

Thyroid Gland

The **thyroid gland** consists of two lobes of endocrine tissue joined in the middle by a narrow portion of the gland, described as a butterfly shape . The gland is even located in the appropriate place for a bow tie, lying in the neck over the trachea just below the larynx.

The major cells that secrete thyroid hormone are organized into colloid-filled follicles.

The major thyroid secretory cells, known as **follicular cells**, are arranged into hollow spheres, each of which forms a functional unit called a **follicle**.

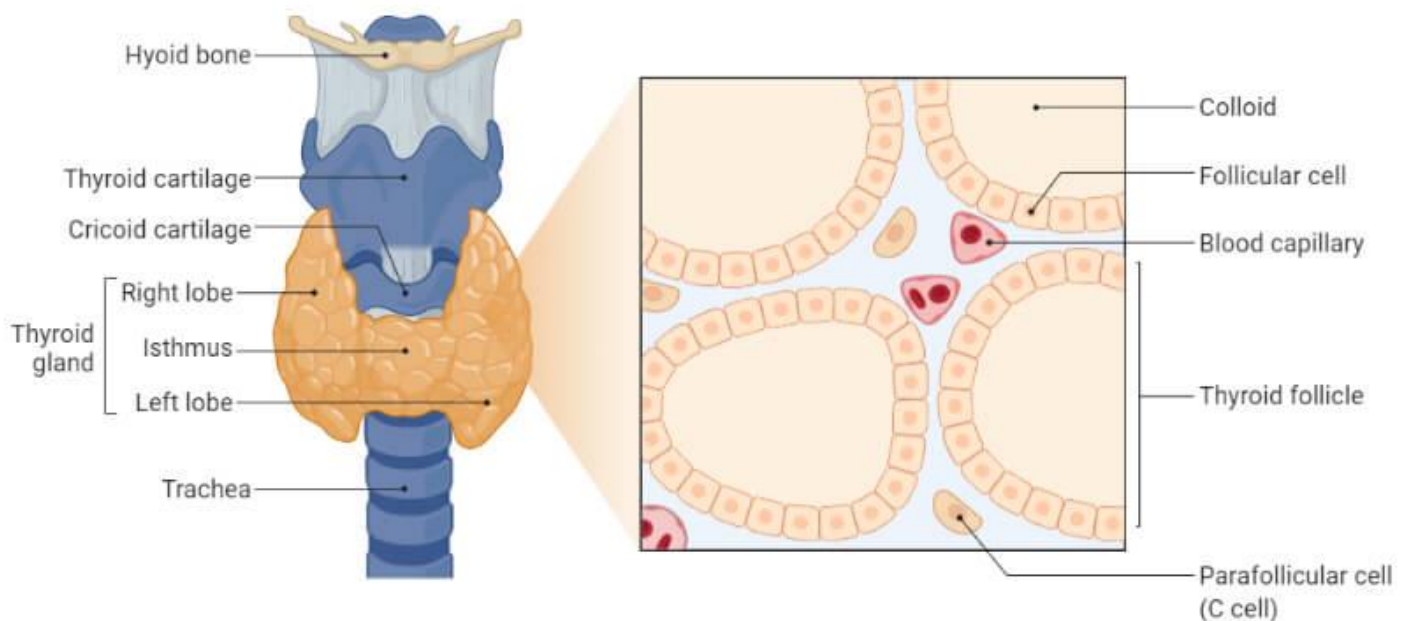
the follicles appear as rings consisting of a single layer of follicular cells enclosing an inner lumen filled with **colloid**, a substance that serves as an extracellular storage site for thyroid hormone.

The chief constituent of colloid is a large glycoprotein molecule known as **thyroglobulin (Tg)**, within which are incorporated the thyroid hormones in their various stages of synthesis.

The follicular cells produce two iodine-containing hormones derived from the amino acid tyrosine: **tetraiodothyronine (T4, or thyroxine)** and **tri-iodothyronine (T3)**.

These two hormones, collectively referred to as **thyroid hormone**, are important regulators of overall basal metabolic rate.

Interspersed in the interstitial spaces between the follicles is another secretory cell type, **Parafollicular cells**, also called **C cells**, which secrete the hormone **calcitonin**. Calcitonin plays a role in calcium (Ca^2) metabolism and is not related to T4 and T3.



Thyroid hormone functions

Thyroid hormone does not have any discrete target organs. It affects virtually every tissue in the body.

The response to an increase in thyroid hormone is detectable only after a delay of several hours, and the maximal response is not evident for several days.

All body cells are affected either directly or indirectly by thyroid hormone. The effects of T3 and T4 can be grouped into several overlapping categories.

1- Effect on Metabolic Rate and Heat Production

Thyroid hormone increases the body's overall basal metabolic rate (BMR). It is the most important regulator of the body's rate of O₂ consumption and energy expenditure under resting conditions.

Closely related to thyroid hormones metabolic effect is its **calorigenic effect** (*calorigenic* means "heat-producing"). Increased metabolic activity results in increased heat production.

2- Sympathomimetic Effect

Any action similar to one produced by the sympathetic nervous system is known as a **sympathomimetic effect**.

Thyroid hormone increases target-cell responsiveness to catecholamines (epinephrine and norepinephrine), the chemical messengers used by the sympathetic nervous system and its hormonal reinforcements from the adrenal medulla.

3- Effect on the Cardiovascular System

Thyroid hormone increases heart rate and force of contraction, thus increasing cardiac output

4- Effect on Growth

Thyroid hormone is essential for normal growth because of its effects on growth hormone (GH) and IGF-I. Thyroid hormone also promotes the effects of GH and IGF-I on the synthesis of new structural proteins and on bone growth.

5- Effect on the Nervous System

Thyroid hormone plays a crucial role in development of the nervous system, especially the CNS, an effect impeded in children who have thyroid deficiency from birth. Thyroid hormone is also essential for normal CNS activity in adults.

Thyroid hormone is regulated by the hypothalamus–pituitary– thyroid axis.

Thyroid-stimulating hormone (TSH), the thyroid tropic hormone from the anterior pituitary, is the most important regulator of thyroid hormone secretion.

TSH stimulates almost every step of thyroid hormone synthesis and release. In addition to enhancing thyroid hormone secretion, TSH maintains the structural integrity of the thyroid gland.

In the absence of TSH, the thyroid atrophies (decreases in size) and secretes its hormones at a very low rate. Conversely, it undergoes hypertrophy (increases the size of each follicular cell) and hyperplasia (increases the number of follicular cells) in response to excess TSH stimulation.

The hypothalamic **thyrotropin-releasing hormone (TRH)**, in tropic fashion, “turns on” TSH secretion by the anterior pituitary , whereas thyroid hormone, in negative feedback fashion, “turns off” TSH secretion by inhibiting the anterior pituitary and hypothalamus.

Abnormalities of thyroid function

Abnormalities of thyroid function are among the most common endocrine disorders.

They fall into two major categories :

1- Hypothyroidism : deficient thyroid hormone secretion.

Common Hypothyroidism symptoms include:

1. tiredness.
2. being sensitive to cold.
3. weight gain.
4. constipation.
5. depression.
6. slow movements and thoughts.
7. muscle aches and weakness.
8. muscle cramps.

2- Hyperthyroidism :excess thyroid hormone secretion .

Common Hyperthyroidism symptoms include:

1. nervousness, anxiety and irritability.
2. mood swings.
3. difficulty sleeping.
4. persistent tiredness and weakness.
5. sensitivity to heat.
6. swelling in your neck from an enlarged thyroid gland (goiter)
7. an irregular and/or unusually fast heart rate (palpitations)
8. twitching or trembling.

