
بسم الله الرحمن الرحيم

Thyroid Gland

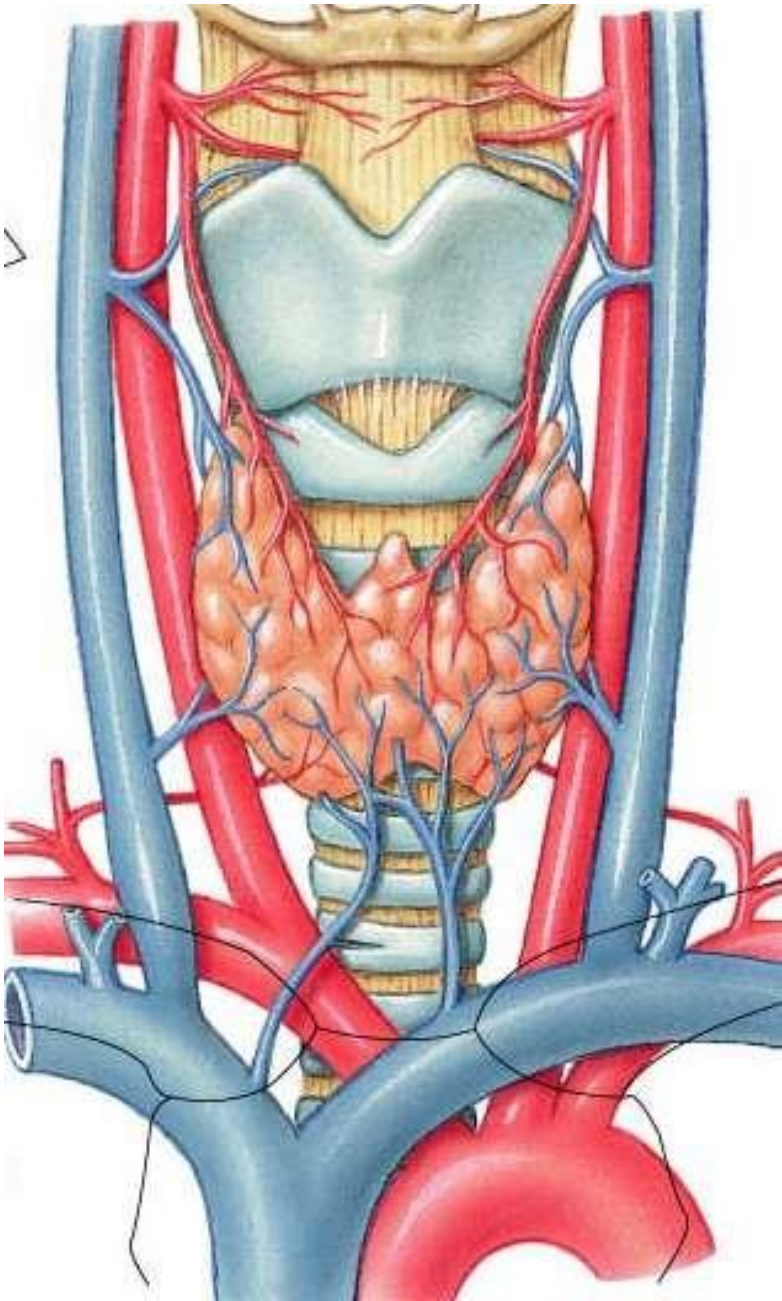
Thyroid gland

- Largest gland in the body
- Location : in the neck inferior to the larynx and over the surface of trachea
- Function:
  - Secretion of thyroxin and triiodothyronine
  - Secretion of calcitonin

Thyroid Gland

- Anterior surface of trachea just inferior of thyroid cartilage (or Adam's apple)
- Two lobes connected by isthmus
- Microscopic thyroid follicles produce thyroid hormone
- C Cells - produce calcitonin ($\downarrow Ca^{2+}$)

Fig 19-7



Structures of Endocrine System

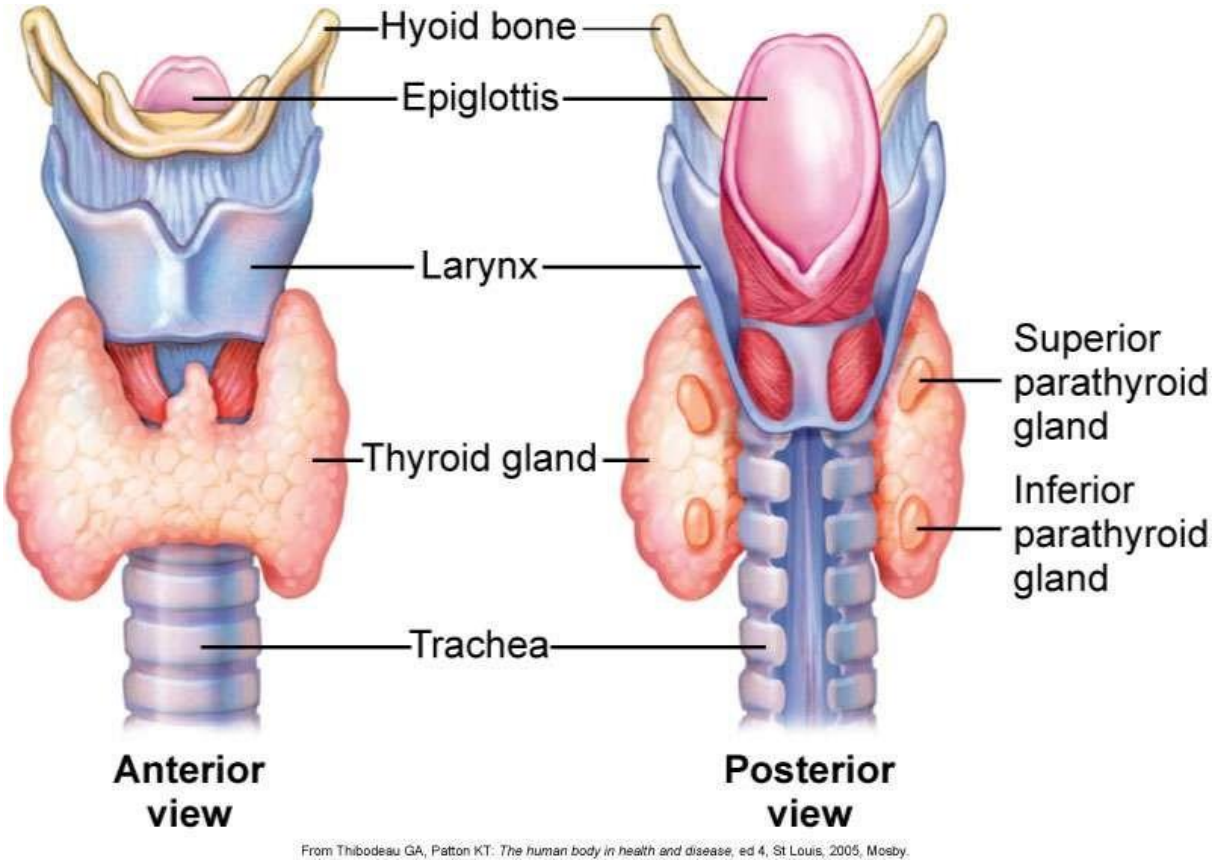
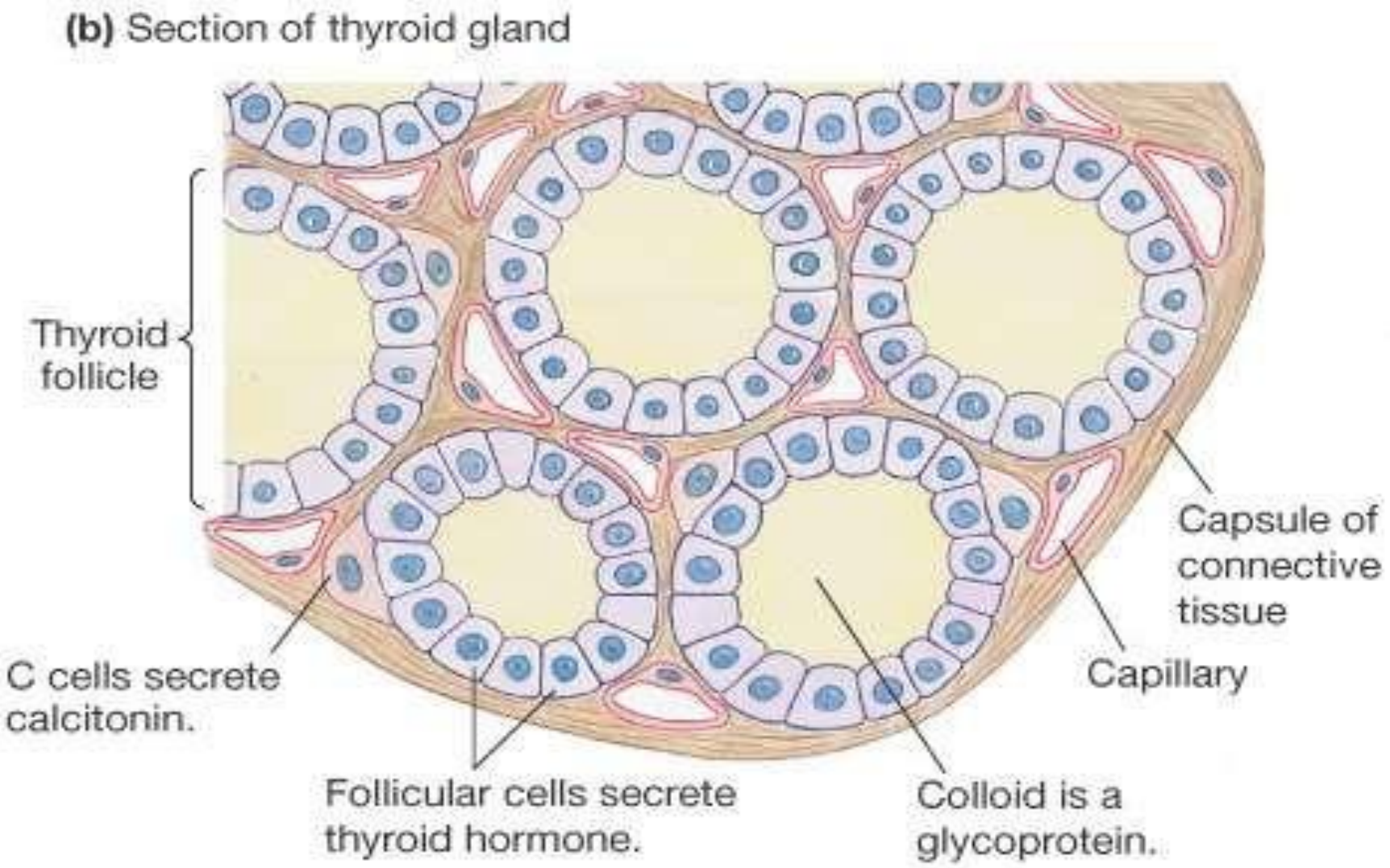
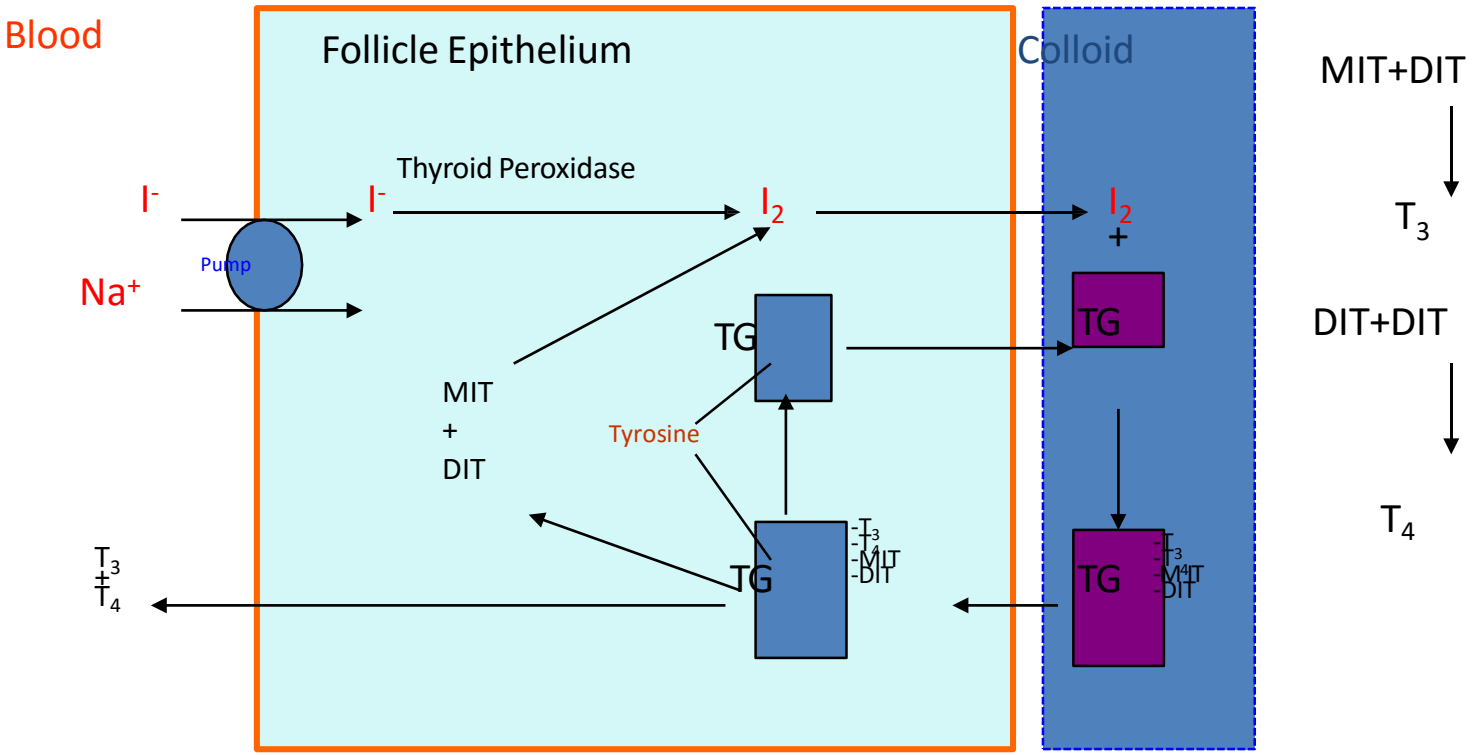


Fig. 48-10. Thyroid and parathyroid glands. Note the surrounding structures.

Thyroid Gland: Hormones and cells



Synthesis of Thyroid Hormone



Thyroid hormone synthesis and secretion involves processes that occur within follicular epithelial cells and in colloid.

I^-: iodide ions; I_2: iodine; TG: thyroglobulin; MIT: monoiodotyrosine; DIT: diiodotyrosine.

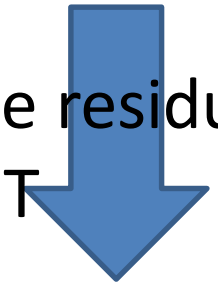
Synthesis of thyroid hormones

1. Iodide trapping

2. Oxidation of iodide
   - By thyroid peroxidase

Synthesis of thyroid hormones

3. Organification
   - Tyrosine residues of thyroglobulin is iodinated
   - Produce monoiodotyrosine residues MIT diiodotyrosine residues DIT



Thyroxine and its precursors: Structure & Synthesis

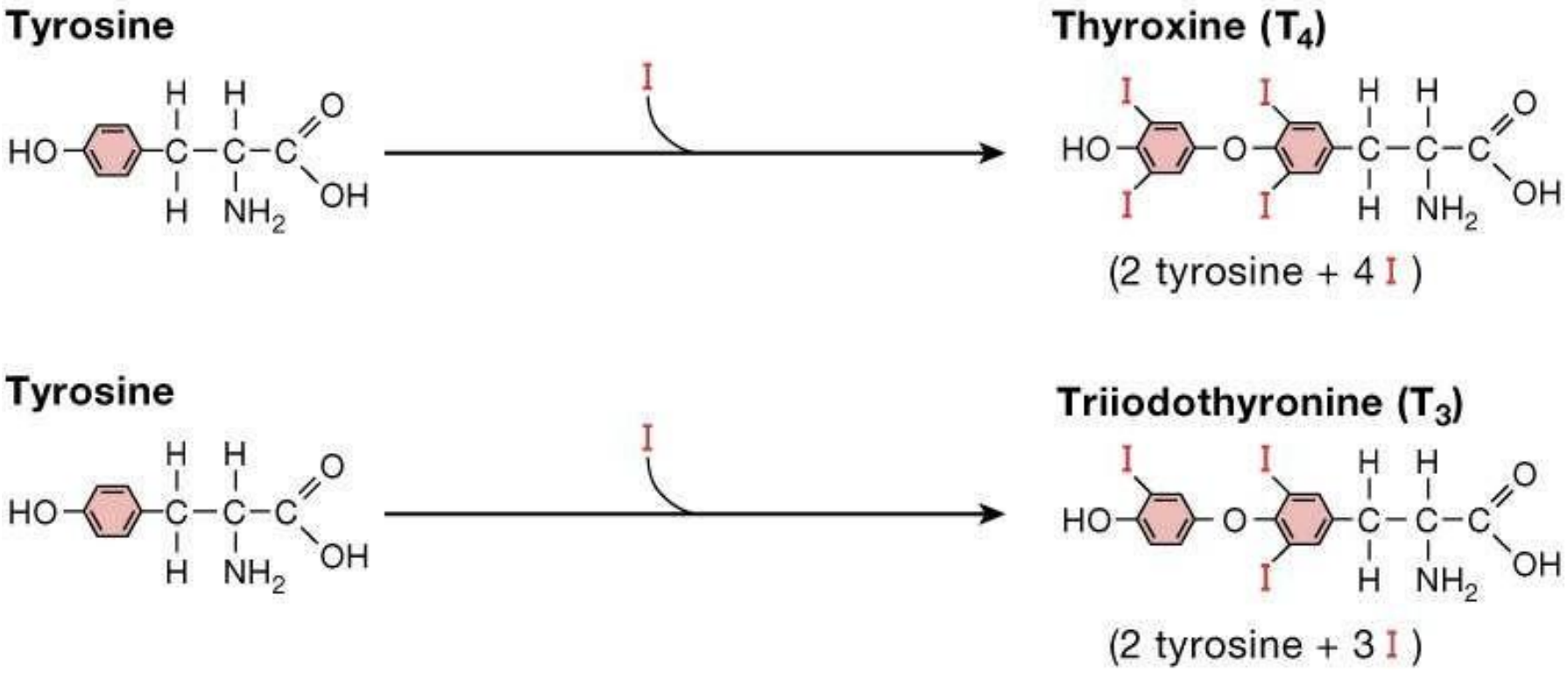
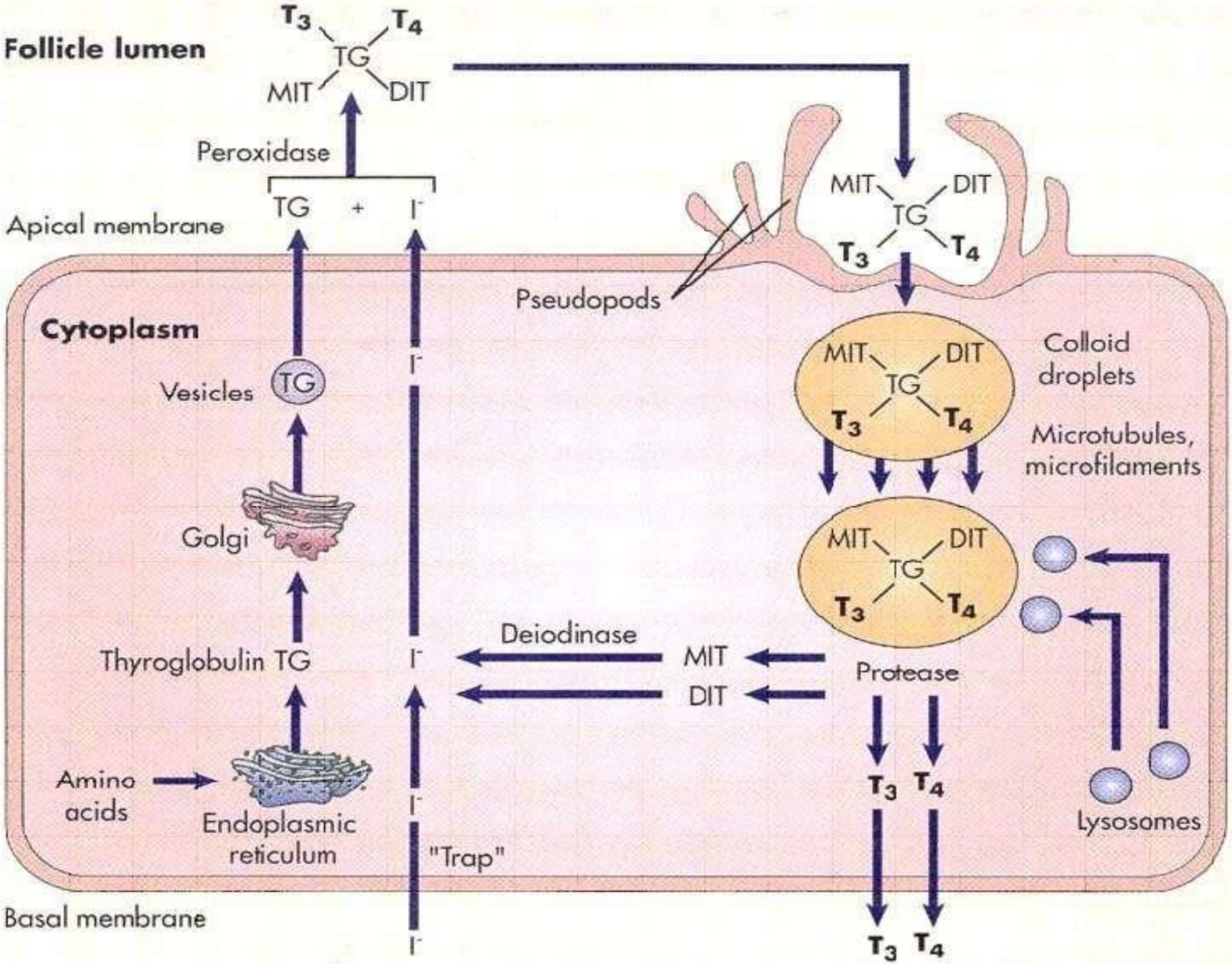


Figure 1-1: Thyroid hormones are made from tyrosine and iodine

Synthesis of thyroid hormones

4. Coupling
   - DIT+MIT=T3
   - DIT+MIT=T4
5. Storage :
   - Along with thyroglobulin
6. Exocytosis and proteolysis
   - Release of T4 & T3
7. Conversion of T4 to T3 in peripheral tissue


Follicle lumen
T3
T4
TG
MIT
DIT
Peroxidase
TG + I-
Apical membrane
Pseudopods
MIT
DIT
TG
T3
T4
Cytoplasm
Colloid droplets
Vesicles
TG
Microtubules, microfilaments
Golgi
Deiodinase
MIT
DIT
Protease
Thyroglobulin TG
I-
Amino acids
Endoplasmic reticulum
"Trap"
Lysosomes
Basal membrane

T4
T3vs

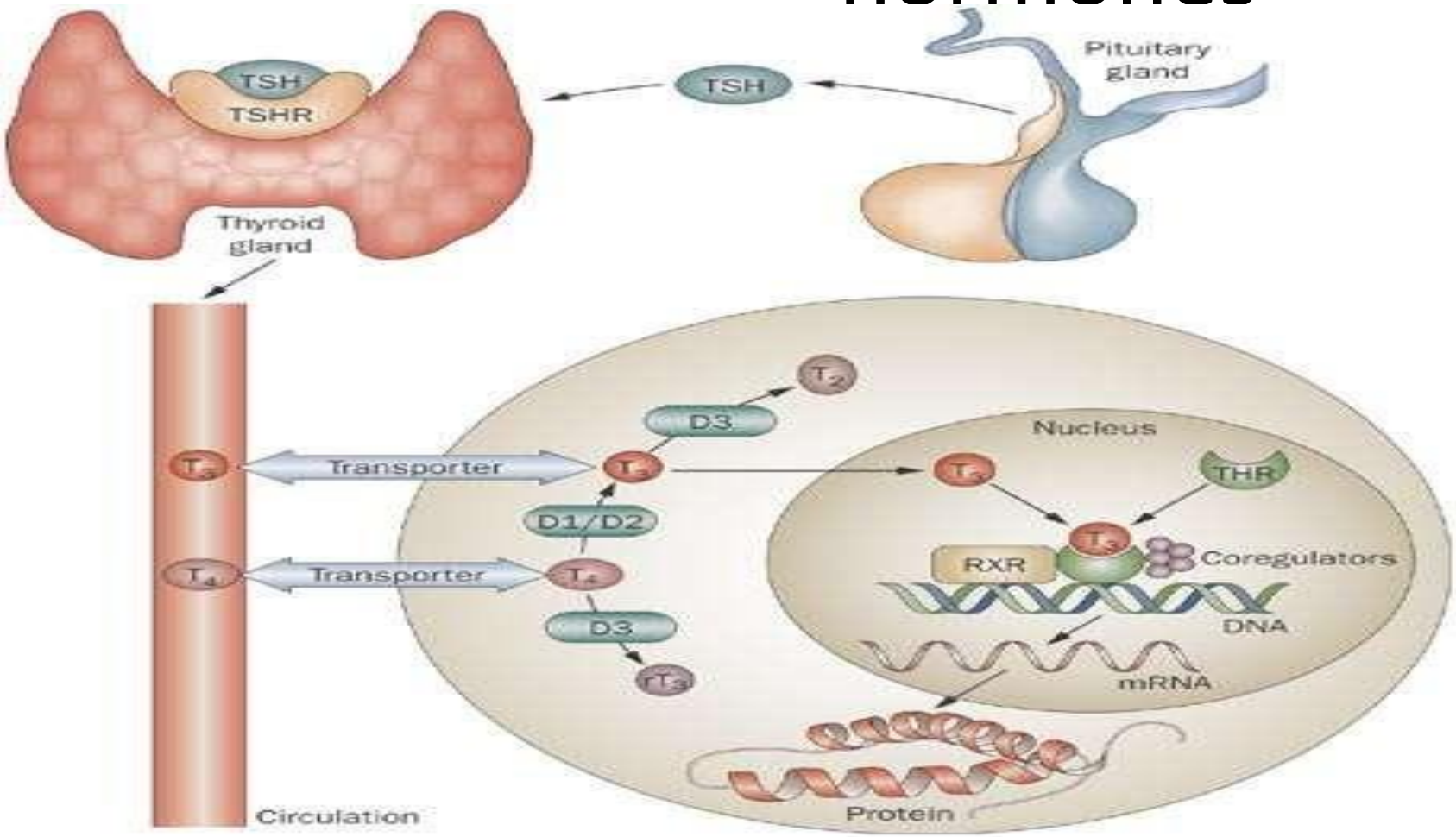
T4

- Thyroid gland synthesize 90%
- 0.04%free
- Not active

T3

- Thyroid gland synthesize 9%
- 0.4% fr
- active

Mechanism of action of thyroid hormones



Thyroid Gland

- Thyroid hormones target almost every body cell
- Can enter cells & bind to intracellular receptors on mitochondria & in nucleus
- Effects include:
  - increased ATP production
  - increased cellular metabolism, energy utilization &oxygen consumption
  - increased body temperature
  - growth & development of skeletal,muscular & nervous system in fetus & children

Effects Of Thyroid Hormones On The Cardiovascular System

- Increase heart rate
- Increase force of cardiac contractions
- Increase stroke volume
- Increase Cardiac output

Effects Of Thyroid Hormones On The Respiratory System

- Increase resting respiratory rate
- Increase minute ventilation
- Increase ventilatory response to hypercapnia and hypoxia

Effects Of The Thyroid Hormones On The Renal System

- Increase blood flow
- Increase glomerular filtration rate

Effects Of The Thyroid Hormones On Oxygen Carrying Capacity

Increase RBC mass

Increase oxygen dissociation from hemoglobin

Effects Of The Thyroid Hormones On Intermediary Metabolism

- Increase glucose absorption from the GI tract
- Increase carbohydrate,lipid and protein turnover
- Down-regulate insulin receptors

Effects Of The Thyroid Hormones In Growth And Tissue Development

- Increase growth and maturation of bone
- Increase tooth development and eruption
- Increase growth and maturation of epidermis,hair follicles and nails
- Increase rate and force of skeletal muscle contraction
- Inhibits synthesis and increases degradation of mucopolysaccharides in subcutaneous tissue

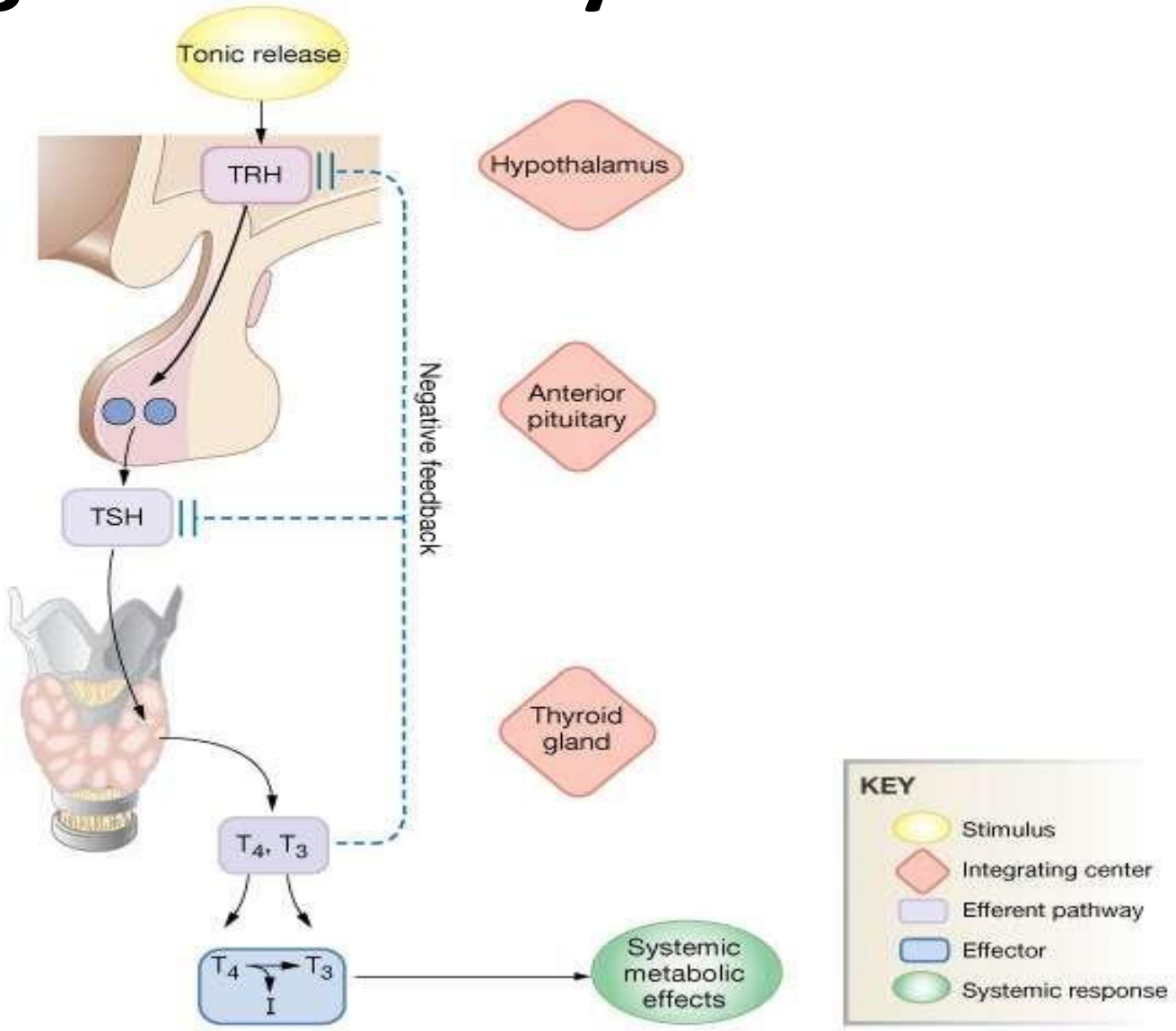
Effects Of The Thyroid Hormones On The Nervous System

- for normal CNS neuronal development
- Enhances wakefulness and alertness
- Enhances memory and learning capacity
- Required for normal emotional tone
- Increase speed and amplitude of peripheral nerve reflexes

Effects Of The Thyroid Hormones On The Reproductive System

- Required for normal follicular development and ovulation in the female
- Required for the normal maintenance of pregnancy
- Required for normal spermatogenesis in the male

Regulation of Thyroid Hormones



Goiter

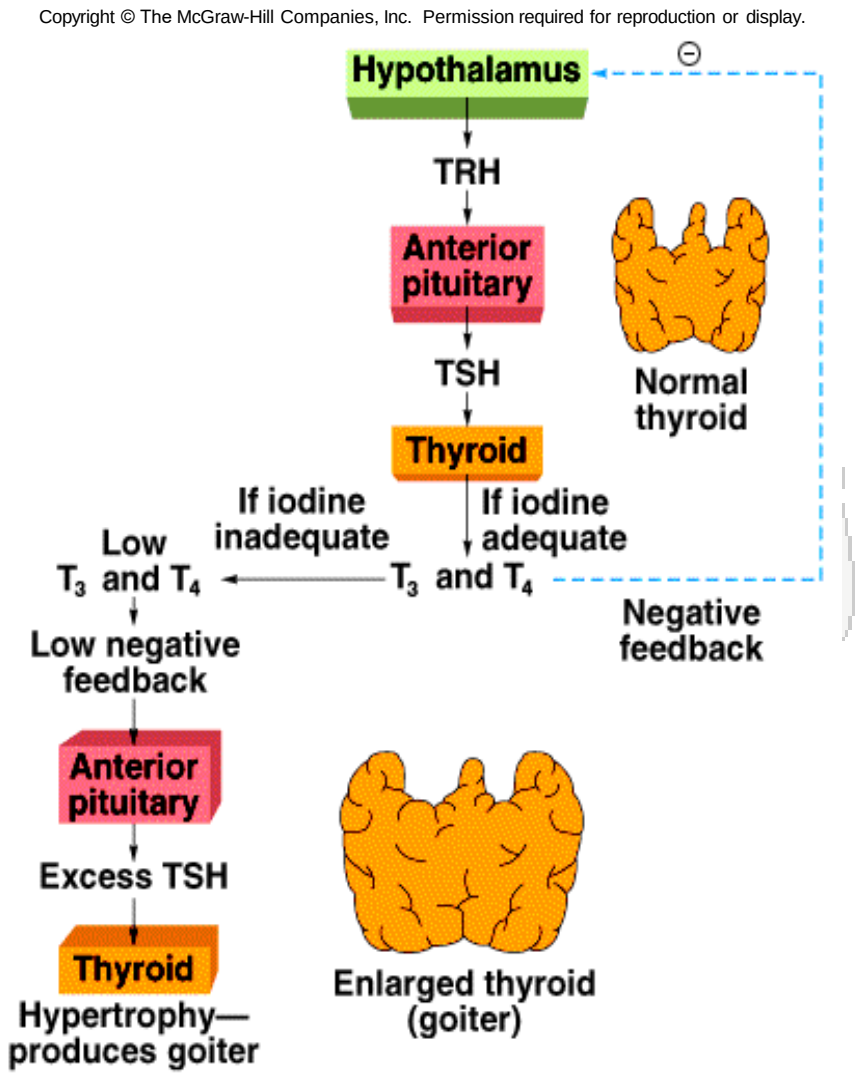
Thyroid Gland Function

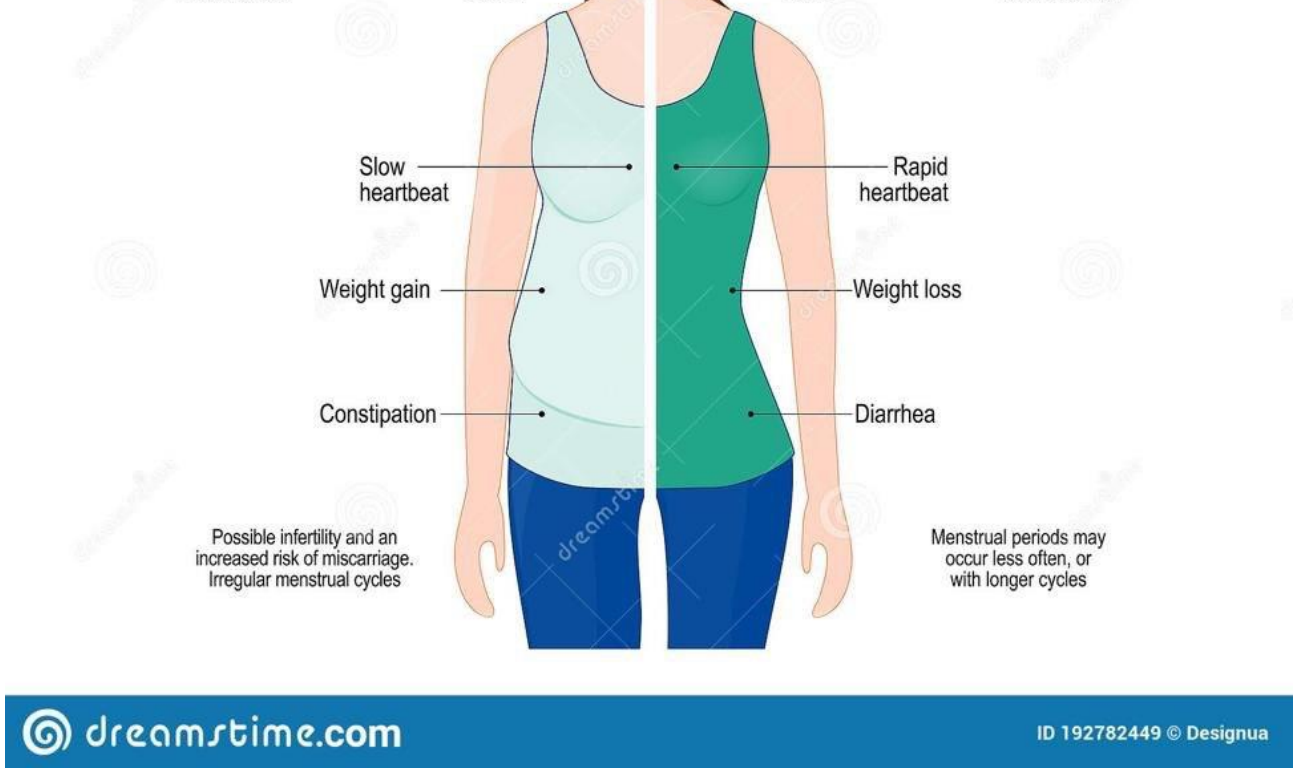
- Thyroxin (T4) and triiodothyronine (T3) → speed up metabolic rate
- Calcitonin → lowers blood Ca^{2+} levels
- Thyroid pathologies: Hyper- and Hypothyroidism

Exophthalmus

Goiter Formation

- **Lack of iodine**
- **Interferes with negative feedback control of TSH**
- **Results in abnormal enlargement of the thyroid gland**



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you