

# **HUMAN ANATOMY AND PHYSIOLOGY-II**

## **UNIT-IV**

### **Endocrine system**

### **Structure and functions of Thyroid gland, p**



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## **THYROID GLAND**

- Thyroid is an endocrine gland situated at the root of the neck on either side of the trachea. It has two lobes, which are connected in the middle by an isthmus.
- It weighs about 20 to 40 g in adults.
- Thyroid is larger in females than in males.
- The structure and the function of the thyroid gland change in different stages of the sexual cycle in females.
- Its function increases slightly during pregnancy and lactation and decreases during menopause.

## **HORMONES OF THYROID GLAND**

Thyroid gland secretes three hormones:

1. Tetraiodothyronine or T<sub>4</sub> (thyroxine)
2. Tri-iodothyronine or T<sub>3</sub>
3. Calcitonin.

T<sub>4</sub> is otherwise known as thyroxine and it forms about 90% of the total secretion, whereas T<sub>3</sub> is only 9% to 10%.

**Table 9.3 Common effects of abnormal secretion of thyroid hormones**

**Hyperthyroidism: increased  $T_3$  and  $T_4$  secretion**

**Hypothyroidism: decreased  $T_3$  and  $T_4$  secretion**

Increased basal metabolic rate

Decreased basal metabolic rate

Anxiety, physical restlessness, mental excitability

Depression, psychosis, mental slowness, lethargy

Hair loss

Dry skin, brittle hair

Tachycardia, palpitations, atrial fibrillation

Bradycardia

Warm sweaty skin, heat intolerance

Dry cold skin, prone to hypothermia

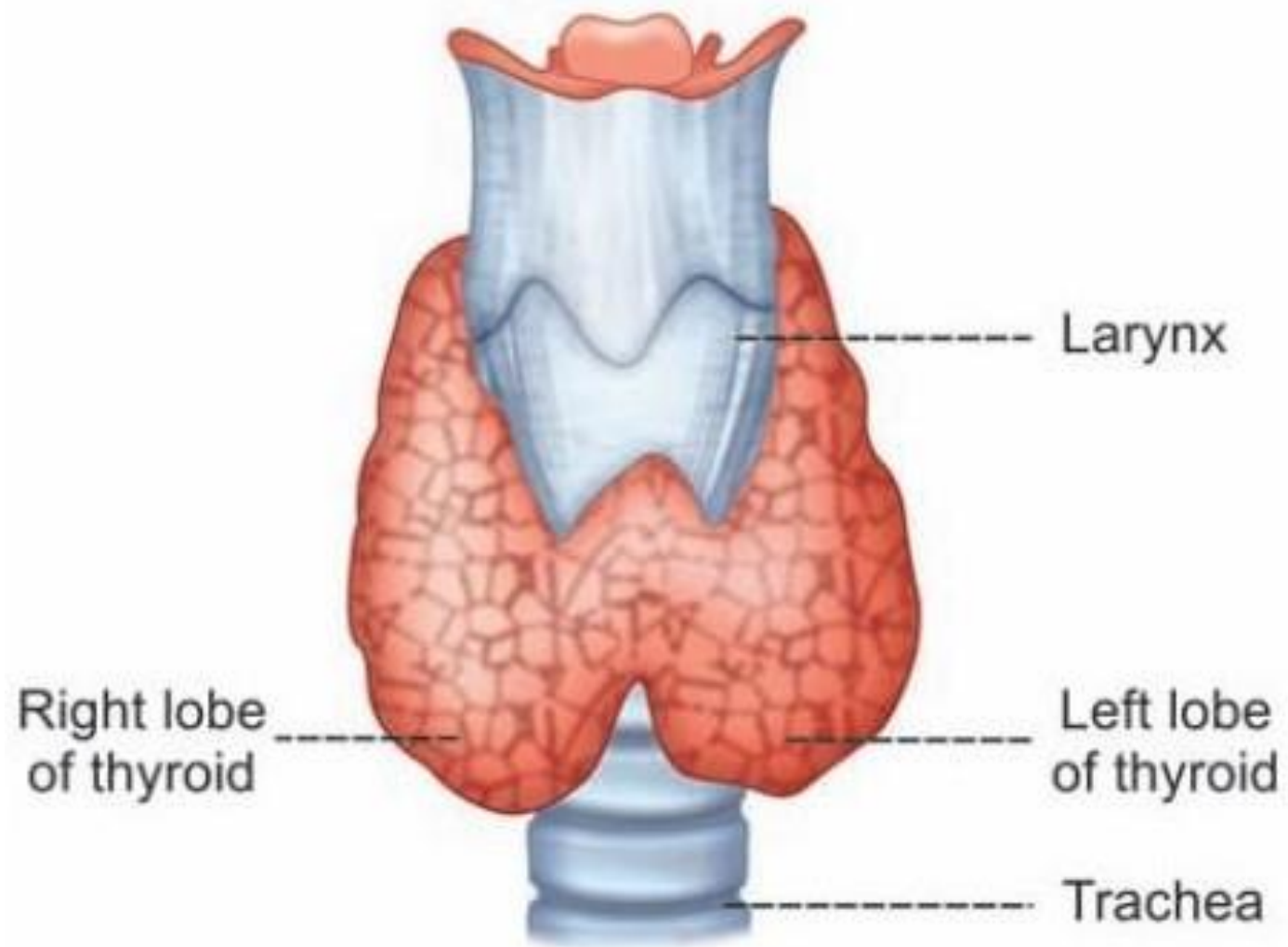
Diarrhoea

Constipation

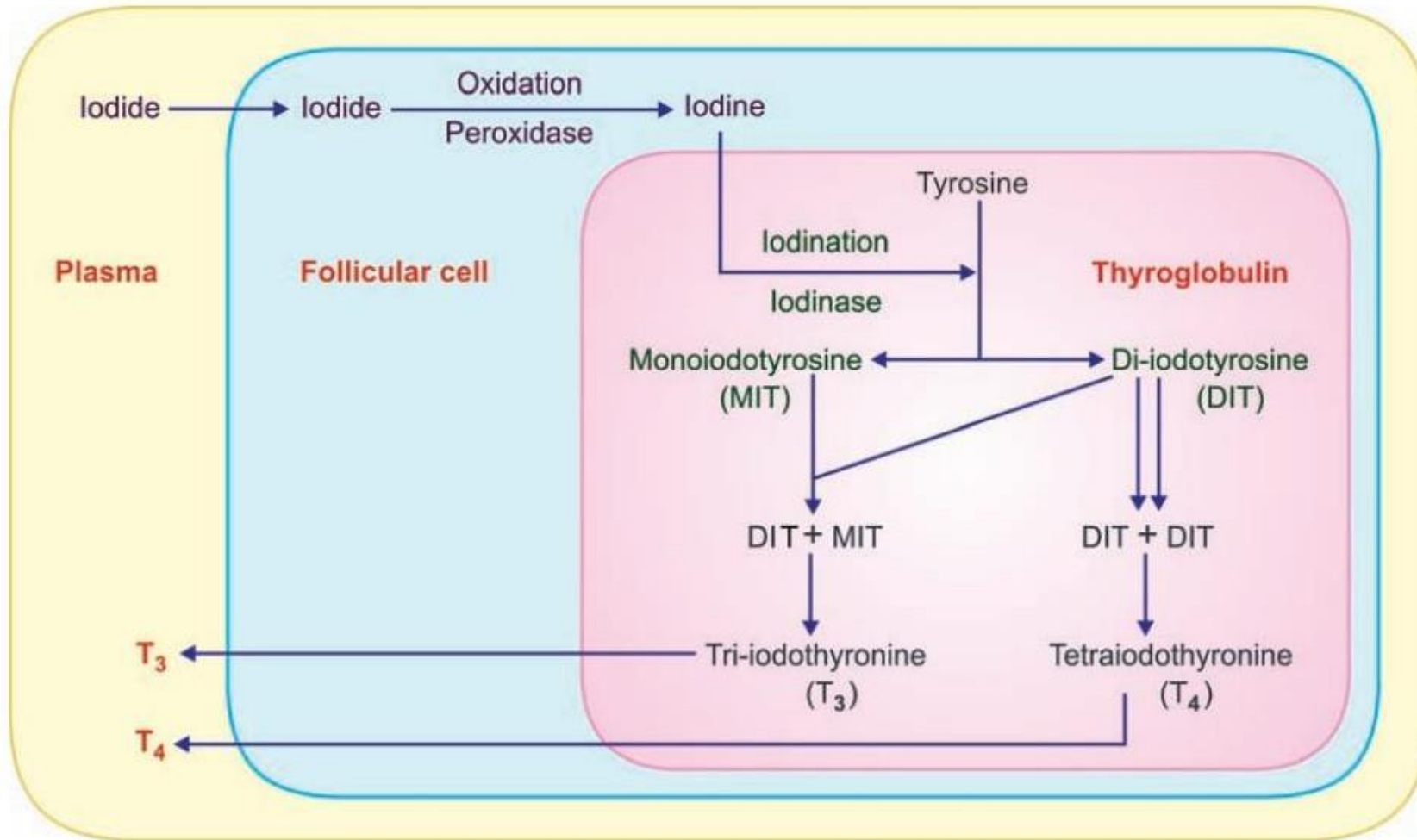
Weight loss, good appetite

Weight gain, anorexia

Exophthalmos in Graves' disease



**FIGURE 67.1:** Thyroid gland

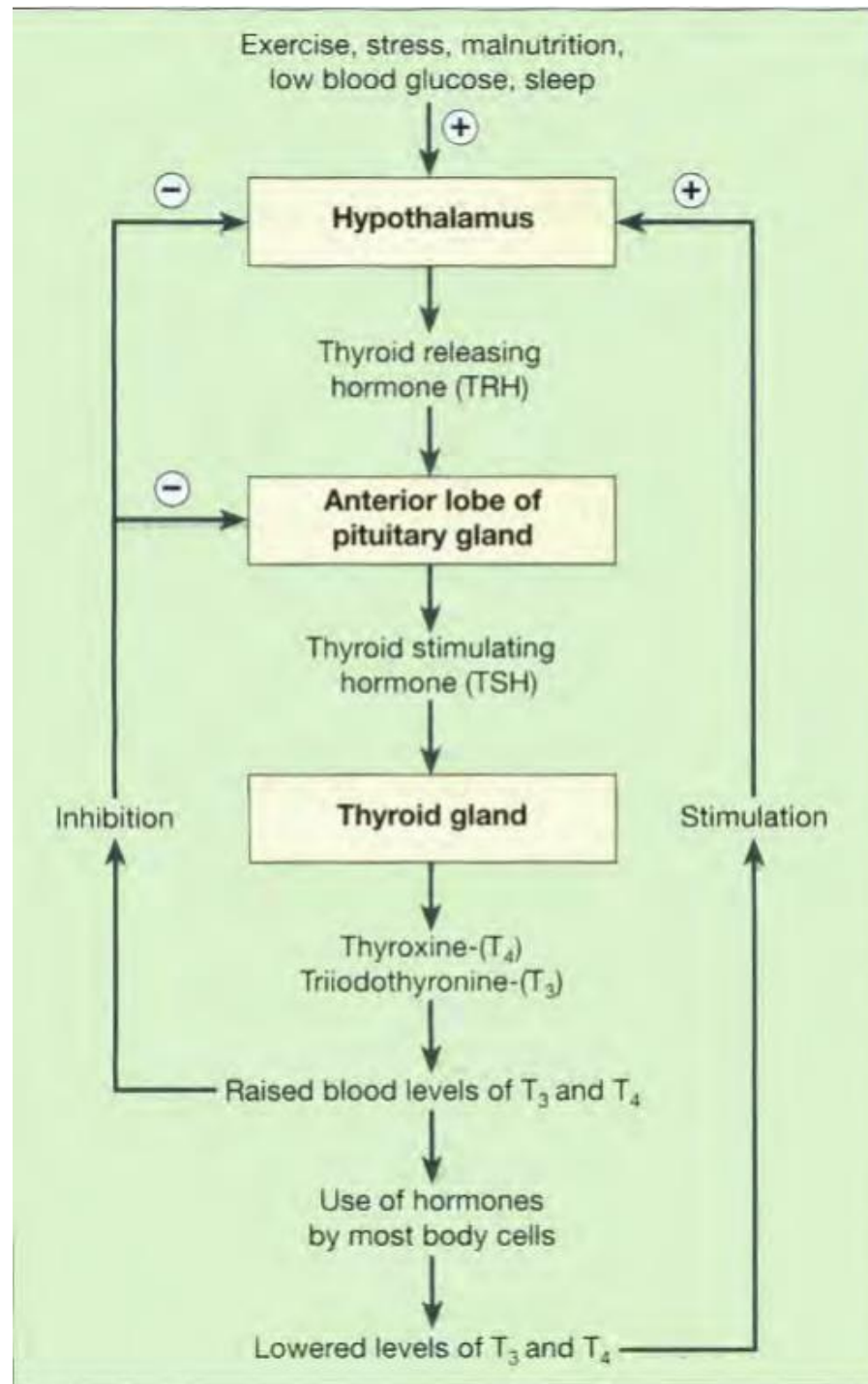


**FIGURE 67.3:** Synthesis of thyroid hormones

## Thyroxine and triiodothyronine

- Iodine is essential for the formation of the thyroid gland hormones, thyroxine (T4) and triiodothyronine (T3).
- The body's main sources of iodine are seafood, vegetables grown in iodine-rich soil and iodinated table salt in the diet.
- The thyroid gland selectively takes up iodine from the blood, a process called **iodine trapping**.
- The thyroid hormones are synthesized as large precursor molecules called thyroglobulin, the major constituent of colloid.
- The release of T3 and T4 into the blood is regulated by thyroid stimulating hormone (TSH) from the anterior pituitary.
- Secretion of TSH is stimulated by the thyroid releasing hormone (TRH) from the hypothalamus and secretion of TRH is stimulated by exercise, stress, malnutrition, low plasma glucose and sleep.
- The level of secretion of TSH depends on the plasma levels of T3 and T4 because these hormones affect the sensitivity of the anterior pituitary to TRH. Increased levels of T3 and T4 decrease TSH secretion and vice versa.
- When the supply of iodine is deficient, excess TSH is secreted and there is proliferation of thyroid gland cells and enlargement of the gland.
- Secretion of T3 and T4 begins about the third month of fetal life and is increased at puberty and in women during the reproductive years, especially during pregnancy.

- Thyroid hormones enter the target cells and regulate the expression of genes in the nucleus, i.e. they increase or decrease the synthesis of some proteins including enzymes.
- They combine with specific receptor sites and enhance the effects of other hormones, e.g. adrenaline and noradrenaline.
- T3 and T4 affect most cells of the body by:
  - ❑ increasing the basal metabolic rate and heat production
  - ❑ regulating metabolism of carbohydrates, proteins and fats.
- T3 and T4 are essential for normal growth and development, especially of the skeleton and nervous system.
- Most other organs and systems are also influenced by thyroid hormones — physiological effects of T3 and T4 on the heart, skeletal muscles, skin, digestive and reproductive systems are more evident when there is underactivity or overactivity of the thyroid gland.





## Calcitonin

- This hormone is secreted by the parafollicular or C-cells in the thyroid gland.
- It acts on bone and the kidneys to reduce the blood calcium ( $\text{Ca}^{2+}$ ) level when it is raised.
- It reduces the reabsorption of calcium from bones and inhibits reabsorption of calcium by the renal tubules.
- Its effect is opposite to that of parathyroid hormone (PTH, parathormone), the hormone secreted by the parathyroid glands.
- Release of calcitonin is stimulated by an increase in the blood calcium level.
- This hormone is important during childhood when bones undergo considerable changes in size and shape.