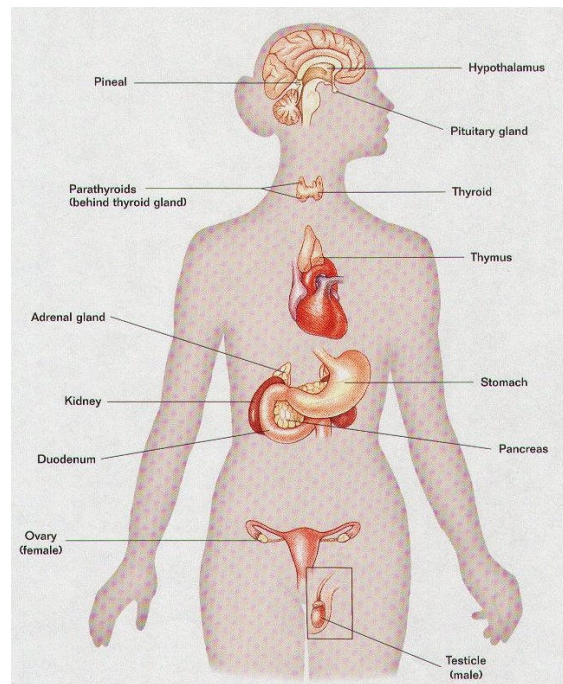


The Endocrine System



Glands that secrete hormones

- 1) **endocrine** glands secrete their product directly into bloodstream
- 2) **exocrine** glands secrete their product through a duct (sweat, sebaceous, salivary, etc.)

What are hormones?

Molecules produced in an endocrine gland and secreted into the bloodstream to cause an effect in a specific organ/tissue

Specific => cells possess receptor for hormone

Effect => a change within target cells to produce a specific physiological result

hormones are involved with the regulation of:

- 1) total body metabolism
- 2) growth
- 3) reproduction

Chemical classification of hormones

- 1) **catecholamines** - water **soluble** (eg. adrenaline/noradrenaline)
- 2) **polypeptides/glycoproteins** - water **soluble** (eg. insulin, ADH)
- 3) **steroids** - **insoluble** in water (estrogens, androgens, cortisol)
T4 and T3 (thyroxine) also **insoluble**, but not steroids

Manufacturing hormones in endocrine glands

prohormone: precursor structure altered to hormone form prior to reaching target cell
eg. proinsulin converted to insulin within pancreatic cells

prehormone: precursor structure altered to hormone form after reaching target cell eg.
T4 converted to T3 (thyroxine) within target cell

Hormone Interactions

A tissue/organ is often affected by multiple hormone types i.e. multiple receptor types present.

These hormones interact to produce a specific result within the tissue/organ.

Synergistic

Permissive

Antagonistic interactions

a) synergistic: 2 or more hormones work together to produce a specific result

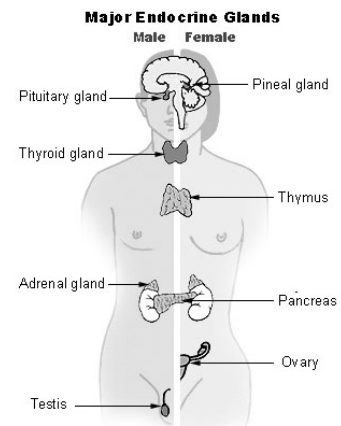
- 1) additive - adrenaline and nor-adrenaline on heart-rate.
- 2) complementary - FSH and testosterone on spermatogenesis.

b) permissive: 1 hormone enhances the effectiveness of a second hormone to produce a specific result.

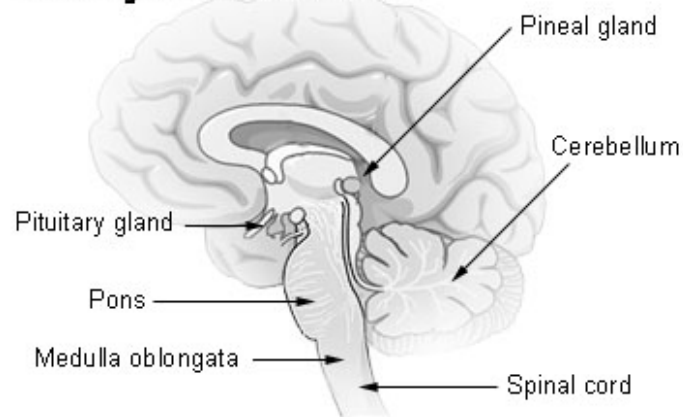
Estrogen and progesterone on uterine development

c) antagonistic: 2 hormones produce opposite results.

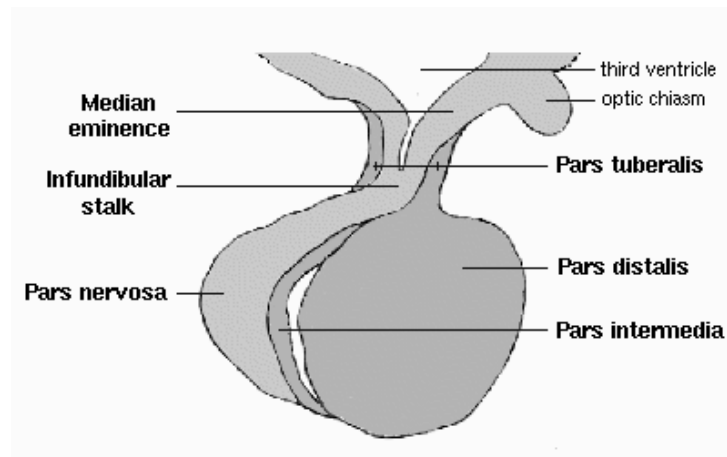
Glucagon and insulin on blood sugar levels.



Pituitary and Pineal Glands



Pituitary Gland



The Primary Endocrine Glands

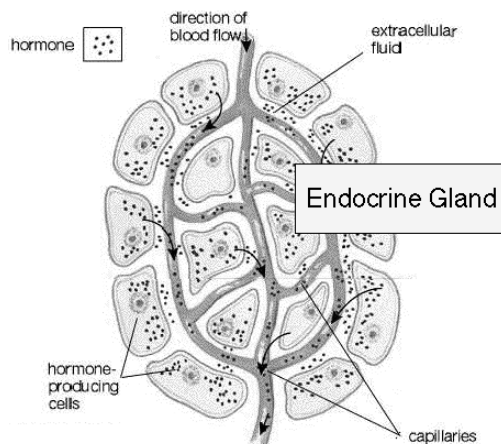
The Pituitary Gland (or hypophysis)

- 1) anterior lobe = **adenohypophysis**
produces and secretes 6 trophic hormones
 - i) Growth Hormone
 - ii) Thyroid Stimulating Hormone
 - iii) Adrenocorticotrophic Hormone
 - iv) Prolactin
 - v) Gonadotrophins: Luteinizing Hormone and Follicle Stimulating Hormone
- 2) posterior lobe = **neurohypophysis**
secretes 2 hormones produced by hypothalamus
 - i) Antidiuretic Hormone (Vasopressin)
 - ii) Oxytocin

The Adrenal Glands (or suprarenal glands)

consists of two distinct secretory regions:

- 1) outer renal cortex - secretes corticosteroids
regulated by the pituitary gland through the secretion of ACTH
 - a) **mineralcorticoids** - mineral balance regulate Na & K balance
eg. **aldosterone**
 - b) **glucocorticoids** - energy balance metabolism of organic molecules. eg. **cortisol**
 - c) **sex steroids** - reproductive function supplements gonads eg. **androgens** and **estrogens**
- 2) inner renal medulla - secretes adrenaline and noradrenaline
regulated by sympathetic nervous stimulation.

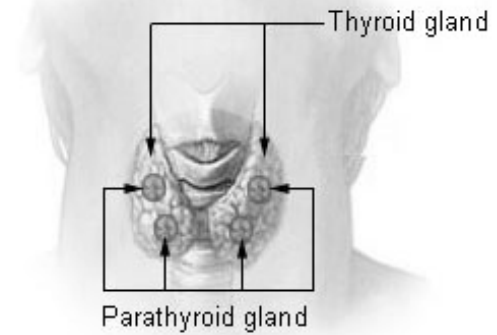


Thyroid and Parathyroid Glands

Thyroid and Parathyroid Glands

1) Thyroid gland

located inferior to larynx
secretes T4 (prehormone) and T3 (thyroxine)
regulate growth and development / BMR (basal metabolic rate)



2) Parathyroid glands

4 separate glands located on posterior of thyroid, superior and inferior positions.
secretes PTH (parathyroid hormone)
regulate blood Calcium

The Pancreas

Both endocrine and exocrine function
endocrine = insulin & glucagon from pancreatic islets
exocrine = digestive enzymes
Endocrine function:

- 1) **Glucagon** from alpha cells - **mobilizes stored energy reserves**
increase blood glucose concentration (glycogenolysis)
increase blood fatty acid/ketones concentration (lipolysis)
- 2) **Insulin** from beta cells - **stores excess food in body energy reserves**
decrease blood glucose and fatty acid concentrations (glycogenesis and lipogenesis)

Clinical Considerations

Disorders of the pituitary:

- 1) Abnormal growth hormone (GH) secretion (too much or too little)
in juveniles = **dwarfism** or **gigantism**
in adults = **pituitary cachexia**
- 2) Inadequate ADH secretion
diabetes insipidus

Disorder of the thyroid:

- 1) Inadequate secretion (hypothyroidism)
in juveniles = **cretinism**
in adults = **myxedema**
- 2) Excess secretion (hyperthyroidism)
Graves disease (Auto-immune disease)

- 3) Inadequate dietary intake of iodine
endemic goiter

Disorders of the pancreas

Diabetes mellitus

Type I = beta cells destroyed; therefore insulin deficient = **hyperglycemia**

Type II = decreased tissue sensitivity to insulin