

HYPOTHYROIDISM

- Thyroid gland is Largest endocrine gland, Butterfly shaped. Weighs about 18-60 gms.
- **Hormones of the Thyroid Gland**

Thyroxine (T₄)- Principal hormone it Increases energy and protein metabolism rate

Triiodothyronine (T₃)- Increases energy and protein metabolism

- **Calcitonin** -Regulates calcium metabolism Works with parathyroid hormone and vitamin D

THYROID DISEASES

1. Hyperthyroidism
2. Hypothyroidism

HYPOTHYROIDISM

Hypothyroidism is a medical condition characterized by an underactive thyroid gland, which fails to produce enough thyroid hormones to meet the body's needs. Thyroid hormones play a crucial role in regulating metabolism, growth, and development throughout the body. Occasionally there may be swelling of the front part of the neck due to goiter. Worldwide, too little iodine in the diet is the most common cause of hypothyroidism. Less common causes include: previous treatment with radioactive iodine, injury to the hypothalamus or the anterior pituitary gland, certain medications, a lack of a functioning thyroid at birth, or previous thyroid surgery

When hypothyroidism is congenital both physical and mental development is impaired and *cretinism* is the result. Also iodide deficiency in childhood may also result in a *cretin* or a mentally retarded hypothyroid dwarf. *Myxoedema* in the adult is severe thyroid gland hypothyroidism with a puffy swollen face due to a hard, non-pitting oedema (called *myxoedema* or *tortoise skin*).

CAUSES-ETIOLOGY, TYPES

- **Primary hypothyroidism**

Iodine deficiency, autoimmune thyroiditis, subacute granulomatous thyroiditis, subacute lymphocytic thyroiditis, postpartum thyroiditis, previous thyroidectomy, previous radioiodine treatment, previous external beam radiotherapy to the neck

Medication: lithium-based mood stabilizers, Amiodarone, alpha, tyrosine kinase inhibitors such as sunitinib

Primary hypothyroidism is caused by microsomal autoantibodies precipitated in the glandular tissue

Infections- Rarely, viral infections or certain medications used to treat infections can temporarily or permanently affect thyroid function.

- **Secondary hypothyroidism**

- is caused by reduced TSH (**Thyroid stimulating hormone**) .Due to the abnormality of pituitary gland.
- **Pituitary Tumors:** Tumors in the pituitary gland can compress normal pituitary tissue, impairing its ability to produce thyroid-stimulating hormone (TSH). Without sufficient TSH, the thyroid gland does not receive the signal to produce thyroid hormones (T3 and T4).
- **Pituitary Surgery or Radiation:** Surgical removal of pituitary tumors or radiation therapy aimed at treating pituitary tumors can inadvertently damage surrounding pituitary tissue, leading to insufficient TSH production.

Tertiary hypothyroidism

It is due to the deficiency of thyroid releasing hormone . Due to the defects in hypothalamus.

Hypothalamic Tumors: Tumors located in or near the hypothalamus can disrupt the production or release of thyrotropin-releasing hormone (TRH). TRH is a hormone produced by the hypothalamus that stimulates the pituitary gland to release TSH.

Other Structural Lesions: Structural abnormalities or lesions in the hypothalamus, either congenital or acquired (such as due to trauma), can interfere with the production or release of TRH

SIGNS AND SYMPTOMS

Symptoms	Signs
Fatigue	Dry, coarse skin
Feeling cold	Cool extremities
Poor memory and concentration	Myxedema (mucopolysaccharide deposits in the skin)
Constipation, dyspepsia	Hair loss
Weight gain with poor appetite	Slow pulse rate

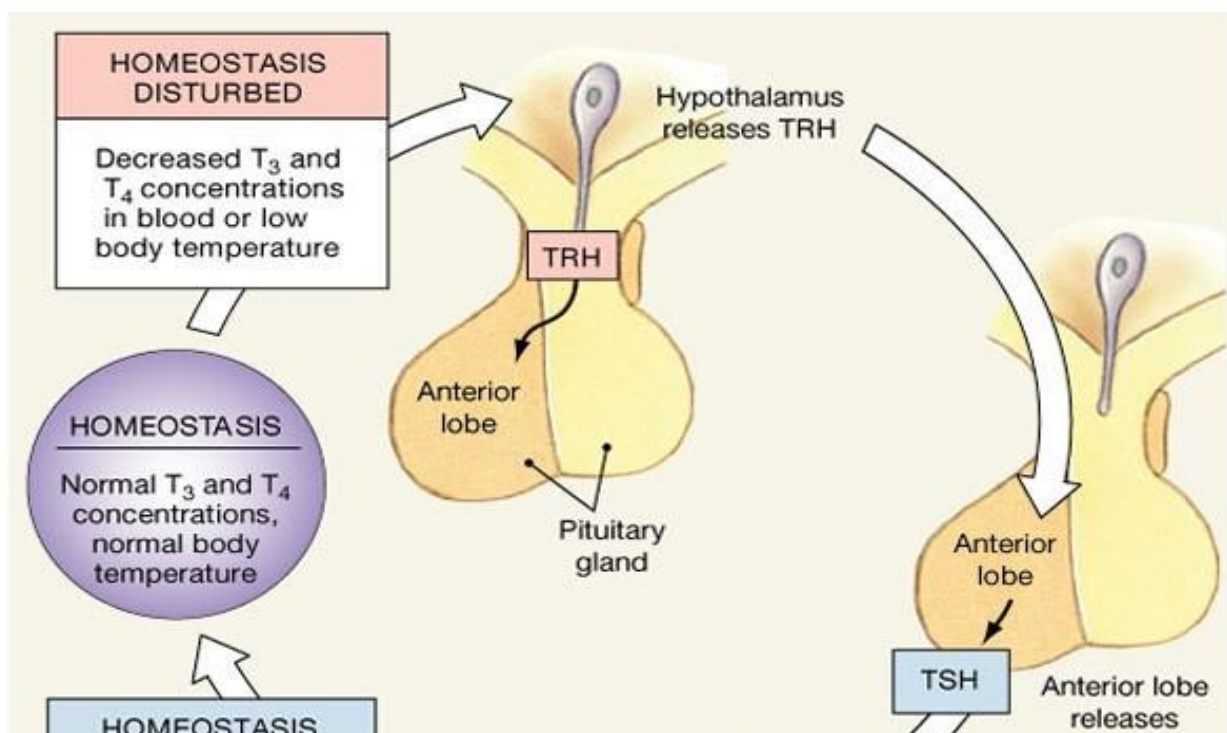
Shortness of breath	Swelling of the limbs
Hoarse voice	Delayed relaxation of tendon reflexes
In females, heavy menstrual periods (and later light periods)	Carpal tunnel syndrome
Abnormal sensation	Pleural effusion, ascites, pericardial effusion
Poor hearing	

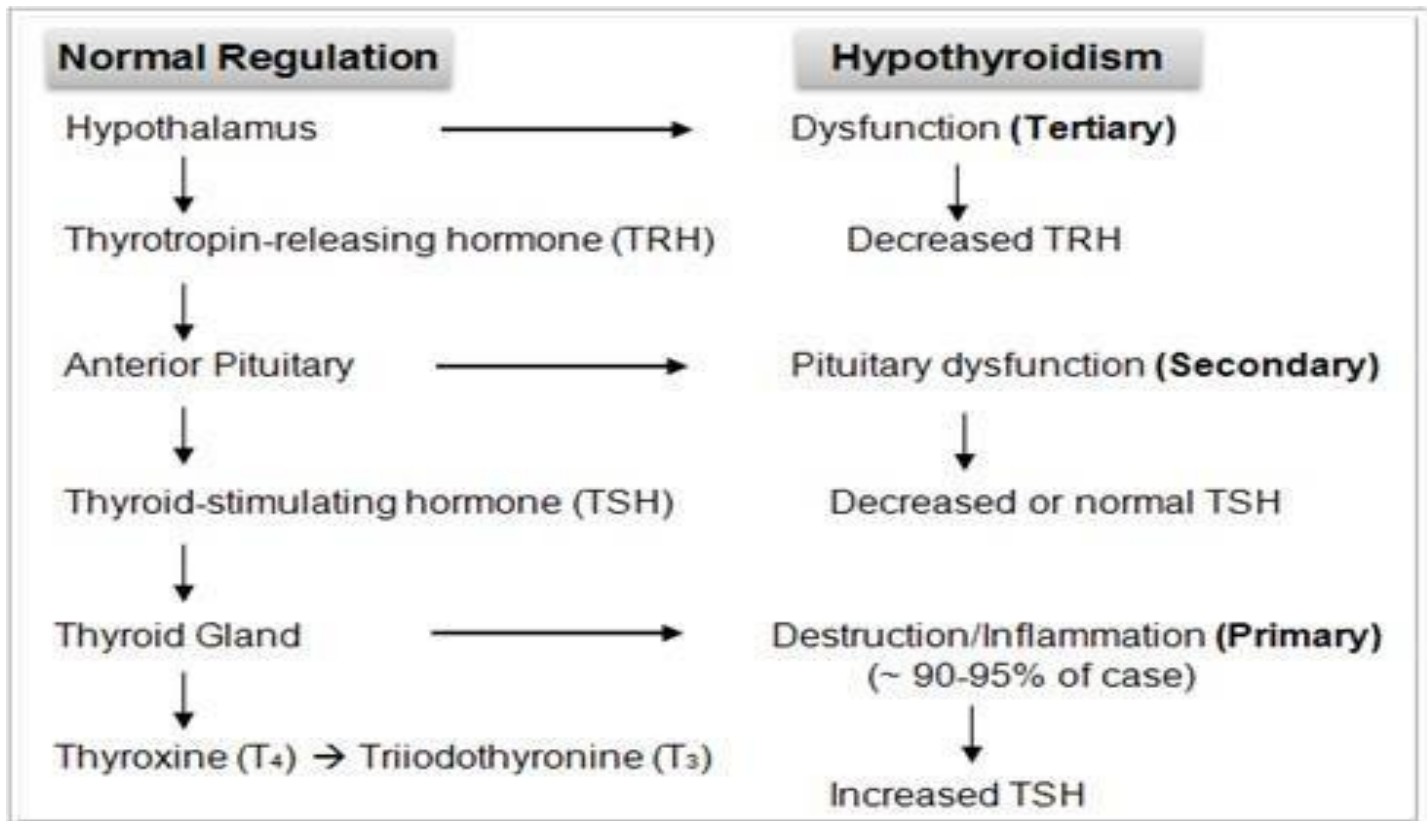
PATHOPHYSIOLOGY

The hypothalamic-pituitary-thyroid axis controls the thyroid gland function and growth.

The production and release of thyroid hormone is controlled by *thyroid-releasing hormone* (TRH) from the hypothalamus. TRH reaches the anterior pituitary via the portal system, where the thyrotropic cells are stimulated to produce *thyroid-stimulating hormone* (TSH) or *thyrotropin*.

- 1 TSH is the only known regulator of thyroid hormone secretion in humans. TSH is released to the systemic blood, by which it travels to the thyroid gland. Here, TSH stimulates the uptake of iodide, and all other processes that promote formation and release of T₄ (and T₃). TSH activates *adenyl cyclase* bound to the cell membranes of the follicular cells and increases their cAMP. T₃ has a strong *inhibitory* effect on TRH secretion, as well as on the expression of the gene for the TRH precursor.





Diagnosis

TSH	T4	Interpretation
Normal	Normal	Normal thyroid function
Elevated	Low	Overt hypothyroidism
Normal/low	Low	Central hypothyroidism
Elevated	Normal	Subclinical hypothyroidism

- Levels of cholesterol, low-density lipoprotein and lipoprotein (a) can be elevated;

MANAGEMENT

1. NON PHARMACOLOGICAL MANAGEMENT

Managing hypothyroidism nonpharmacologically involves a combination of dietary adjustments, lifestyle changes, and complementary therapies.

1. Dietary Adjustments

- **Balanced Diet:** Focus on a nutrient-dense diet that includes plenty of fruits, vegetables, lean proteins, and whole grains to support overall health.
 - **Iodine Intake:** Ensure adequate iodine intake, as it is essential for thyroid function. Sources include iodized salt, seaweed, fish, dairy products, and eggs. However, avoid excessive iodine, as it can worsen hypothyroidism.
 - **Selenium:** This mineral is important for thyroid health. Good sources include Brazil nuts, sunflower seeds, and seafood.
 - **Zinc:** Essential for thyroid function. Foods rich in zinc include oysters, crab, beef, and pumpkin seeds.
- Avoid Goitrogens:** Certain foods can interfere with thyroid function, especially when consumed in large quantities. These include cruciferous vegetables (like broccoli, cabbage, and Brussels sprouts), soy products, and certain fruits like peaches and strawberries. Cooking these foods can reduce their goitrogenic effect.

2. Lifestyle Changes

- **Regular Exercise:** Engaging in regular physical activity can help boost metabolism and alleviate some symptoms of hypothyroidism, such as weight gain and fatigue.
- **Stress Management:** Practices like yoga, meditation, and deep-breathing exercises can help manage stress, which can impact thyroid function.
- **Adequate Sleep:** Ensure you get enough sleep, as hypothyroidism can cause fatigue and impact sleep quality.

PHARMACOLOGICAL TREATMENT

Pharmacological management of hypothyroidism primarily involves thyroid hormone replacement therapy. The goal is to restore normal thyroid hormone levels, relieve symptoms, and maintain normal metabolism. Here are the main aspects of pharmacological treatment:

1. Levothyroxine

Levothyroxine (T4) is the synthetic form of the thyroxine hormone and is the most commonly prescribed medication for hypothyroidism. It is typically taken orally once daily.

Mechanism of Action

□ Thyroxine Replacement:

- **Mimics Natural Hormone:** Levothyroxine is a synthetic version of the naturally occurring thyroid hormone T4. It is structurally identical to endogenous T4.

- **Conversion to T3:** Once administered, levothyroxine is absorbed into the bloodstream and converted to triiodothyronine (T3) in peripheral tissues. T3 is the active form of thyroid hormone that exerts metabolic effects on cells.

□ **Cellular Effects:**

- **Binding to Receptors:** T3 enters the nucleus of cells and binds to thyroid hormone receptors. This binding influences the transcription of genes involved in various metabolic processes.

Metabolic Effects:

- **Regulates metabolism:** Influences the basal metabolic rate, oxygen consumption, and heat production.
- **Growth and Development:** Essential for normal growth and development, especially in the nervous system.
- **Cardiovascular:** Increases heart rate and cardiac output.
- **Lipid and Carbohydrate Metabolism:** Enhances lipid mobilization and glucose utilization.

Adverse Drug Reactions (ADRs)

□ **Cardiovascular:**

- Palpitations
- Tachycardia (rapid heart rate)
- Increased blood pressure
- Arrhythmias, including atrial fibrillation

□ **Central Nervous System:**

- Anxiety
- Nervousness
- Insomnia
- Tremors

□ **Gastrointestinal:**

- Increased appetite
- Weight loss
- Diarrhea

□ **Musculoskeletal:**

- Muscle weakness
- Increased risk of osteoporosis and fractures (long-term over-treatment)

□ **General:**

- Heat intolerance
- Excessive sweating

2. Liothyronine

- **Alternative Treatment:** Liothyronine (T3) is the synthetic form of the triiodothyronine hormone. It is less commonly used than levothyroxine and is typically prescribed when levothyroxine alone does not adequately relieve symptoms