

Endocrine System

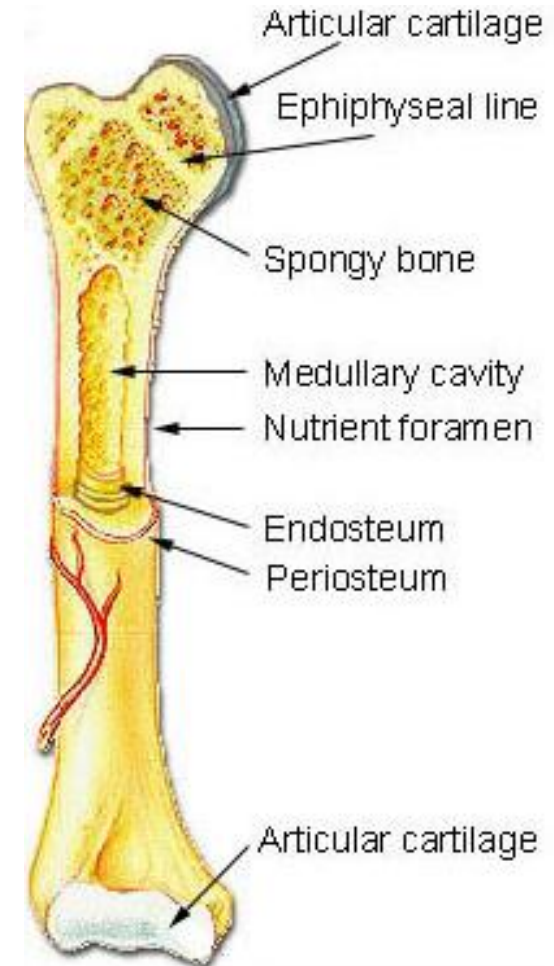
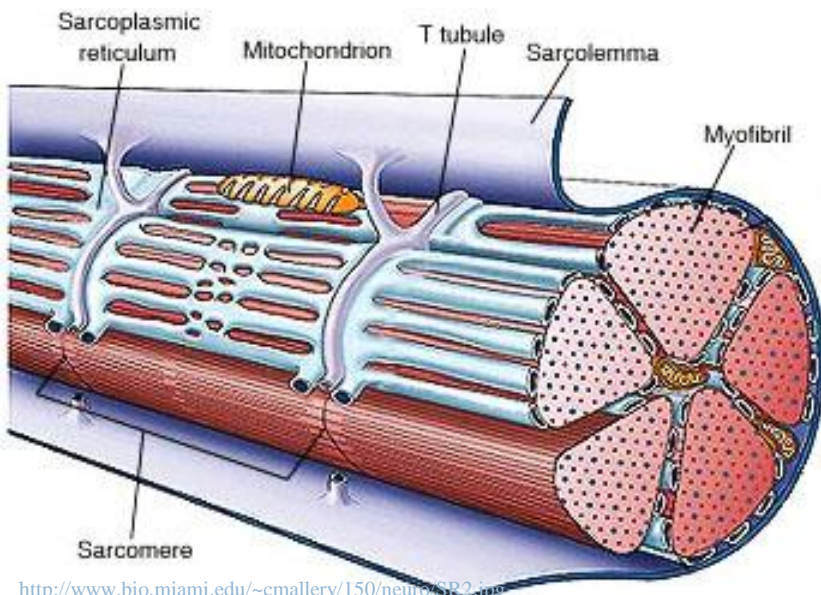
Calcium Regulation

Calcium Regulation

- Antagonistic hormones:
 - PTH
 - calcitonin

Calcium Storage

- 99% stored in bones
- In cells: mitochondria and ER
- In skeletal muscles: sarcoplasmic reticulum (SR)



Calcium Function

- Muscles
 - Ca levels inside muscle cells change when muscles contract
- Nerves
 - Ca stimulate release of neurotransmitters

Bone Cells

- **Osteoblast**: bone-forming cells, take Ca from blood to build into bones
- **Osteoclast**: break down Ca in bones and release into blood

Parathyroid Gland

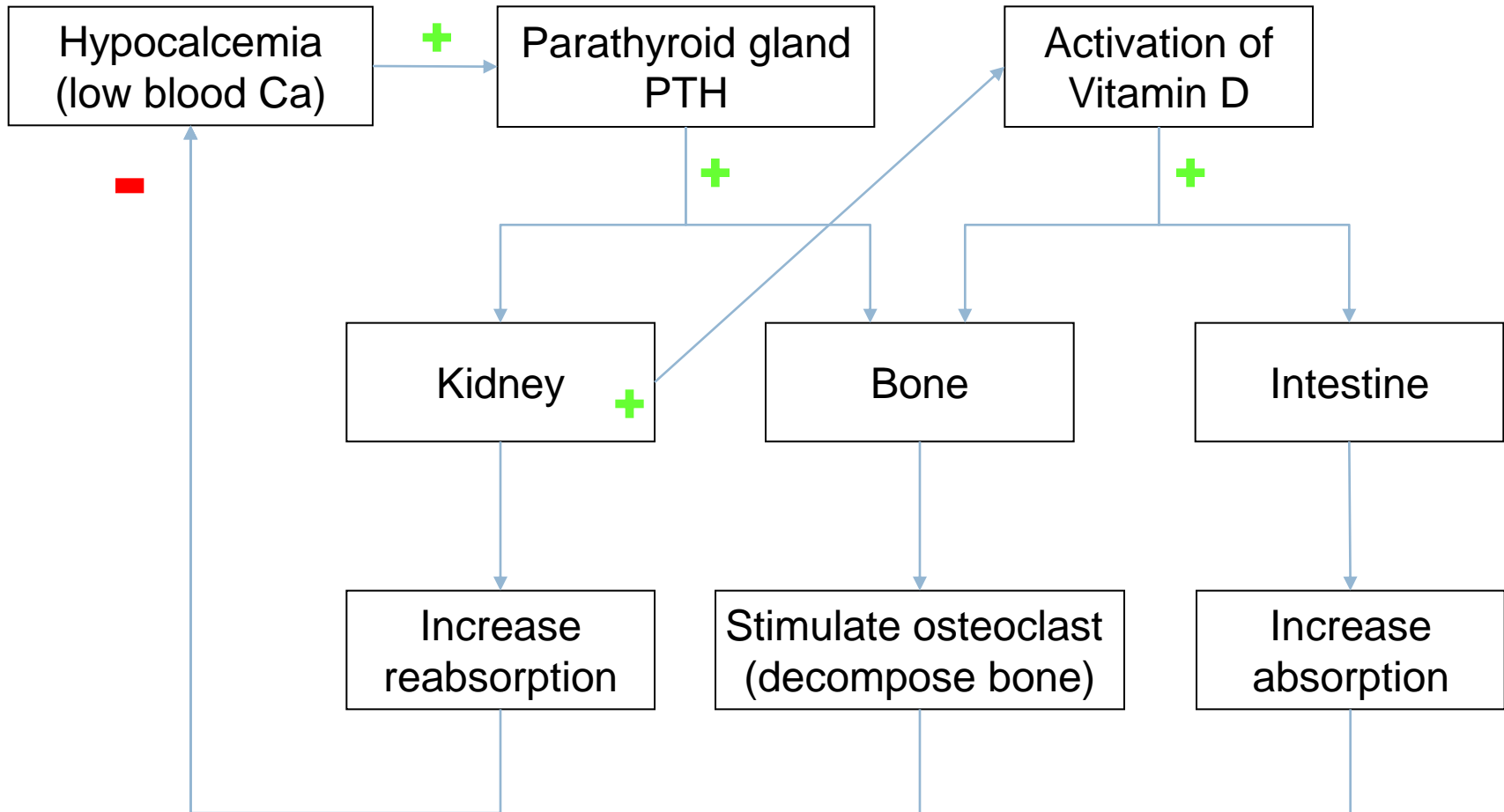
- 4 small oval shaped glands
- Located behind the thyroid glands
- Each lobe of thyroid gland is adjacent to 2 parathyroid gland
- Secretes parathyroid hormone (PTH)



Parathyroid Hormone (PTH)

- Peptide hormone
- Continuously produced (tonic secretion)
- Stimulated by a decrease in blood calcium (**hypocalcemia**)

Hypocalcemia



PTH Targets

- Bone
 - Induces osteoclast
 - Decompose bone to release stored Ca into blood
- Kidney
 - Stimulates reabsorption of calcium
 - Converts vitamin D precursor to active vitamin D

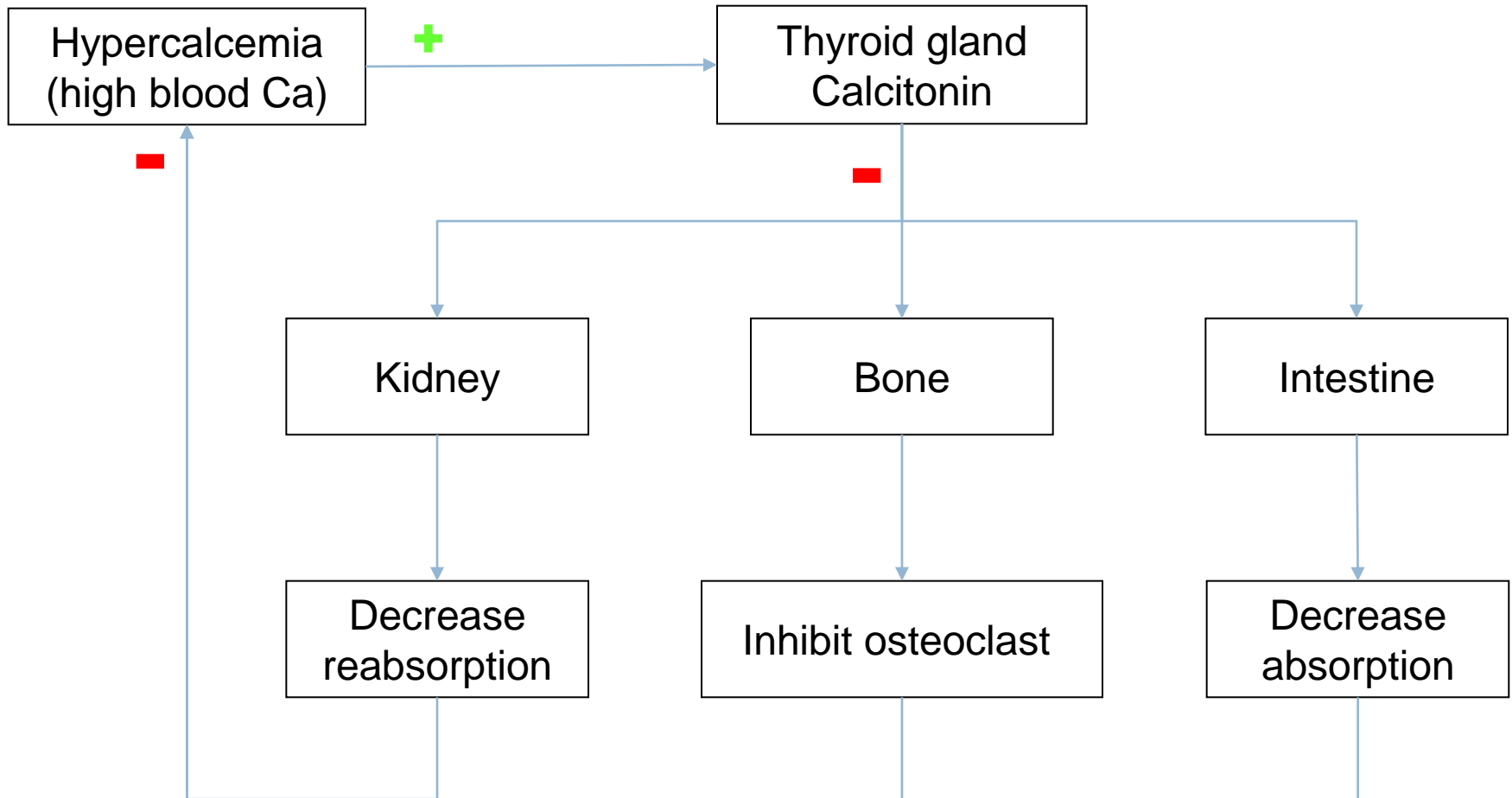
Vitamin D

- Steroid hormone
- Can be ingested in food or formed in skin when exposed to sunlight
- Activated form of vitamin D
 - Reinforces the effect of PTH (increase blood Ca)
 - Targets bone to release Ca
 - Targets intestine to absorb Ca

Calcitonin

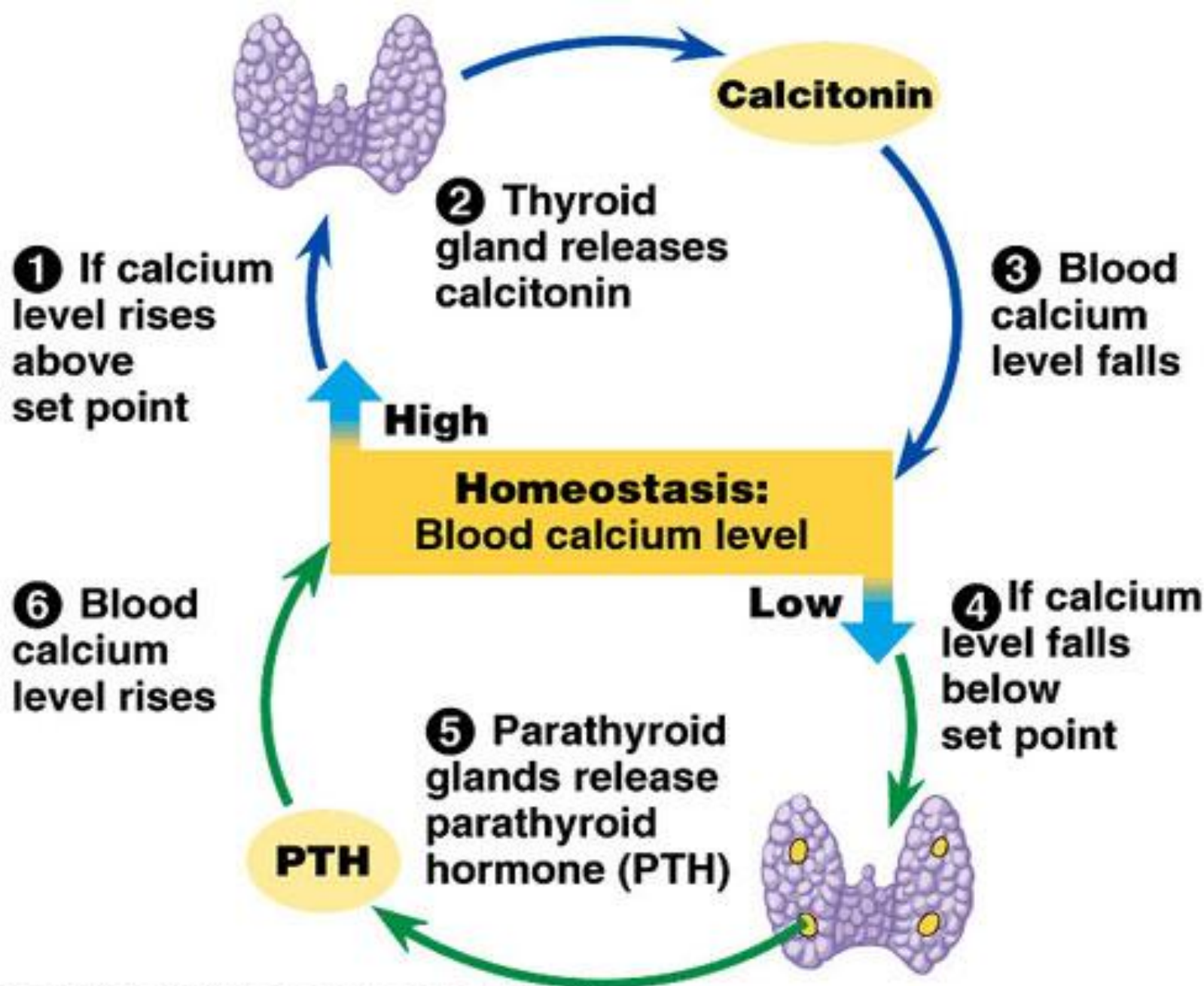
- Peptide hormone
- Secreted by **thyroid gland**
- Stimulated by increase of blood calcium (**hypercalcemia**)
- Antagonist of PTH: decreases blood calcium

Hypercalcemia



Calcitonin Targets

- Bone
 - Stimulates Ca uptake into bones
 - Inhibits osteoclasts
 - Less bone tissue removal
- Kidney
 - Inhibits Ca reabsorption
 - Increases rates of Ca loss by urinating
 - higher concentration of Ca in urine
- Intestine
 - inhibits Ca absorption



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Calcium Regulation Disorders

- Hypoparathyroidism
- Hypocalcemia
- Hyperparathyroidism
- Hypercalcemia
- Osteoporosis

Osteoporosis

- Loss of density in bones, leading to fragile bones
- Causes
 - Hyperparathyroidism
 - Hyperactive Parathyroid (high levels of PTH)
 - Hypovitaminosis D
 - Lack of Vitamin D in diet
 - Decrease in enzyme catalyzing Vitamin D
 - Over activity of osteoclasts

Osteoporosis Symptoms

- increase risk of bone fractures
- Joint pain
- kyphosis (hunchback)
- <http://www.youtube.com/watch?v=rHyeZhc0ZcQ&feature=related>