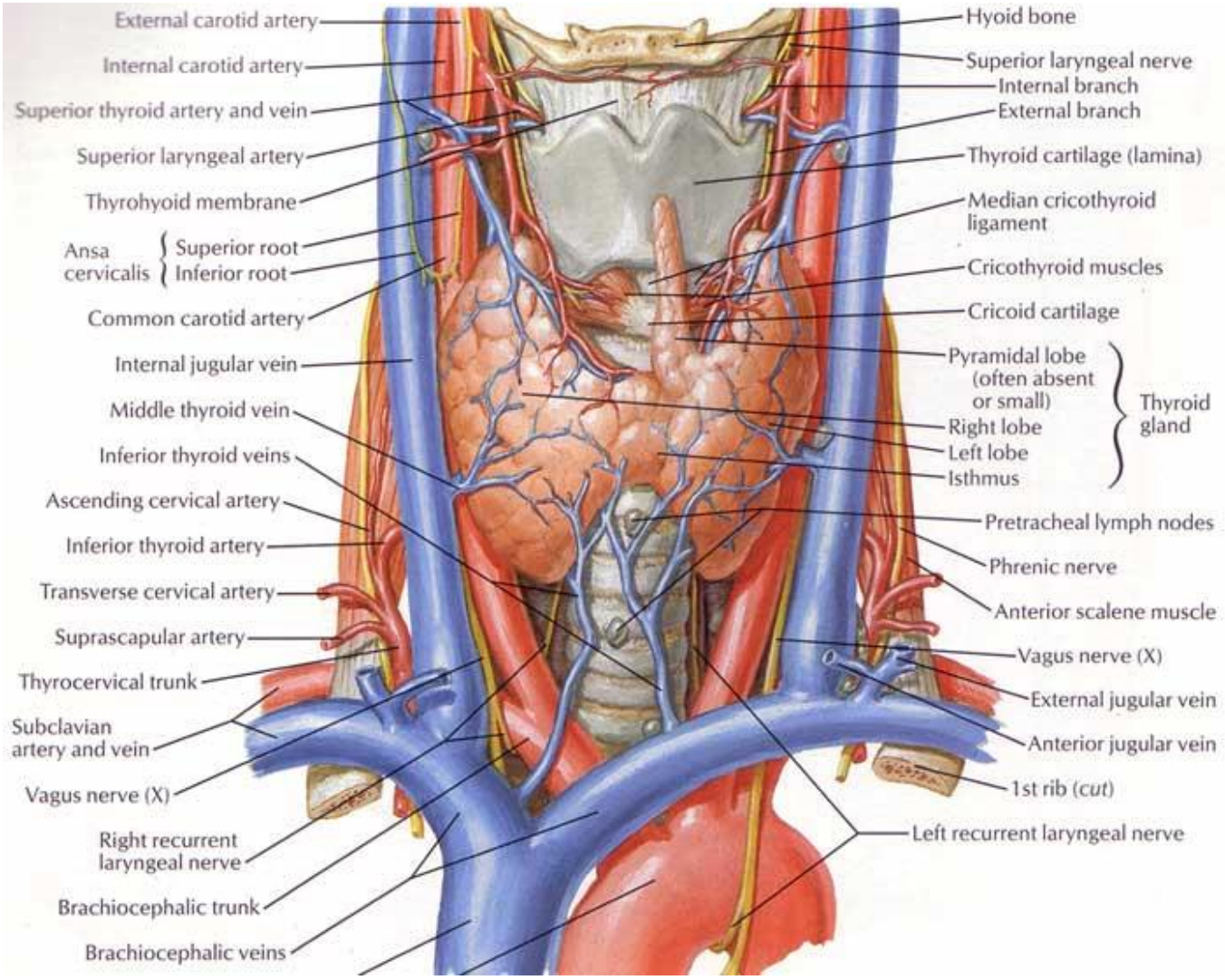
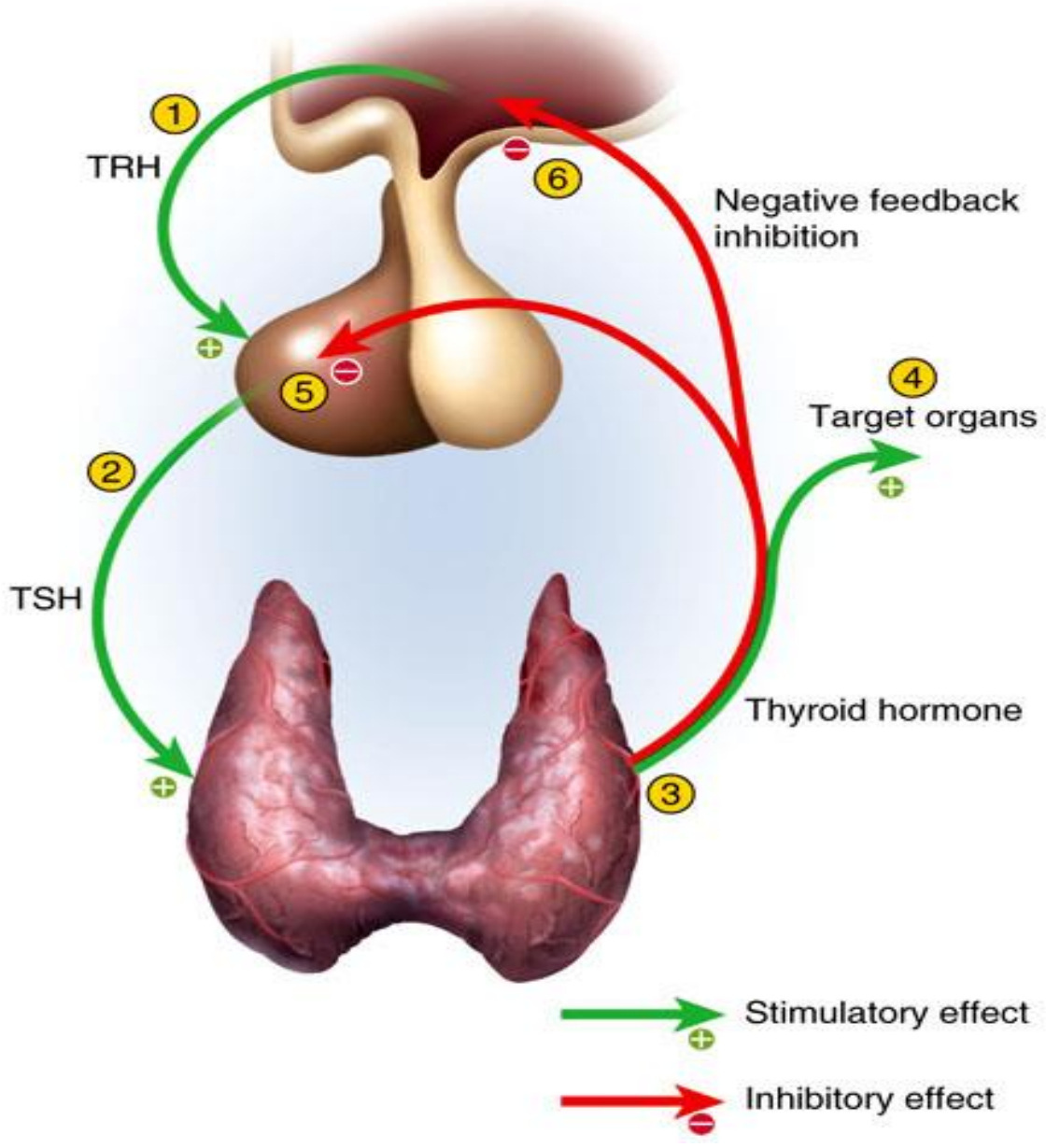
Thyroid Gland



Introduction

★ **Hypothalamo-pituitary-thyroid axis** : (Feed back mechanism)

- Any decrease in level of thyroid hormons (T3 & T4) in the circulation , stimulates hypothalamic secretion of thyrotropin releasing hormone (TRH) which stimulate the anterior pituitary to secret thyroid stimulating hormone (TSH) .



- **TSH** stimulates the thyroid gland to secret thyroid hormones (T3 & T4) .
- **Any elevation in the level of T3 & T4** in the circulation inhibit the hypothalamus and anterior pituitary to secret TRH & TSH i.e the level of thyroid hormones is inversely proportional to the level of TSH (negative feed back mechanism) .

★ **Thyroid hormones synthesis :**

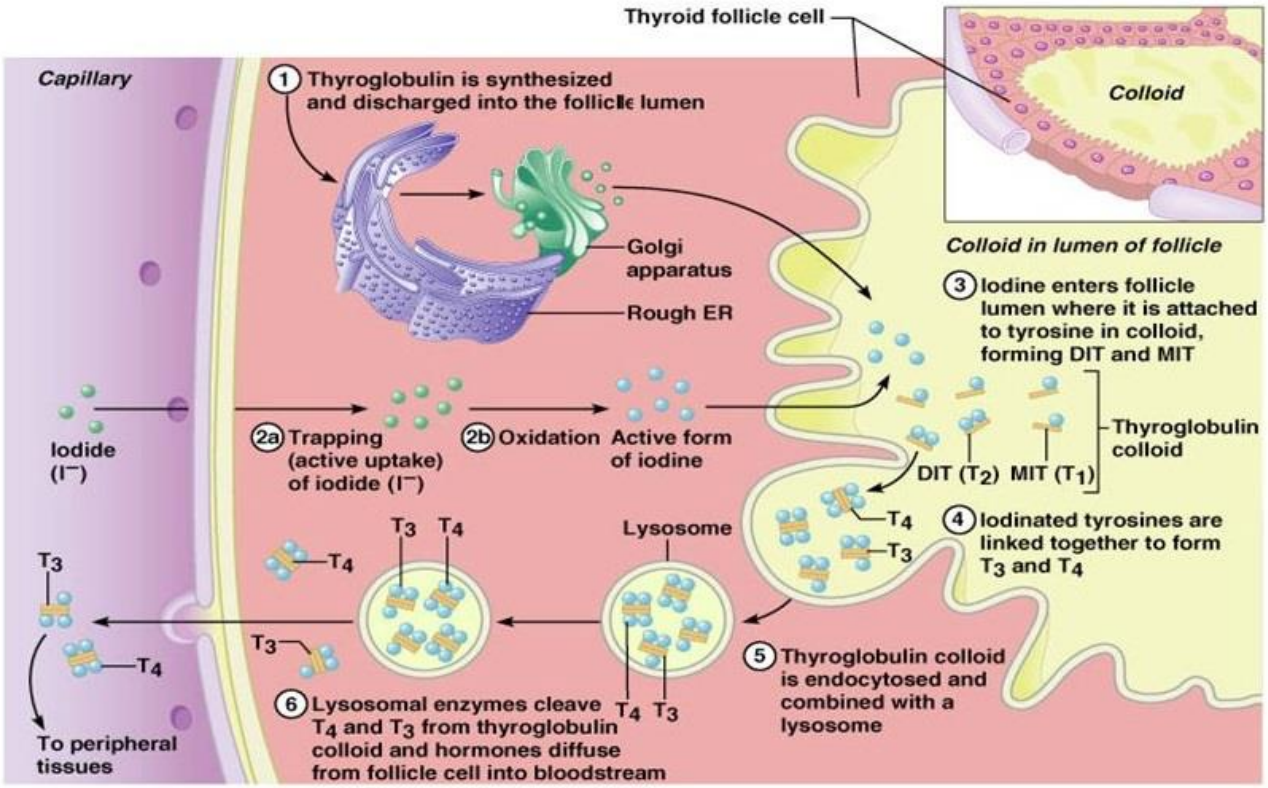
- Dietary ***iodine*** (in water , sea foods , iodized salt , diary products & vegetables) is ***abdorbed*** in the upper part of small intestine .
- 80-90% of iodine is traped & stored in the thyroid gland , while excess iodine is excreted by the kidney .
- ***TSH*** stimulates the follicular cells of thyroid gland leading to the followings (remember 3 hyper + TOB + CSR)
  1) **Hyperplasia** (increase number) of follicular cells .
  2) **Hypertrophy** (increase size) of follicular cells which become tall columnar cells instead of cubical cells .
  3) Increase **vascularity** of the gland .
  4) **Trapping** of iodine from the blood .
  5) **Oxidation** of iodides into organic iodine by peroxidase enzyme
  6) **Binding** of iodine with tyrosine by tyrosinase enzyme to for mono & diiodotyrosine .
  7) **Coupling** of mono & diiodotyrosine to form T3 & T4 which unite with thyroglobin and are **stored** in the follicles .

- Few mono & diiodotyrosine (are not coupled to form T3 & T4), are deiodinated by dehalogenase enzyme and the released iodine is reused in thyroid hormone synthesis .

8) **Release** of T3 & T4 into the circulation upon need :

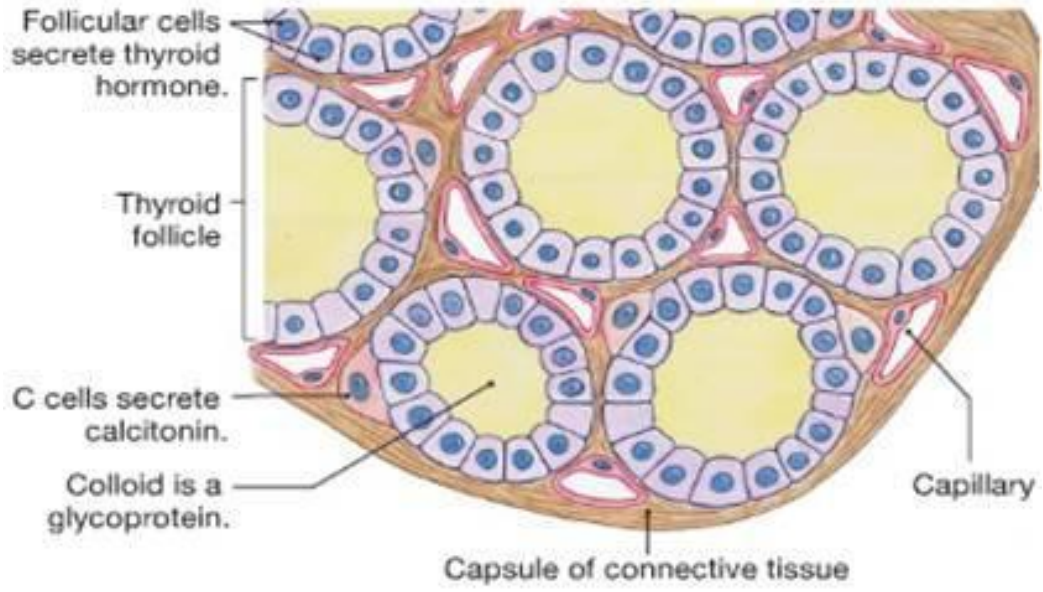
- The ***major*** part of T3 & T4 in the circulation is ***bounded*** to plasma proteins (albumin , prealbumin & globulin) .
- A ***minor*** part of T3 & T4 in the circulation is present as ***free*** part which is functionally active .
- ***T3*** is ***formed by*** thyroid gland and by peripheral conversion of T4 to T3 .
- T3 is physiologically ***more quick*** and more ***powerful*** than T4 .

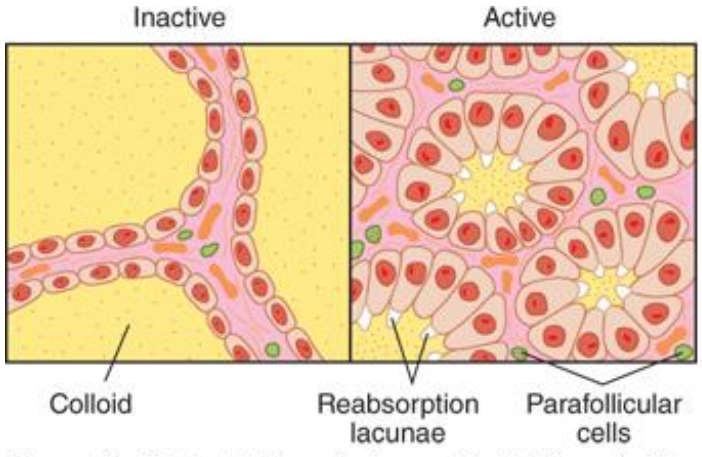
SYNTHESIS OF THYROID HORMONES

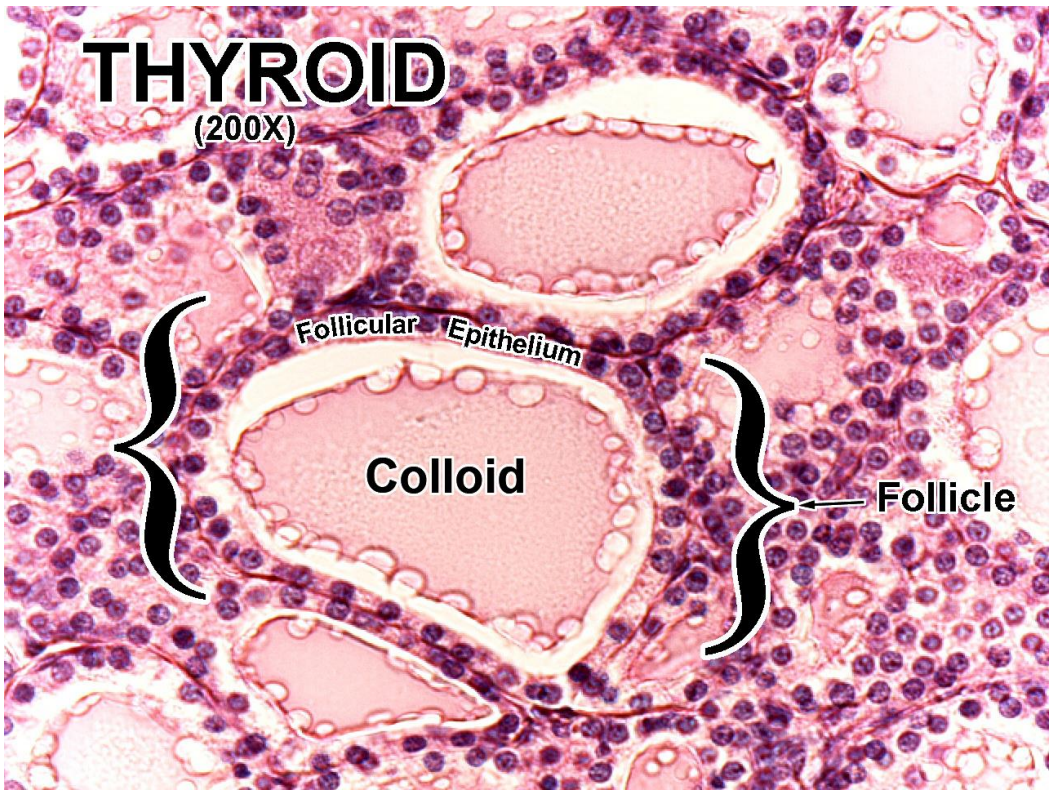


★ **Histology of thyroid gland :**

- The ***functional unite*** of the thyroid gland is the ***lobule*** which is supplied by a ***single arteriole*** .
- Each lobule ***consists of*** 20-40 follicle .
- Each follicle is ***lined by*** follicular cells .
- The ***resting follicles*** are lined by cuboid cells and moderate amount of thyroglobulin is stored in the lumen .
- The ***active follicles*** are lined by tall columnar cells and little amount of thyroglobulin is stored in the lumen .
- **Para-follicular C** cells secret calcitonin .







★ **Physiological effects of thyroid hormones** :

I) ***Development*** **:** Essential for mental , physical and sexual development & maturity in ***young age*** .

II) Metabolic function :

1- **Increase metabolic rate** , caloric production and body temperature .

2- Increase blood flow , oxygen & glucose consumption nearly in **every cell** in the body (with few exception) .

3- Increase **protein** synthesis in case of normal level of thyroid hormone but catabolic in hyperthyroidism.

4- Increase rate & force of contraction of **skeletal muscles** in normal level but muscle weakness in case of hyperthyroidism .

5- Increase absorption of glucose , glycogenolysis → hyperglycemia .

6- Lower low density cholesterol .

7- Enhance **B-adrenergic receptors** to catecholamines .

8- Increase **cardiac** excitability , conductivity , contractility and heart rate

9- Increase cardiac output .

10- Peripheral vasodilatation and **increase blood flow** to different organs .

11- Increase rate and depth of **respiration** .

12- Increase secretion and motility of **GIT** .