

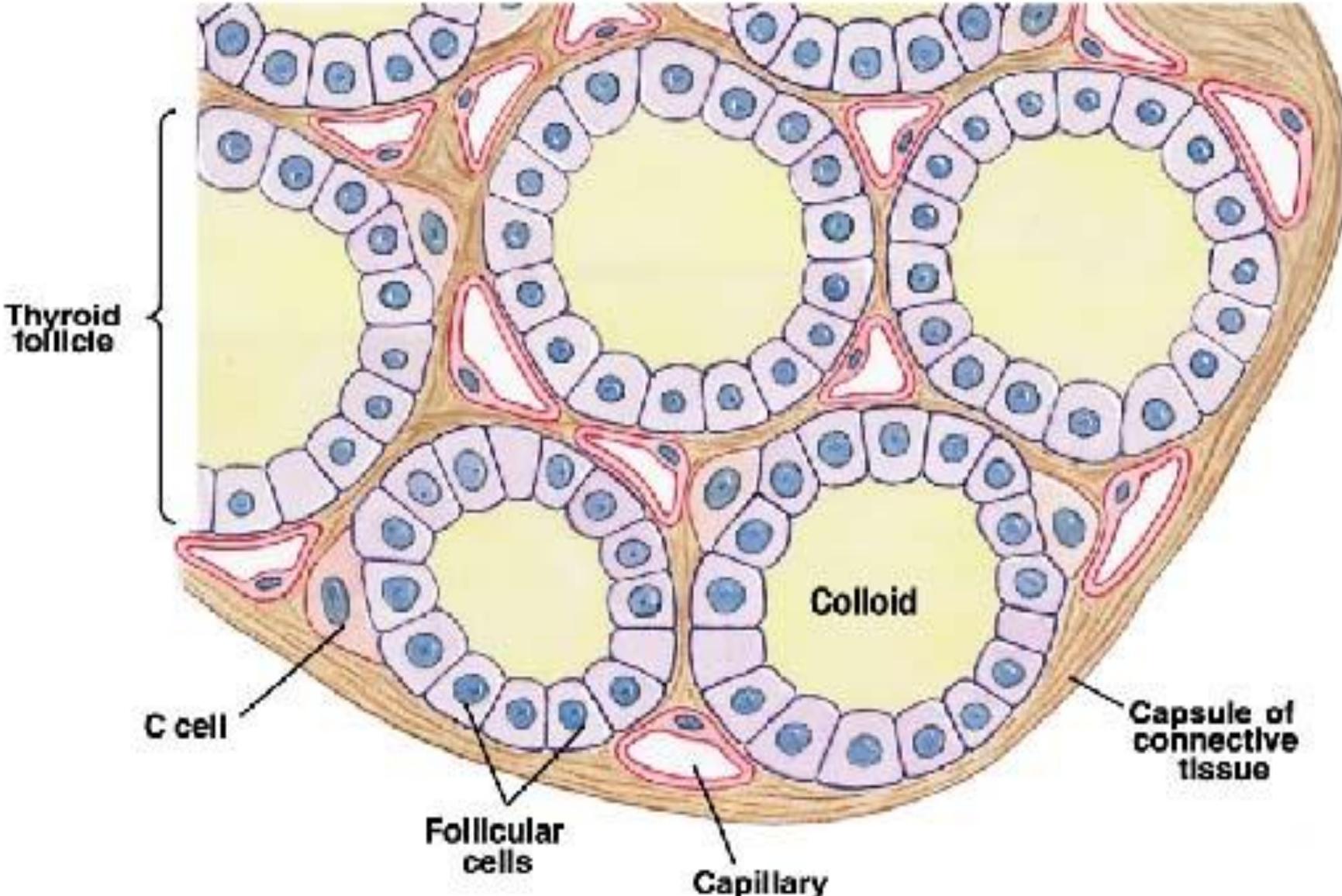
Thyroid gland

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Structure

- It is formed of two lobes connected by a narrow isthmus .
- The gland is formed of thyroid follicles , each follicle is surrounded by a single layer of epithelial cells and its lumen is filled with a protein material called colloid (which is formed and secreted by follicular cells).
- In between the follicles there are other cells called parafollicular cells .
- The gland is richly supplied with blood vessels .

Section of thyroid gland



Thyroid hormones

1. Thyroxine (T_4) : tetraiodothyronine
2. Triiodothyronine (T_3)

both T_3 & T_4 are formed by thyroid follicles

3. Calcitonin : secreted by parafollicular cells (C cells) it causes lowering of blood Ca^{++} level .

Transport of thyroid hormone

- **Once T_3 and T_4 enter the circulation , they bound to plasma proteins and only less than 1% of the hormones are free .**
- **This free form of the hormone is the active form that can perform its actions .**
- **T_3 is more active than T_4 and T_4 is converted to T_3 inside target cells.**

Mechanism of action :

- Thyroid hormone enter the cells , bind to the receptor in the nucleus → increase transcription of mRNA that stimulate the production of various enzymes in the ribosomes .



Actions of T₃ and T₄

1. *Metabolic function*

a. Calorigenic action :

Thyroid hormones increase O₂ consumption, heat production and basal metabolic rate (BMR).

b. On protein metabolism :

Normal level of thyroid hormones increase protein synthesis (anabolic effect) .

High level of thyroid hormones increase protein breakdown (catabolic effect) .

c. On carbohydrate metabolism :

Thyroid hormone increase glucose absorption from GIT so blood glucose increase after meal , but rapidly fall to normal level again due to increased uptake of glucose by the tissues to be used for energy production .

d. On lipid and cholesterol metabolism :

They lower blood lipid and cholesterol by increasing its removal from circulation by the liver.

e. Stimulate conversion of carotenes to vitamin A in the liver .

2. Effect on growth and development

Thyroid hormones are necessary for growth and maturation of most tissues.

3. On CNS

- Thyroid hormones are essential for normal brain development during fetal life and in children .**
- In adult , they increase response of brain to catecholamines and increase activity of reticular activating system (RAS) .**

4. On CVS

a. They increase all cardiac properties by increasing number and affinity of B adrenergic receptors (to catecholamines) and by direct effect which lead to :

- Increase heart rate (H.R.)**
- Increase stroke volume (S.V.)**
- Increase cardiac out put (COP)**
- Increase systolic blood pressure .**

b. Cutaneous V.D occurs by the produced heat .

**↓ peripheral resistance causes
decreased diastolic blood pressure .**

c. Increased pulse pressure.

5. On respiration

- shift of O_2 curve to Rt by increasing 2,3 DPG in RBCs**
- Increase pulmonary ventilation due to increased metabolic rate with more O_2 utilization and more CO_2 formation (through activation of chemoreceptors) .**

6. On GIT

- Increase appetite and food intake .**
- Increase GIT motility .**

7. On sex functions :

- Thyroid hormone are essential for normal menstrual cycle & Spermatogenesis (normal fertility)**

Regulation of thyroid hormone

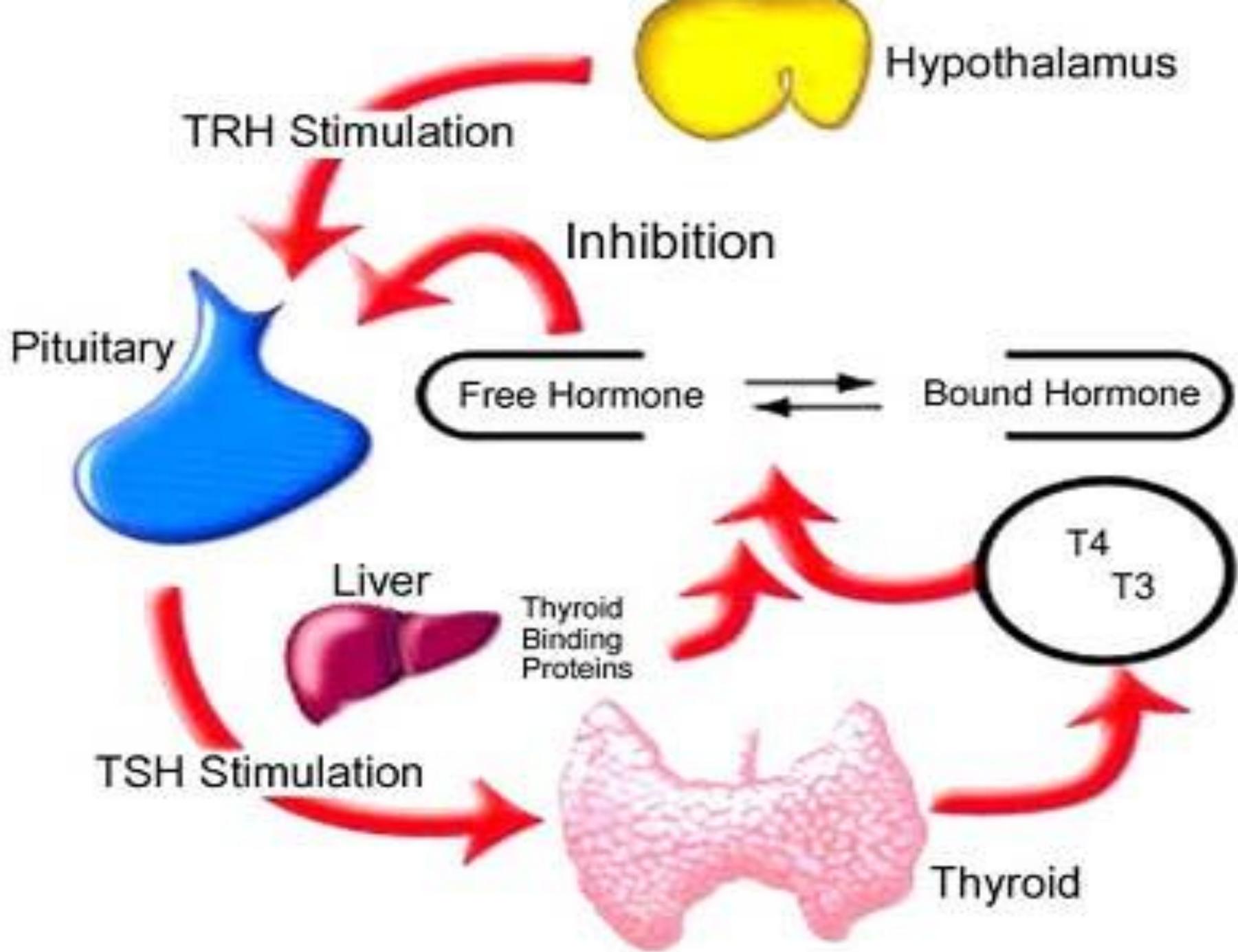
1. Hypothalamic regulation

1. TRH (thyrotropin releasing hormone)

- Exposure to cold increase TRH release
- Stress , emotions and warmth decrease TRH

2. Somatostatin

- It inhibit TSH secretion thus it inhibit thyroid hormone secretion .

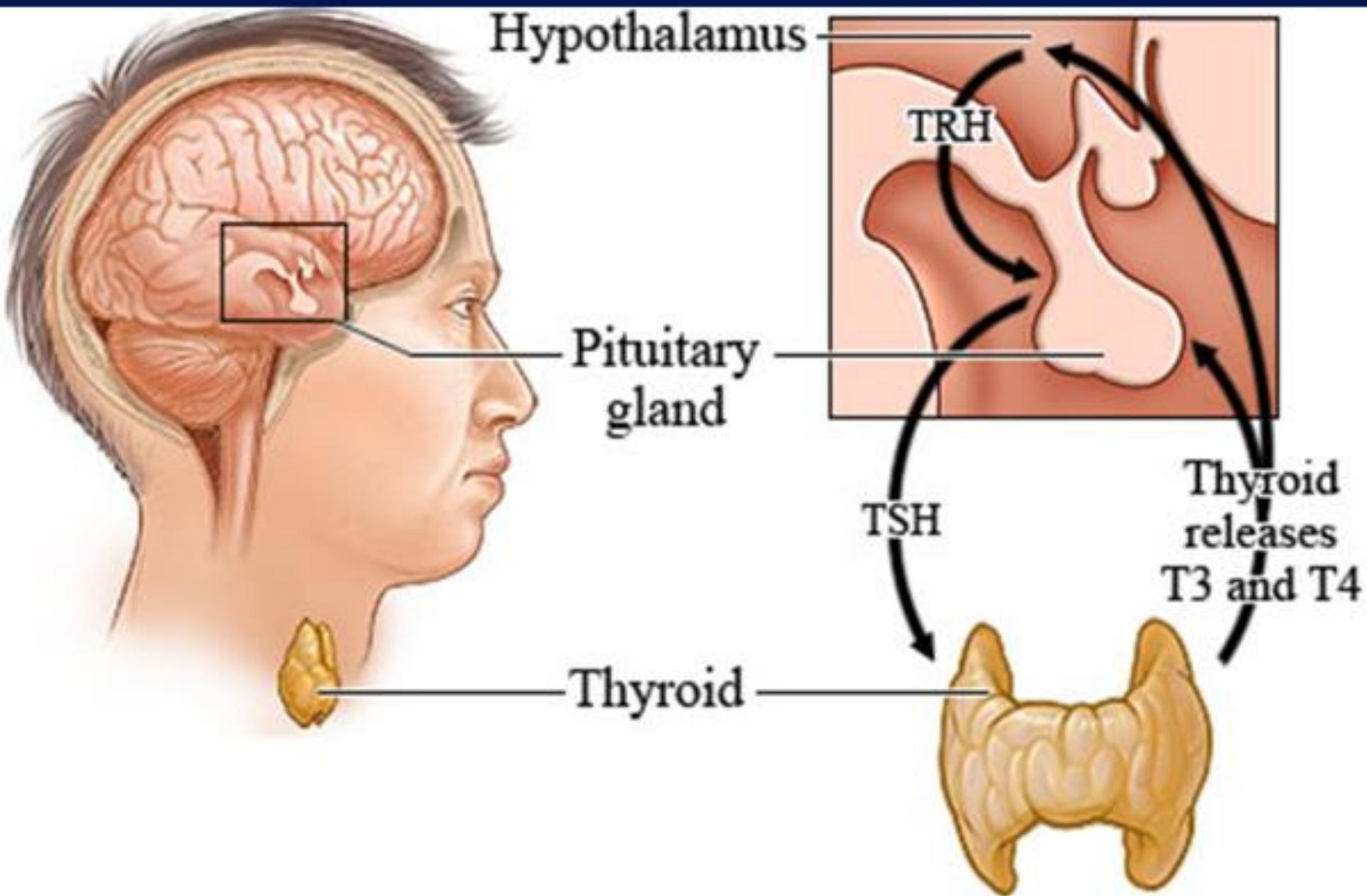


2. Pituitary regulation (TSH)

3. Feedback regulation :

- \uparrow free T_3 and T_4 in blood inhibit TSH secretion by negative feedback on anterior pituitary and hypothalamus .

- Thus , when free T_3 and T_4 decreased in blood TSH secretion will be increased .



4. Blood iodide level :

- Adequate dietary iodine intake is essential for normal thyroid function .**
- Decreased iodine intake \rightarrow \downarrow T3 and T4 synthesis and release \rightarrow \uparrow TSH \rightarrow \uparrow size of the gland = thyroid enlargement (goiter)**
- Excess iodide in blood \rightarrow decreases thyroid hormone in blood as it inhibits thyroid hormone synthesis and release by blocking the action of TSH .**

Goiter

Definition : goiter is non-inflammatory and non-malignant thyroid enlargement .



- **Types :**

- 1. Simple goiter :**

It is associated with normal thyroid function

It is due to :

- **Mild iodine deficiency**
- **During puberty and pregnancy , due to increase need for iodine .**
- **Thyroid hormone decreased at first causing increase in TSH which causes thyroid enlargement with more formation of thyroid hormone thus thyroid function remains normal .**

2. Colloid Goiter :

Cause : severe iodine deficiency

Here , the enlarged thyroid gland can't synthesize excess thyroid hormone due to severe iodine deficiency .

It is associated with hypothyroidism .

3. Toxic Goiter : This thyroid enlargement is associated with thyroid hyper function .

it is called Graves' disease .

it is an auto immune disease in which the immune system secretes auto antibodies called long- acting thyroid stimulators (LATS) .

These antibodies activate TSH receptors producing hyperthyroidism due to increased formation of thyroid hormone .

■ LATS have long duration of action .

A vibrant sunset scene with a bright sun partially obscured by dark, silhouetted mountains. The sky is a mix of deep reds, oranges, and purples, with some clouds catching the light. The sun's reflection is visible on the water in the foreground. The text 'THank you' is overlaid in a large, blue, sans-serif font with a white outline. The 'T' is significantly larger than the other letters.

THank you