

The Endocrine System

Hypothalamus

Pituitary gland

Pineal gland (epiphysis)

Thyroid gland

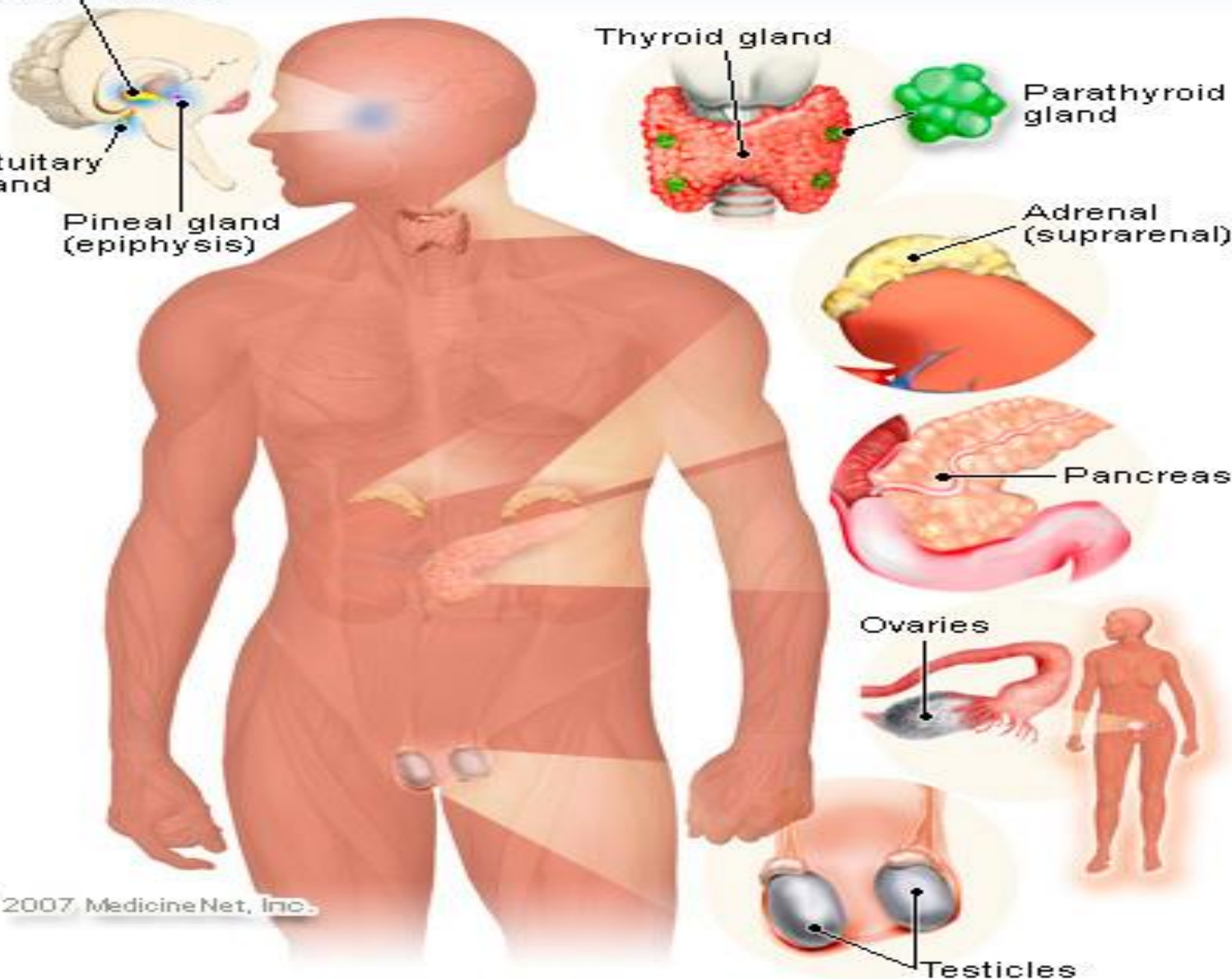
Parathyroid gland

Adrenal (suprarenal)

Pancreas

Ovaries

Testicles



Endocrine System

- Its the second major system which exercises control over the body
- Its characterized by rapidly response to various kind of stimuli

Endocrine System

The endocrine system is made up of glands that produce and secrete hormones, chemical substances produced in the body that regulate the activity of cells or organs. These hormones regulate the body's growth, metabolism (the physical and chemical processes of the body), and sexual development and function. The hormones are released into the bloodstream and may affect one or several organs throughout the body.

The major endocrine glands

The major endocrine glands arranged in two groups

1-The first group

a-the anterior pituitary gland

The adrenal cortex

The thyroid gland

The sex glands or gonads

2- The second group

a-The posterior pituitary gland

B-the adrenal medulla

c-the parathyroid glands

d-pancreas

- The anterior pituitary gland controls the other members of the first group by secreting trophic hormones.(such as ACTH or corticotrophin)
- The anterior pituitary gland is under the control of the hypothalamus which secretes releasing and inhibiting hormones (e.g corticotrophin-releasing factor).
- The glands of the second group are controlled by other stimuli ,both chemical and neural

The Hormones

Hormones are chemical messengers created by the body. They transfer information from one set of cells to another to coordinate the functions of different parts of the body.

The endocrine system is regulated by feedback in much the same way that a thermostat regulates the temperature in a room. For the hormones that are regulated by the pituitary gland, a signal is sent from the hypothalamus to the pituitary gland in the form of a "releasing hormone," which stimulates the pituitary to secrete a "stimulating hormone" into the circulation. The stimulating hormone then signals the target gland to secrete its hormone. As the level of this hormone rises in the circulation, the hypothalamus and the pituitary gland shut down secretion of the releasing hormone and the stimulating hormone, which in turn slows the secretion by the target gland. This system results in stable blood concentrations of the hormones that are regulated by the pituitary gland.

Pituitary Gland

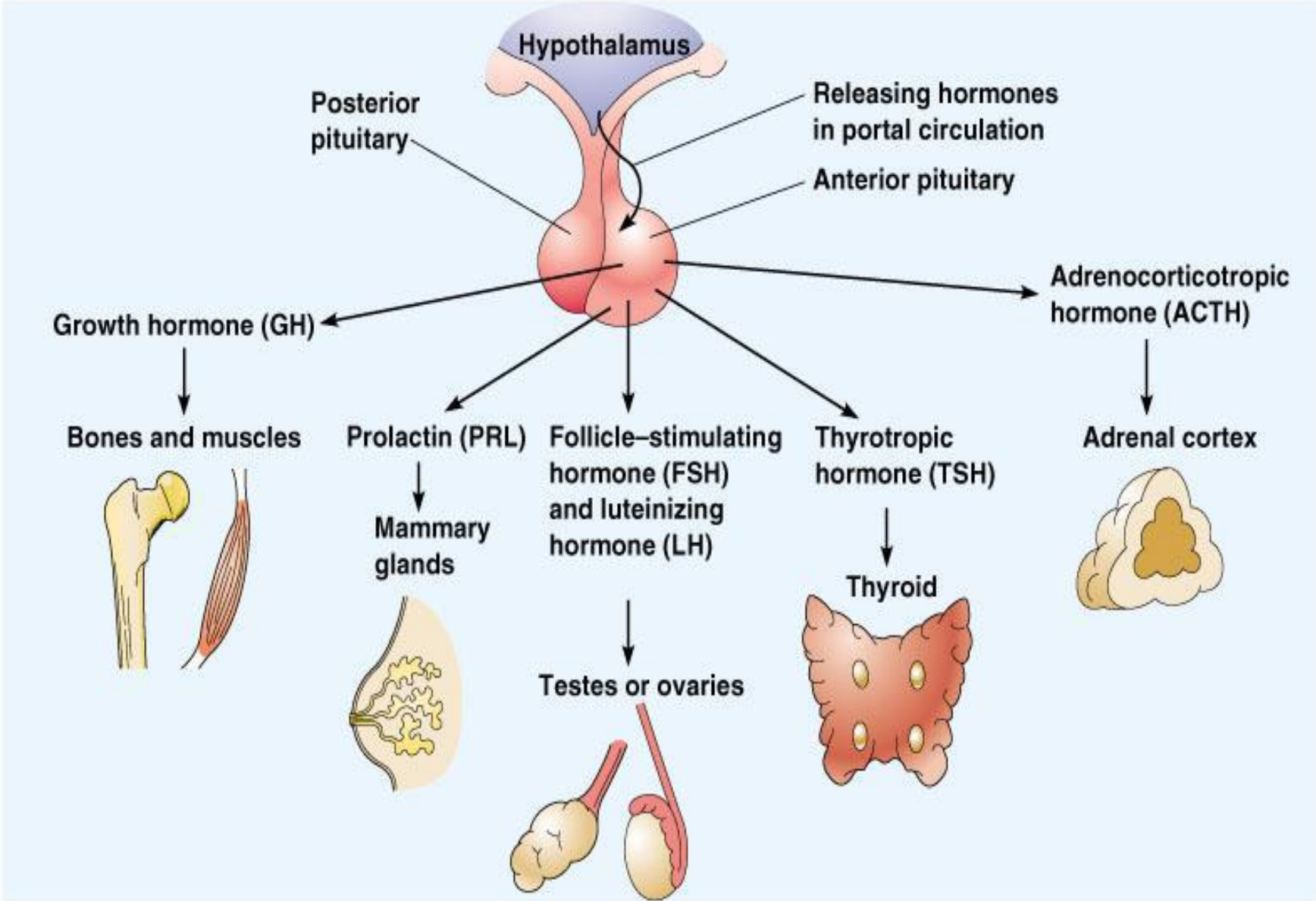
1. Size of a grape
2. Hangs by a stalk from the hypothalamus
3. Protected by the sphenoid bone
4. Has two functional lobes
5. Anterior pituitary – glandular tissue
6. Posterior pituitary – nervous tissue

Hormones of the Anterior Pituitary

1. Six anterior pituitary hormones
2. Two affect non-endocrine targets
3. Four stimulate other endocrine glands (tropic hormones)

Characteristics of all anterior pituitary hormones

1. Proteins (or peptides)
2. Act through second-messenger systems
3. Regulated by hormonal stimuli, mostly negative feedback



Growth Hormone (GH)

1. General metabolic hormone
2. Major effects are directed to growth of skeletal muscles and long bones
3. Causes amino acids to be built into proteins
4. Causes fats to be broken down for a source of energy

Functions of Other Anterior Pituitary Hormones

1. Prolactin (PRL)

- Stimulates and maintains milk production following childbirth
- Function in males is unknown

2. Adrenocorticotrophic hormone (ACTH)

- Regulates endocrine activity of the adrenal cortex

3. Thyroid-stimulating hormone (TSH)

- Influences growth and activity of the thyroid

Functions of Other Anterior Pituitary Hormones

- Gonadotropic hormones

Regulate hormonal activity of the gonads

- Follicle-stimulating hormone (FSH)
- Stimulates follicle development in ovaries
- Stimulates sperm development in testes

Functions of Other Anterior Pituitary Hormones

- Gonadotropic hormones (continued)
 - Luteinizing hormone (LH)
 - Triggers ovulation
 - Causes ruptured follicle to become the corpus luteum
 - Stimulates testosterone production in males
 - Referred to as interstitial cell-stimulating hormone (ICSH)

Pituitary - Hypothalamus Relationship

- Release of hormones is controlled by releasing and inhibiting hormones produced by the hypothalamus
- Hypothalamus produces two hormones that are transported to neurosecretory cells of the posterior pituitary
- The posterior pituitary is not strictly an endocrine gland, but does release hormones

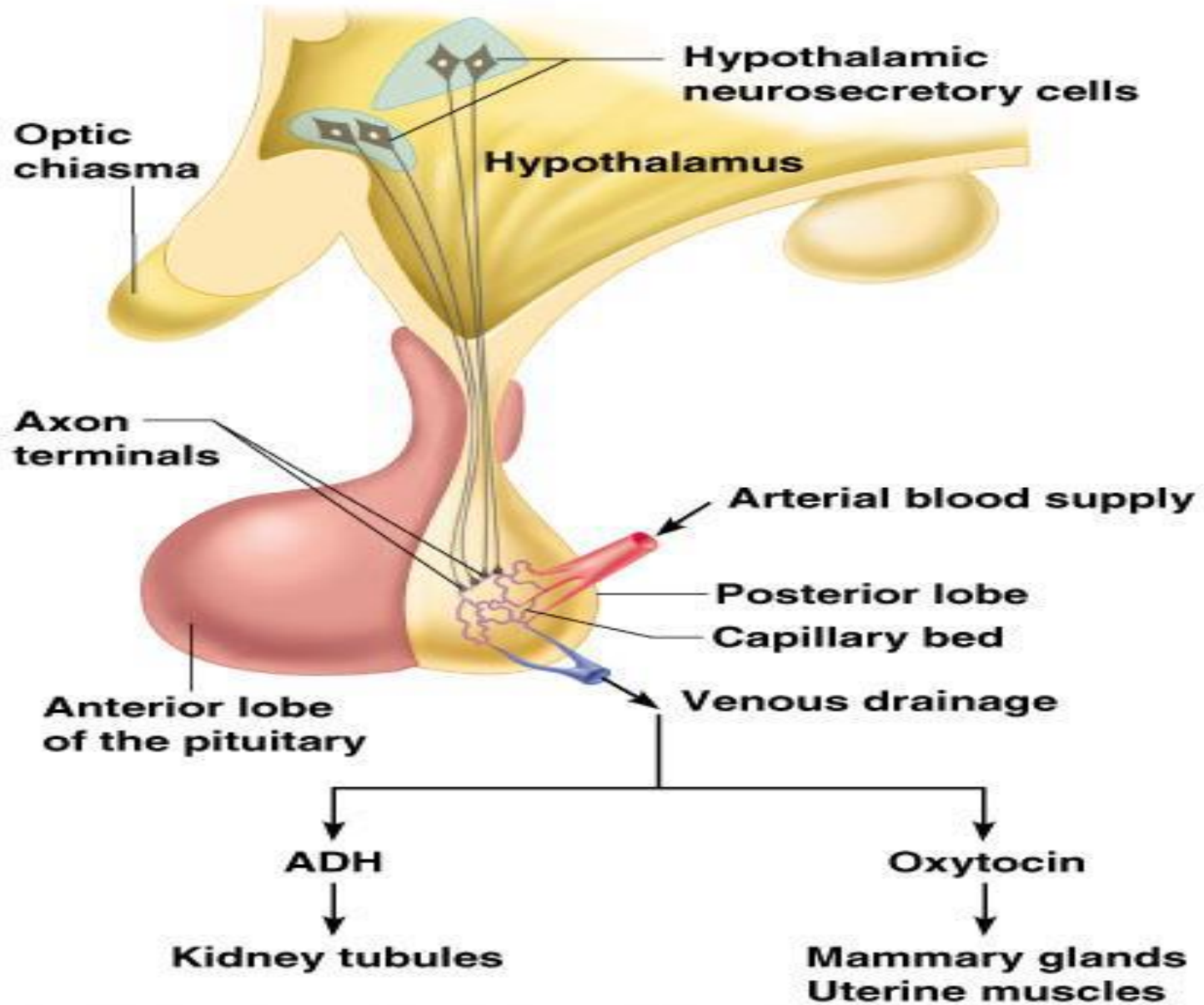
Hormones of the Posterior Pituitary

1. Oxytocin

- ❖ Stimulates contractions of the uterus during labor
- ❖ Causes milk ejection

2. Antidiuretic hormone (ADH)

- ❖ Can inhibit urine production
- ❖ In large amounts, causes vasoconstriction leading to increased blood pressure (vasopressin)



Hormones Regulated by the Hypothalamic/Pituitary System

Hypothalamic Releasing Hormone	Pituitary Stimulating Hormone	Hormone
Thyrotropin-releasing hormone (TRH)	Thyroid-stimulating hormone (TSH)	Thyroid hormones T4, T3
Corticotropin -releasing factor (CRF)	Adrenocorticotropin hormone (ACTH)	Cortisol
Luteinizing hormone-releasing hormone (LHRH) or gonadotropin-releasing hormone (GnRH)	Follicle-stimulating hormone (FSH), luteinizing hormone (LH)	Estrogen or testosterone
Growth hormone-releasing hormone (GHRH)	Growth hormone	Insulinlike growth factor-I (IGF-I)

The Thyroid gland

- The position

Its situated in the lower part of the neck

- The structure of the thyroid gland

1. It consist of two lobes on either side of the trachea , joined together by the isthmus which passes in front of the trachea just below the cricoid cartilage
2. The lobes are conical and have upper and lower poles.
3. Microscopically , it consist of many follicles ,their shape depends on the stimulating by thyrotrophin(thyroid stimulating hormone,TSH).

Superior
thyroid artery

Larynx

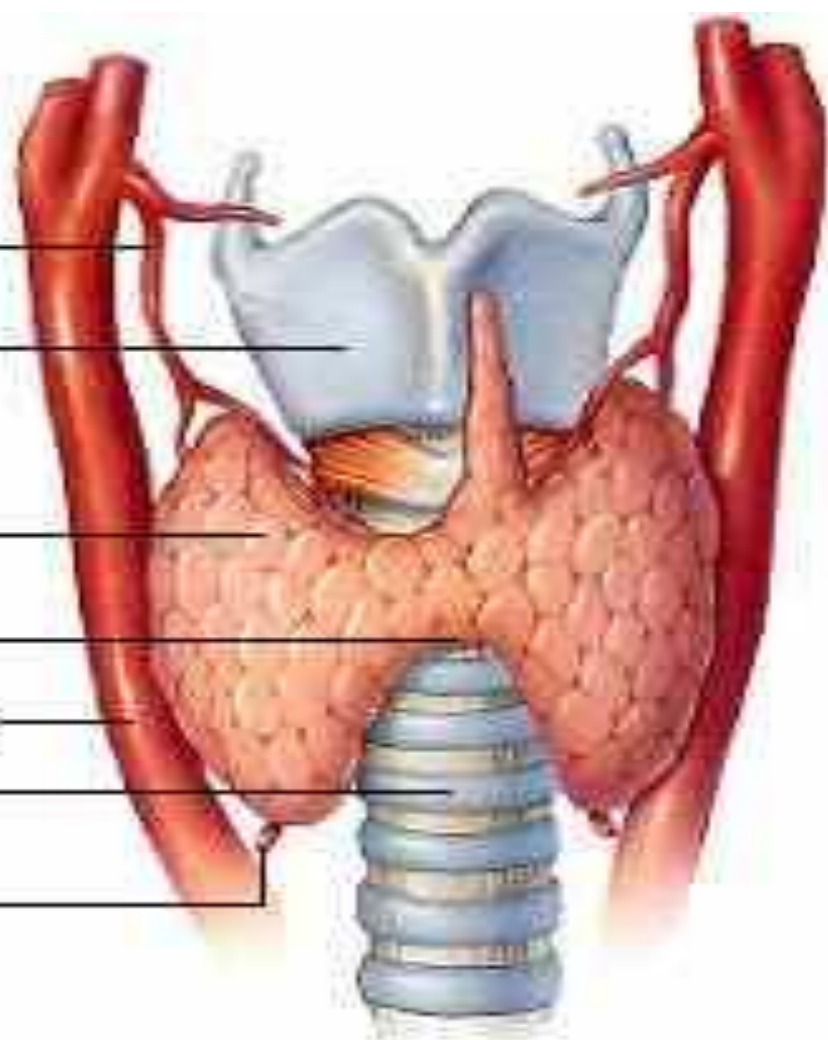
Thyroid gland

Isthmus

Common carotid artery

Trachea

Inferior thyroid artery



The function of The Thyroid gland

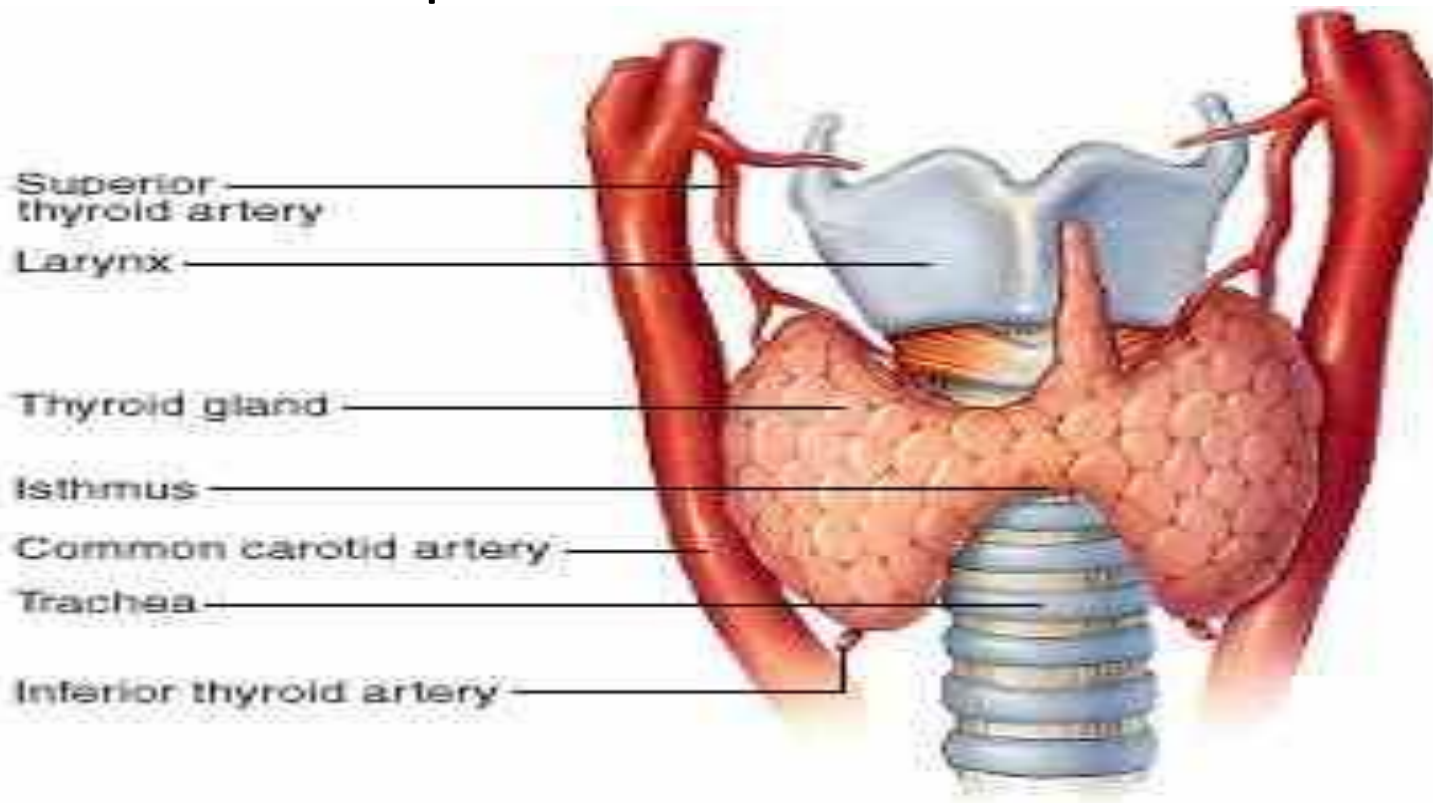
- It secretes two types of hormones
 - ❖ The follicular cell which produces thyroid hormones
Secretes two non-steroid hormones
 - Triiodothyronine (T3)
 - Thyroxine (T4)
- Regulates metabolism
 - increases protein synthesis
 - promotes glycolysis, gluconeogenesis, glucose uptake
 - **Calcitonin**: calcium metabolism which is produced by the C (clear) cells

Parathyroid gland

- Are small ovoid glands smaller than the pea
- Lie on the posterior surface of the thyroid gland
- They are two pairs superior and inferior
- They released parathyroid hormone which raised serum calcium level

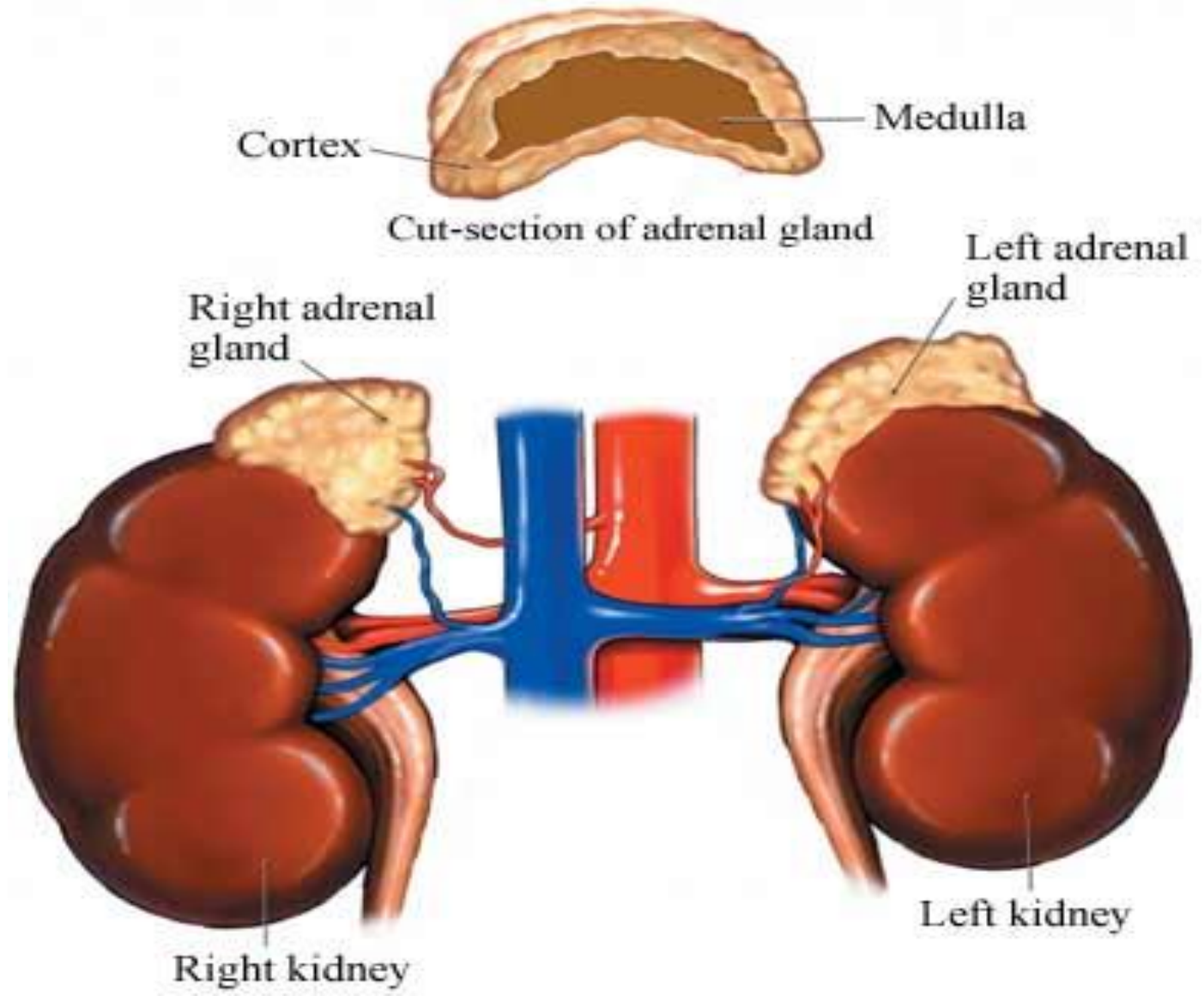
Parathyroid hormone (PTH)- regulates Ca^{2+} in blood

If Ca^{2+} level drops bones is broken down



The Adrenal glands

- **Are two small flattened yellowish bodies situated on the upper of each kidney**
- **The outer part of the gland is the cortex(yellowish)**
- **The inner part of the gland is the Medulla(dark)**



The adrenal Medulla

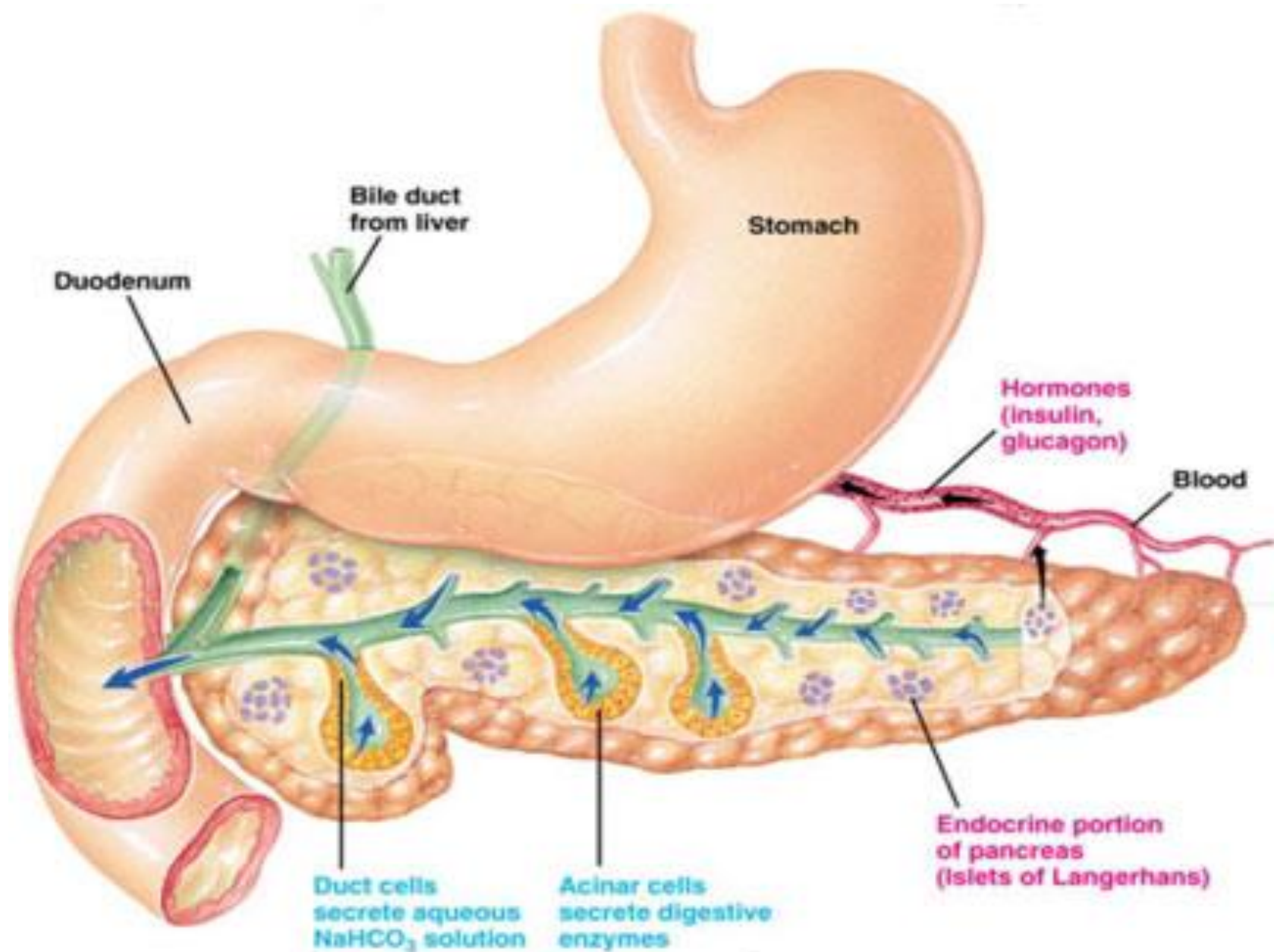
- Situated directly atop each kidney and stimulated by the sympathetic nervous system
- Secretes the **catecholamines**
 - **Epinephrine**: elicits a fight or flight response
 - Increase H.R. and B.P.
 - Increase respiration
 - Increase metabolic rate
 - Increase glycogenolysis
 - Vasodilation
 - **Norepinephrine**

Adrenal Cortex

- **Secretes over 30 different steroid hormones (corticosteroids)**
 - **Mineralocorticoids**
 - Aldosterone: maintains electrolyte balance
 - **Glucocorticoids**
 - Cortisol:
 - Stimulates gluconeogenesis
 - Mobilization of free fatty acids
 - Glucose sparing
 - Anti-inflammatory agent
 - **Gonadocorticoids**
 - testosterone, estrogen, progesteron

Pancreas

- Located slightly behind the stomach
- **Insulin**: reduces blood glucose
 - Facilitates glucose transport into the cells
- Promotes glycogenesis
 - Inhibits gluconeogenesis
- **Glucagon**: increases blood glucose



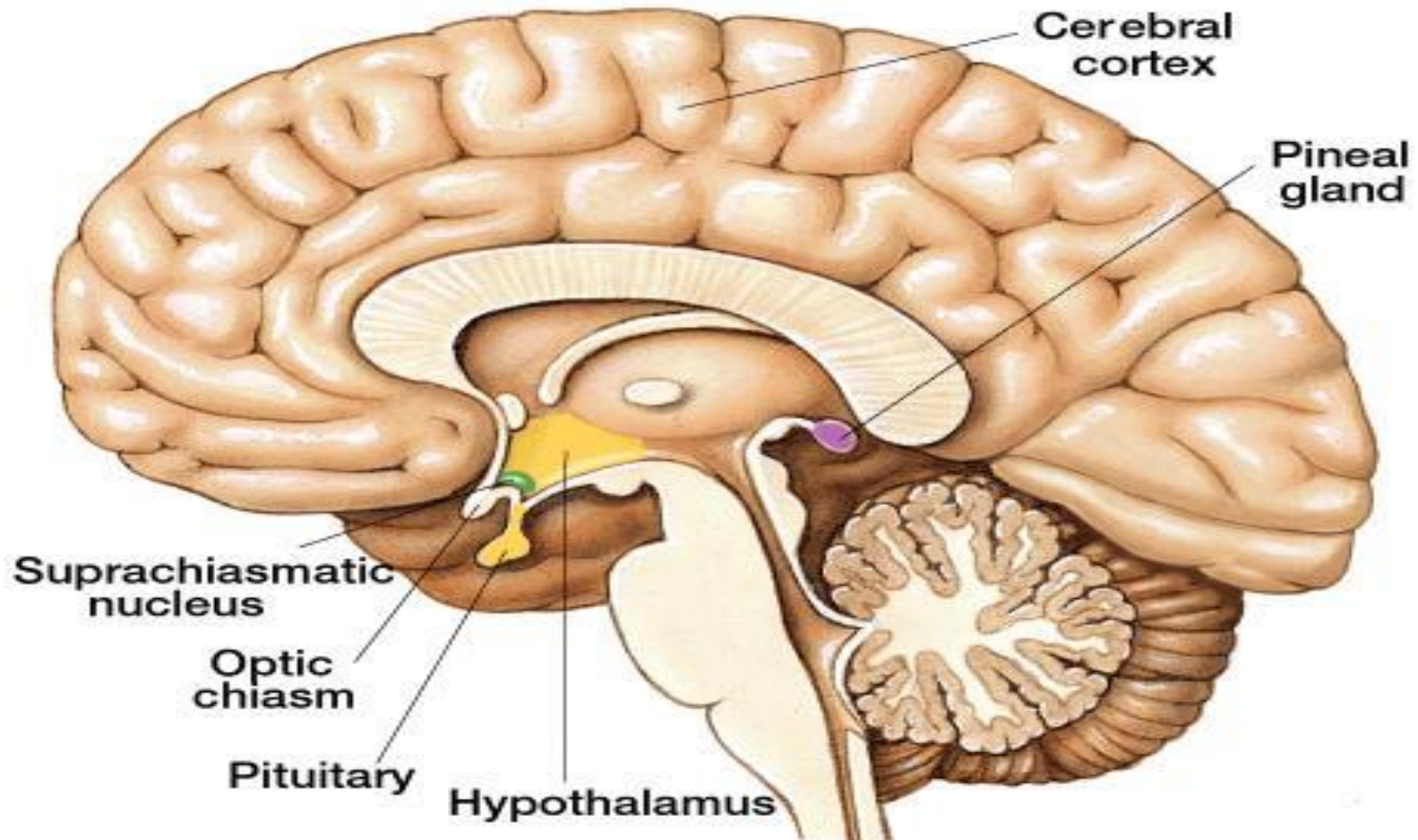
Pineal Gland

- Pineal Gland is a small redish –gray structure (about the size of a pea)
- Situated in the midline of the brain immediately behind the third ventricle and under the posterior end of corpus callosum

Pineal Gland

Melatonin

Establishes body's day/ night cycle



Gonads

1. testes (testosterone) = sex characteristics
 - muscle development and maturity
2. ovaries (estrogen) = sex characteristics
 - maturity and coordination