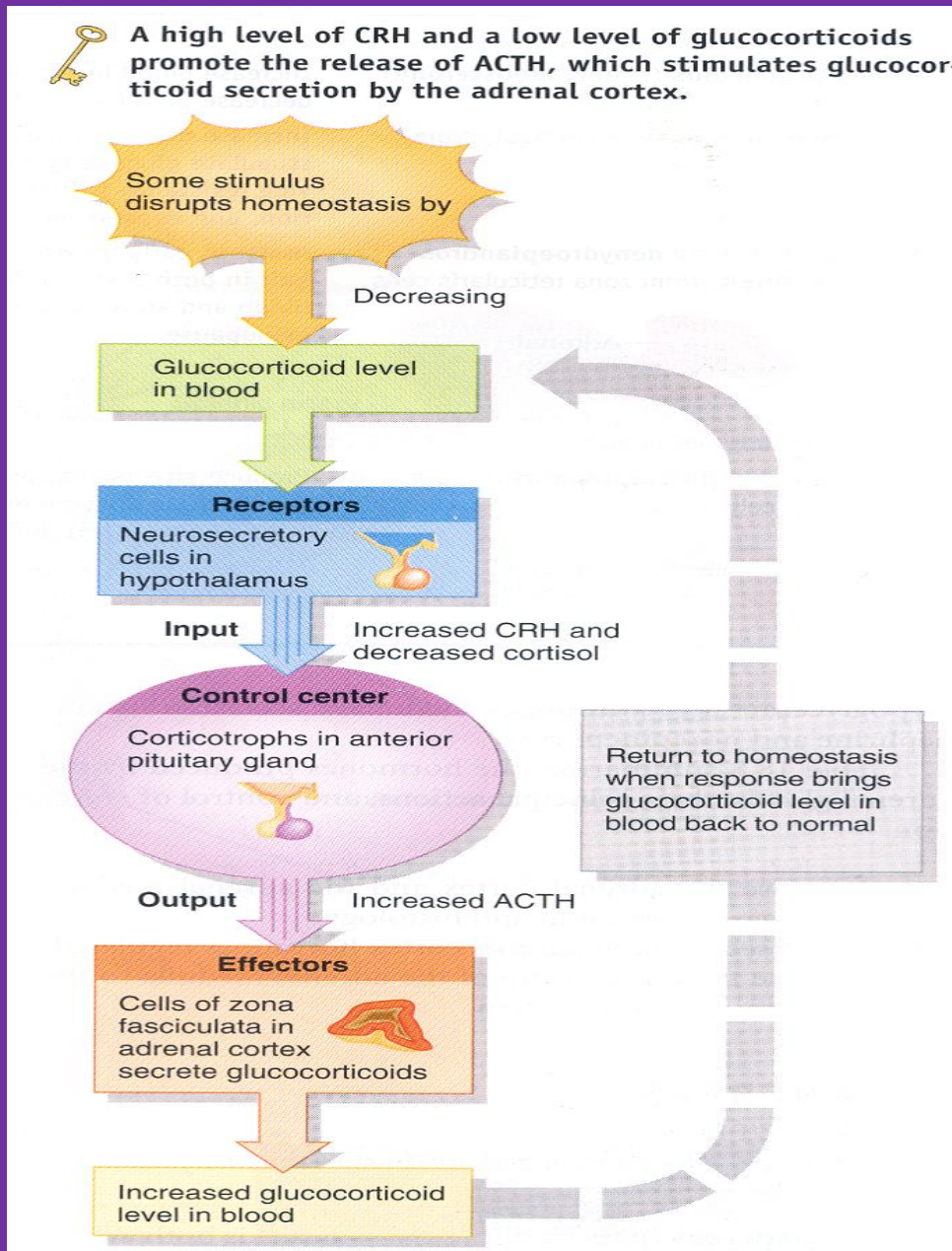
development

Complete removal of both adrenal is followed by

death in 10 to 15 days

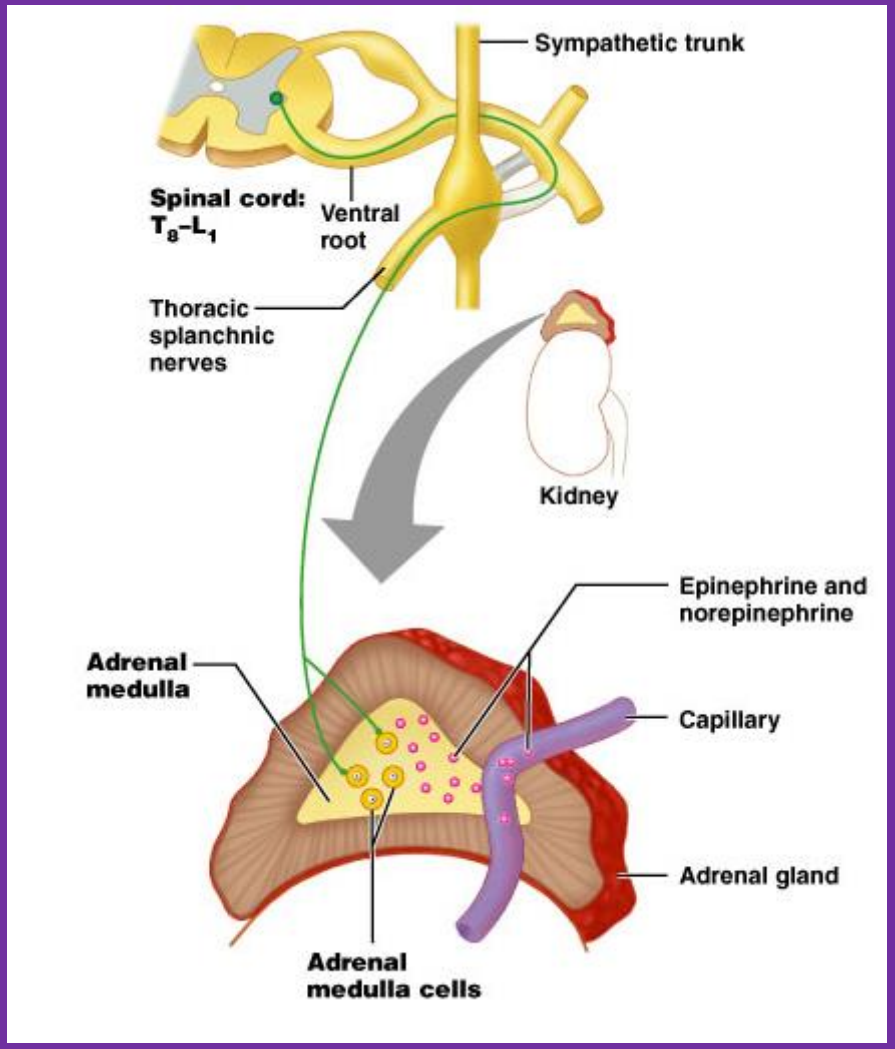
Adrenal cortex feedback

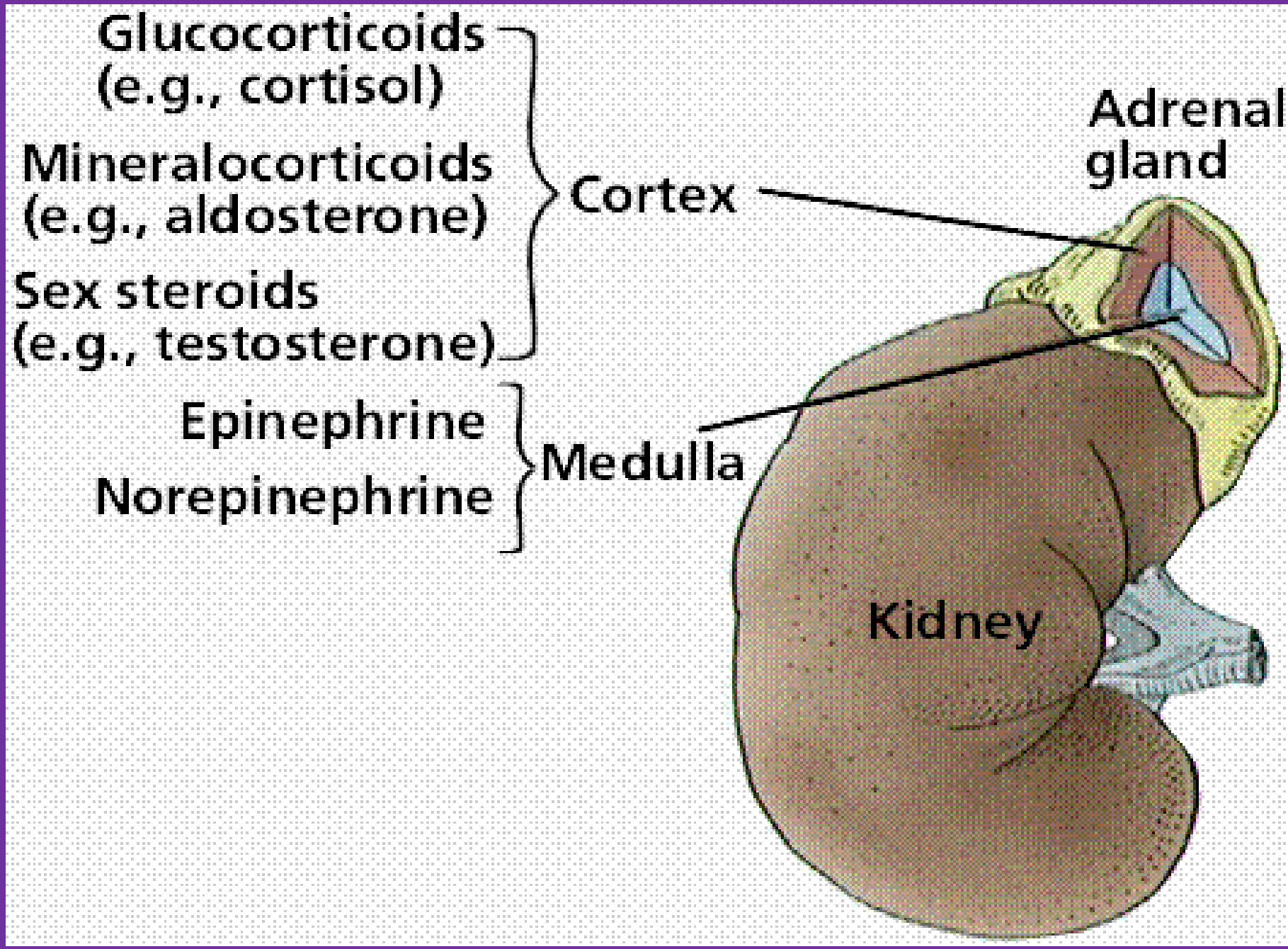
- Low glucocorticoid (cortisol) levels or low blood sugar
- Stim. Hypothal. = CRH
- CRH stim. Anterior Pit. = ACTH
- ACTH stim. Adrenal Cortex.
- Increase glucocort. Level then blood sugar level



Adrenal medulla

- Part of autonomic nervous system
- Spherical chromaffin cells are modified postganglionic sympathetic neurons
  - Secrete epinephrine and norepinephrine
  - Amine hormones
  - Fight, flight, fright
- Vesicles store the hormones




Glucocorticoids
(e.g., cortisol)
Mineralocorticoids
(e.g., aldosterone)
Sex steroids
(e.g., testosterone)
Cortex
Epinephrine
Norepinephrine
Medulla
Adrenal gland
Kidney

The Gonads (testes and ovaries)

main source of the steroid sex hormones

- Testes
  - Interstitial cells secrete androgens
  - Primary androgen is testosterone

    -Maintains secondary sex characteristics

    -Helps promote sperm formation

Ovaries

Androgens secreted by thecal folliculi

-Directly converted to estrogens by follicular granulosa cells

-Granulosa cells also produce progesterone

-Corpus luteum also secretes estrogen and progesterone

Gonad → producing eggs and sperms

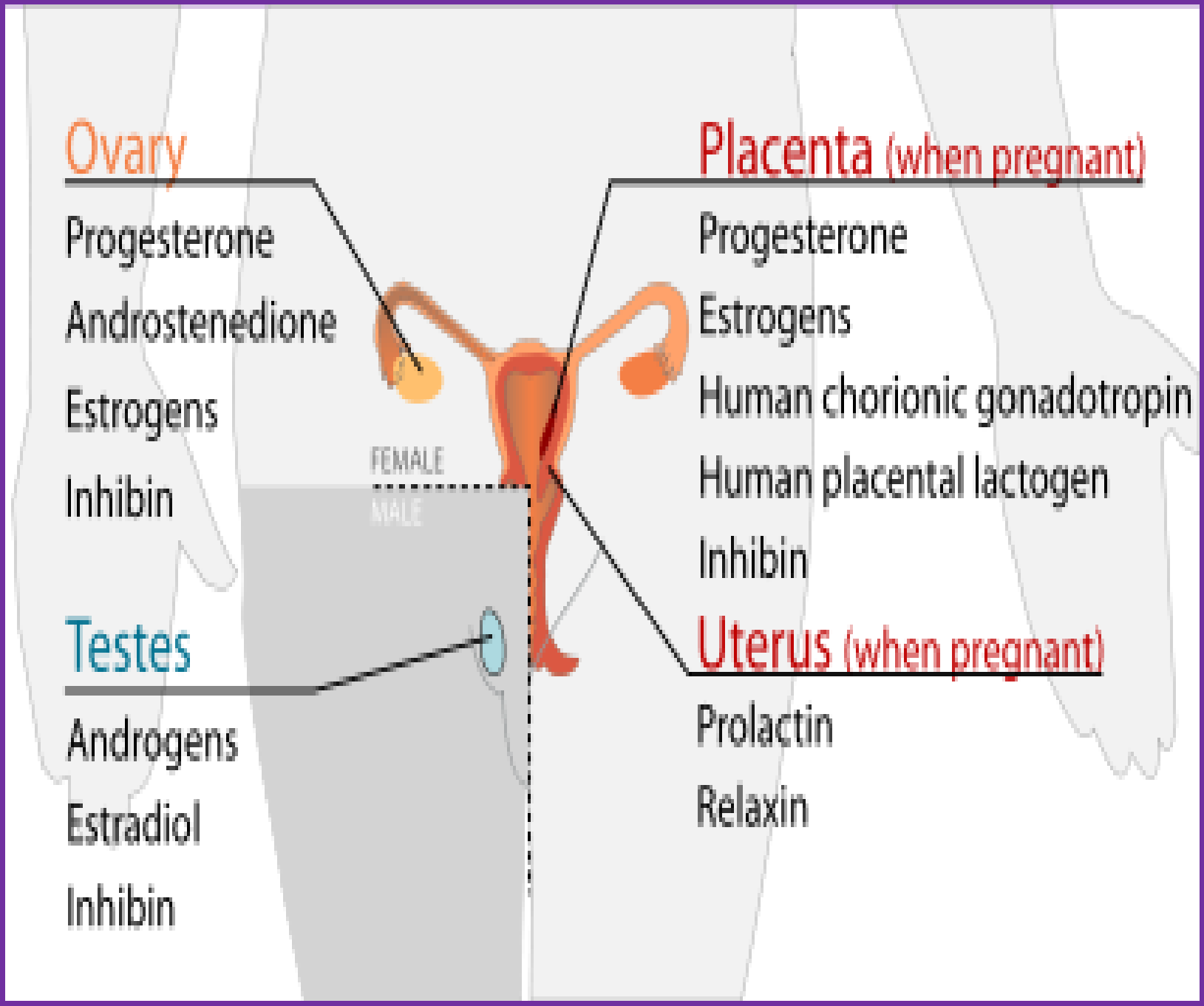
→ secrete hormones

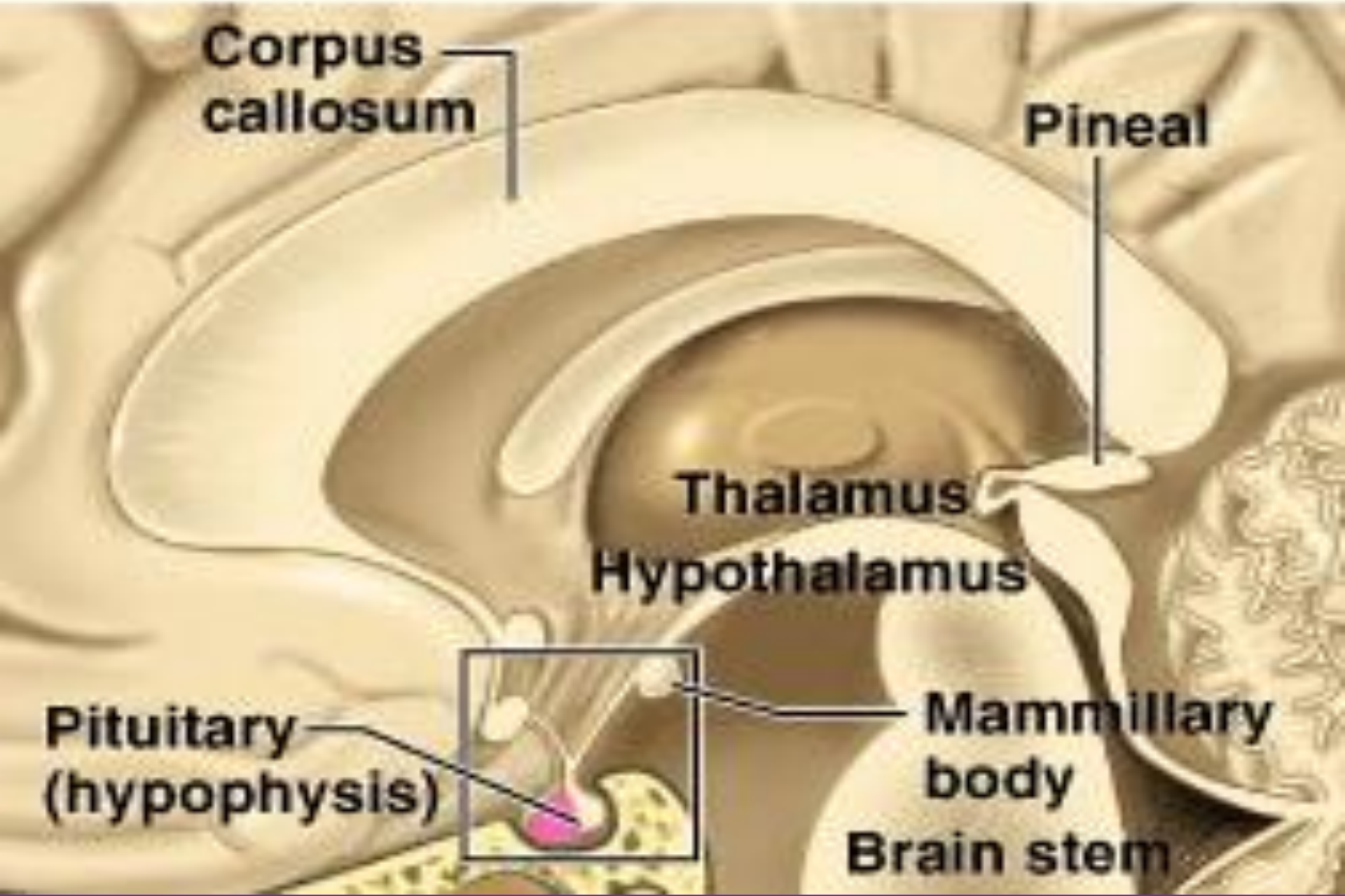
→ affect the secondary organ and sexual characteristics

Hormones → androgens

→ estrogens

→ progesterone


Ovary
Progesterone
Androstenedione
Estrogens
Inhibin
Testes
Androgens
Estradiol
Inhibin
FEMALE
MALE
Placenta (when pregnant)
Progesterone
Estrogens
Human chorionic gonadotropin
Human placental lactogen
Inhibin
Uterus (when pregnant)
Prolactin
Relaxin


Corpus
callosum
Pineal
Thalamus
Hypothalamus
Pituitary
(hypophysis)
Mammillary
body
Brain stem

Pineal

pineal body - roof of diencephalon

- secretes melatonin
- concentrates the pigment of melanophores (fish and amphibians)
- inhibit gonadal development
- involved in the regulation of circadian rhythm
- synthesis of melatonin

enzyme (Hydroxyindole-O-methyltransferase)

Prostaglandins(hormones)

-secreted by various tissue cells

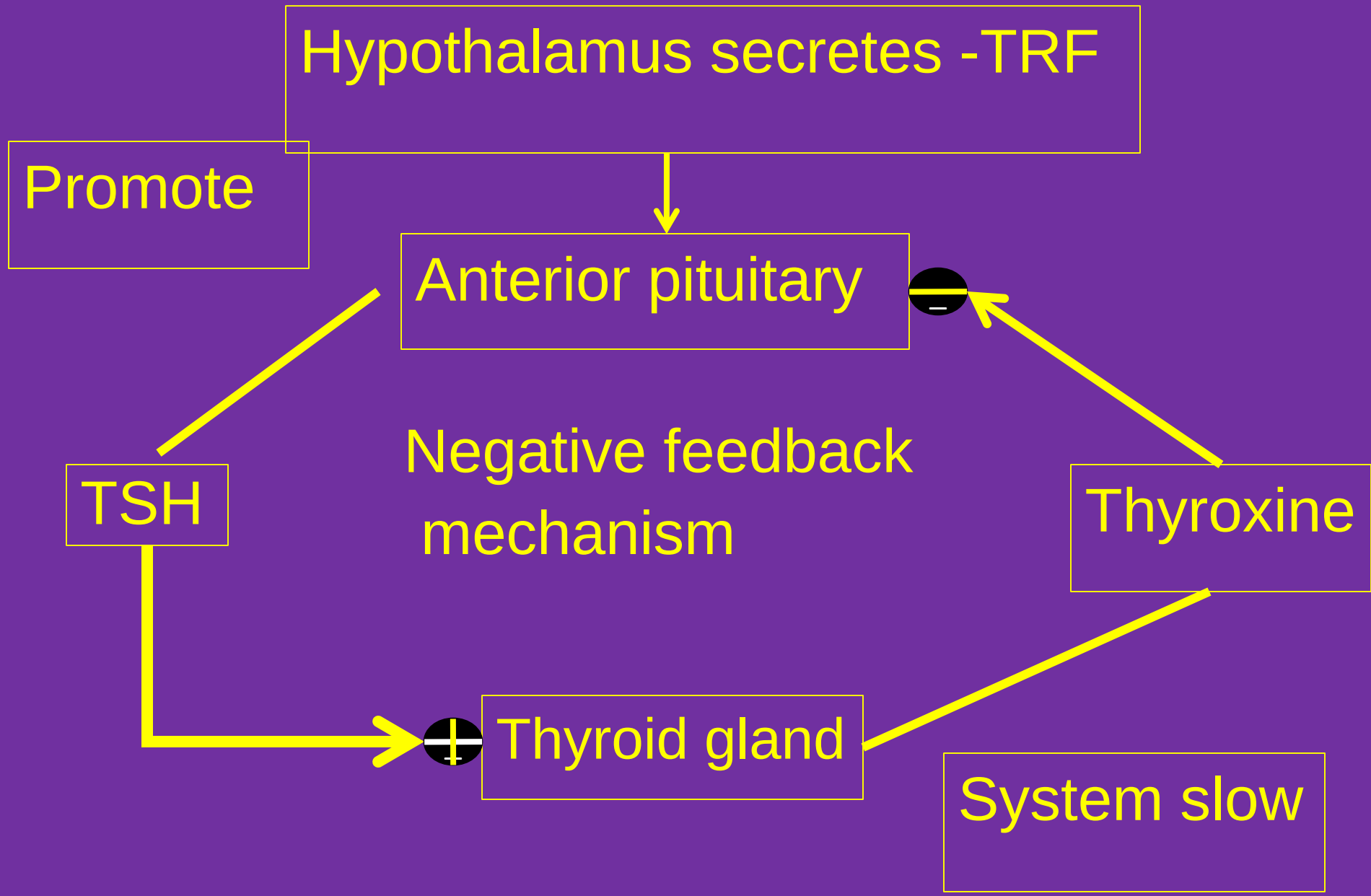
-effect on smooth muscle,various glands,

reproductive physiology

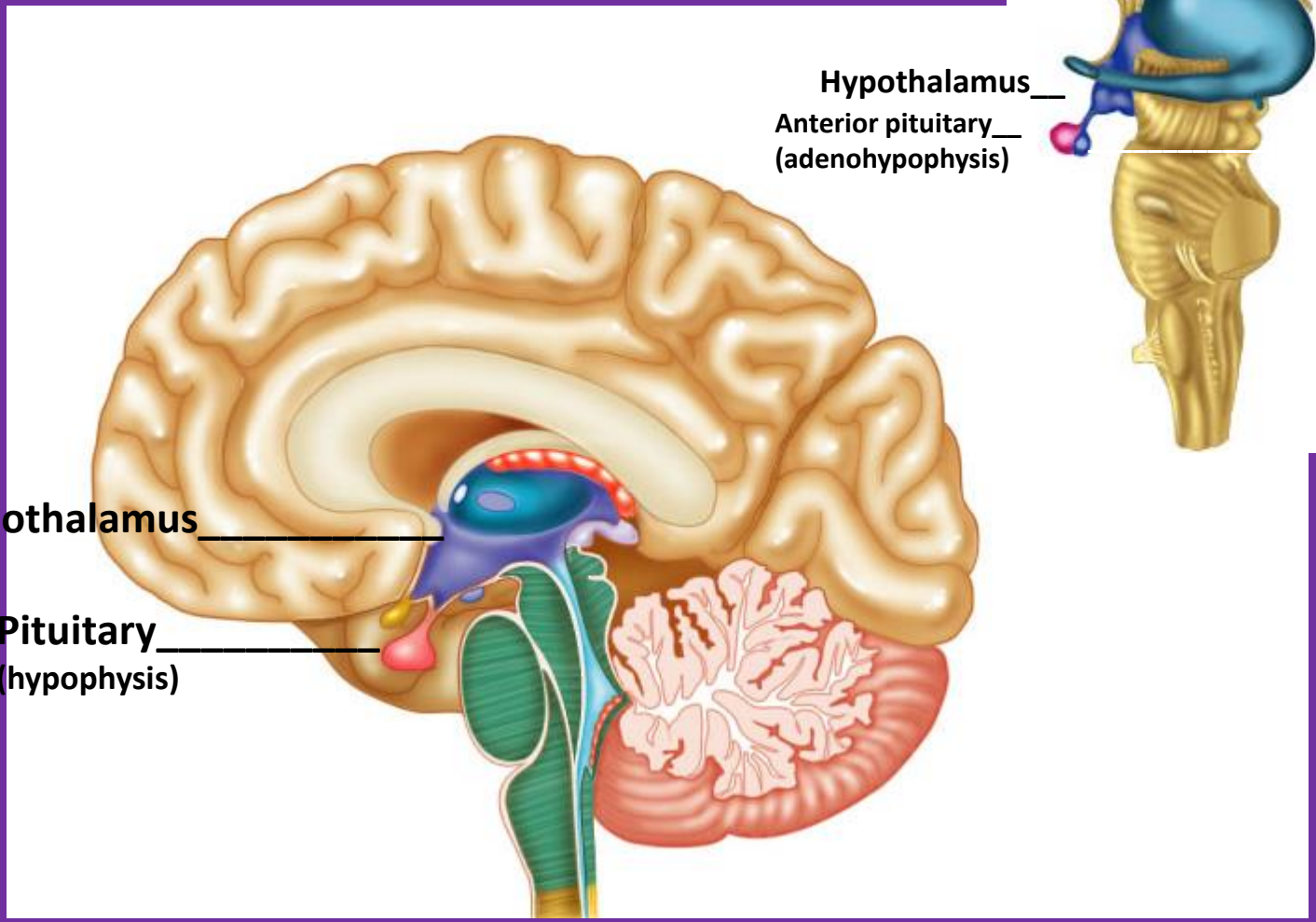
Erythropoetin (hormones)

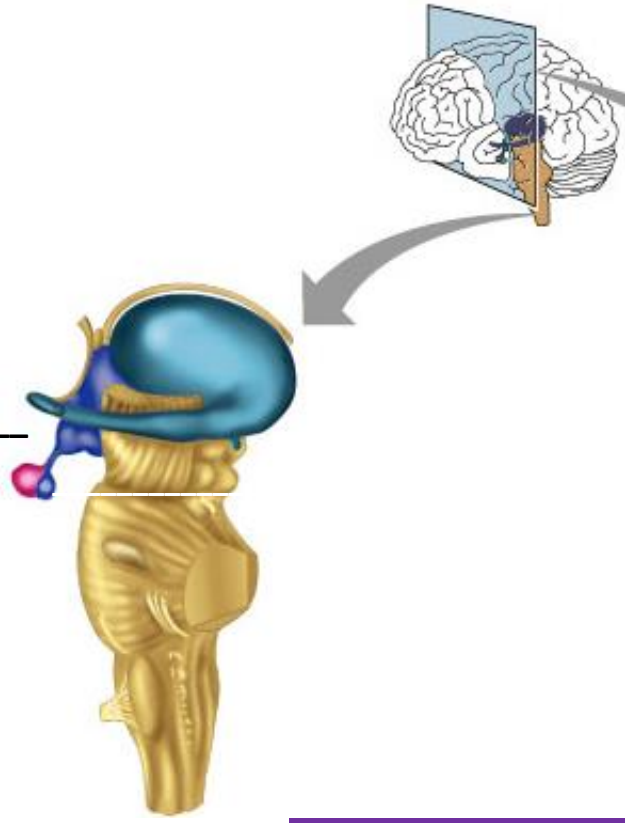
-produced by the kidney cells

-production of red blood cells

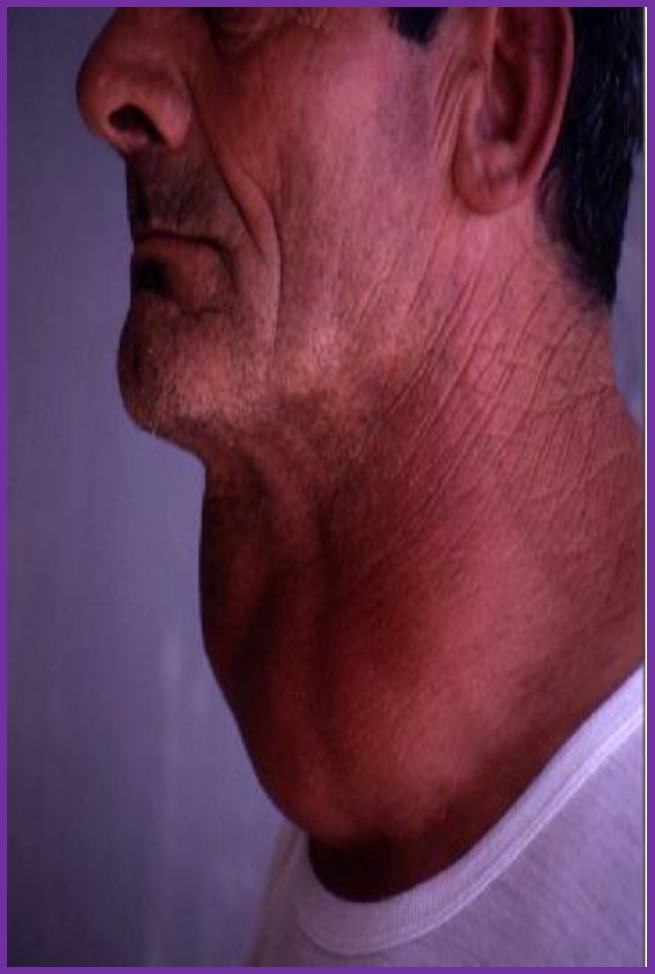

Hypothalamus secretes -TRF
Promote
Anterior pituitary
Negative feedback mechanism
TSH
Thyroxine
Thyroid gland
System slow

Learn the 3 endocrine organs on this slide:`Hypothalamus
Pituitary (hyophysis)
Pineal



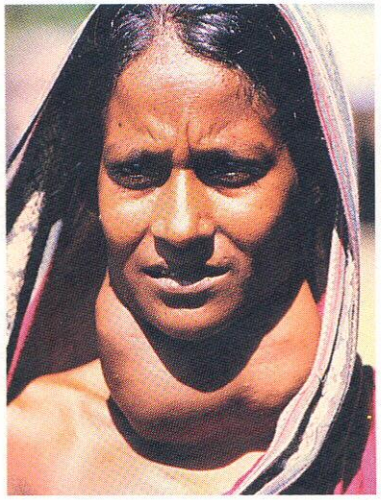


Goiter



Hypersecretion of TSH or TH

(b) Exophthalmos



(c) Goiter

↑GH as Juvenile

↓GH = pituitary dwarfism