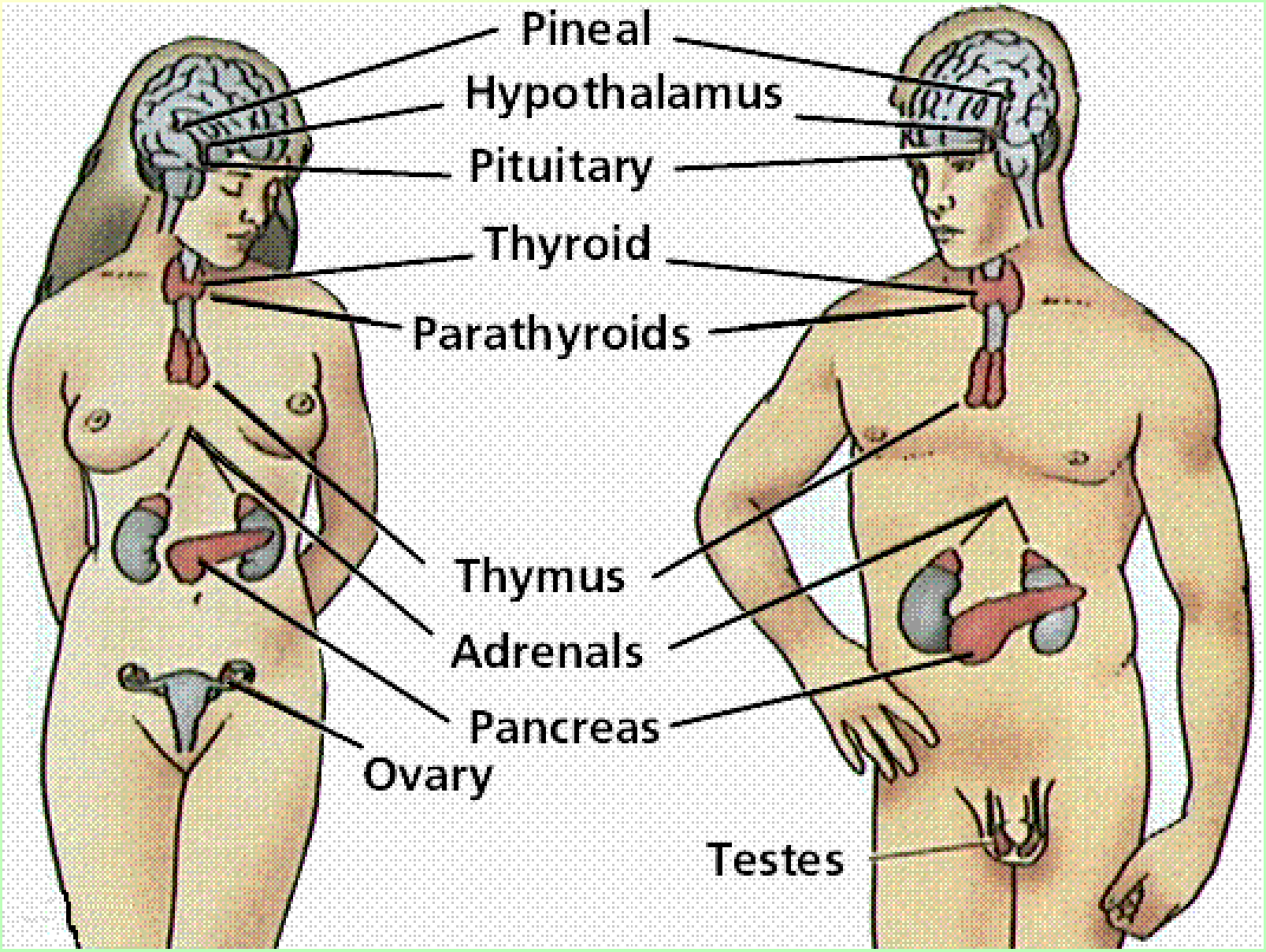
Endocrine System


Pineal
Hypothalamus
Pituitary
Thyroid
Parathyroids
Thymus
Adrenals
Pancreas
Ovary
Testes

Endocrine System

- A gland is any organ that produces a secretion
- 2 types: endocrine and exocrine

Endocrine:

•Organized groups of tissue that use materials from the blood to make hormones
•Ductless: hormones secreted directly into bloodstream as the blood circulates through the gland
•Secretions are carried to all areas of the body where they have a special influence cells, tissues and organs

Exocrine:

•Secretions from the glands must go through a duct which carries it to a body surface or organ
•Includes sweat, salivary, lacrimal and pancreas (acts as both endocrine AND exocrine)

Functions

- To secrete hormones "chemical messengers" that coordinate and direct activities of target cells and target organs
- Transported throughout the body by the bloodstream performing certain functions and stimulating other glands to produce their function

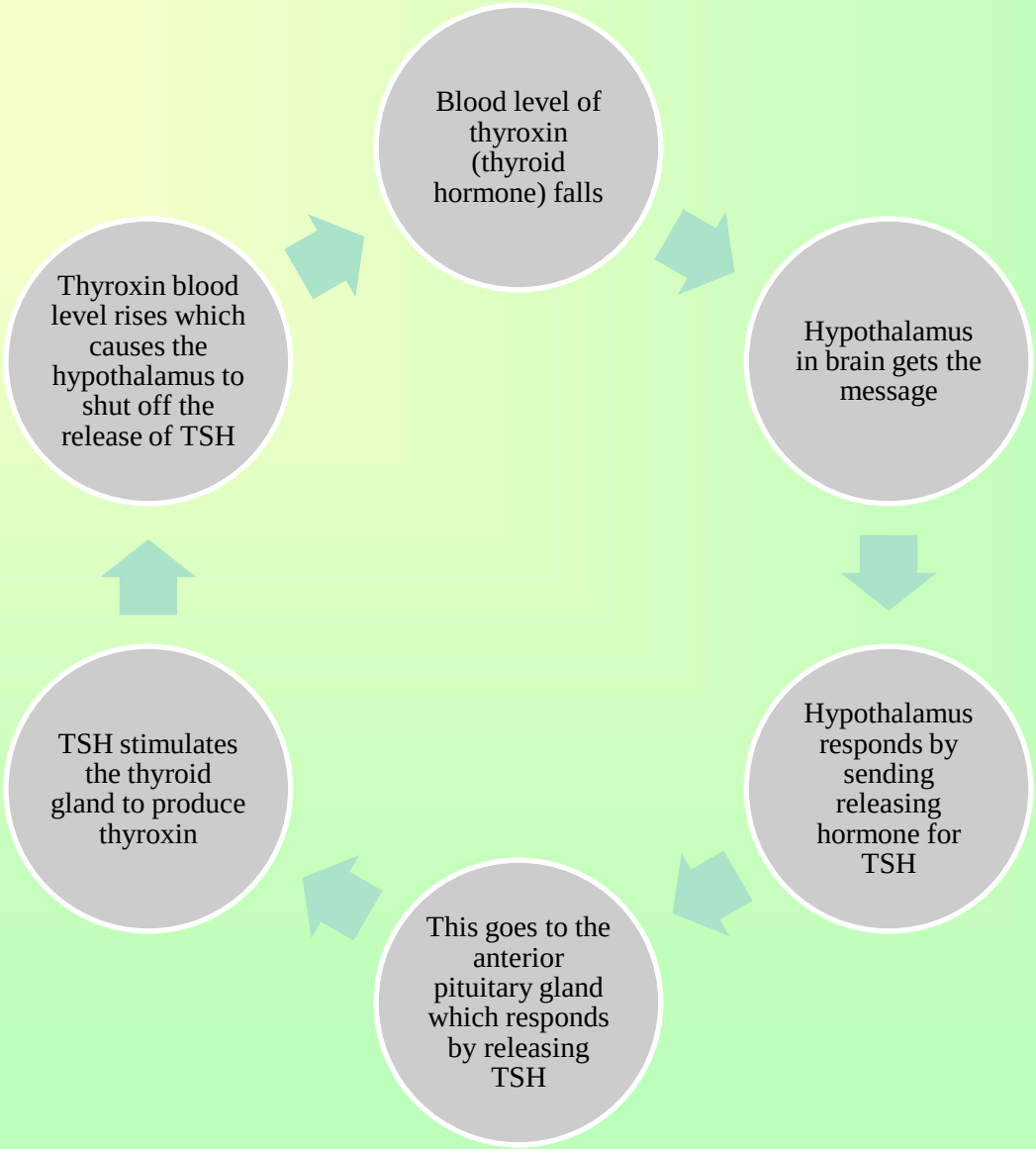
Major glands

- Pituitary
- Pineal body
- Thyroid
- Parathyroid
- Thymus
- Adrenals
- Pancreas
- Gonads (ovaries/testes)

Hormonal control

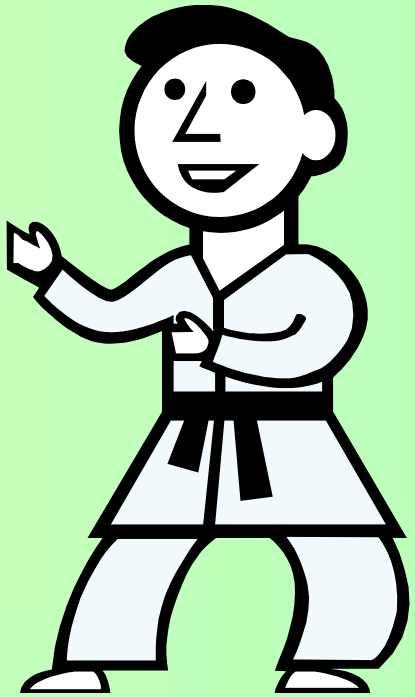
- Secretion of hormones operates on a “negative feedback” system – under the control of the nervous system
- Negative feedback occurs when there is a drop in hormone level which triggers a response to increase the amount of hormone in the blood

Negative Feedback re: thyroid



Pituitary Gland

- Tiny structure about the size of a grape at the base of the brain
- Connected to the hypothalamus (“brain” of the brain – stimulates release of hormones from the pituitary gland)
- Master Gland
- Produces many hormones that affects other glands
- Contains 2 lobes each producing its own hormones



Pituitary-hypothalamus interaction

- Hormones of the anterior pituitary are controlled by releasing chemical (factors) produced by the hypothalamus
- As hormones are needed, the hypothalamus releases a specific releasing factor for each hormone

Hormones of the Pituitary

- Somatotropin (GH)- growth hormone; helps fat be used for energy
- Thyrotropin (TSH)- stimulates growth of the thyroid gland
- Adrenocorticotropic (ACTH)- stimulates growth of the adrenal gland
- Melanocyte (MSH) production of melanin pigment in the skin
- Follicle stimulating (FSH) – growth of the ovarian follicles, production of estrogen in females; & production of sperm in males
- Luteinizing (LH) – stimulates ovulation and produces progesterone in females
- Prolactin (LTH) – develops breast tissue & secretion of milk from mammary glands
- Interstitial cell-stimulating (ICSH) – production of testosterone by the interstitial cells of the testes
- Oxytocin (pitocin) – released during childbirth; causes contraction of the uterus during childbirth
- Vasopressin/antidiuretic (ADH) – promotes reabsorption of water in kidneys, constricts blood vessels

Diseases of Pituitary

- Diabetes insipidus
  - Decreased secretion of antidiuretic hormone (posterior lobe) that prevents water from being absorbed in kidneys leading to an excessive amount of water and electrolyte loss

Gigantism

- Over-secretion of growth hormone prior to puberty.
- Excessive growth of long bones
- Treatment: drug therapy to inhibit GH release

Acromegaly

- Over-secretion of growth hormone during adulthood
- usually from tumor
- Enlargement of the extremities and/or face
- Treatment: drug therapy to inhibit GH release

Dwarfism

- Under-production of growth hormone during childhood
- Long bone growth is decreased
- Body is proportioned and intelligence is normal
- Treatment: early diagnosis & injections of GH for 5 or more yrs.

Thyroid Gland

- Butterfly shaped mass found in front of the trachea; shaped like an *H*
- The hormones produces by the thyroid gland are controlled by the TSH in the pituitary gland
- Requires iodine to produce its hormone which is found in foods and salt

Thyroid Gland Hormones

- Triiodothyronin (T_3) – works together w/
- Thyroxine (T_4) – controls rate of body's metabolism, how cells use glucose and oxygen to produce heat/energy; controls levels of calcium in the blood; stimulates physical and mental growth
- Calcitonin – accelerates storage of calcium in bones and lowers blood calcium levels; 99% of calcium in the body is stored in bones, necessary for blood clotting, and holding cells together
  - Proper secretion prevent hypercalcemia in blood

Diseases of Thyroid Gland

Hyperthyroidism

- Over-activity of thyroxin leading to enlargement of the gland
- Consume large quantities of food, but loss of body fat and weight
- Tx: total or partial removal of thyroid gland or radiation to suppress the activity

Grave's disease

- Severe form of hyperthyroidism
- More common in women
- Symptoms: strained and tense facial expression, exophthalmia, goiter, nervous irritability

goiter

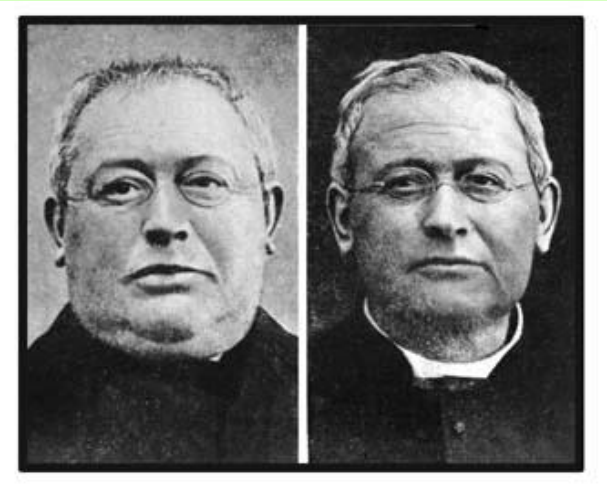
exophthalmos

Hypothyroidism

- Under-secretion of thyroxin; due to los T3 & T4 levels or high TSH levels
- Adult hypothyroidism may be due to iodine deficiency
- Major cause due to inflammation of the thyroid which destroys the ability of the gland to make thyroxine
- Dry/itchy skin, dry/brittle hair, constipation, muscle cramps

Myxedema

- Face becomes swollen, weight increases and memory begins to fail
- Treatment is daily thyroid hormone
- Follow-up tests to measure TSH blood levels are important

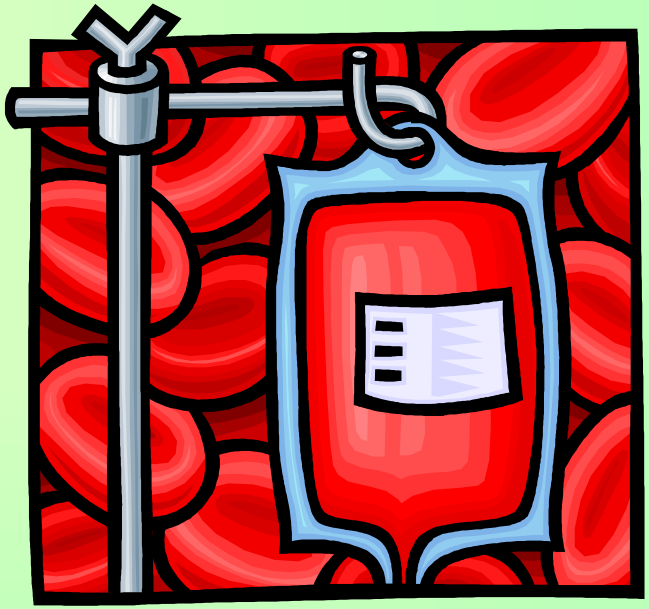


Cretinism

- Develops early in infancy or childhood
- Lack of mental/physical growth resulting in mental retardation and malformation
- Sexual development and physical growth does not reach beyond 7-8 year old children
- Normal development cannot be completely restored w/ tx.

Parathyroid Gland

- Four small glands behind the thyroid (size of grains of rice)
- Parathormone (PTH) - Regulates calcium in blood and stimulates bone cells to break down bone tissue and release calcium/phosphates into the blood
- Maintains proper levels of circulating calcium

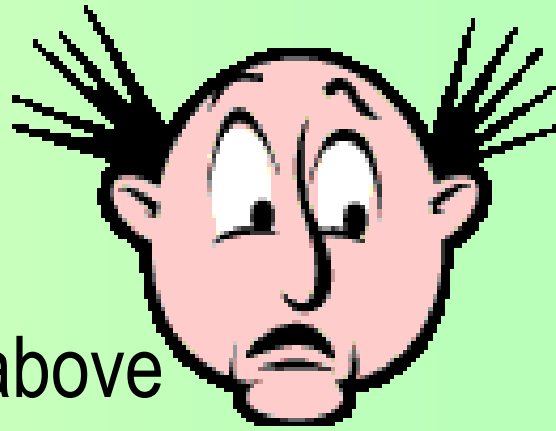


Disease of Parathyroid

- Hyperparathyroidism
  - Over-activity of parathyroid resulting in increased calcium in the blood
  - Leads of kidney stones, GI disturbances
  - Bones become weak, deformed and fracture easily because calcium is drawn from the bone

- Hypoparathyroidism
  - Under-activity of parathyroid gland causing a low level of calcium in blood
  - Tetany, hyperirritability of nervous system, twitching
  - Death can occur if the larynx and respiratory muscles are involved.

Adrenal Gland



- “suprarenal” glands because found above each kidney
- 2 parts: cortex (outer portion) & medulla (inner portion)
- ACTH from the pituitary stimulates activity of the cortex
- Cortex hormones known as corticoids
  - Very effective as anti-inflammatory drugs
  - classified in 3 catagories:

Adrenal Gland hormones

- Mineralocorticoids which aid with absorption of sodium into the blood stream and the excretion of potassium from the blood stream; speeds up absorption of water in the kidneys
- Glucocorticoids which aid in metabolism by increasing glucose in the blood; help body resist stress
- Gonadocorticoids which reduce inflammatory responses and act as sex hormones stimulating male/female sexual characteristics

Medulla

- epinephrine & norepinephrine activates nervous system to act in stress & causing "flight or fight" syndrome

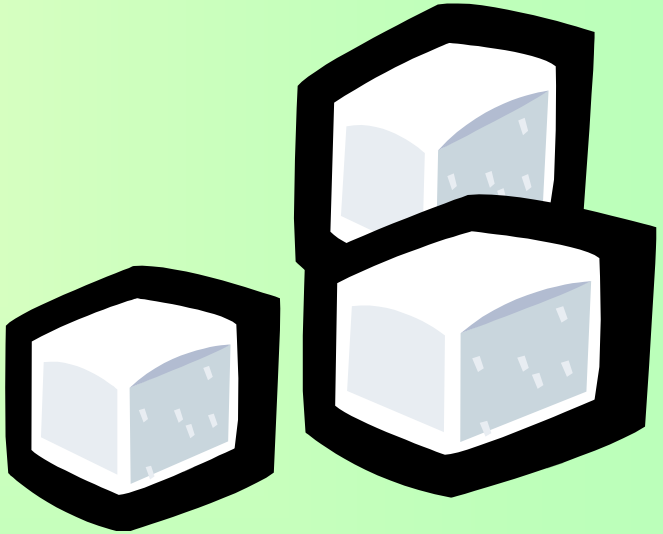
Disease of Adrenal glands

- Addison's disease
  - Decreased function of adrenal cortex
  - Excessive pigmentation, low blood pressure when standing, muscular weakness/fatigue, diarrhea, wt. loss, vomiting
  - Tx. Replace
  - hormone

- Cushing's syndrome
  - Hypersecretion of glucocorticoids
  - Causes hyperglycemia, hypertension, poor wound healing, bruising, "moon" face and obesity

Pancreas

- Fish-shaped organ behind stomach
- Exocrine (secretes pancreatic juices that are carried to small intestines to aid in digestion) and endocrine gland (produces insulin needed for cells to absorb sugar from the blood)
- **Insulin** – metabolizes sugar
- **Glucagon** – maintains blood level of glucose



Diseases of Pancreas

- Diabetes mellitus
  - Decreased secretion of insulin w/ affects metabolism of carbs, proteins, fats
  - 2 types of D.M.
    - Type 1: juvenile onset; thought to be an autoimmune reaction involving genetic and virus factors that destroy parts of the pancreas
      - More severe, requires insulin injections
    - Type 2: adult onset; most common in adults over 45, overweight, heredity, certain ethnic groups
      - Frequently occurs in obese adults and may not be insulin dependent
      - Controlled w/ diet
  - Hyperglycemia, polyuria, polydipsia, polyphagia, glycosuria, weight loss, fatigue, slow healing of skin infections and vision changes

Ovaries

- Female sex glands
- Located behind pelvic cavity
- Secretes hormones that regulate menstruation and secondary sexual characteristics
- Estrogen – promotes growth and development of sex organs in female
- Progesterone – maintains lining of the uterus

Testes

- Male sex gland
- Located in scrotal sac and suspended outside the body
- Testosterone - regulates sexual characteristics of male

Thymus

- Mass of tissue found under the sternum
- Active in early life activating cells in the immune system
- Atrophies during puberty
- Produces only one hormone – thymosin which stimulates production of antibodies in early years

Pineal Body

- Small structure attached to the third ventricle in the brain
- Little known about the gland
- Secreted 3 main hormones
- Melatonin – regulates sleep/wake cycle; may delay puberty by inhibiting sex hormones
- Adrenoglomerulotropin – stimulates adrenal cortex
- Seratonin – prevent vasoconstriction of blood vessels in the brain

Placenta

- Temporary endocrine gland produced only during childbirth
- Estrogen – stimulates growth of reproductive organs
- Chorionic gonadotropin – causes ovaries to continue secretions
- Progesterone – maintains lining of uterus to provide fetal nutrition
- Promotes milk production in breasts
- Expelled after birth of child
- "afterbirth"