

Endocrine System

Pituitary (Hypophysis)

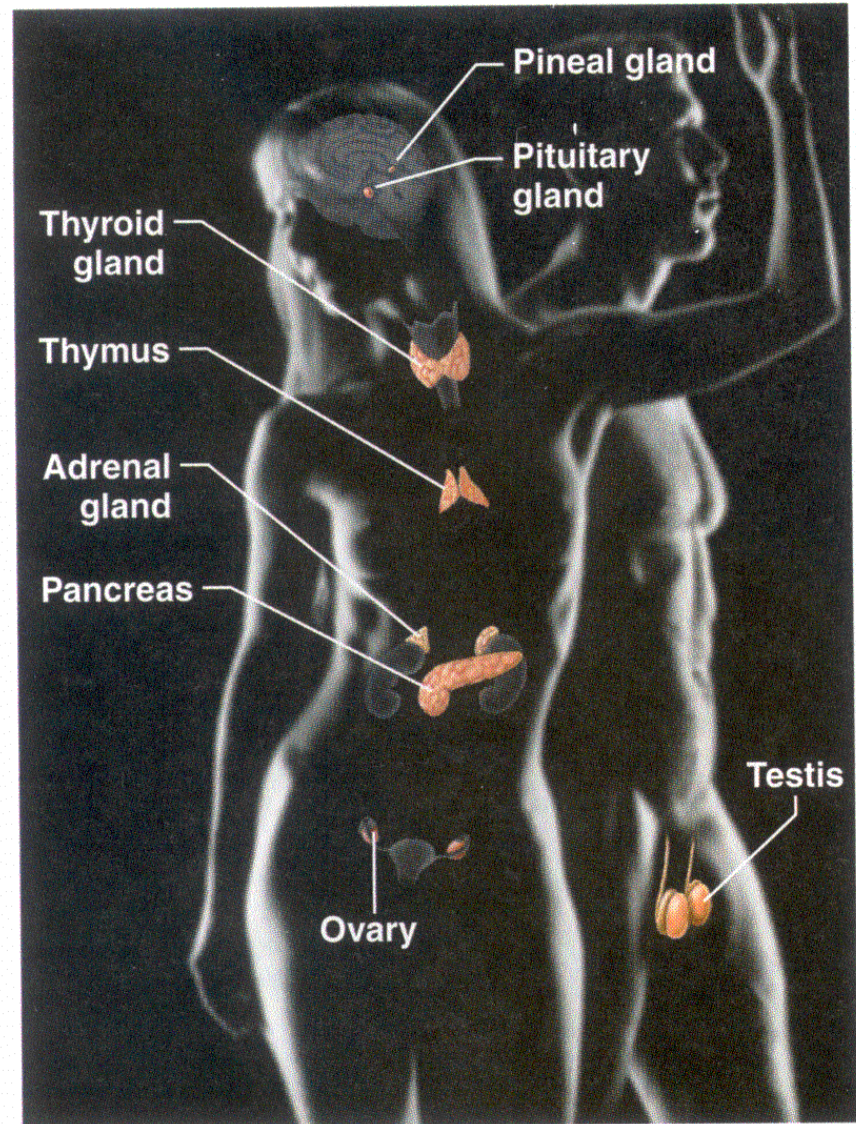
Thyroid

Parathyroid

Adrenal

Pancreas

Gonads



Endocrine System

Second great communication system of body (NS is other)

Blood borne messengers which control and integrate many body functions

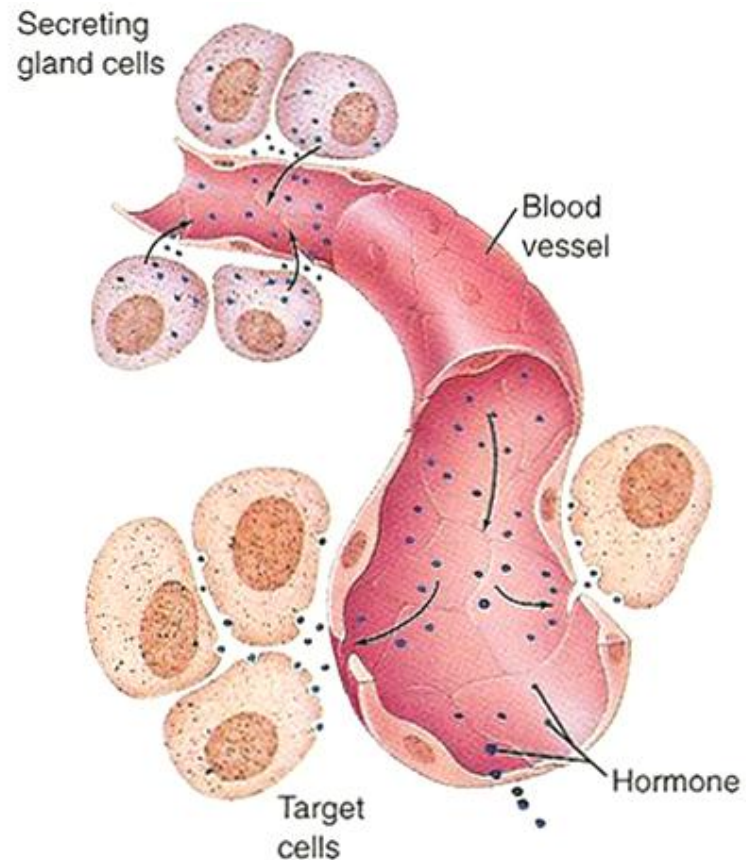
Reproduction

Organic metabolism

Energy balance

Mineral metabolism

Growth



Endocrine versus Nervous Systems

Endocrine system:

- Slow and general
- blood borne
- receptors
 - on cell membrane (protein/peptide hormones)
 - within cell (steroid hormones)

Nervous system:

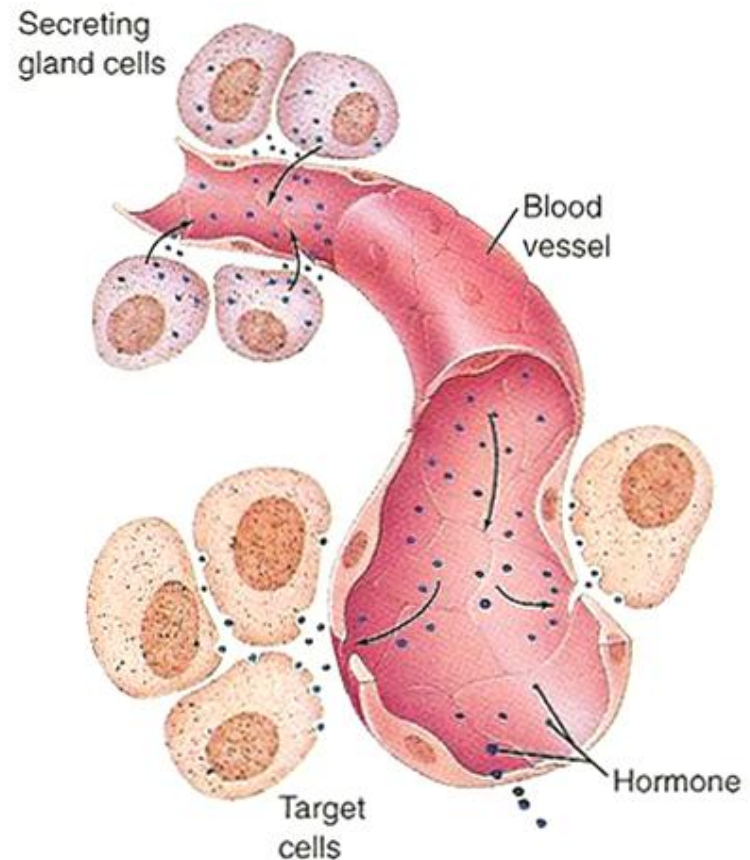
- fast, precise and local
- action potentials
- receptors only at synapse

Endocrine System = organs whose secretory products are hormones

Hormone = chemical substance secreted into the blood and carried to other sites of the body where its actions are exerted

Target cells = cells capable of responding to hormone must have receptors for hormone

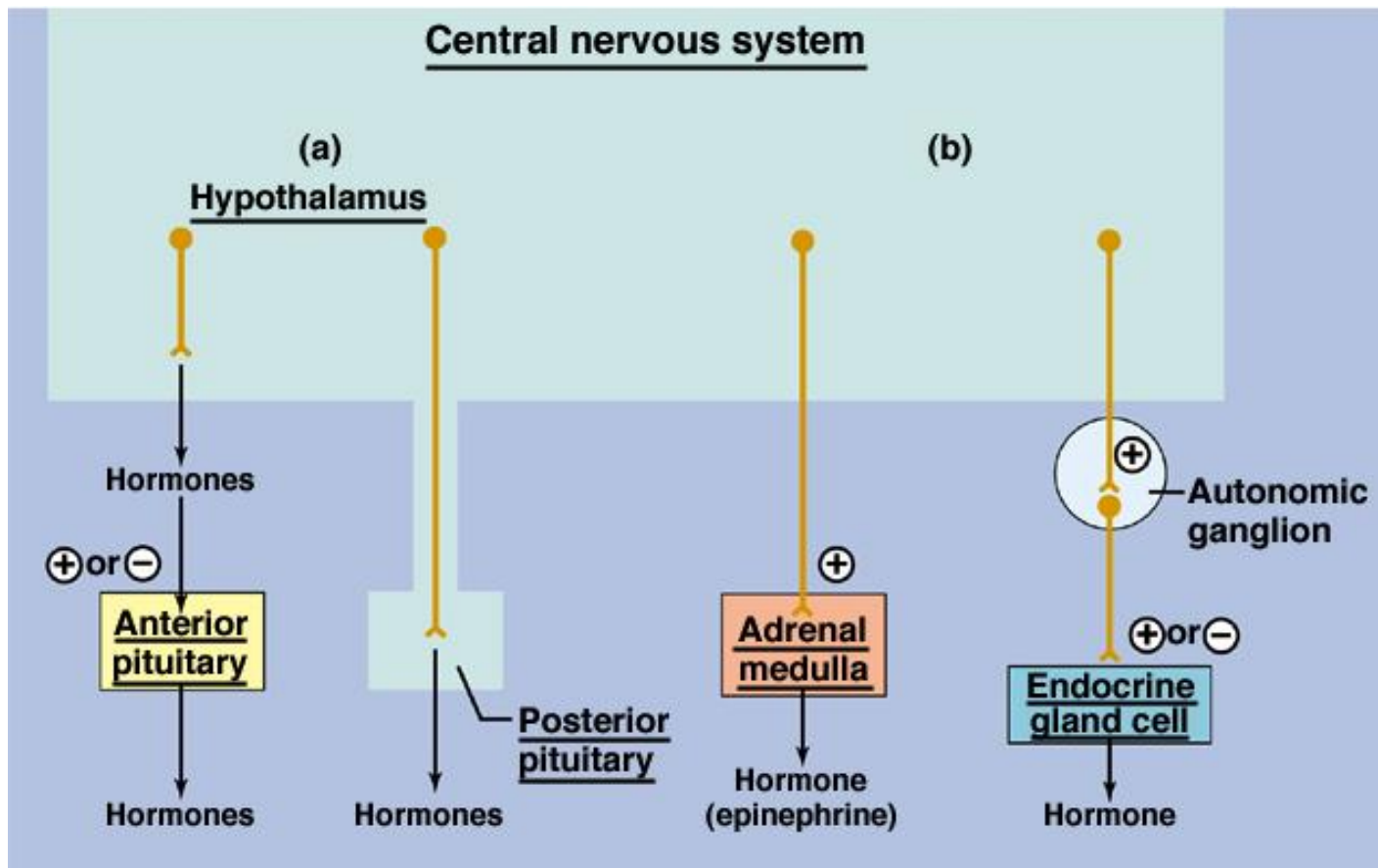
Presence of specific receptors determines specificity of actions of hormones



Neuroendocrine =

CNS plays a crucial role in controlling hormone secretion

Conversely, hormones markedly alter neural function

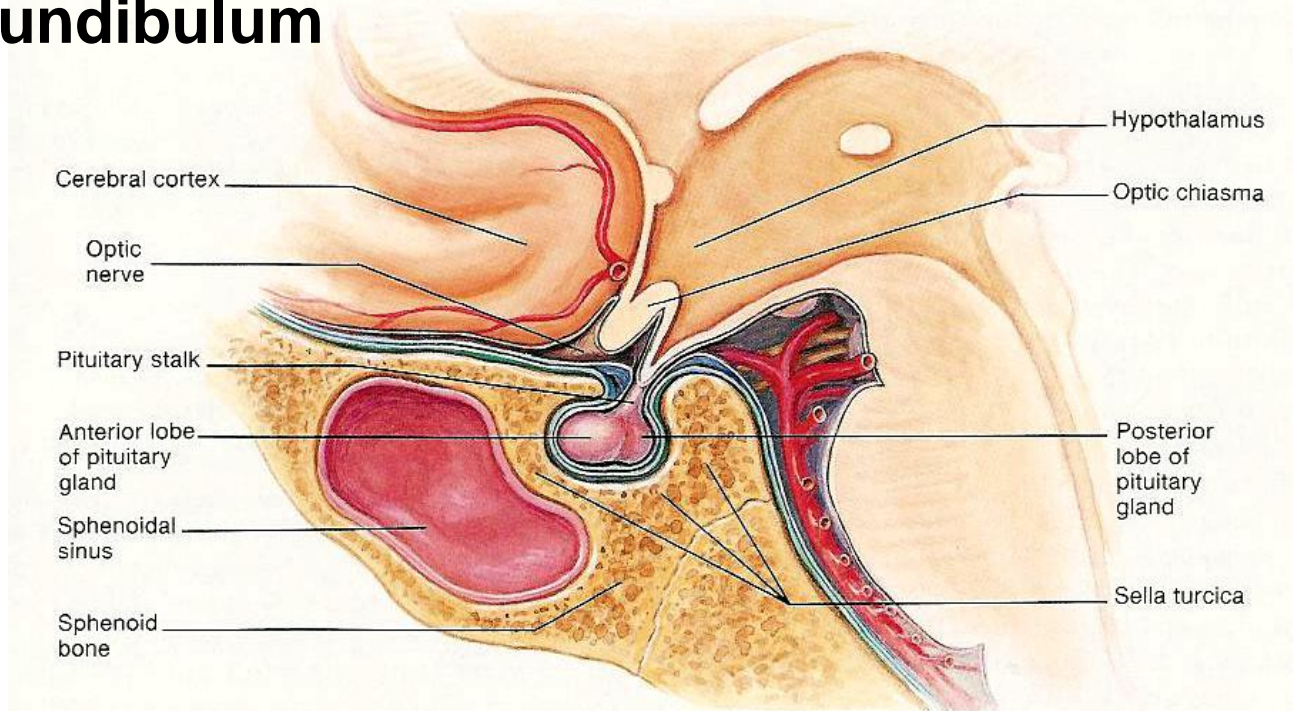
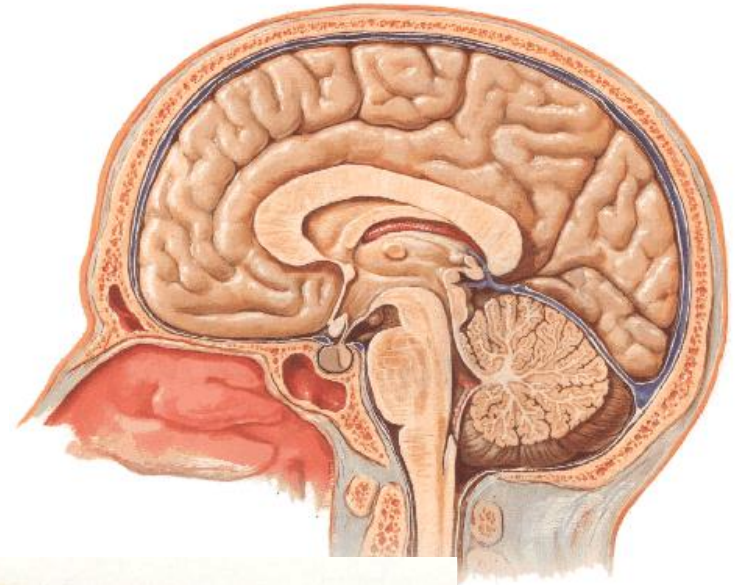


Hypophysis = Pituitary

Lies in sella turcica of sphenoid bone

About size of pea, less than 1 gram

Attached to hypothalamus via **infundibulum**

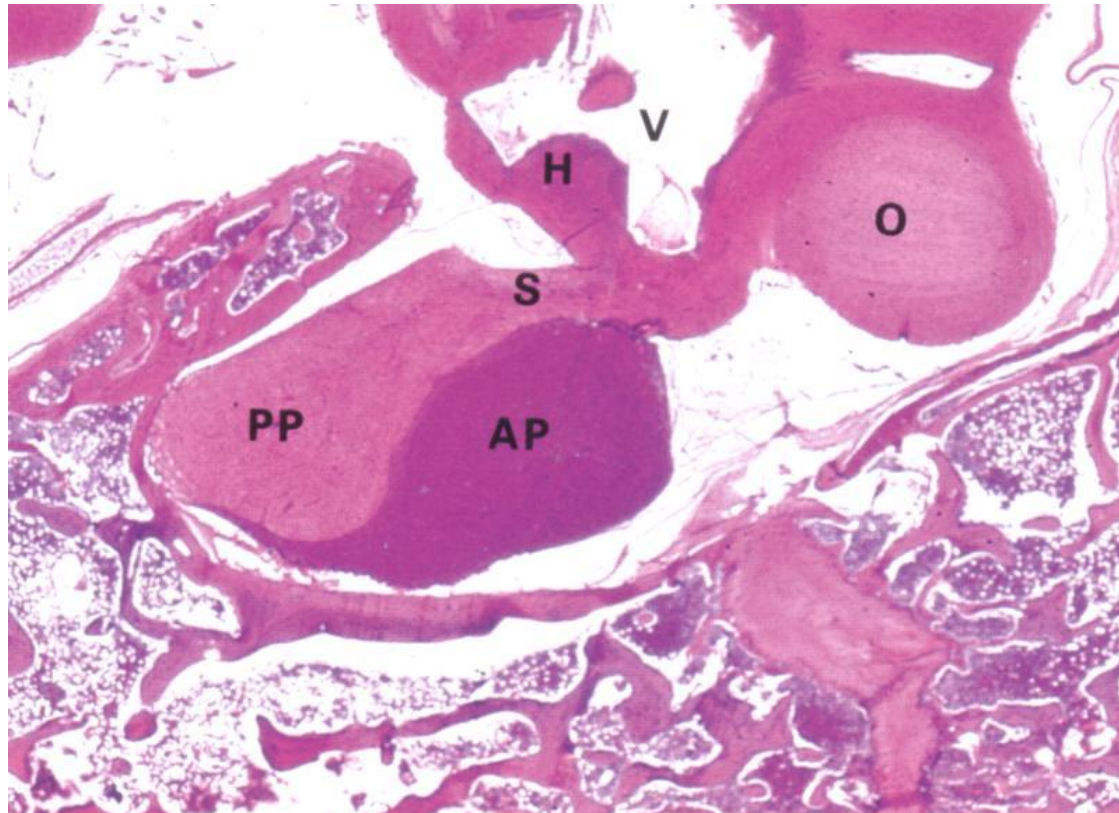


Hypophysis = Pituitary

2 major divisions

Adenohypophysis = anterior lobe (pars distalis)

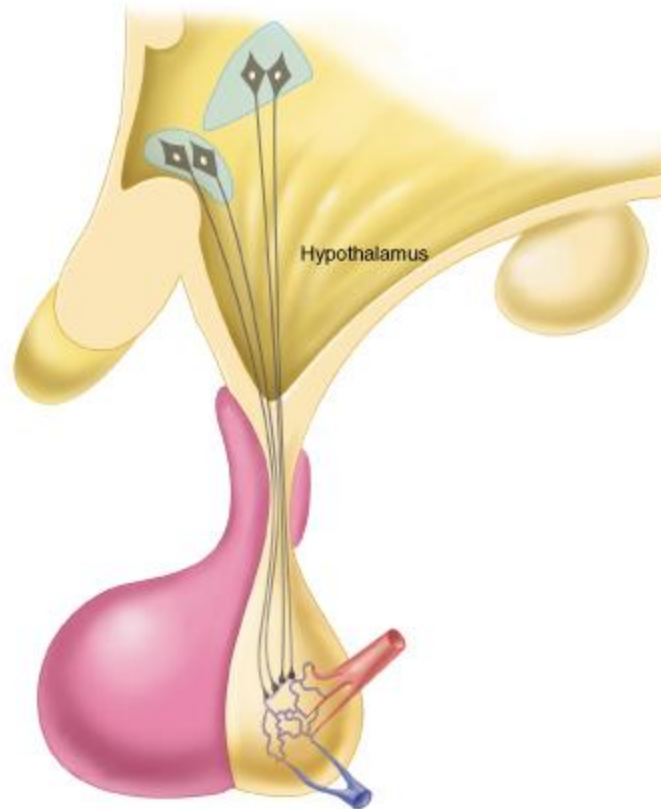
Neurohypophysis = posterior lobe (pars nervosa)



Neurohypophysis = Posterior Lobe

Axons from nuclei of hypothalamus

Hormones formed in hypothalamus, travel down axons, stored in axon terminals in posterior lobe



1) ADH = antidiuretic hormone

Regulated by osmoreceptors of hypothalamus

Functions

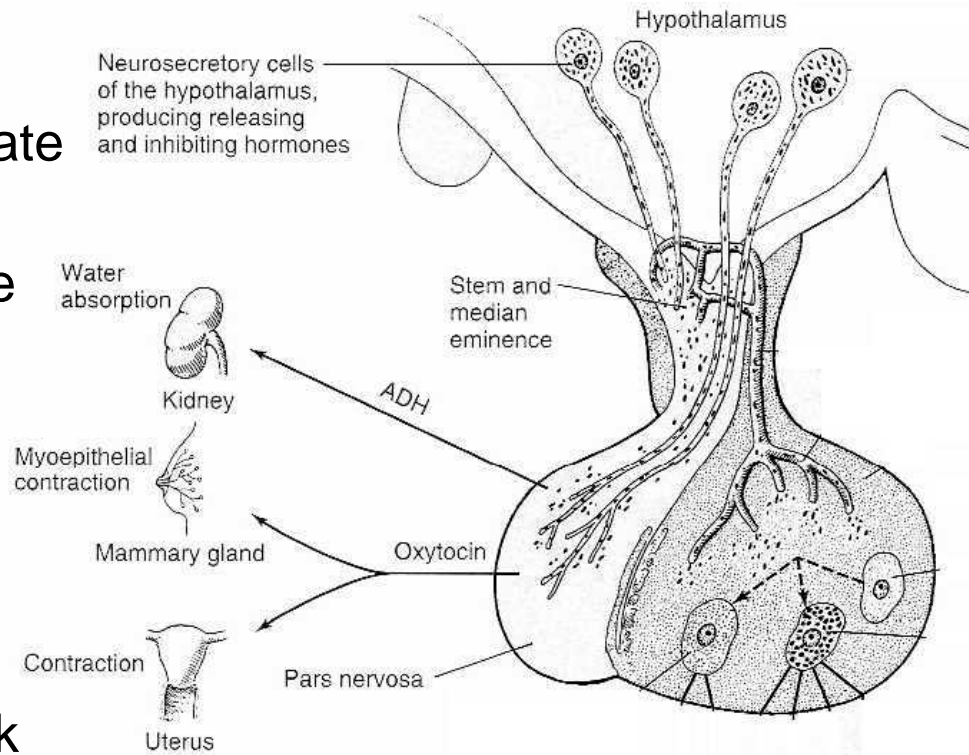
- 1) Increase reabsorption of water at **kidney** to regulate plasma osmolarity
- 2) Vasoconstrict to increase blood pressure

2) Oxytocin

Regulated by sensory input

Contraction of

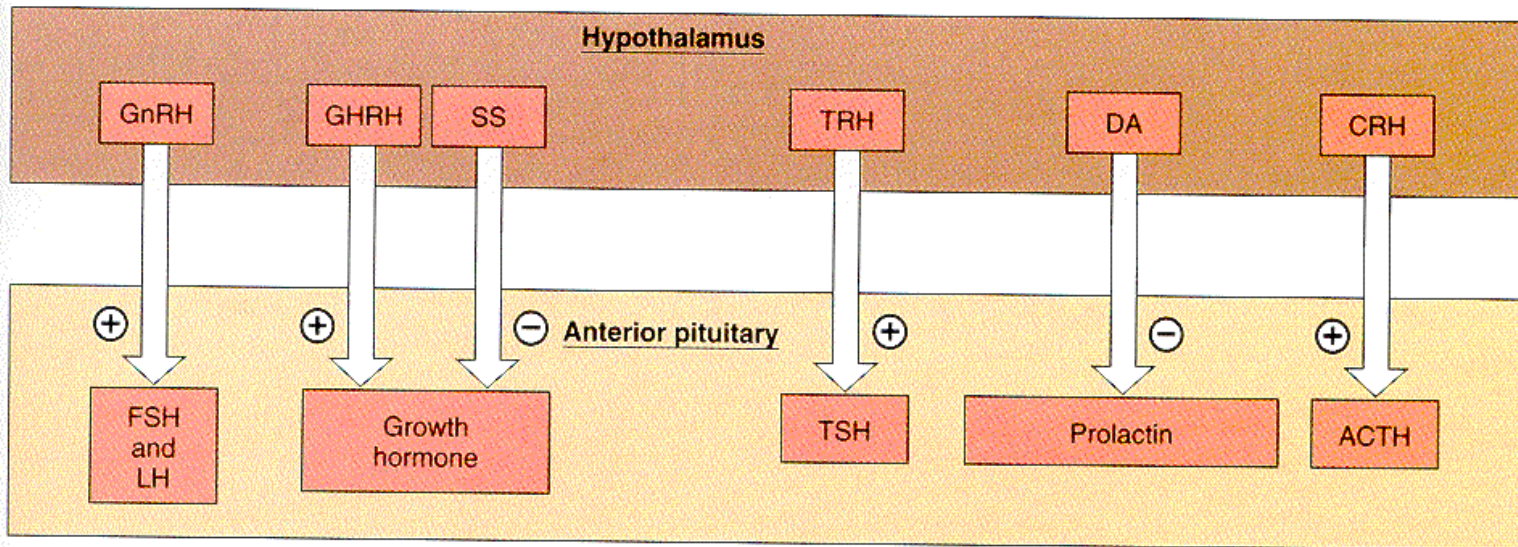
- 1) Myoepithelial cells of **mammary gland** for milk letdown
- 2) Smooth muscle of **uterus** for parturition (delivery)
- 3) “Trust”, “Love” hormone



Hypothalamus controls activity of anterior pituitary:

Hypothalamic secretions serve as **releasing factors and inhibiting factors** for secretions of the anterior lobe

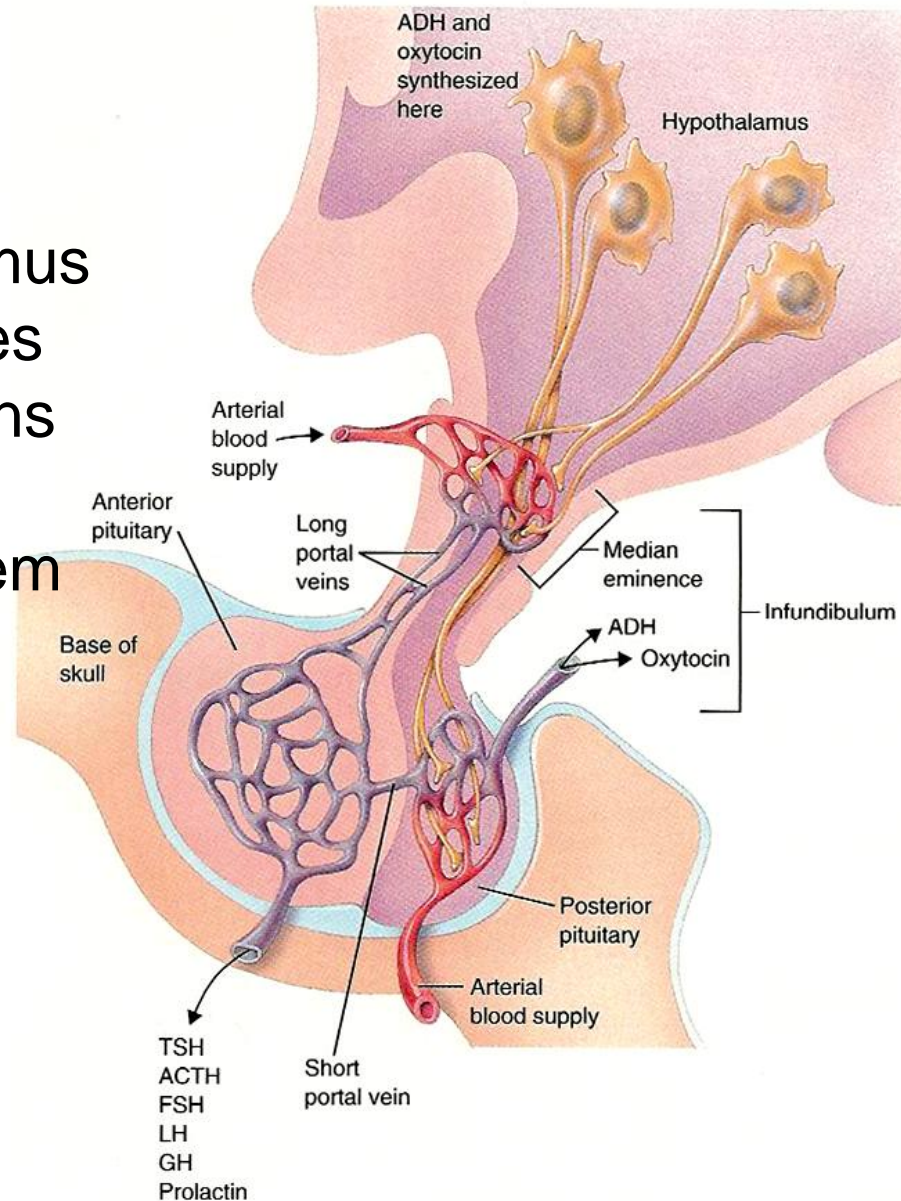
GHRH, GHIF, dopamine (inhibit PRL), GnRH (stimulate FSH & LH), ACRH



Adenohypophysis = Anterior Lobe

Hypothalamic control via
venous portal system

Capillaries of hypothalamus
> portal veins > capillaries
of anterior pituitary > veins
to heart = hypothalamo-
hypophyseal portal system

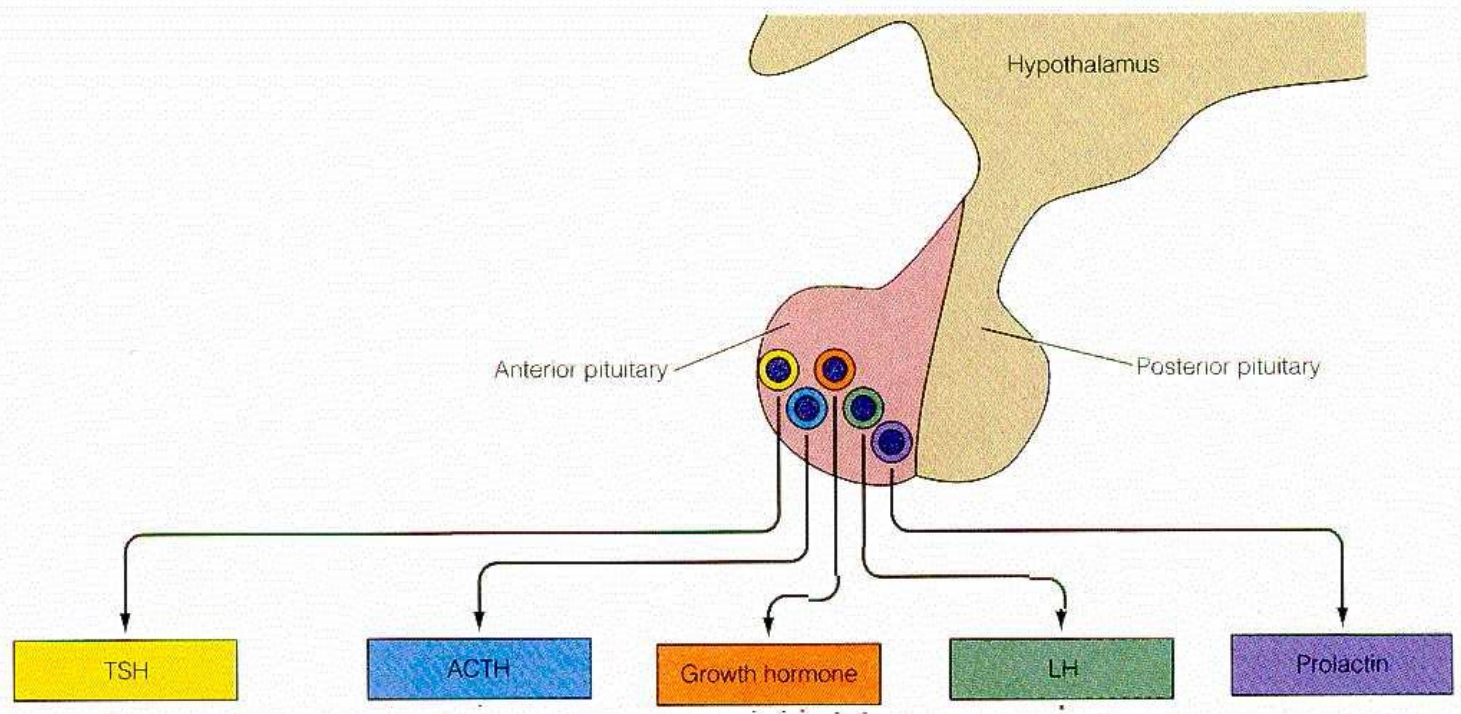
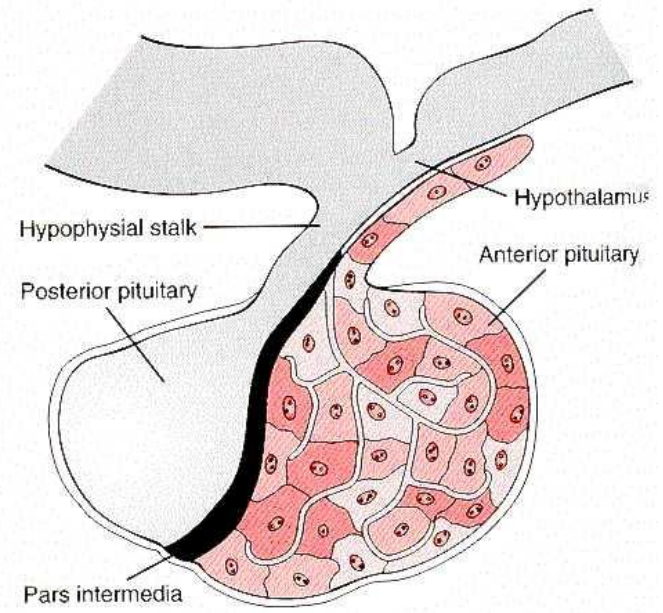


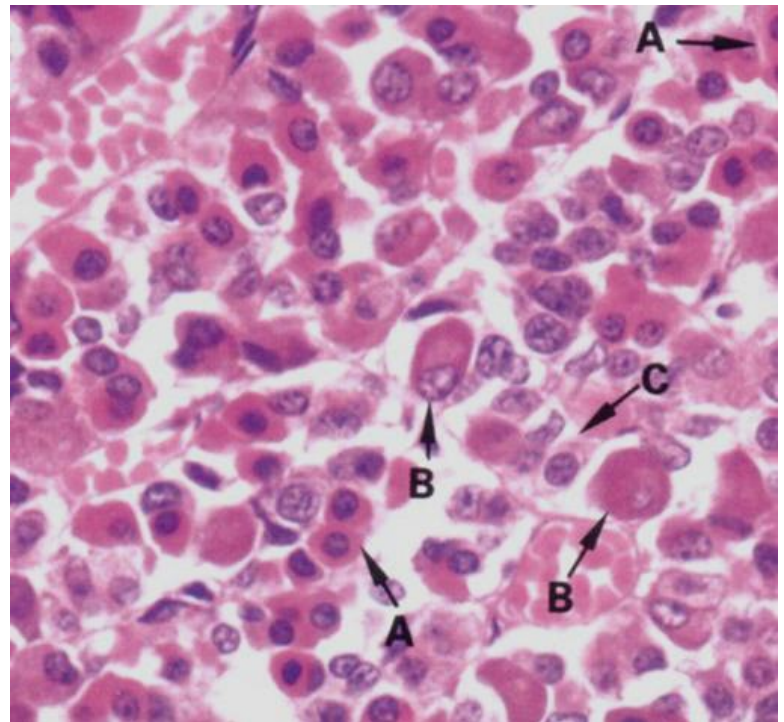
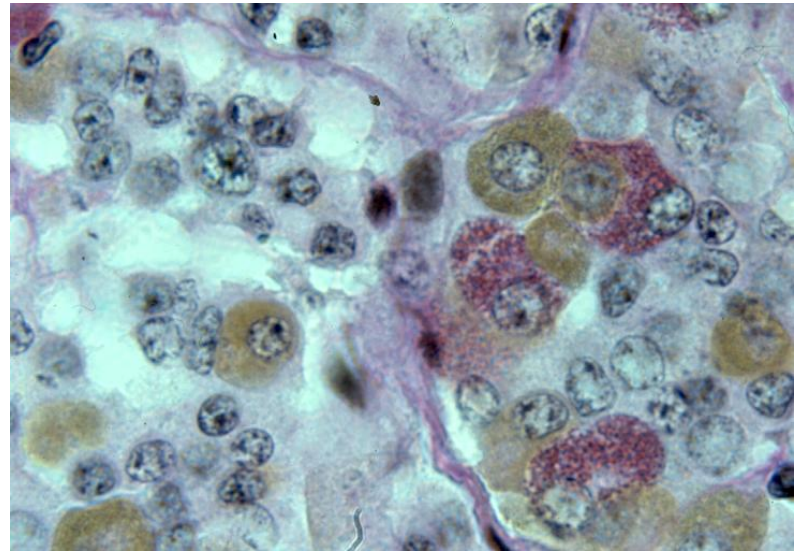
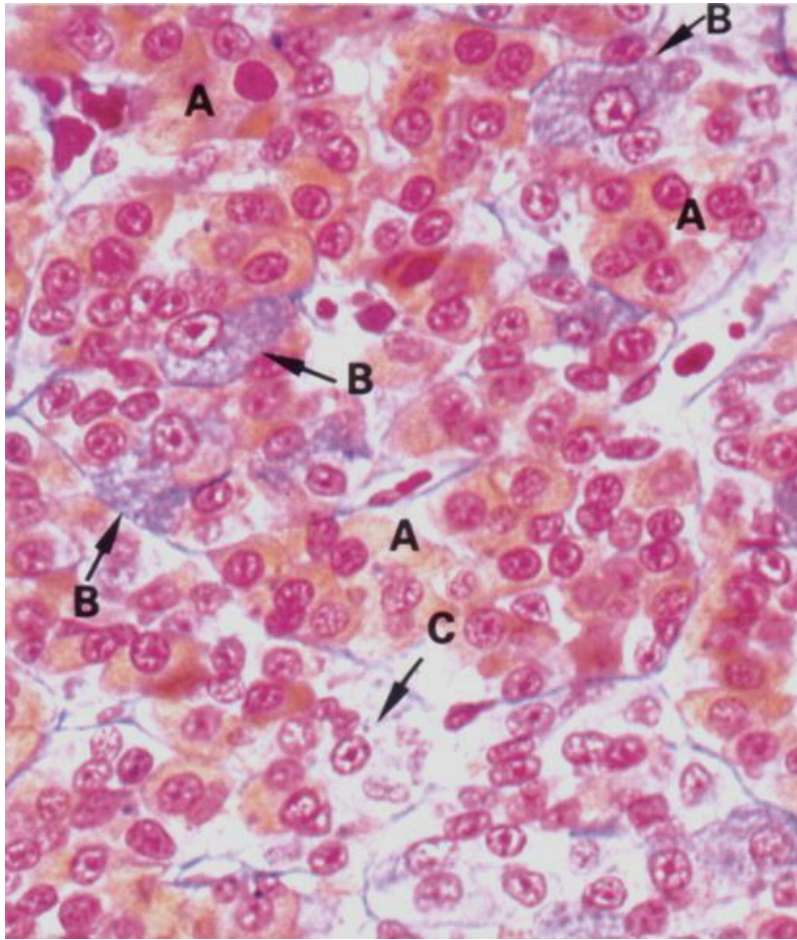
3 cells

1) Acidophils

2) Basophils

3) Chromophobes





Acidophils

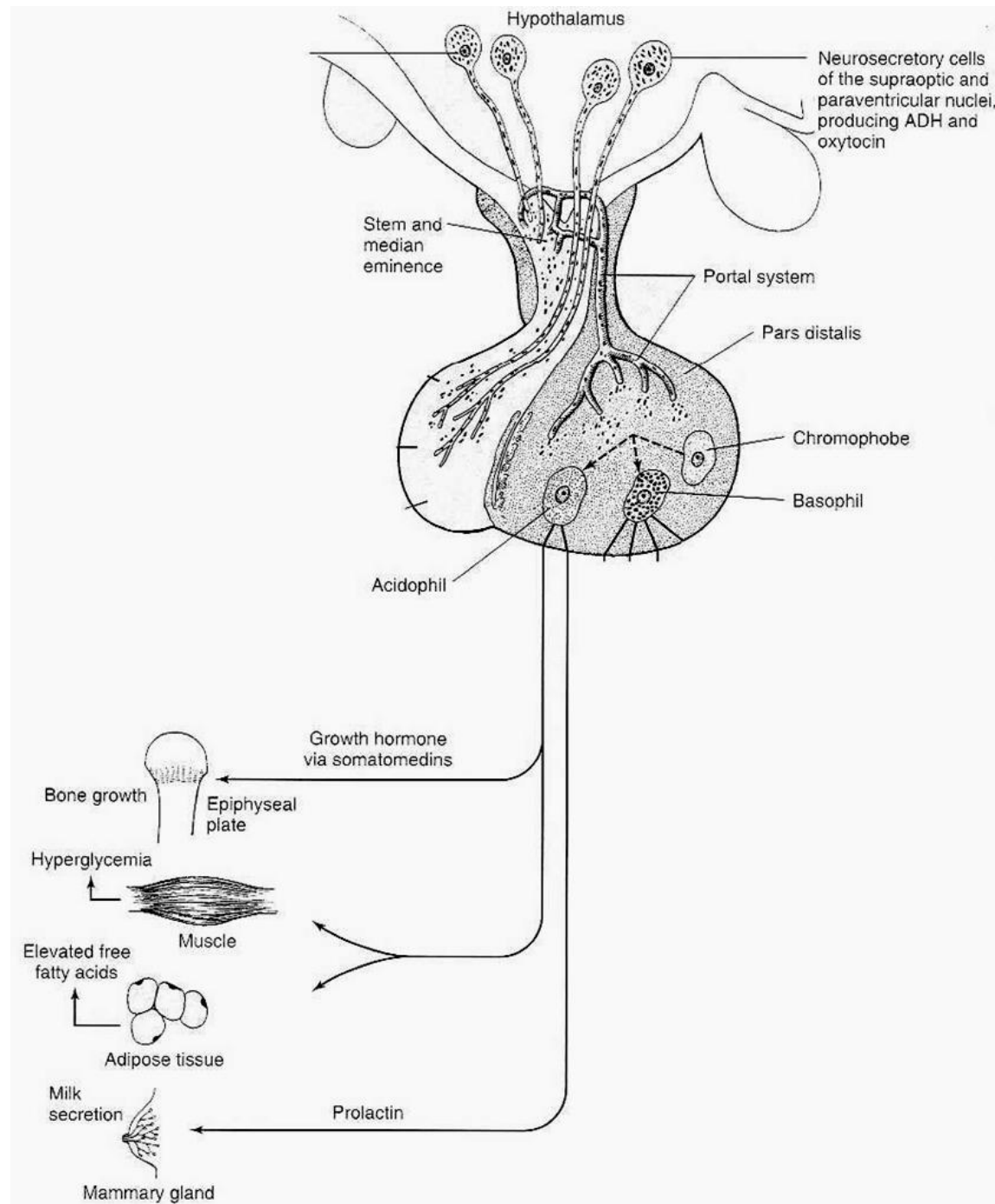
GH = Growth hormone

Regulate growth and metabolism (anti-insulin effect)

PRL = Prolactin

Milk synthesis and secretion

Chromophobes = empty cells



Basophils

Secrete series of hormones which regulate other endocrine glands

ACTH = **adrenocorticotrophic hormone**

Regulates adrenal cortex

TSH = **Thyroid stimulating hormone**

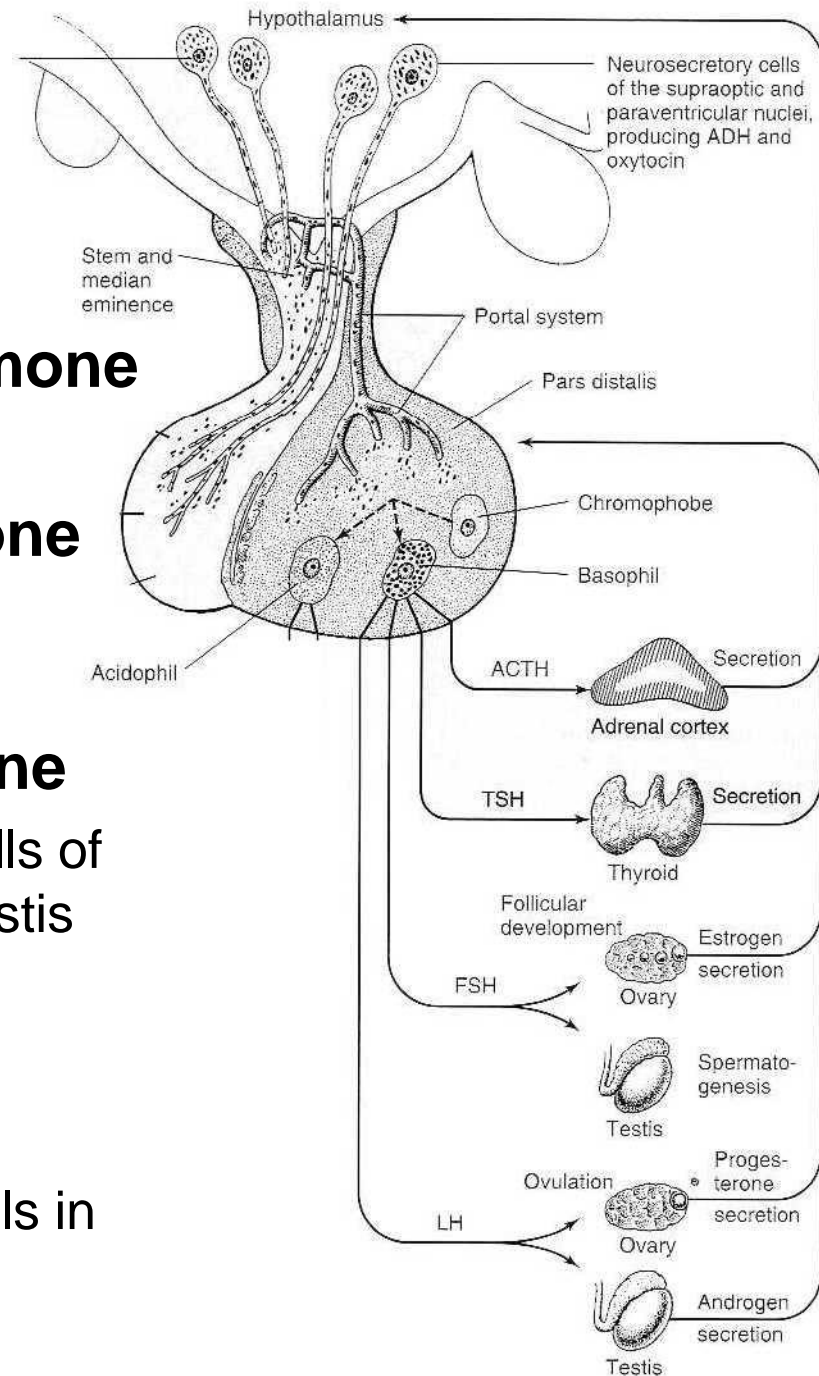
Regulates production and release of thyroxin from thyroid gland

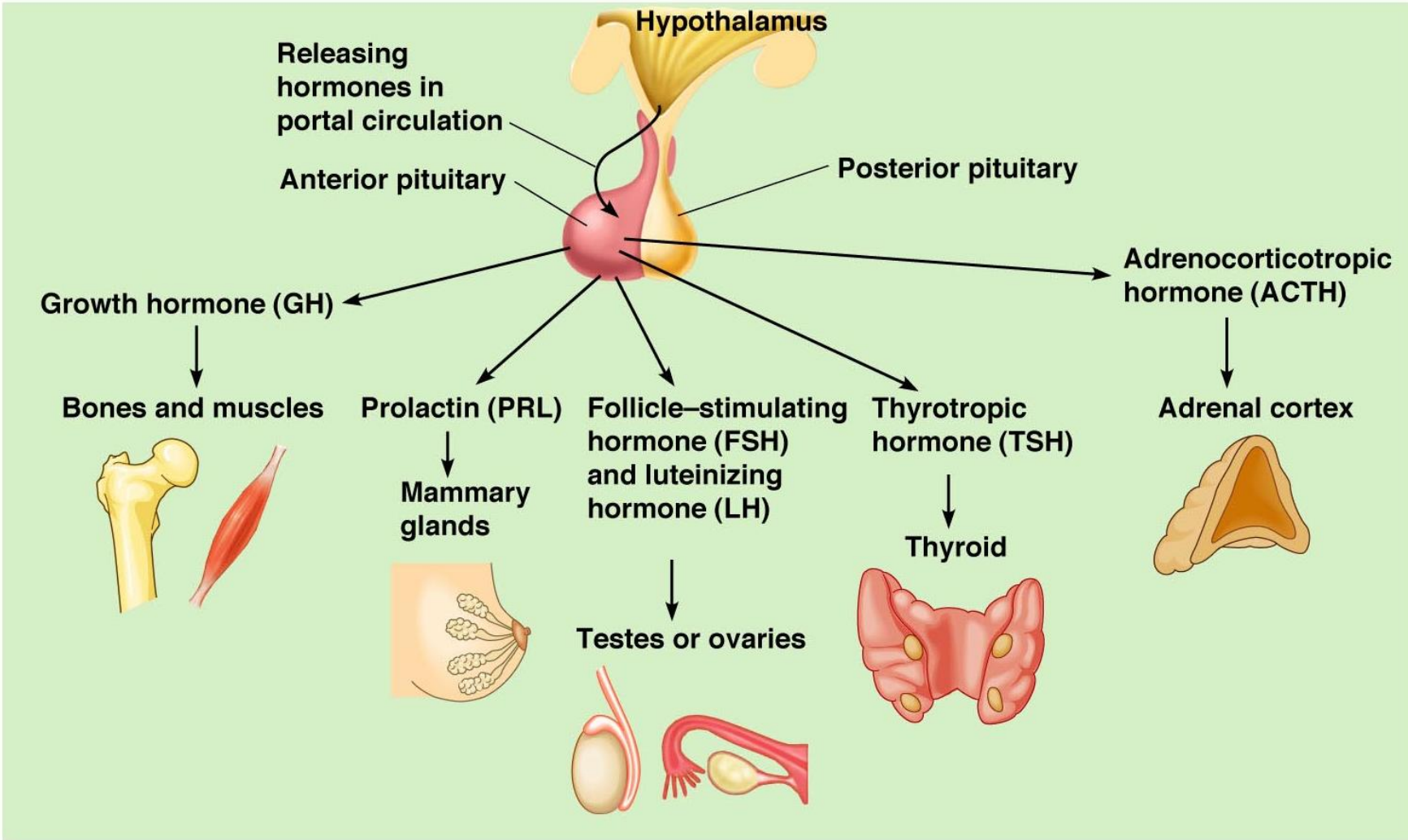
FSH = **Follicle stimulating hormone**

Regulates development of follicular cells of ovary, & seminiferous tubules of the testis (sites of gametogenesis)

LH = **Luteinizing hormone**

Regulates ovulation & development of corpus luteum in ovary & interstitial cells in testis (sites of hormone synthesis)





Robert Wadlow; 8'11"



Sultan Kösen; 8'1"; 8'3", 2012





Wadlow weighed a maximum of 435 lbs

Tallest Women

Zeng Jinlian : 8' 1.75"; died 1982 at 18

Jane Buford: 7'11"; died 1922 at 27

Yao Defen: 7'8"; born 1972

Sandy Allen: 7'7.75" ; died 2008 at 53

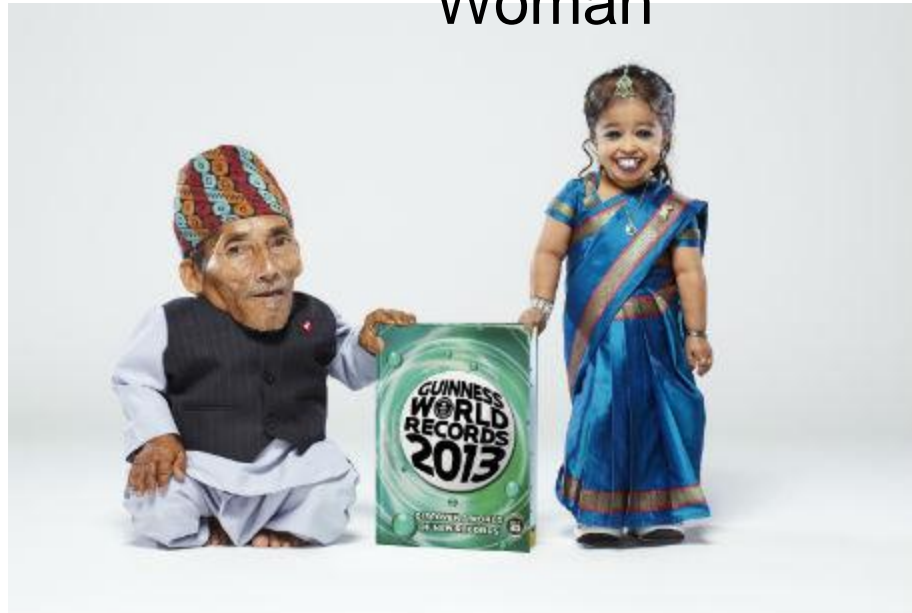


Acromegaly



FIGURE 17.7 *An individual with acromegaly.* This condition results from hypersecretion of growth hormone in the adult. Notice the enlarged jaw, nose, and hands. Left to right, the same person is shown at age 16, age 33, and age 52.

World's Shortest Man & Woman



Male: Chandra Bahadur Dangi,
72, 21.5"

Female: Jyoti Amge, 18, <25"

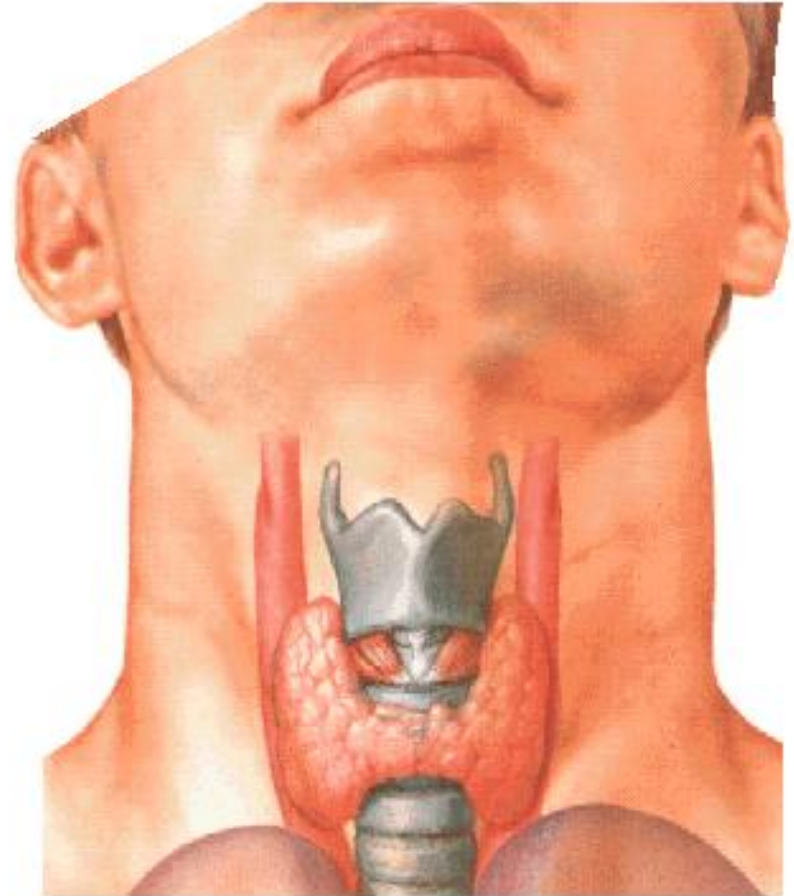
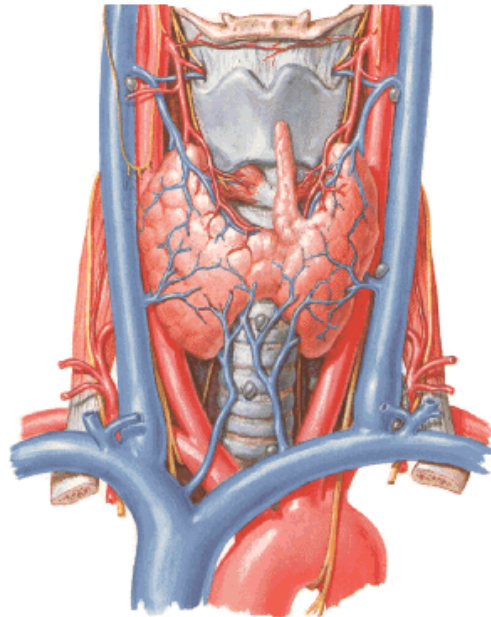
Book: 12"

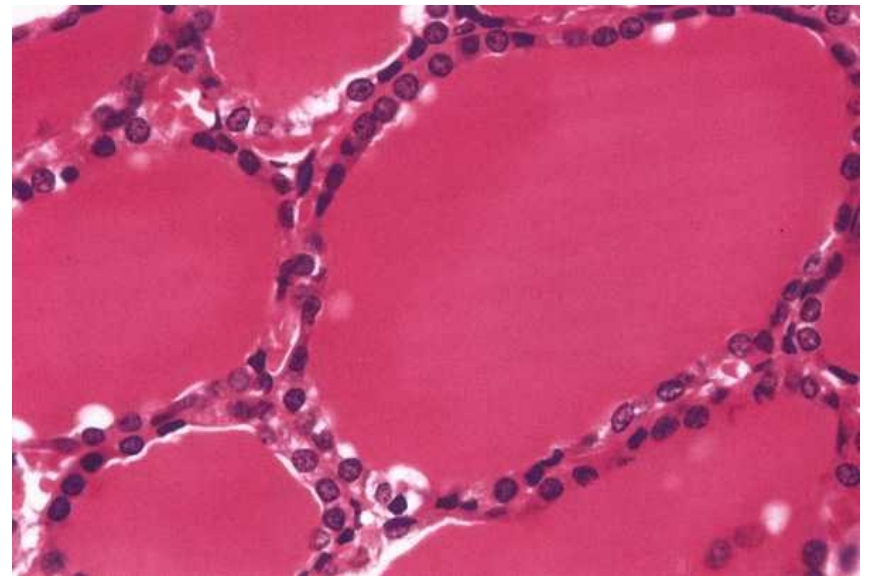
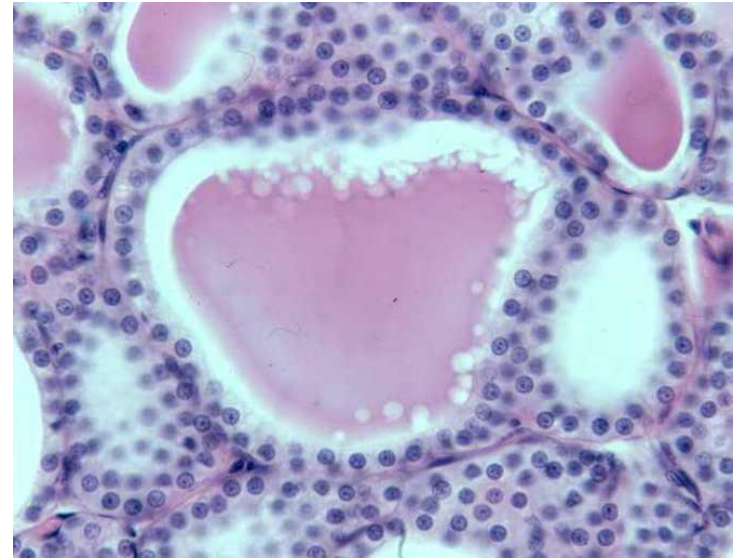
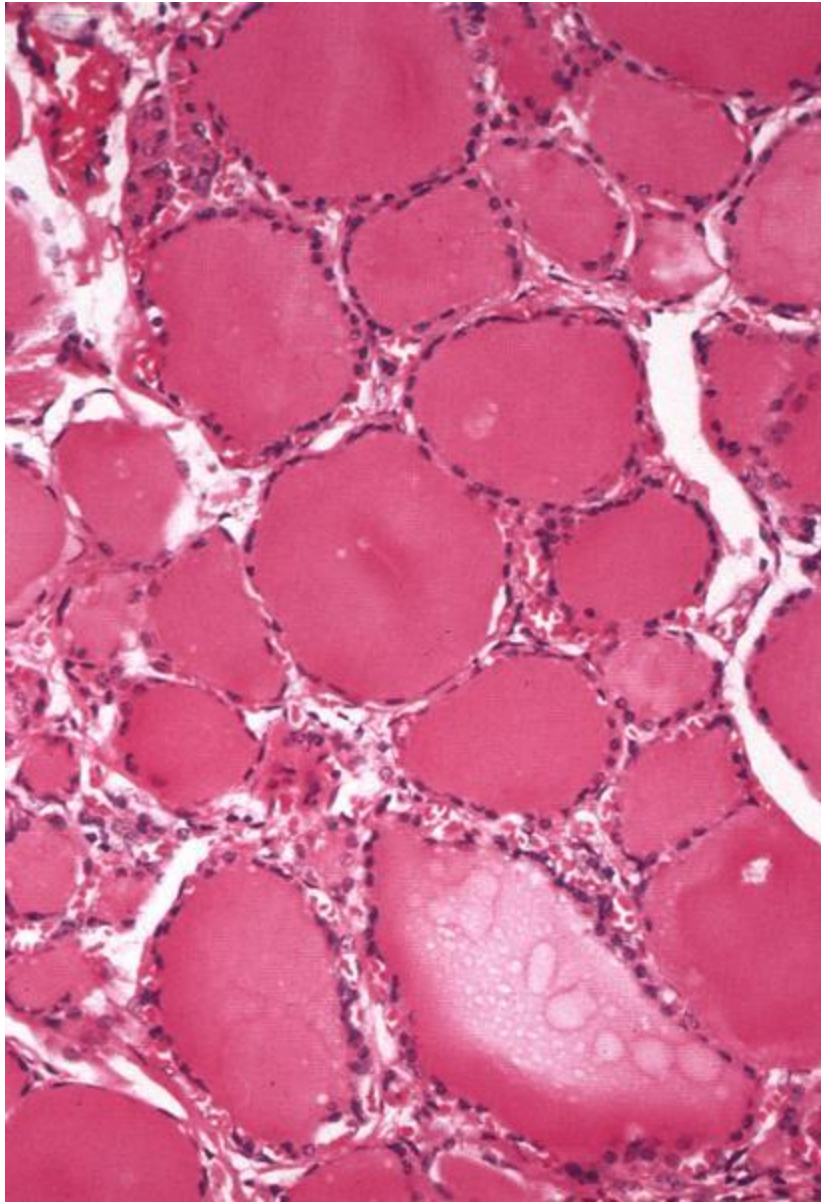
Thyroid Gland

Largest endocrine gland, 20 to 30 grams

2 lobes – overlap junctions of larynx and trachea

Connected anteriorly by an isthmus; pyramidal lobe sometimes



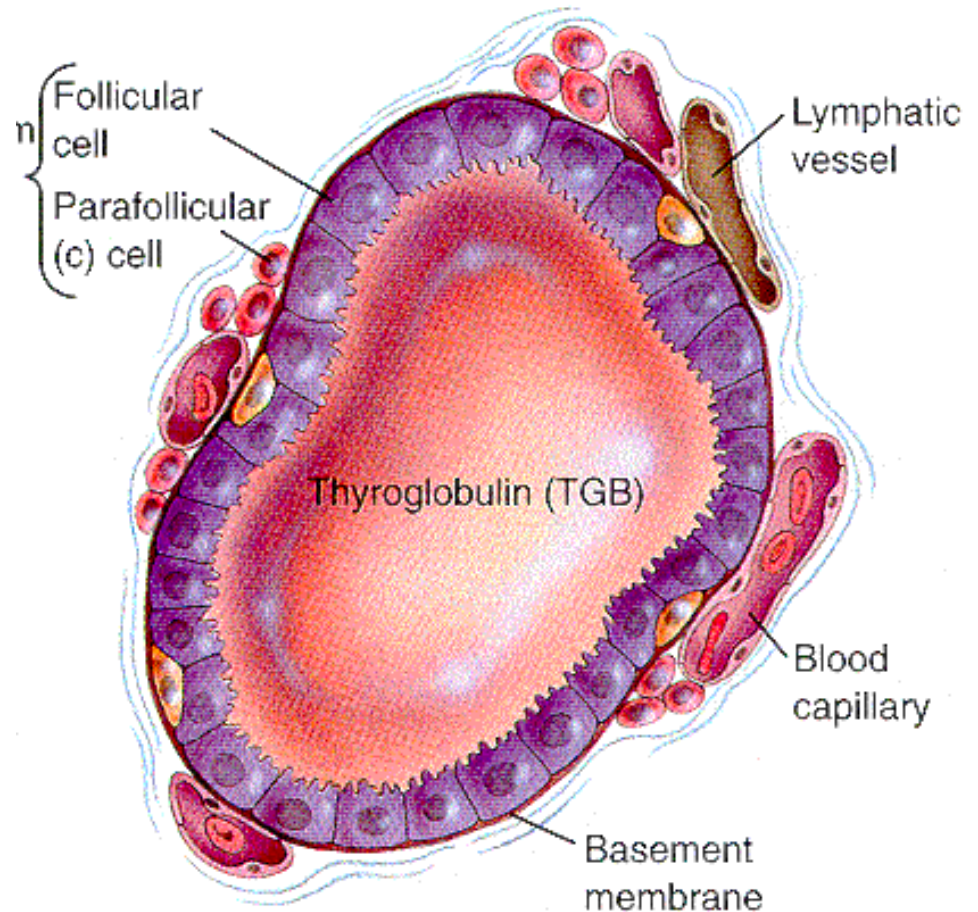


Structure

C cells = parafollicular cells

Clusters of light cells found between follicles

Secrete calcitonin



Thyroid Gland Secretions

Thyroid hormone

Increases **metabolic rate**

Influences mental acuity, and growth & development of CNS, and of tissues in general

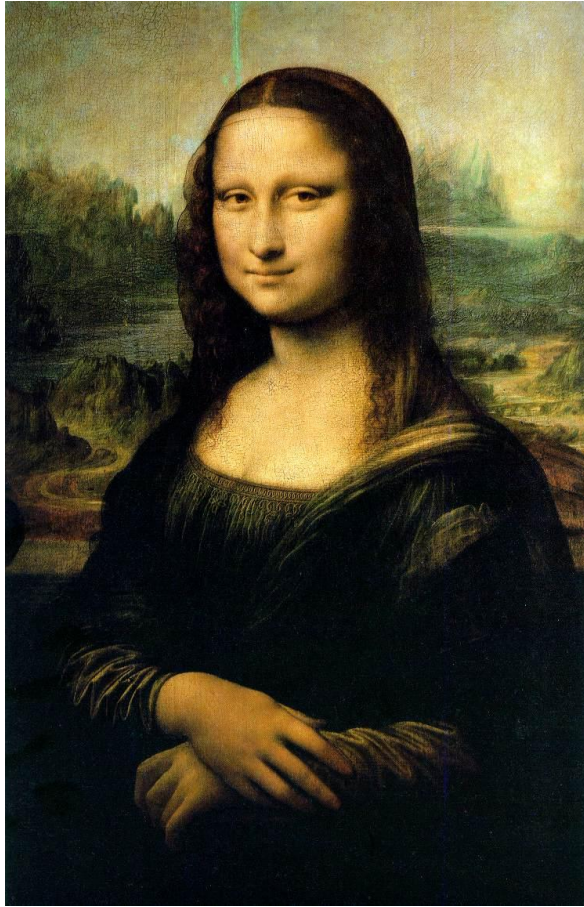
Calcitonin

Decreases plasma calcium mainly by decreasing bone reabsorption and increasing bone deposition

Goiter



Thyroid Gland

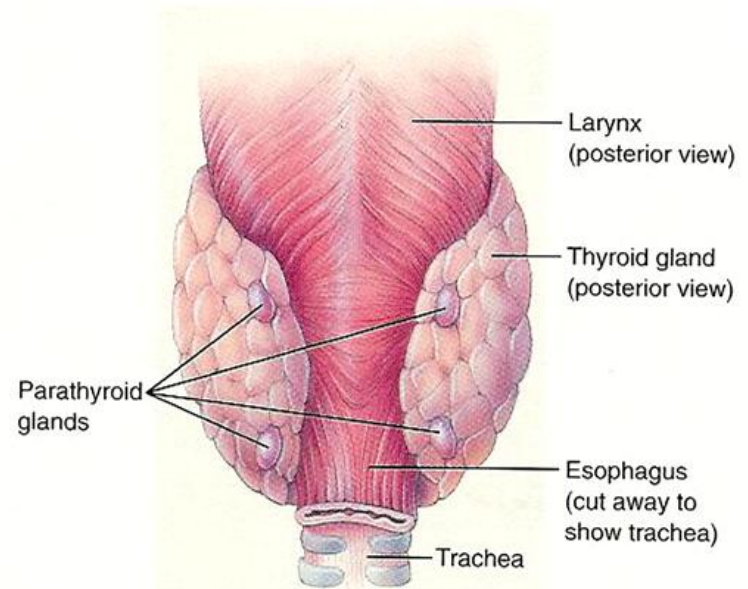
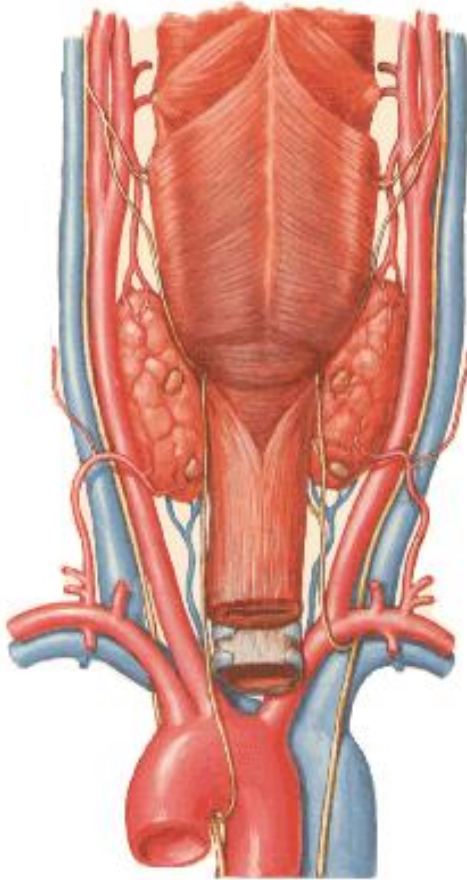


Exophthalmos



Parathyroid glands

4 small glands located on dorsal aspect of lobes of thyroid gland

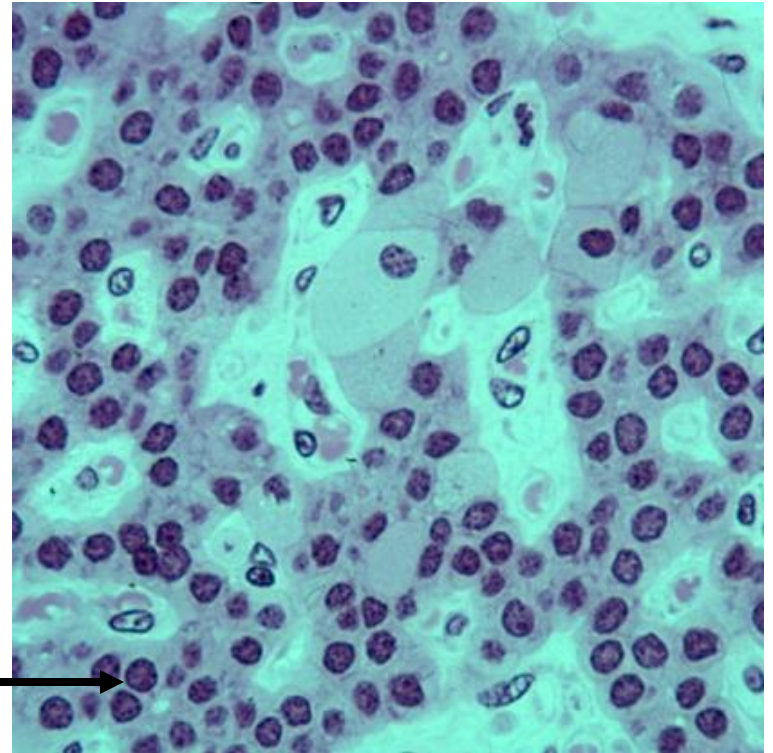


Parathyroid hormone

Releases in response to decreases plasma calcium

Increases plasma calcium by

- increasing bone reabsorption and decreasing bone deposition
- increasing GI absorption of calcium
- increasing reabsorption of calcium at the kidney

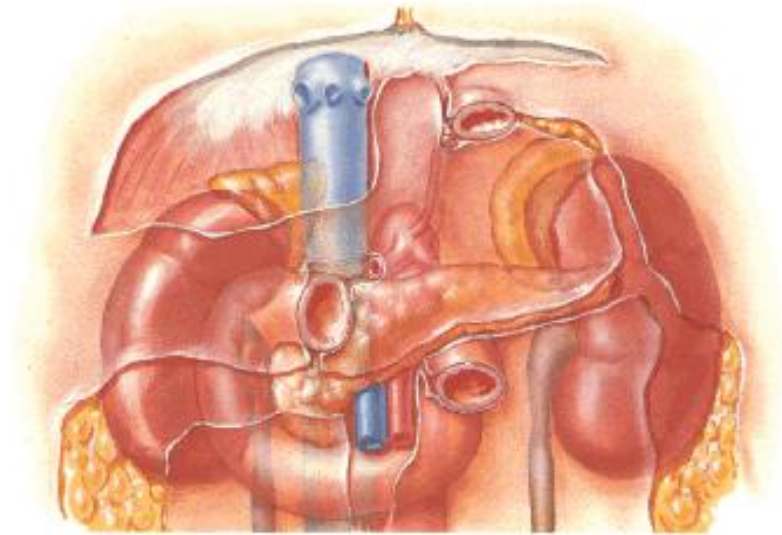
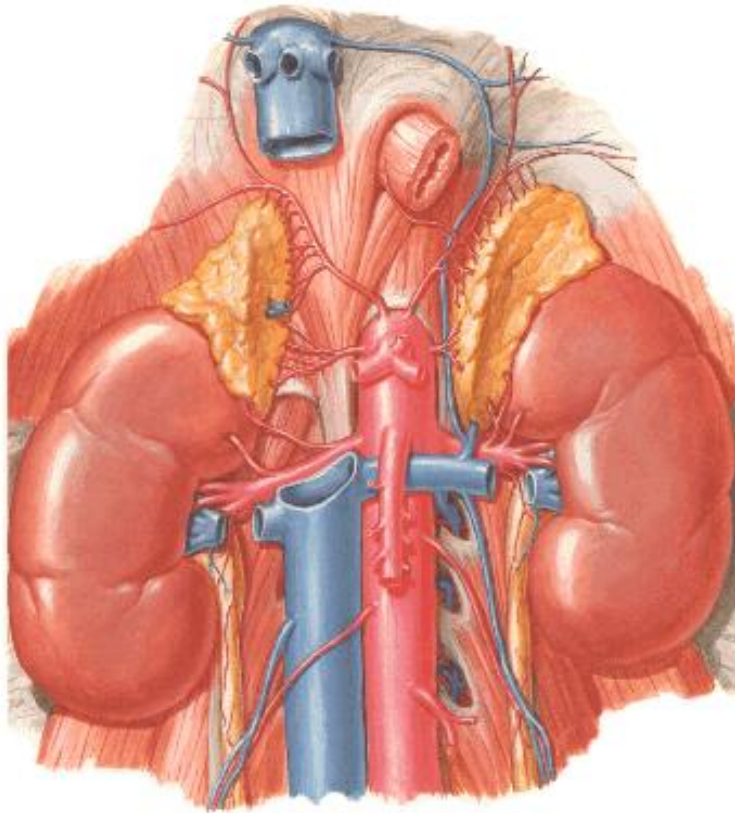


Decreased plasma calcium causes tetany (muscle spasms) due to increased excitability of neurons and muscles

Adrenal Glands (Suprarenal Glands)

Paired glands

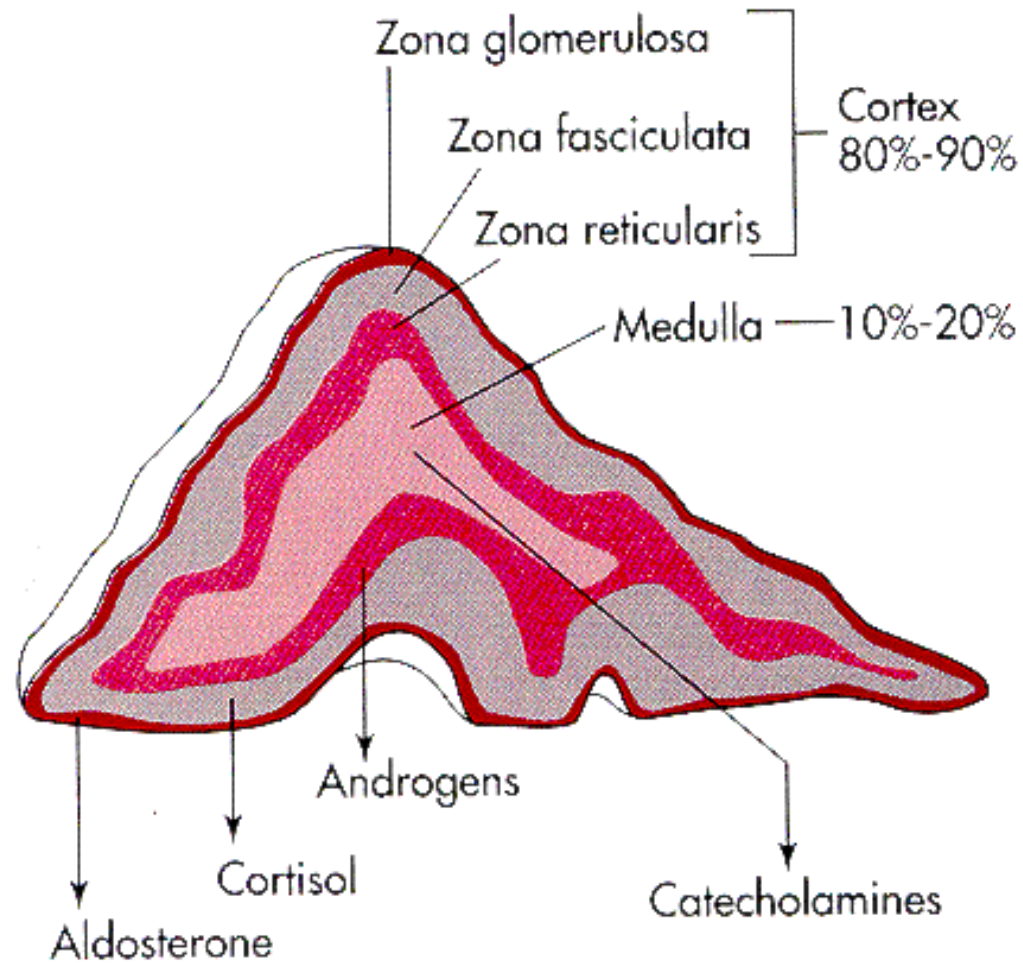
Located on superior surface of kidneys



Structure:

Cortex

Medulla



Adrenal Medulla

Basically a **sympathetic ganglion** converted to endocrine function

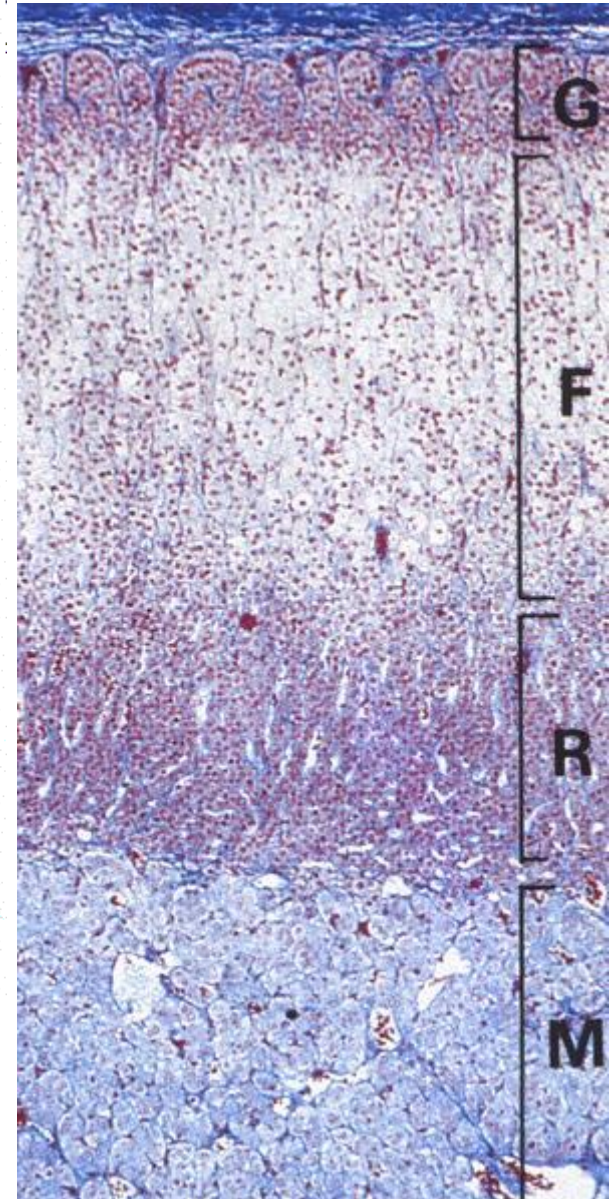
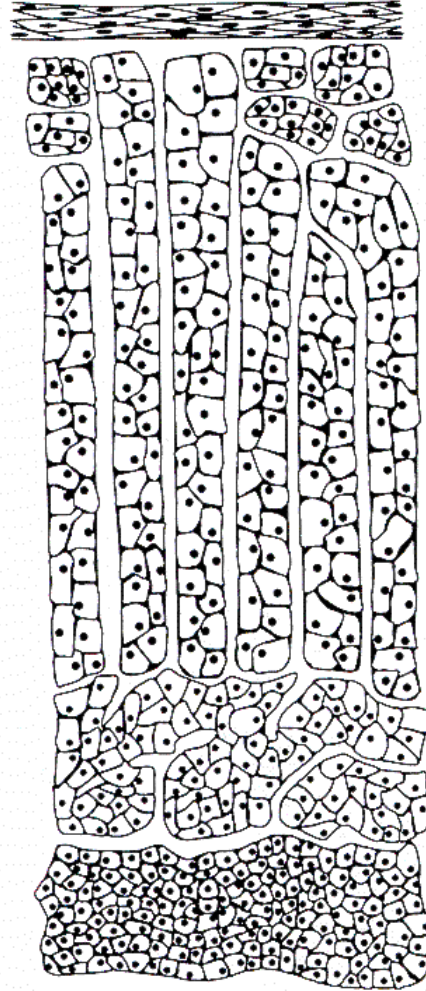
Secretes **epinephrine and norepinephrine** (the neurotransmitters of the sympathetic system)

Same actions as **sympathetic NS** activity - Increase heart rate; Vasoconstriction; Increases blood pressure; Increased blood sugar; Decreased intestinal activity

Adrenal Cortex

3 layers

- 1) Zona glomerulosa
- 2) Zona fasciculata
- 3) Zona reticularis



Adrenal Cortex Secretions

- **Zona glomerulosa:** secretes mineralocorticoid (aldosterone) ; regulates blood pressure and plasma volume
- **Zona fasciculata:** secretes glucocorticoids (cortisol) and some sex steroids; regulates metabolism, anti-insulin effects; ACTH target
- **Zona reticularis:** secretes sex steroids and some glucocorticoids; weak sex effects

Cushing's Syndrome

Normal



Cushing's



Addison's Disease



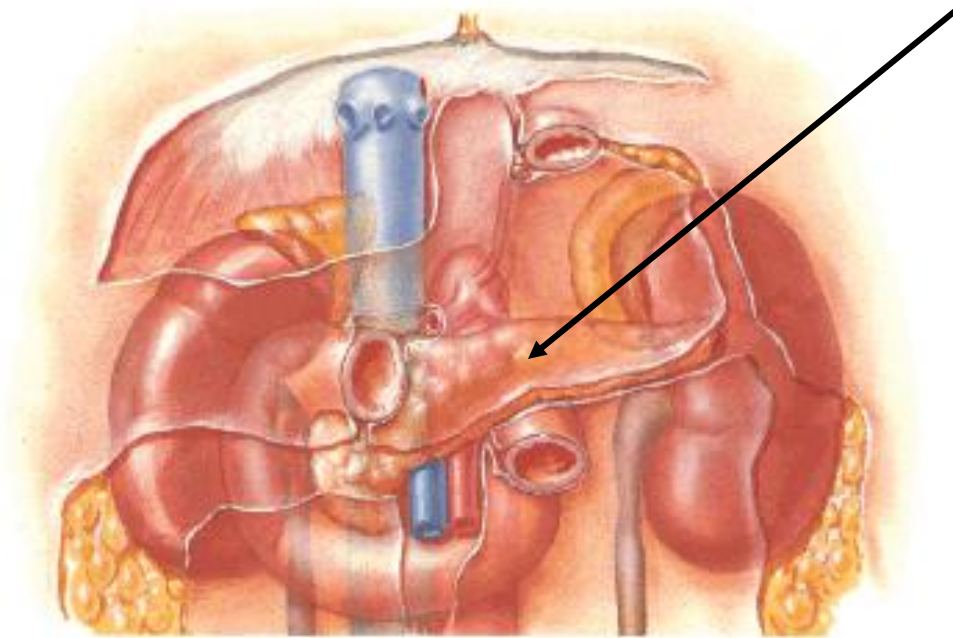
Hyperandrogenism

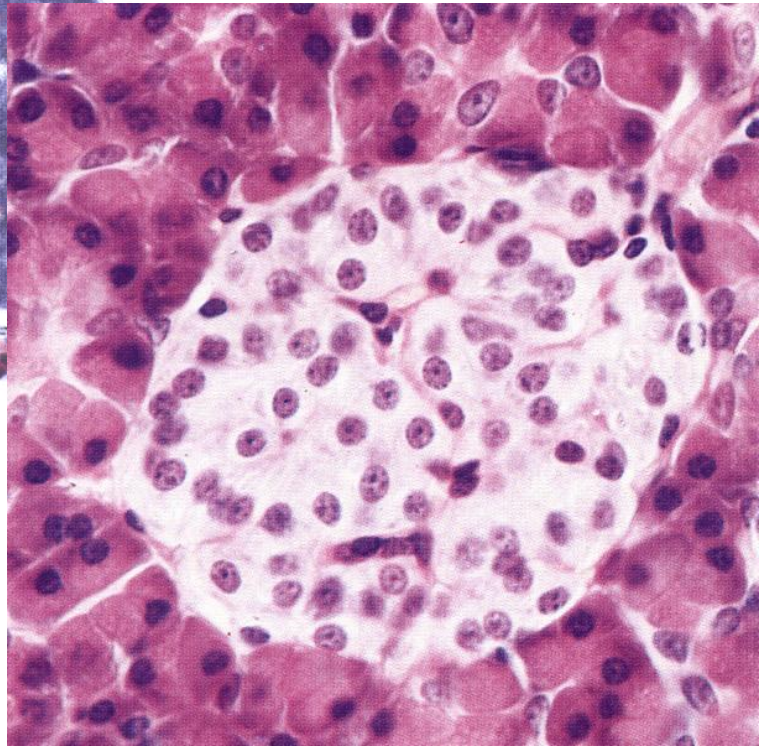
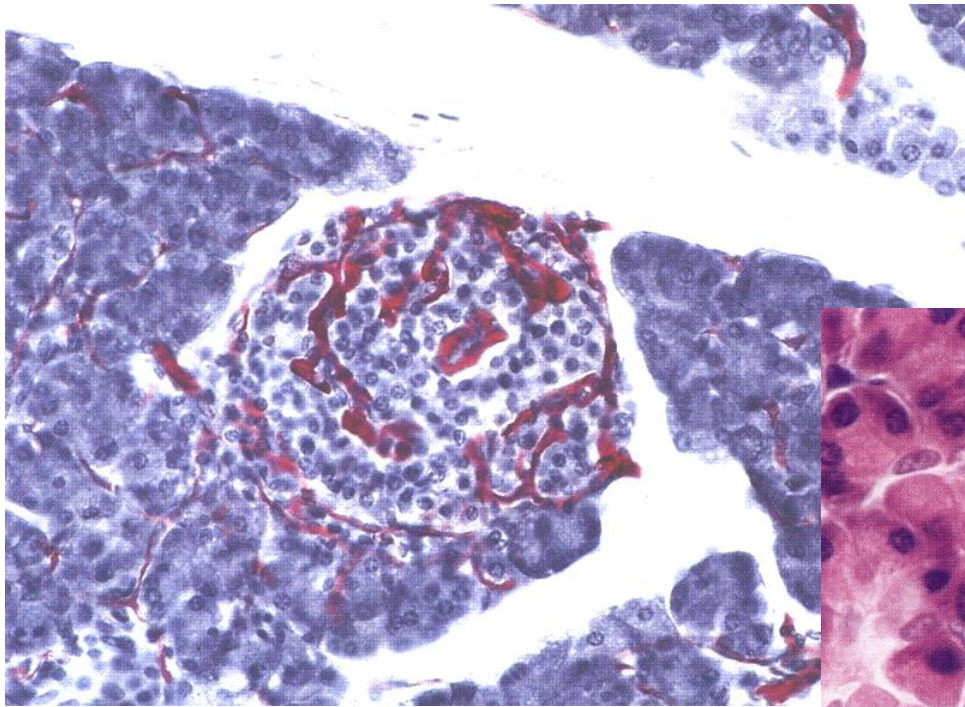


Pancreas

Islets of Langerhans

Secrete **insulin and glucagon** in response to changes in plasma glucose levels

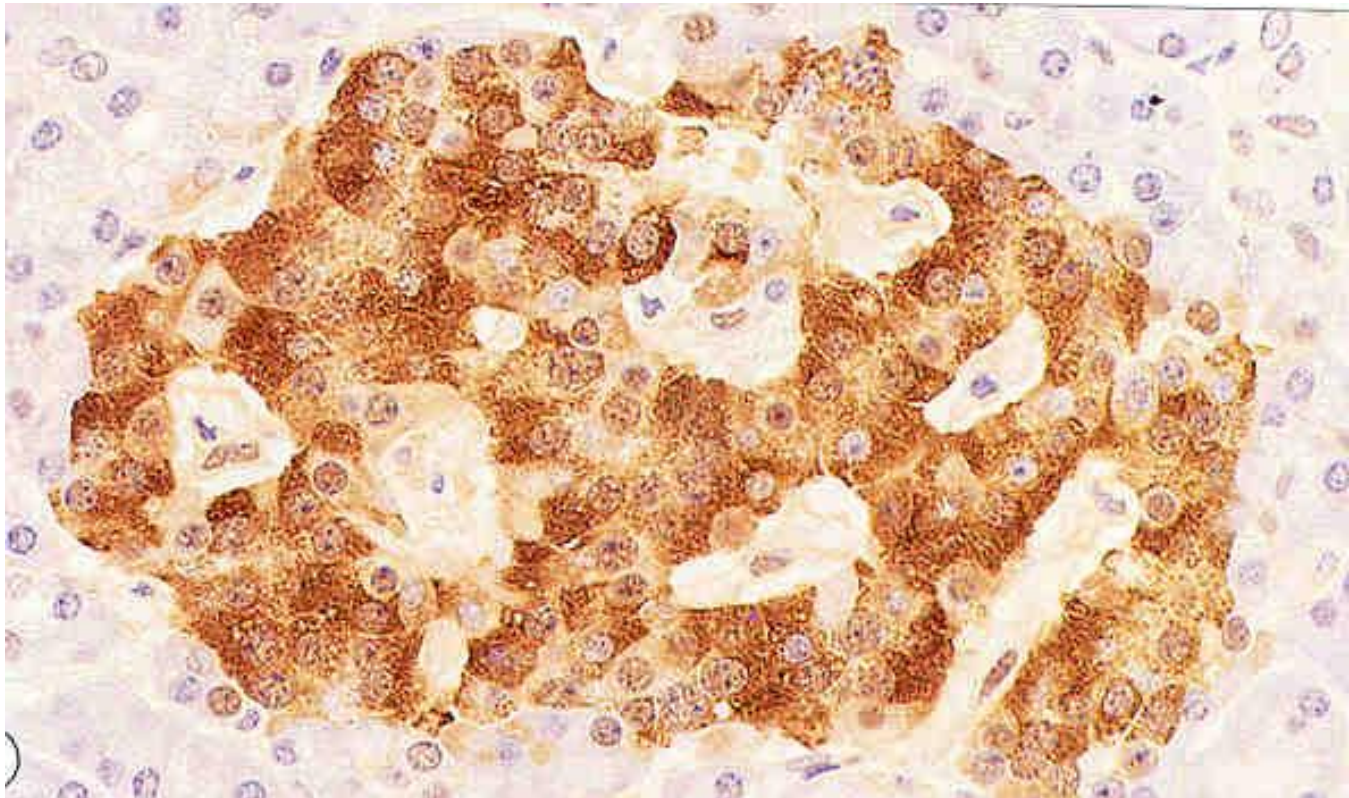




Beta (B) cells

Secrete insulin

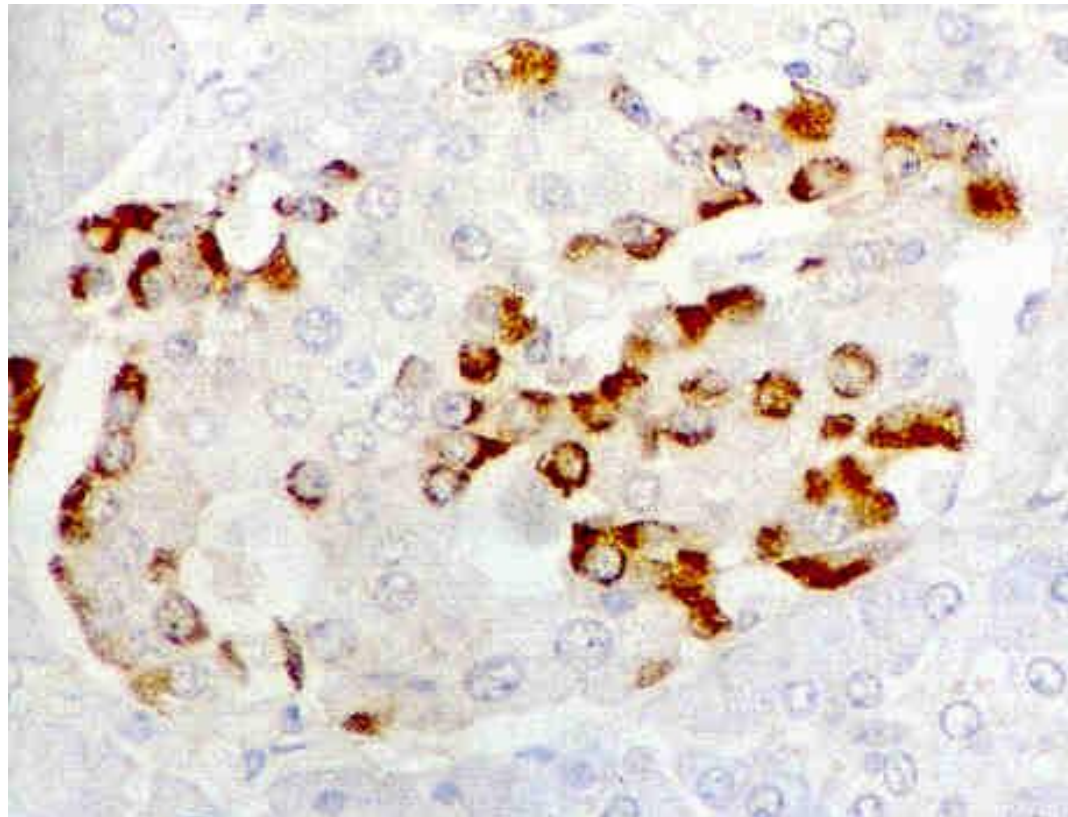
Decreases plasma glucose by increasing movement of glucose into cells and its metabolic utilization; inhibits metabolism of lipids



Alpha (A) cells

Secrete **glucagon**

Increases plasma glucose by increasing synthesis and release of glucose by the liver



Other Endocrine Glands

Gonads

Ovaries and testis secrete sex steroids (estrogen, progesterone, testosterone)

Thymus

Thymosin – lymphocyte maturation

Pineal

Melatonin

Placenta

hCG, estrogen, progesterone, hPL

Heart

atrial natriuretic factor

GI tract

Various hormones regulate GI enzyme and bile secretion & motility