

Mustansiriyah University

College of science

Biology Dept.

Zoology

4th class

ENOCRINOLOGY LAB.

(4)

NAME :

THE THYROID GLAND

- **The thyroid gland** is the largest, butterfly-shaped endocrine glands & is located at the base of the neck immediately below the Larynx, on each side of & anterior to the trachea.
- The thyroid gland **consists of** two lobes of endocrine tissue (lying on either side of trachea) joined in the middle by a narrow portion of the gland called as the **Isthmus**.
- The thyroid has one of the **highest rates of blood flow per gram** of tissue.
- In a normal adult male, it **weighs 15-20 g** but is capable of enormous growth, sometimes achieving a weight of several hundred grams.



The Thyroid

Thyroid Gland
is UNIQUE among other endocrine
glands in 3 ways

1. PHYSICAL

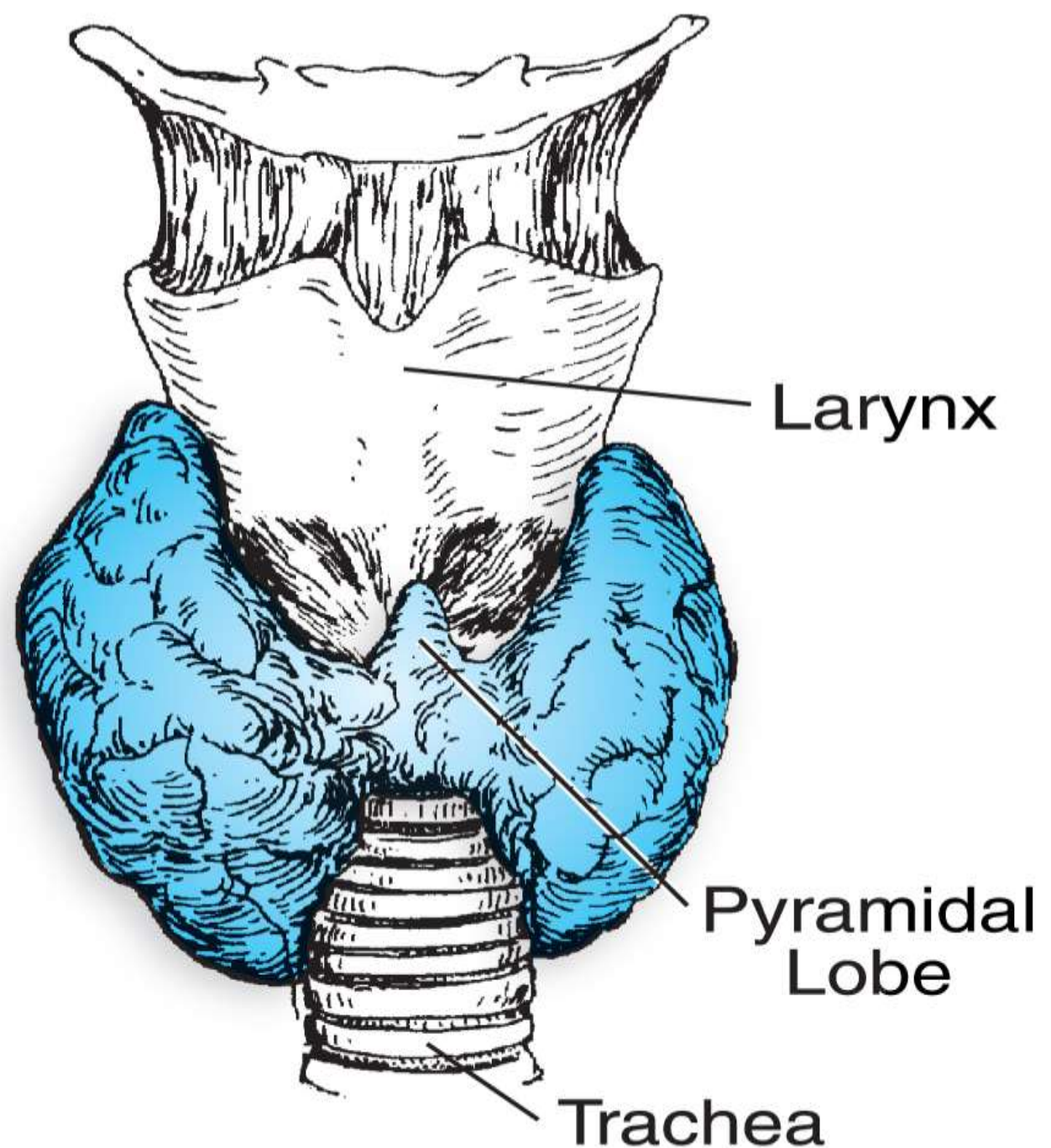
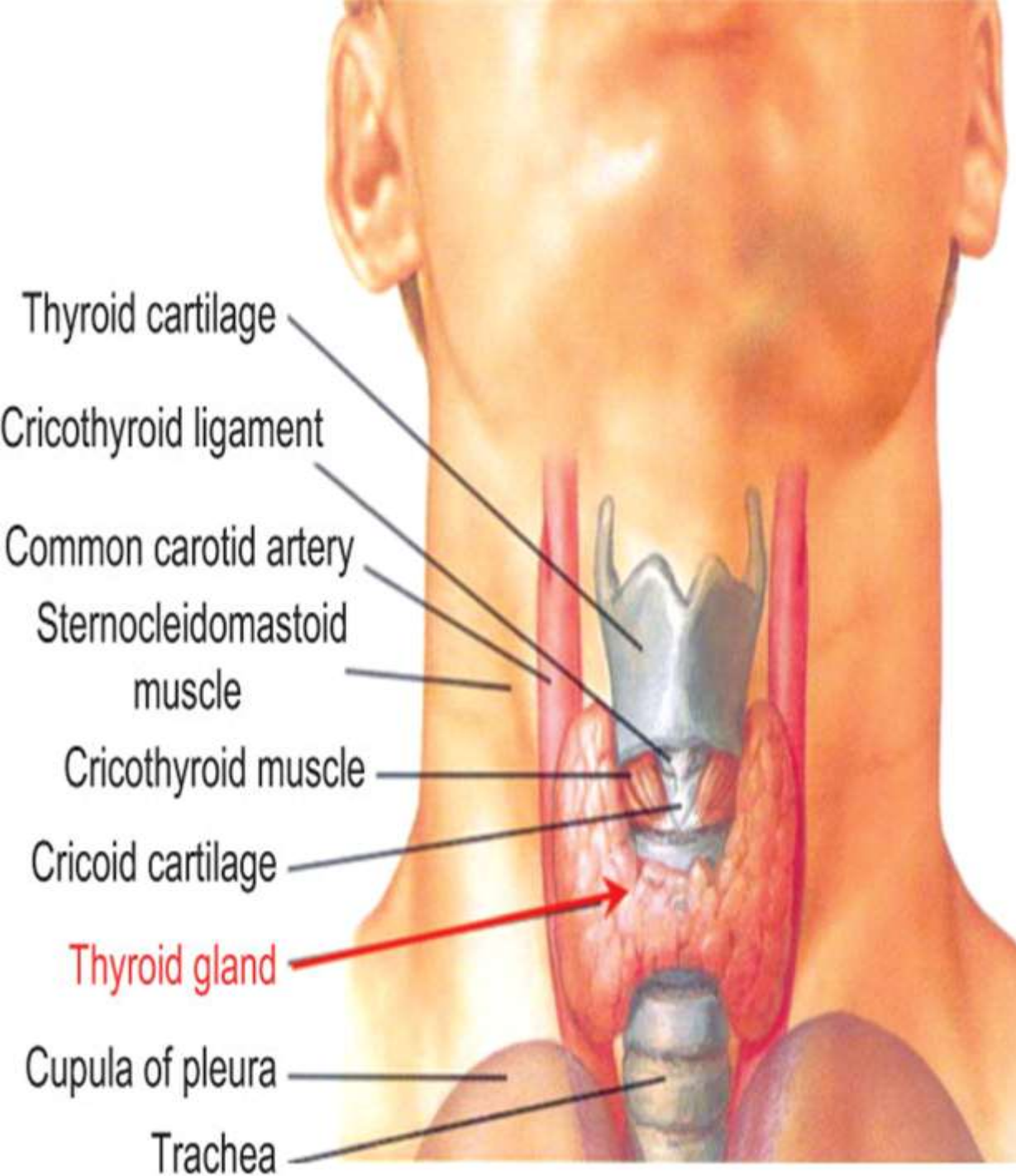
Only gland which
can be seen &
palpated.

2. BIOCHEMICAL

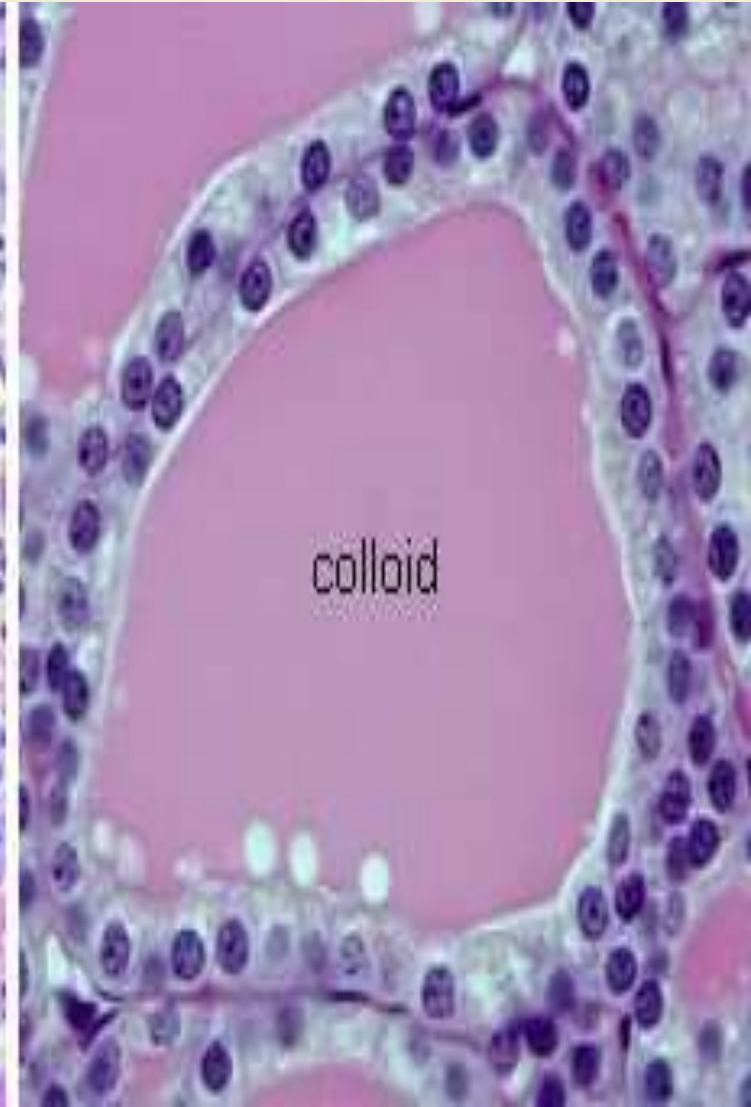
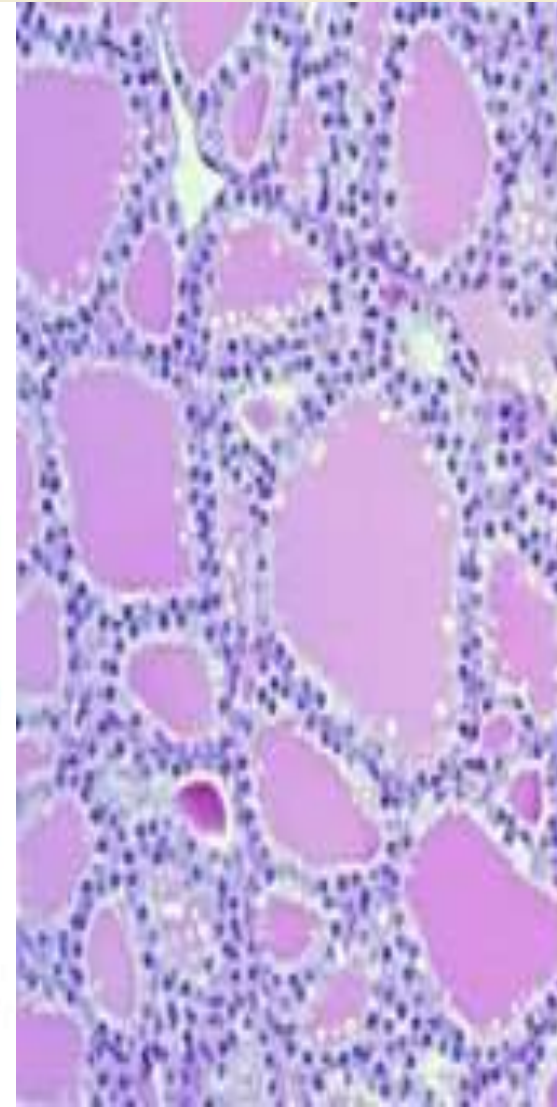
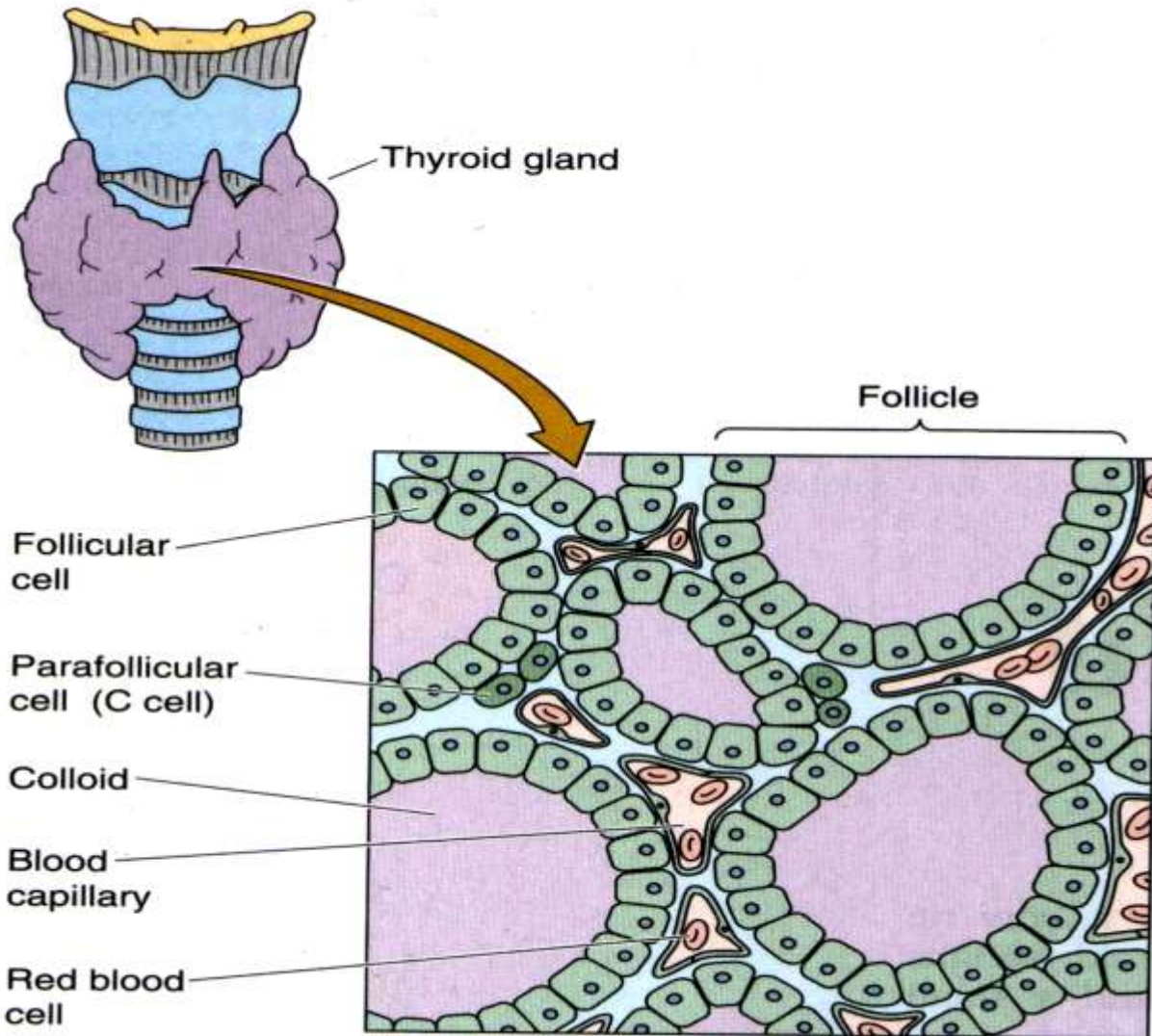
Only hormone that
needs a trace
element Iodine for
its production

3. PHYSIOLOGY

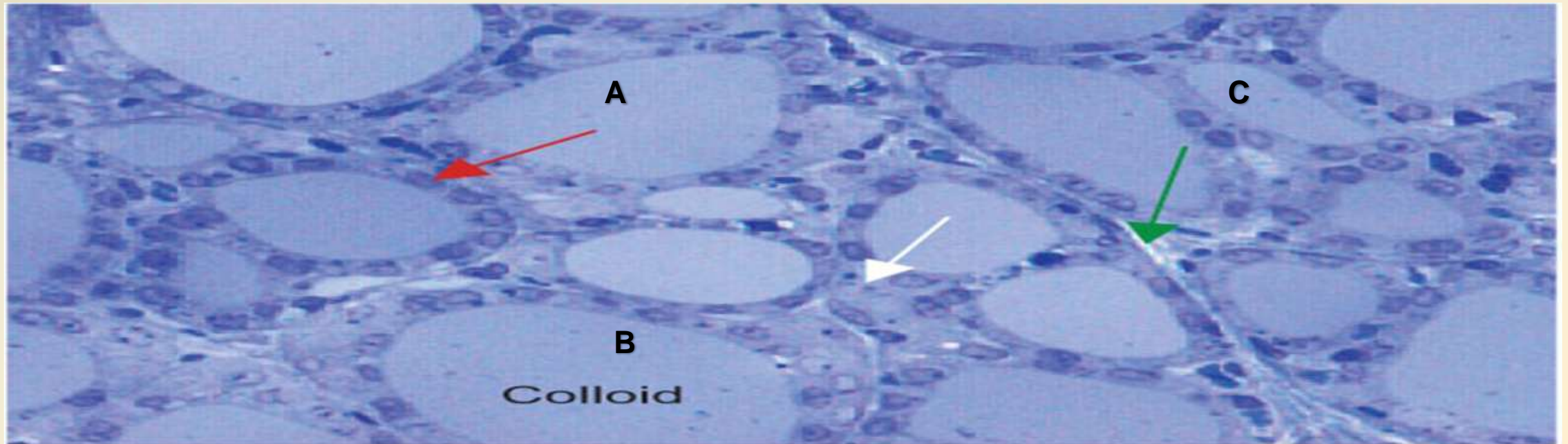
Hormone is stored
in an extracellular
site in the *Thyroid
Colloid.*



Histology of Thyroid



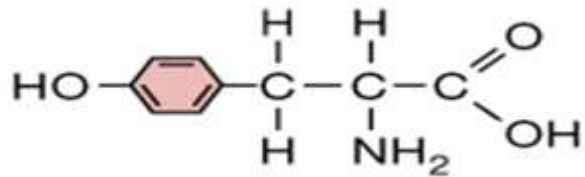
- A. The functional unit: follicle– epithelial cells (cuboidal)produces **thyroid hormones**
- B. Glycoprotein colloid, inside the follicle, called thyroglobulin
- C. A group of follicle forms a lobule surrounded by connective tissue (septum)



THYROID HORMONES

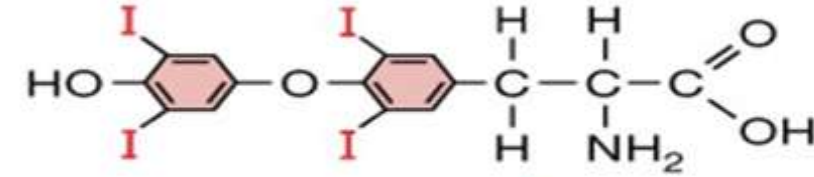
- The Thyroid gland secretes 3 major hormones:
- Thyroxine or T₄ : having 4 atoms of Iodine. (secreted in largest amount)
 - Triiodothyronine or T₃ : having 3 atoms of Iodine (secreted in lesser amount)

Tyrosine



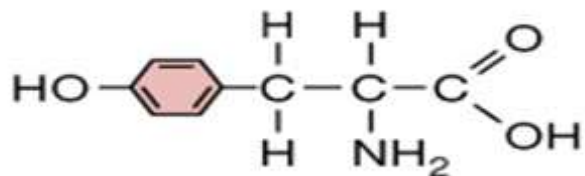
I

Thyroxine (T₄)



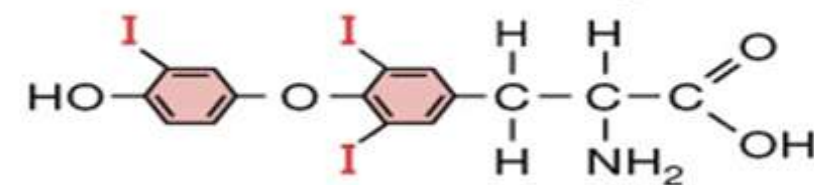
(2 tyrosine + 4 I)

Tyrosine

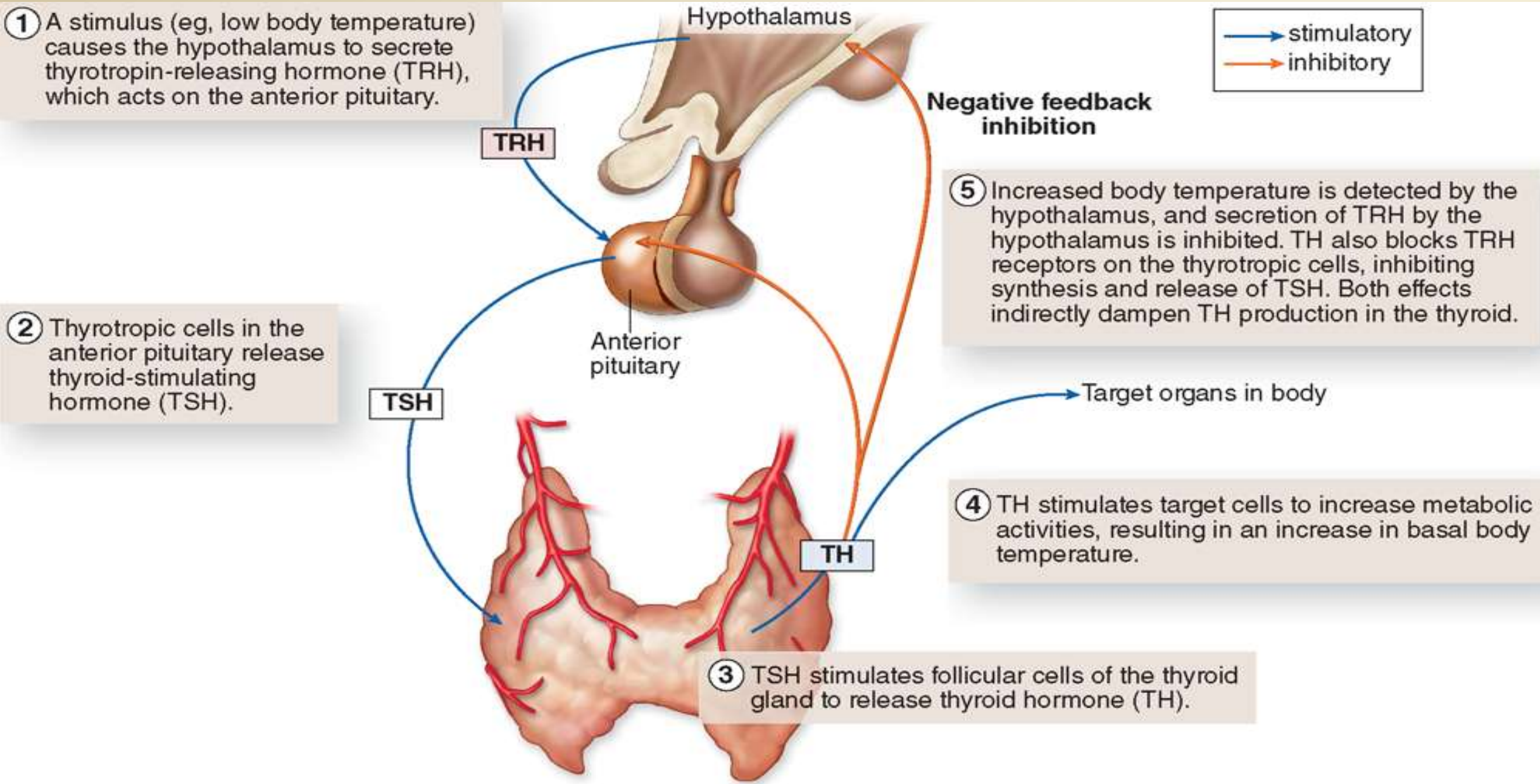


I

Triiodothyronine (T₃)



(2 tyrosine + 3 I)



① A stimulus (eg, low body temperature) causes the hypothalamus to secrete thyrotropin-releasing hormone (TRH), which acts on the anterior pituitary.

② Thyrotropic cells in the anterior pituitary release thyroid-stimulating hormone (TSH).

③ TSH stimulates follicular cells of the thyroid gland to release thyroid hormone (TH).

④ TH stimulates target cells to increase metabolic activities, resulting in an increase in basal body temperature.

⑤ Increased body temperature is detected by the hypothalamus, and secretion of TRH by the hypothalamus is inhibited. TH also blocks TRH receptors on the thyrotropic cells, inhibiting synthesis and release of TSH. Both effects indirectly dampen TH production in the thyroid.

Negative feedback inhibition

Target organs in body

THYROID HORMONES

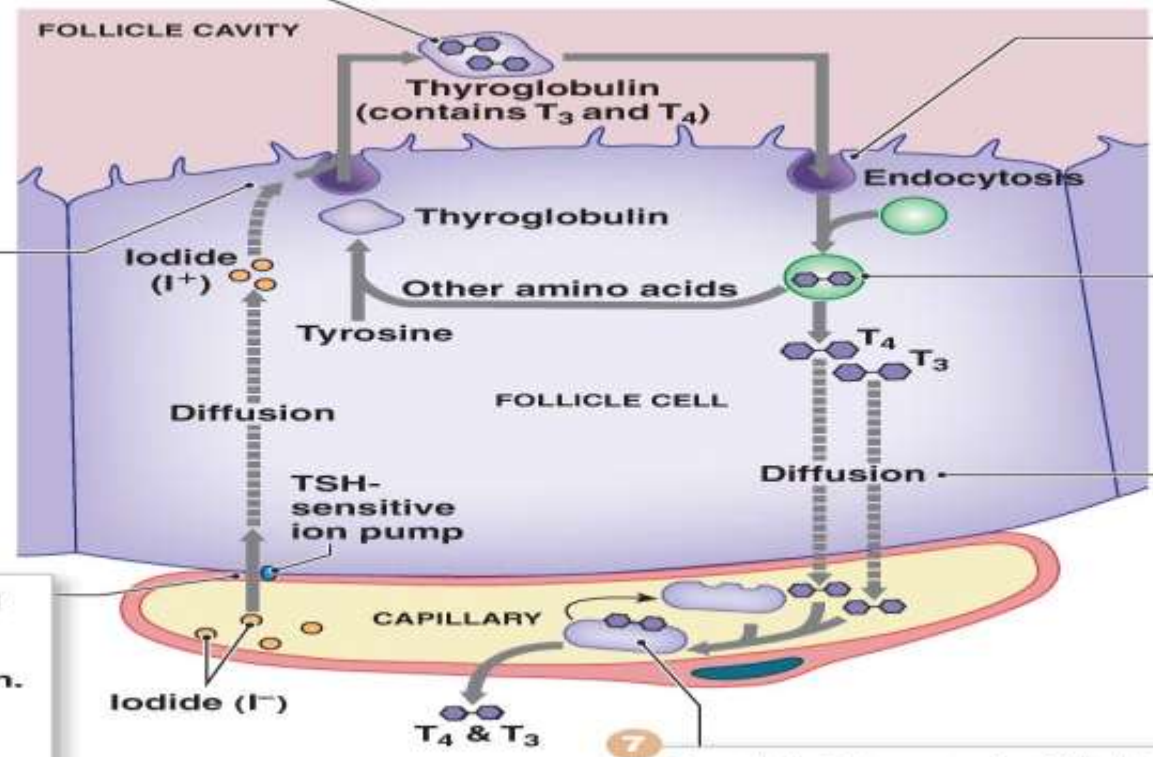
- About 93% of secreted hormone is T_4 , while 7% is T_3 . However, almost all T_4 is ultimately converted into T_3 .
- The functions of the 2 hormones are the SAME but they differ in rapidity & intensity of action.
- T_3 is about 4 times as potent as T_4 , and has a much greater biological activity but is present in blood in much smaller quantities & for a much shorter time!

The continuous process by which thyroid hormones are produced and then stored within thyroglobulin in thyroid follicles

3 The hormone **thyroxine** (thī-ROKS-ēn), or **T₄**, contains four iodide ions. A related molecule called **T₃** contains three iodide ions. Eventually, each molecule of thyroglobulin contains four to eight molecules of T₃, T₄, or both.

2 The iodide ions diffuse to the apical surface of each follicle cell, where they are enzymatically converted to an activated form of iodide (I⁺). This reaction also attaches one or two activated iodide ions to the tyrosine portions of a thyroglobulin molecule within the follicle lumen.

Start **1** Iodide ions are absorbed from the diet and are delivered to the thyroid gland by the bloodstream. Carrier proteins in the basal membrane of the follicle cells actively transport iodide ions (I⁻) into the cytoplasm.



4 Follicle cells remove thyroglobulin from the follicle cavity by endocytosis.

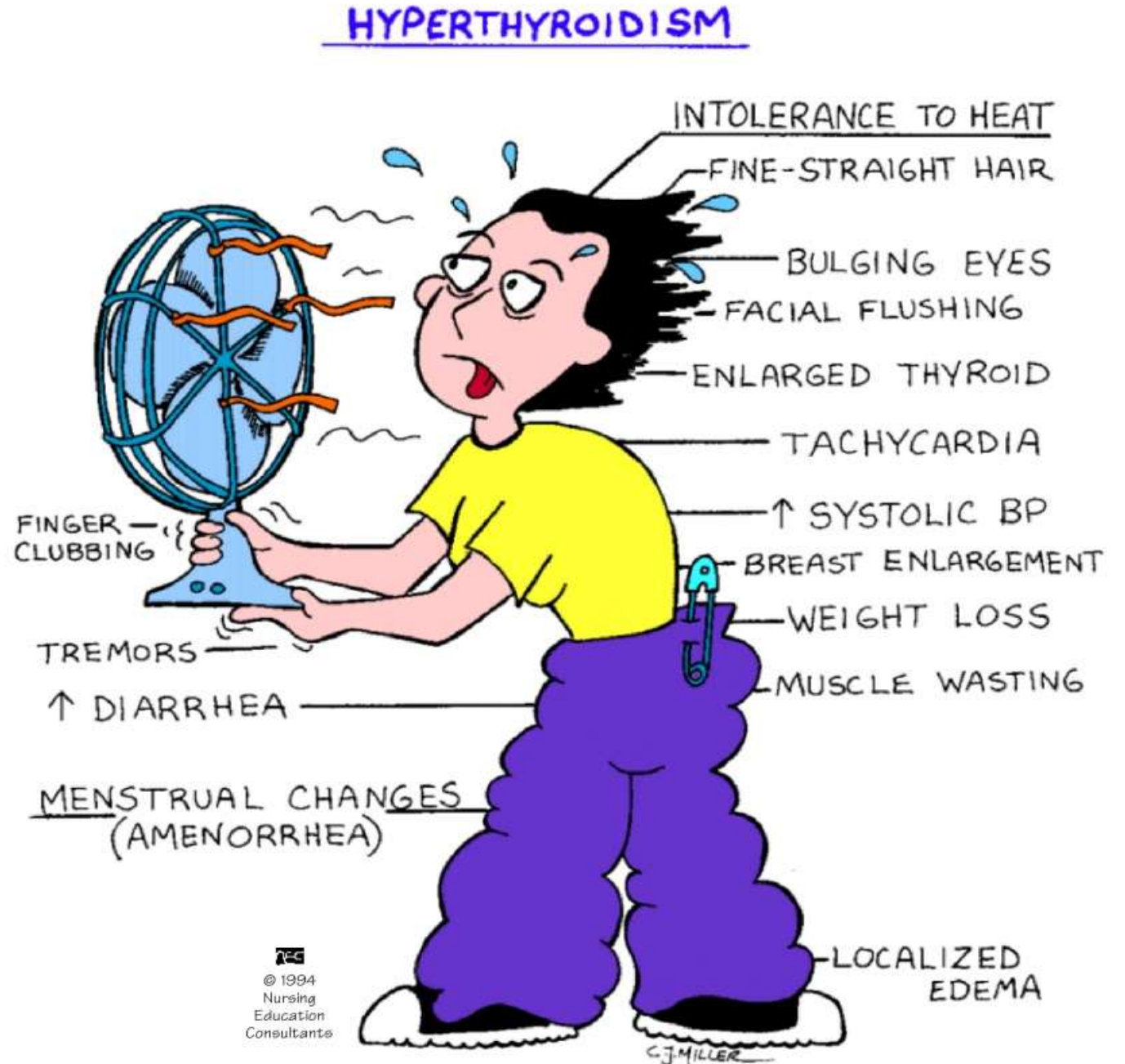
5 Lysosomal enzymes break the thyroglobulin down, and the released amino acids and thyroid hormones enter the cytoplasm. The amino acids are then recycled and used to synthesize more thyroglobulin.

6 The released molecules of T₃ and T₄ diffuse across the basement membrane and enter the bloodstream. About 90 percent of all thyroid secretions is T₄; T₃ is secreted in comparatively small amounts although its metabolic effects are much stronger than those of T₄.

7 Roughly 75 percent of the T₄ molecules and 70 percent of the T₃ molecules entering the bloodstream become attached to transport proteins called **thyroid-binding globulins (TBGs)**. The transport proteins release thyroid hormones only gradually, and the bound thyroid hormones represent a substantial reserve: The bloodstream normally contains more than a week's supply of thyroid hormones.

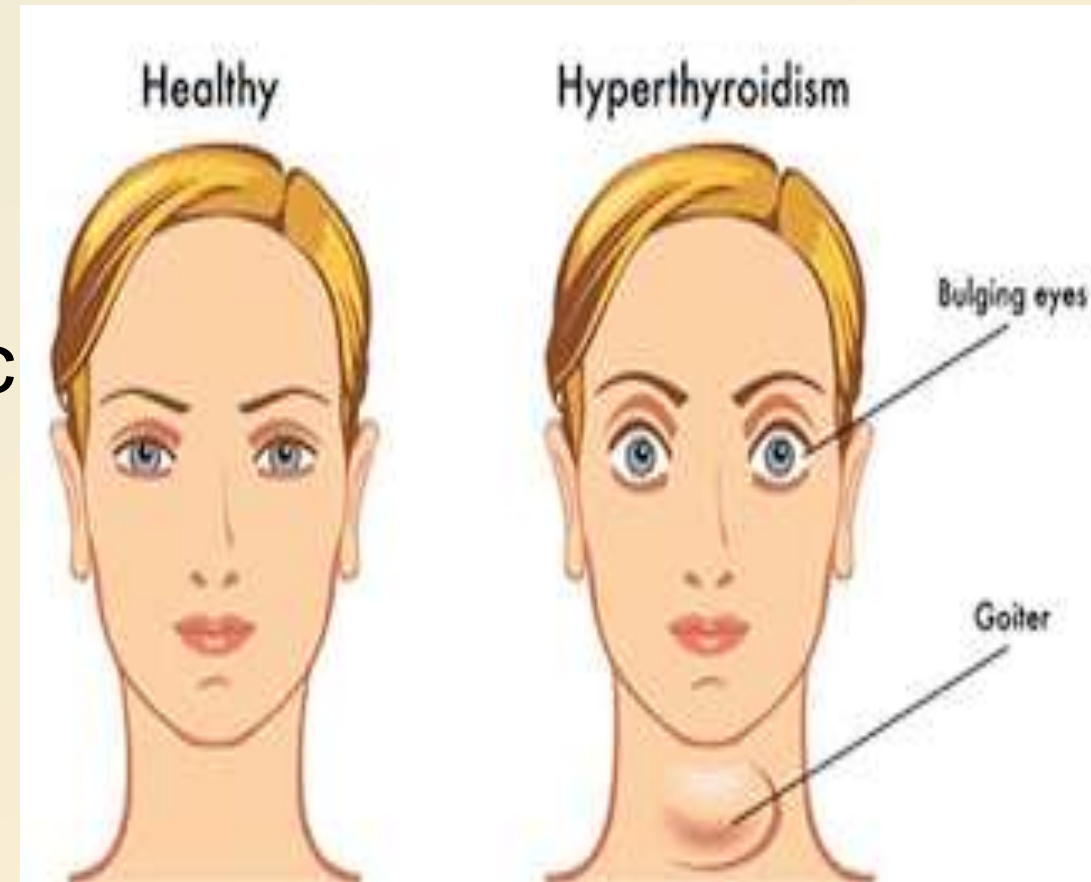
Hyperthyroidism

Hyperthyroidism is present when the thyroid gland is over secreting hormones.



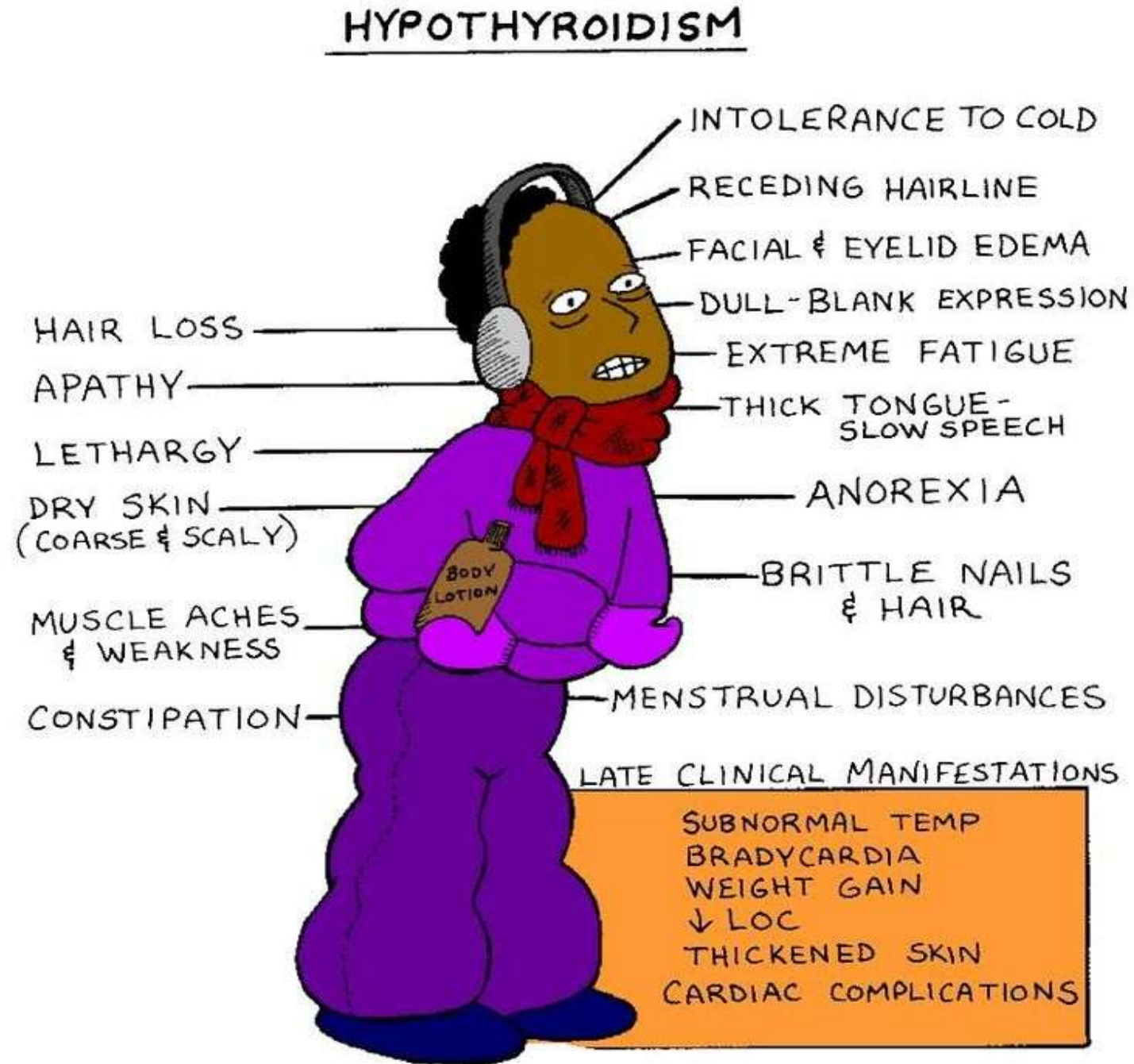
Causes of Hyperthyroidism

- Grave's disease.
- A benign nodule on the thyroid.
- Thyroiditis.
- Taking too much of the synthetic thyroid hormone.



Hypothyroidism

- Hypothyroidism is present when the thyroid gland is producing little or no thyroid hormones. Thus slowing things down....



Causes of Hypothyroidism

- Hashimoto's thyroiditis also known as chronic lymphocytic **thyroiditis** and **Hashimoto's disease**, (is an autoimmune **disease** in which the thyroid gland is gradually destroyed).
- Treatment for hyperthyroidism
- Congenital hypothyroidism
- Radiation therapy given to the head and/or neck