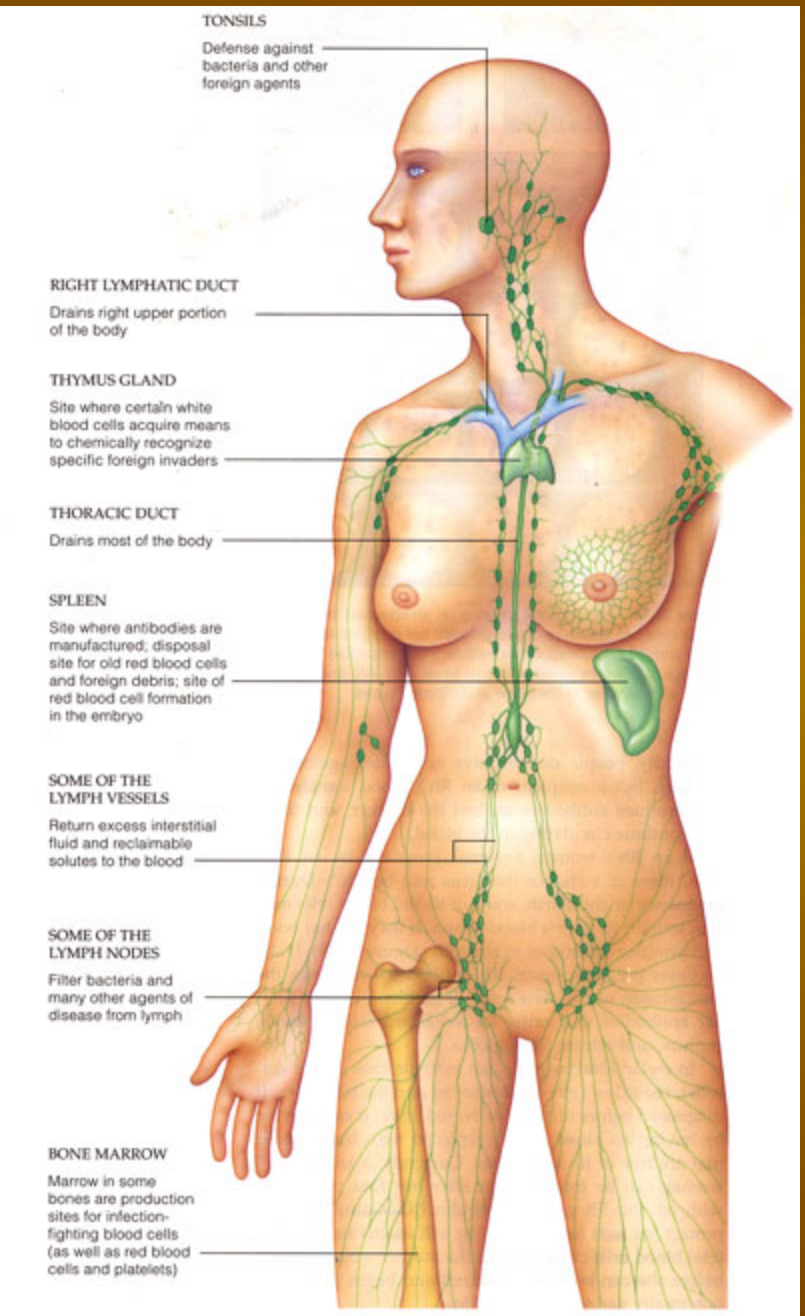
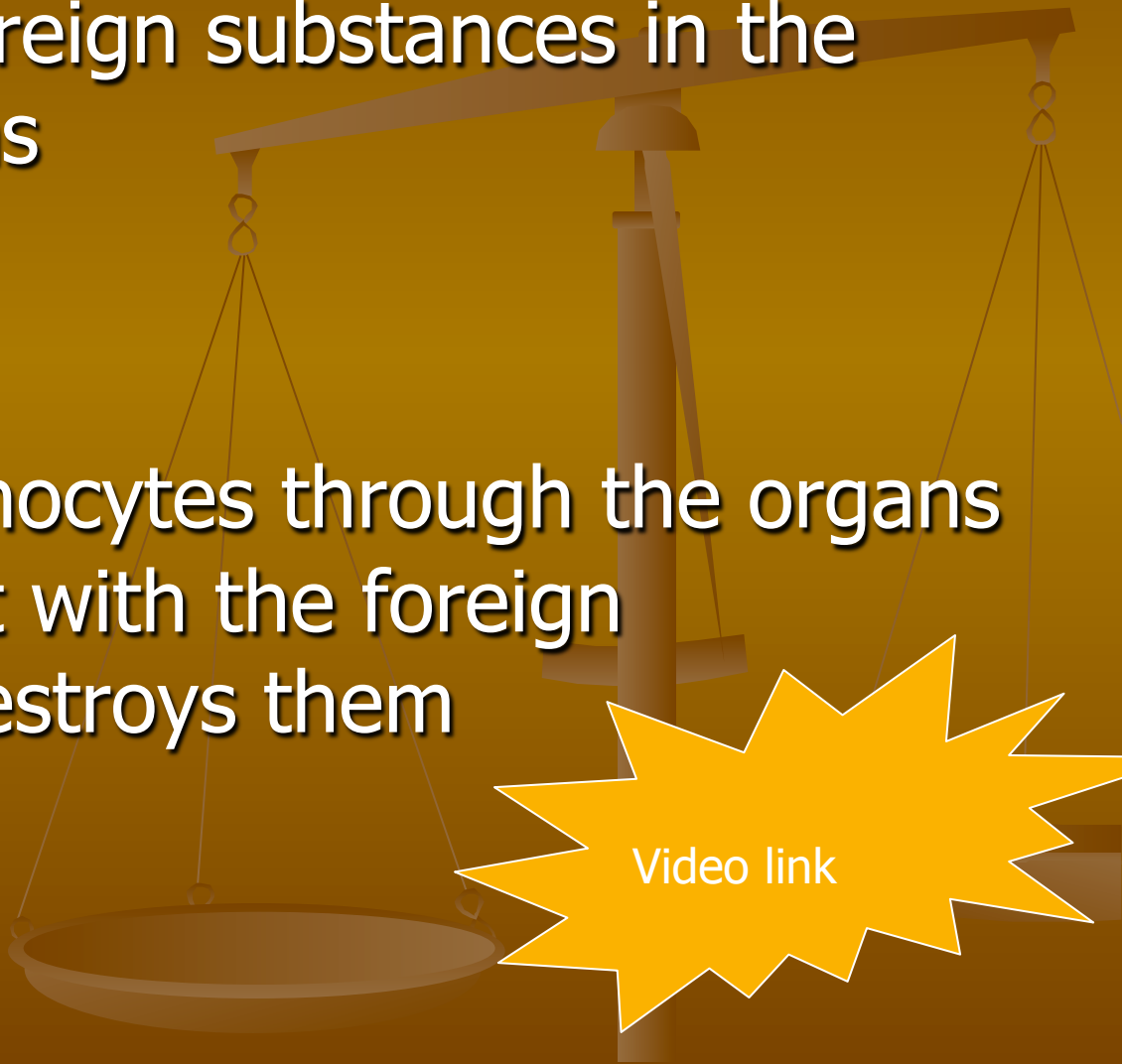


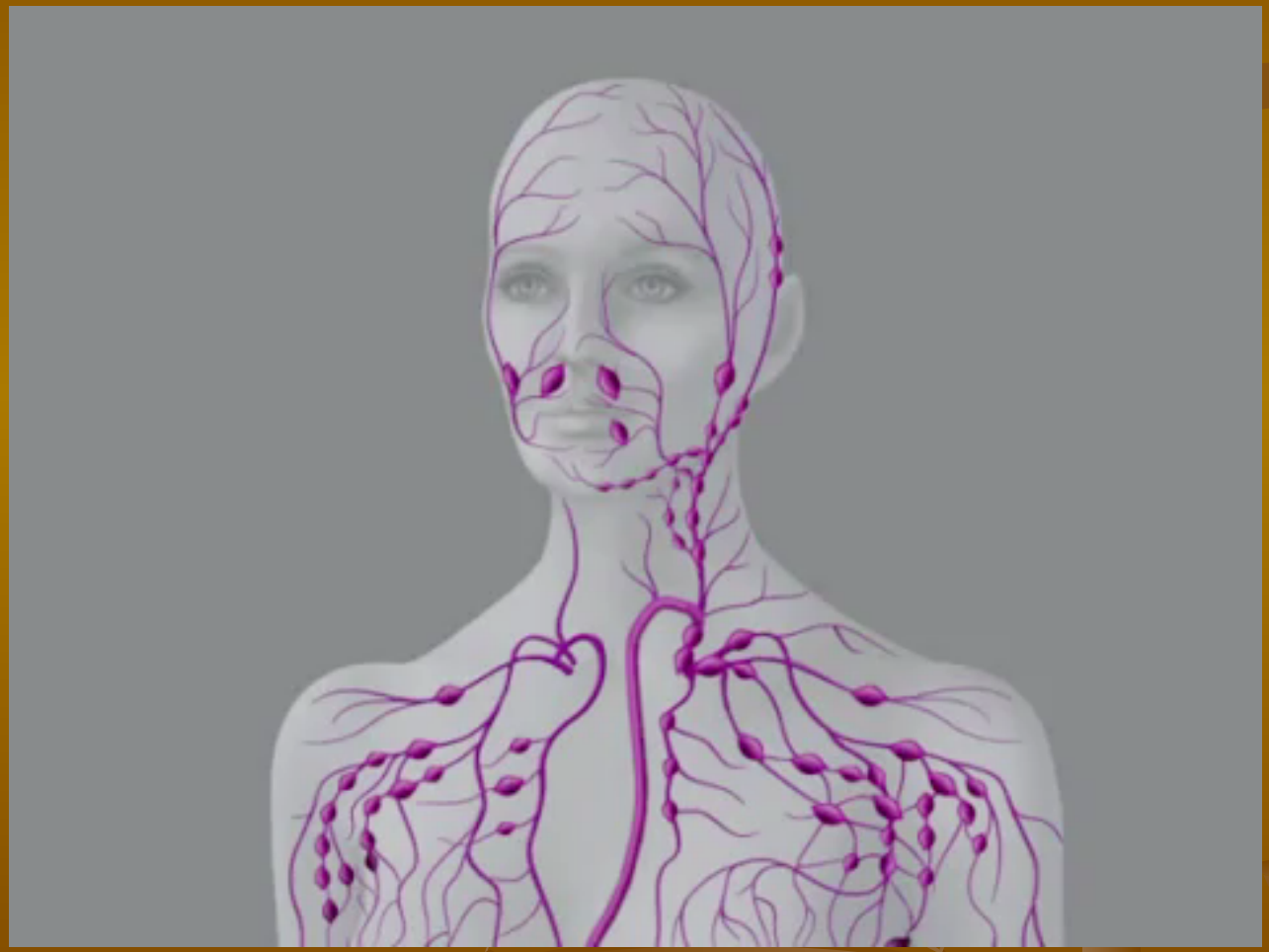
Lymphatic System

- Collects & returns interstitial fluid & plasma proteins to blood
- Defends body from disease by producing lymphocytes
- Absorbs lipids from intestine & transports them to blood

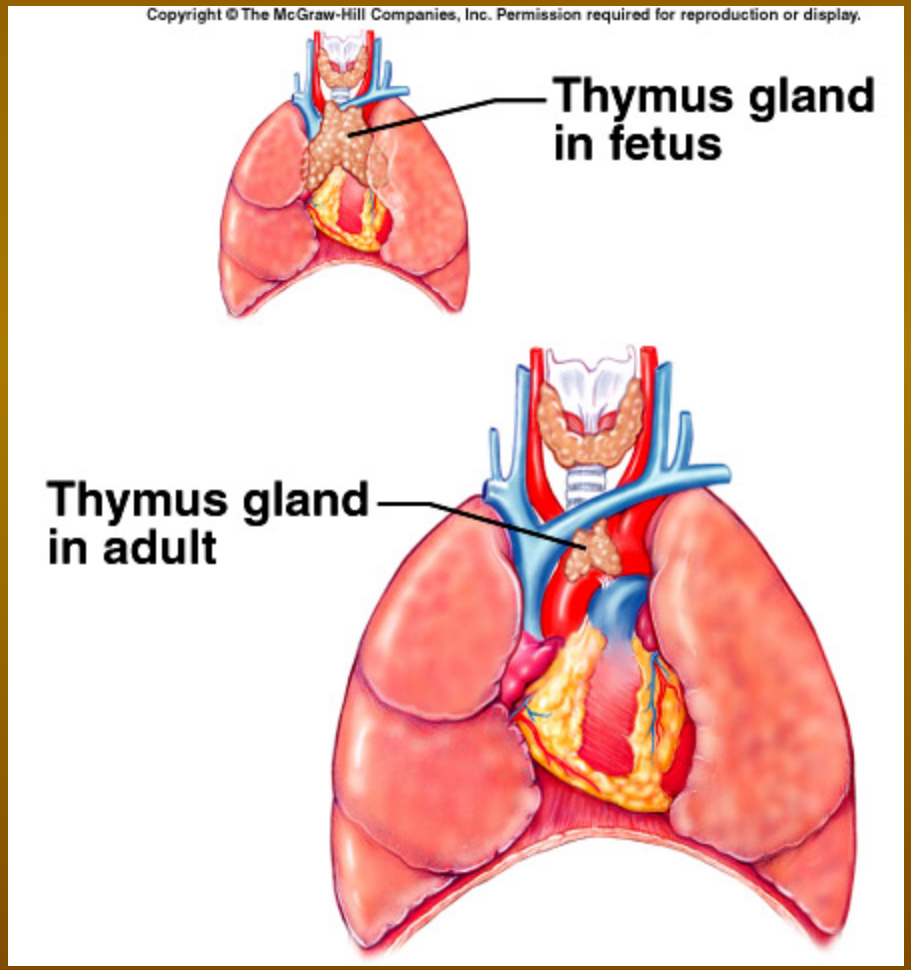
- Concentrates foreign substances in the lymphatic organs

- Circulates lymphocytes through the organs to make contact with the foreign substances & destroys them





Thymus gland



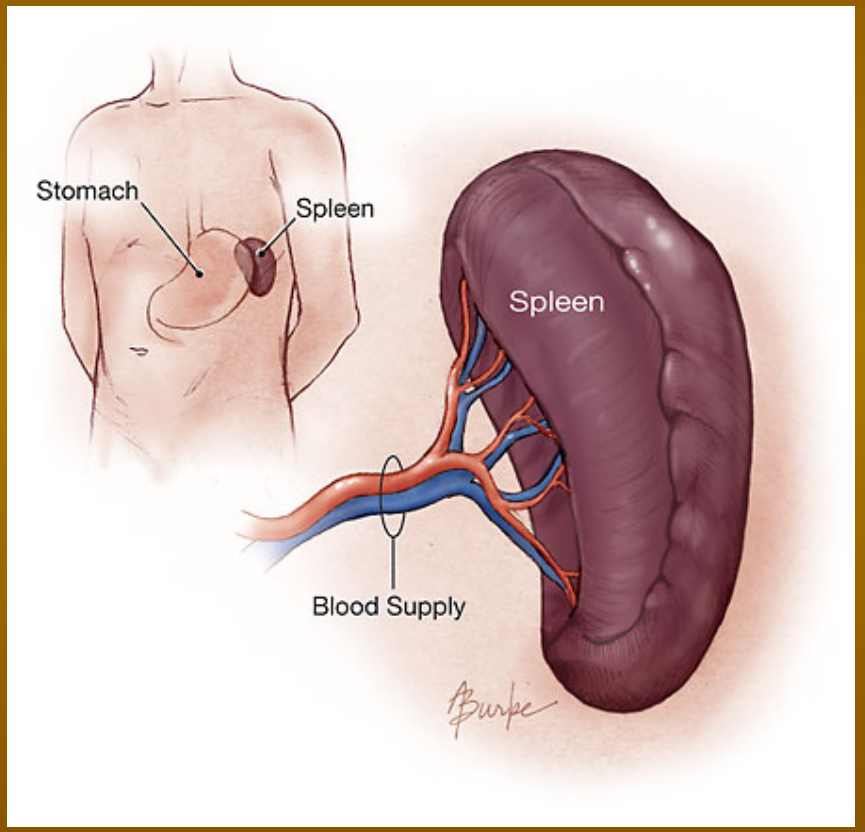
- Contains lymphocytes (white blood cells)
- T- lymphocytes (T cells) leave gland & provide cell-mediated immunity
  - *Helper T cells*
  - *Cytotoxic/ killer T cells*
  - *Supressor T cells*

- Helps to produce T cells that destroy invading microbes (directly or indirectly)
  - HUGE in infant
  - Reaches maximum size during puberty
  - Replaced by fat & connective tissue in adult

- *Removal of gland prior to processing T cells results in a failure to develop cellular immunity!*

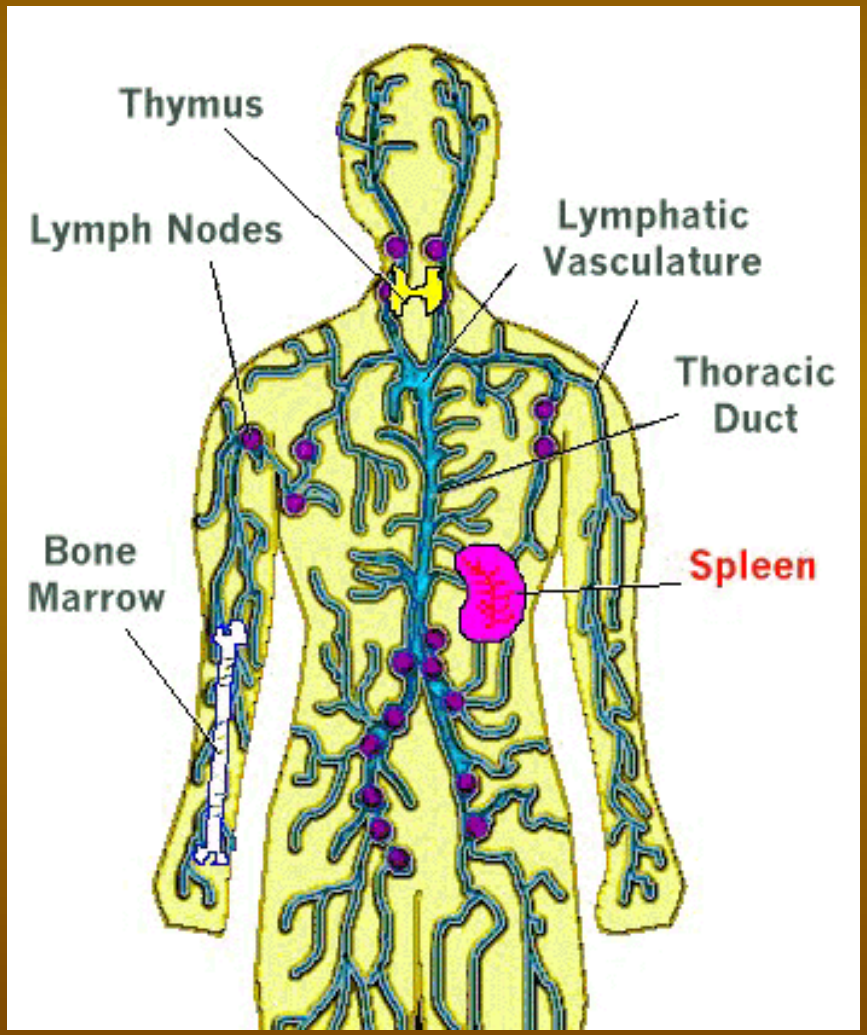
Spleen

- Contains lymphocytes (macrophages) that remove unwanted materials from blood
- Filters blood much like lymph nodes filter lymph
- Also acts as blood reservoir

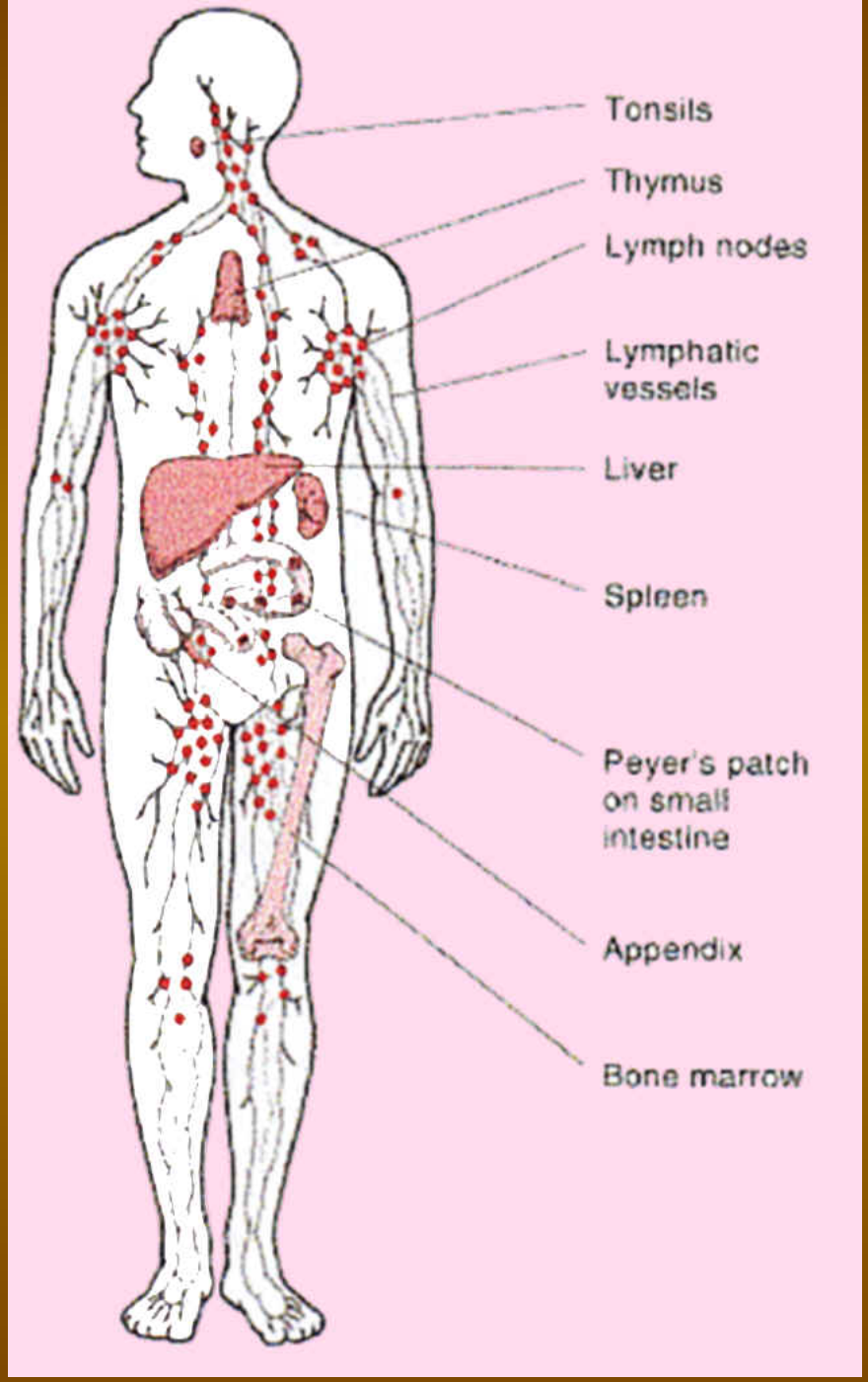


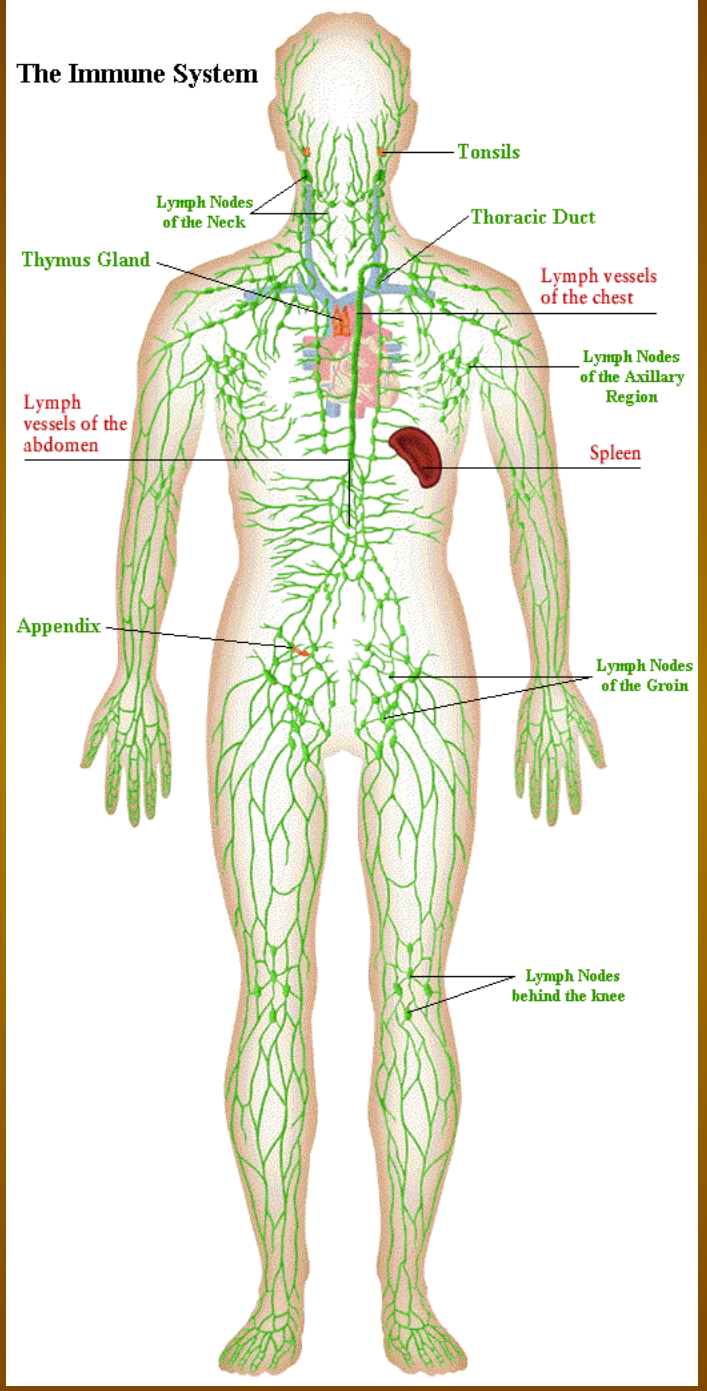
- Produces B lymphocytes (antibody-producing cells)
- Phagocytizes bacteria & worn-out or damaged erythrocytes & thrombocytes
- Stores & releases blood in case of demand like a hemorrhage
  - Forms blood cells in early fetal development

Lymph nodes



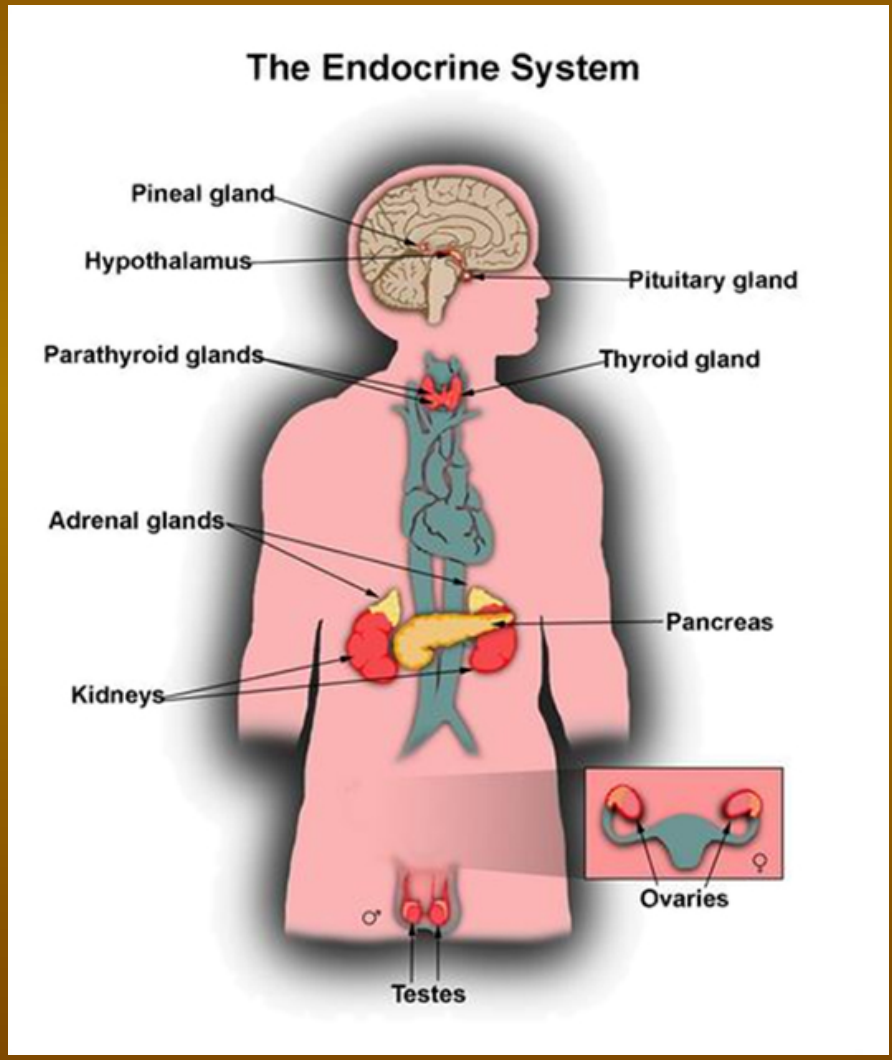
- Contain large number of lymphocytes & macrophages
- Destroy foreign substances (bacteria), damaged cells & cellular debris


Tonsils
Thymus
Lymph nodes
Lymphatic vessels
Liver
Spleen
Peyer's patch on small intestine
Appendix
Bone marrow

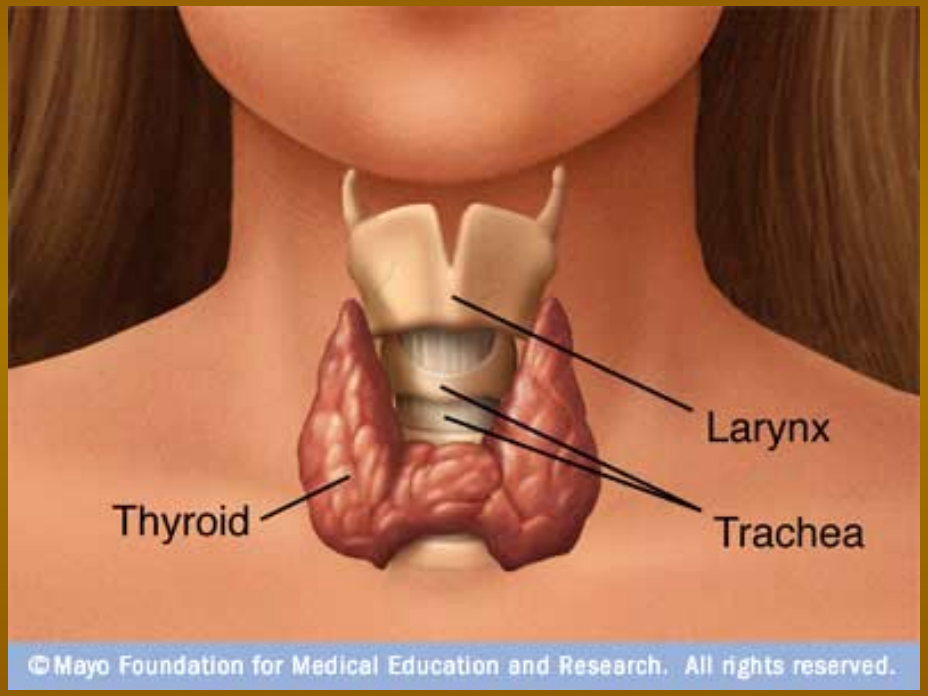

The Immune System
Tonsils
Lymph Nodes of the Neck
Thoracic Duct
Thymus Gland
Lymph vessels of the chest
Lymph Nodes of the Axillary Region
Lymph vessels of the abdomen
Spleen
Appendix
Lymph Nodes of the Groin
Lymph Nodes behind the knee

Endocrine System

- HOMEOSTASIS!
- Regulation of metabolic processes
- Controls rates of chemical reactions
- Aids in regulating water & electrolyte balance
- Role in reproduction & development
- *(hypothalamus is the link btw nerv & endo)*



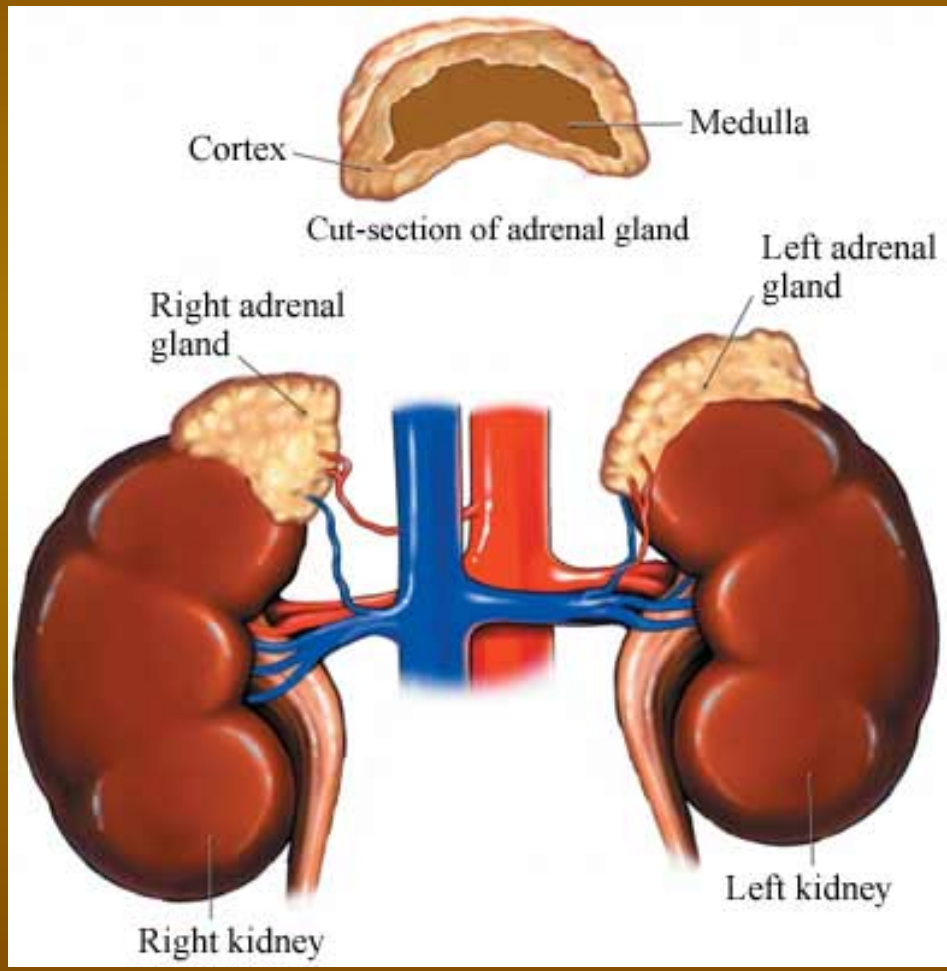
Thyroid Gland



- Helps to regulate metabolism (carbs, protein & fats) which effects growth & development
  - *Energy release from carbohydrates*
  - *Protein synthesis*
  - *Lipid breakdown*
- Regulates blood calcium concentration

Adrenal Gland

- Medulla- Hormones associated with “fight-or-flight” response
- Cortex- Over 30 different hormones
- Regulation of electrolytes, nutrient metabolism, & early development of reproductive organs



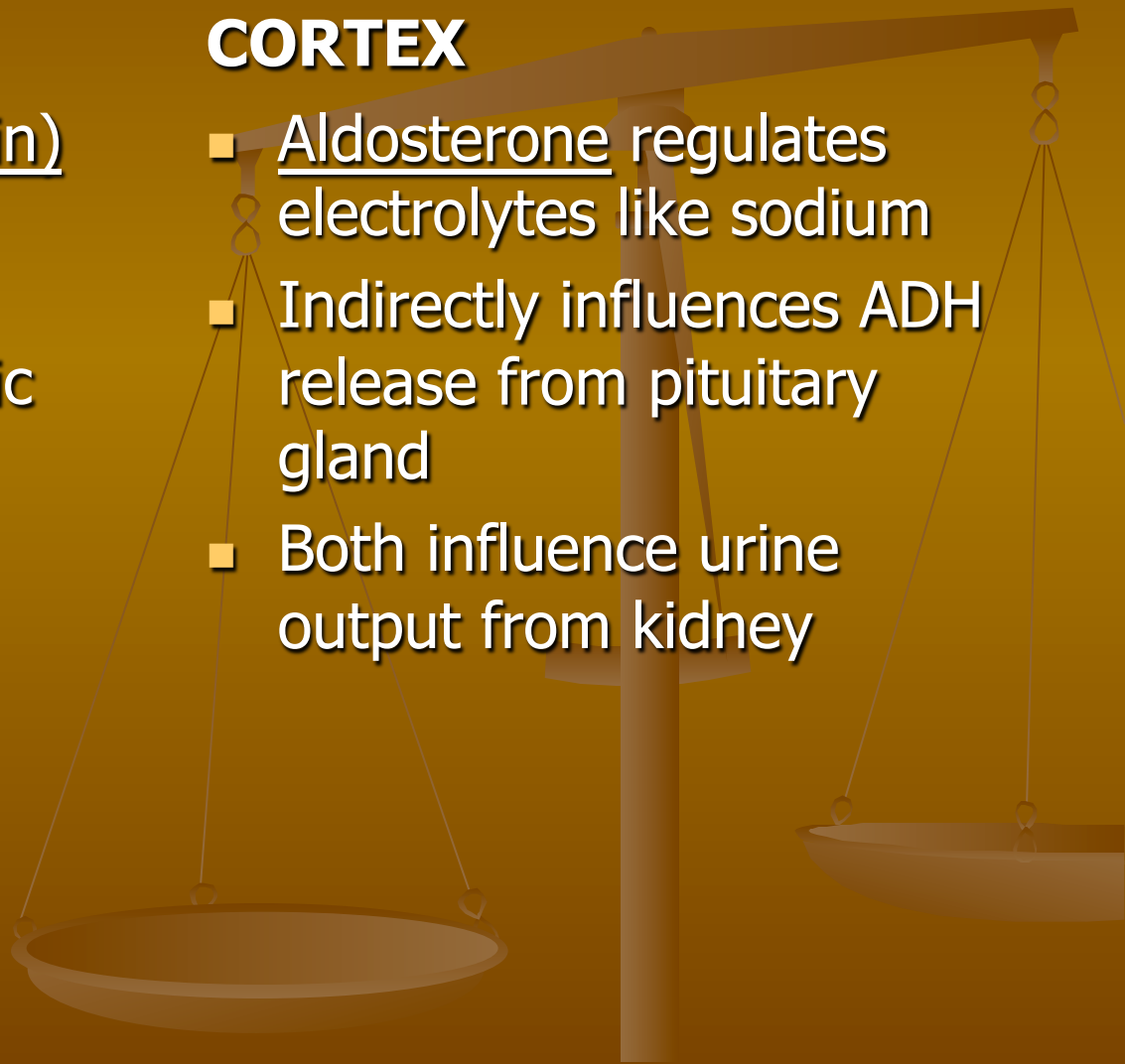
Click for fiight or flight response

MEDULLA

- Epineprhine (adrenalin) and norepinephrine (noradrenalin)
- Resemble sympathetic n.s. affects
- Lasts up to 10 times longer

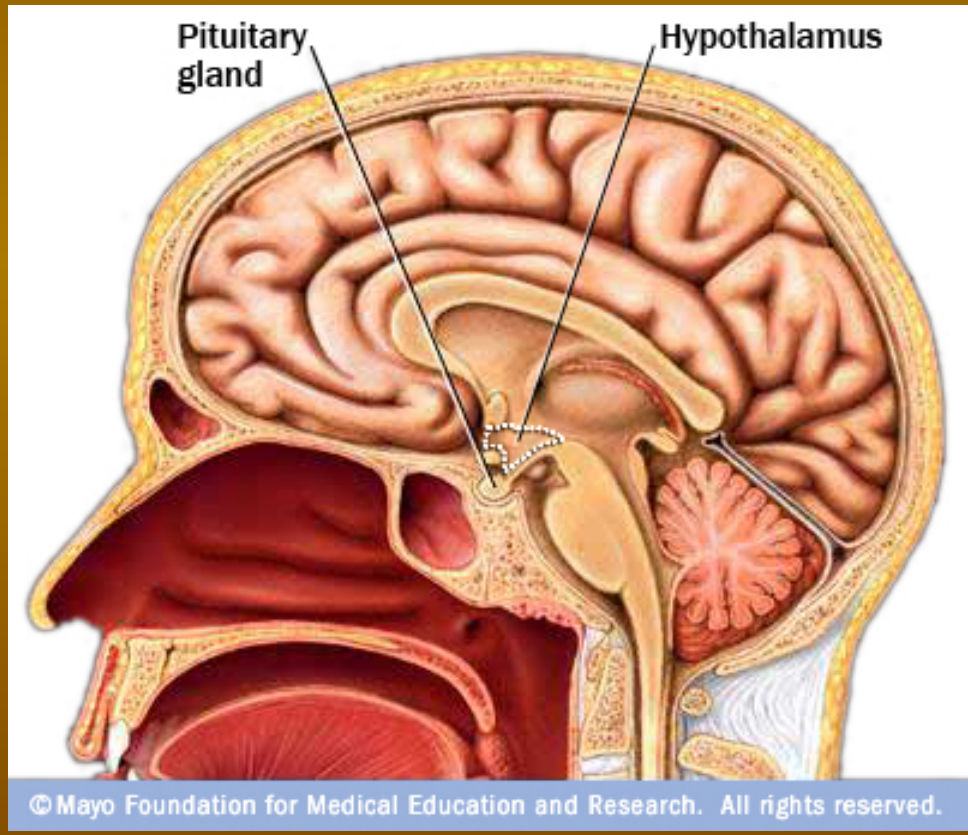
CORTEX

- Aldosterone regulates electrolytes like sodium
- Indirectly influences ADH release from pituitary gland
- Both influence urine output from kidney



Pituitary Gland

- Helps to control growth, blood pressure, urine production, pregnancy, labor & milk production in females, & controlling secretions from other endocrine glands



**Connected to hypothalamus by a stalk

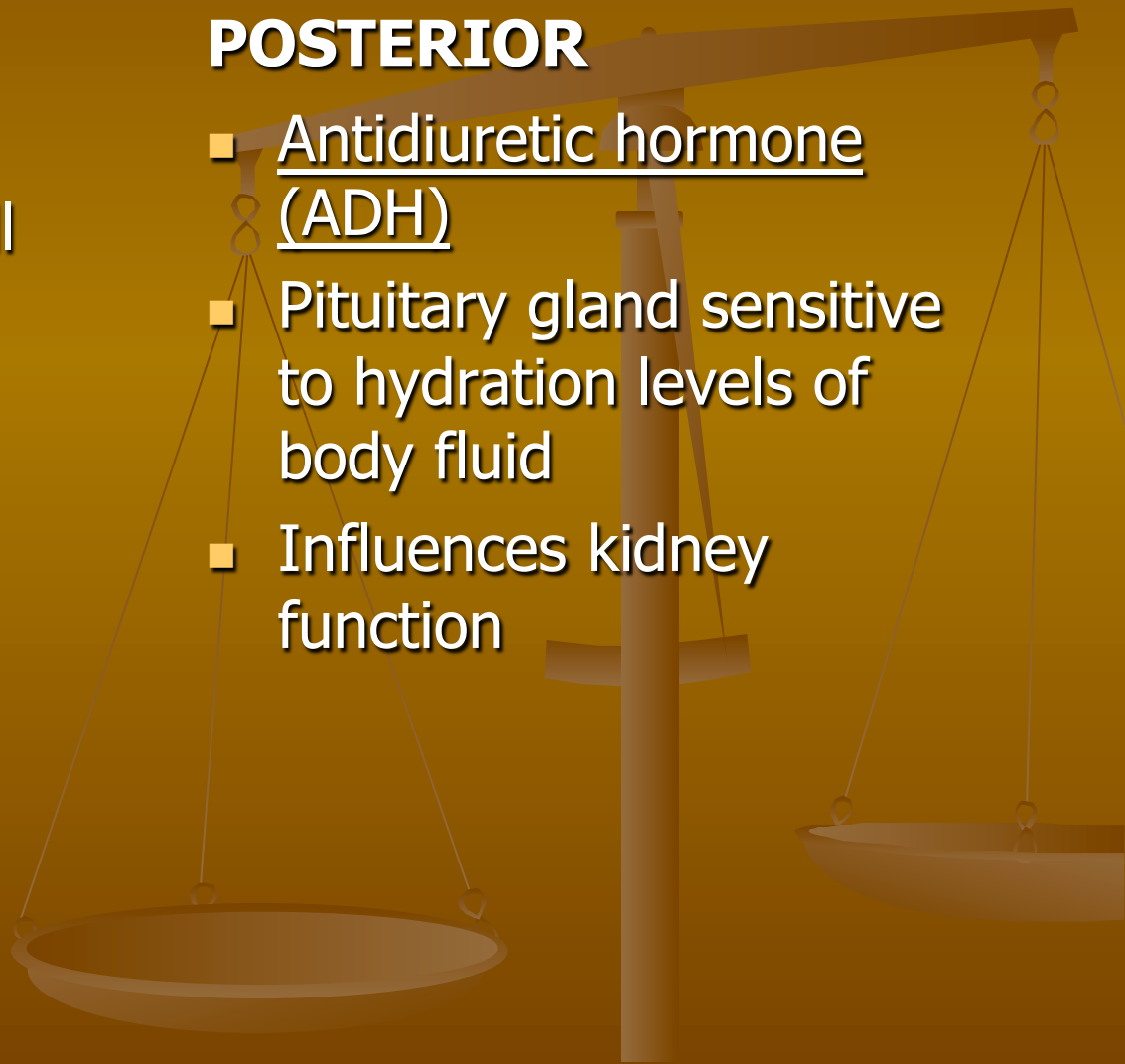
Hypothalamus tells pituitary to release its hormones

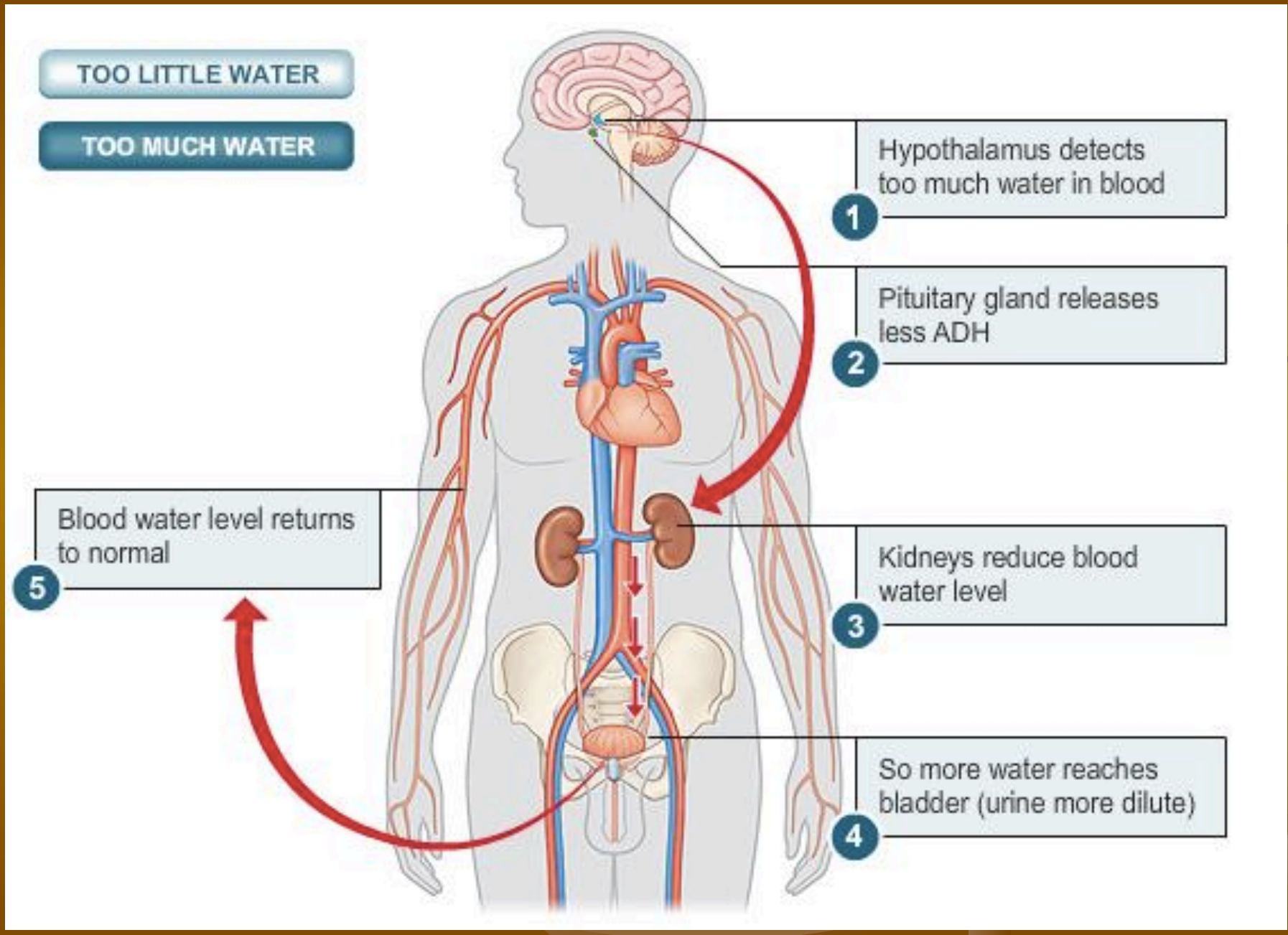
ANTERIOR

- Growth hormone
- Body cell size and cell division
- Thyroid-stimulating hormone

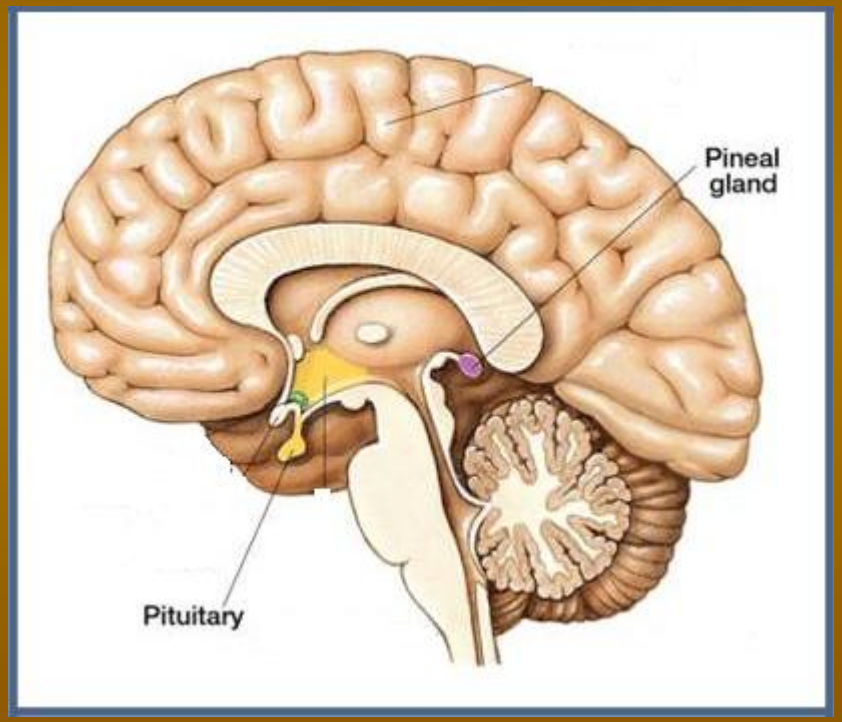
POSTERIOR

- Antidiuretic hormone (ADH)
- Pituitary gland sensitive to hydration levels of body fluid
- Influences kidney function




TOO LITTLE WATER
TOO MUCH WATER
Hypothalamus detects too much water in blood
1
Pituitary gland releases less ADH
2
Kidneys reduce blood water level
3
So more water reaches bladder (urine more dilute)
4
Blood water level returns to normal
5

Pineal Gland

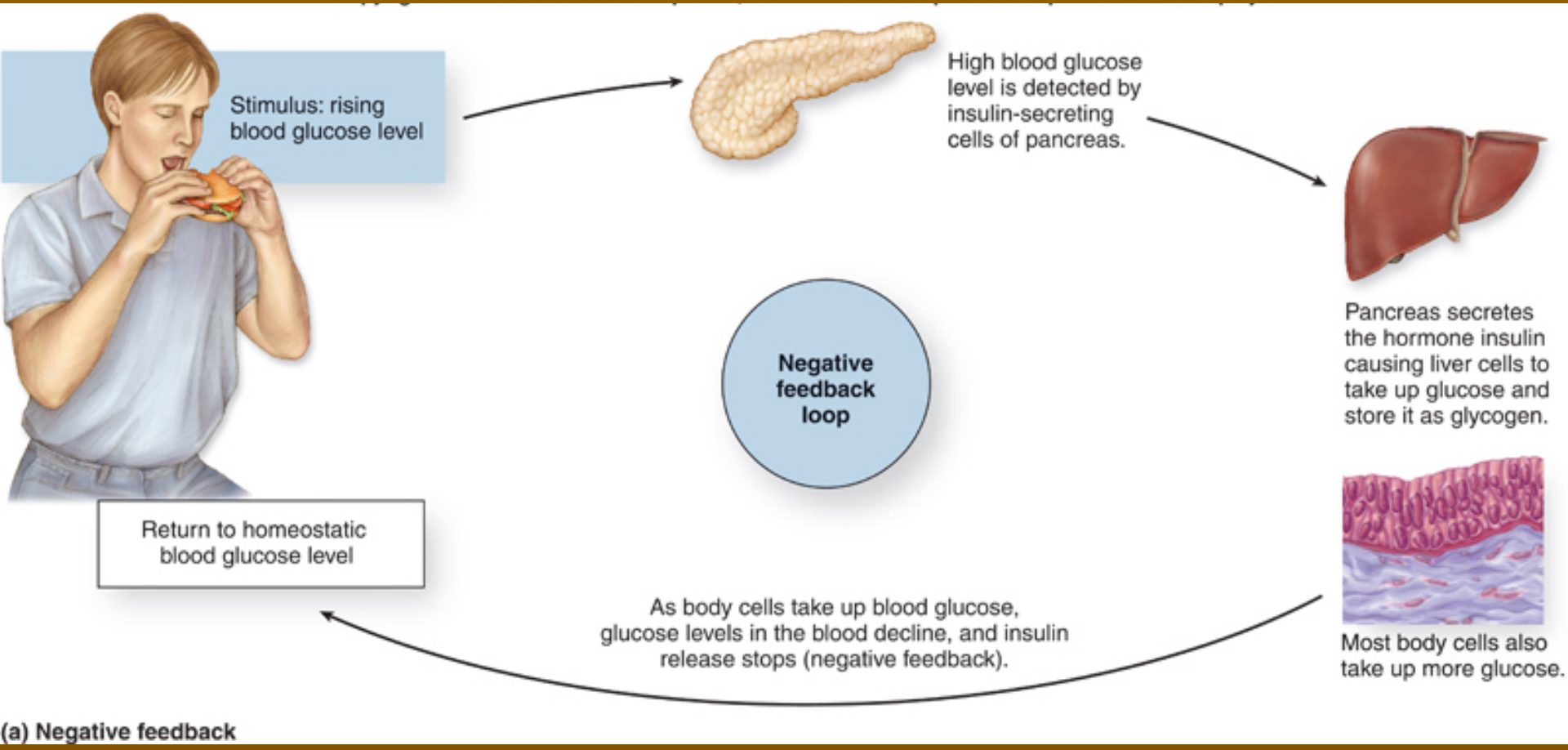


- Regulation of circadian rhythms
- Sleep-wake cycles
- Seasonal cycles in mammals (fertility, etc)

Other organs with endocrine functions

- Pancreas- digestive
- Stomach- digestive
- Small intestine- digestive
- Thymus-lymphatic
- Ovaries- reproductive
- Placenta (pregnancy)
- Testes- reproductive

Negative feedback



(a) Negative feedback