

It is the largest endocrine gland in the body. (weight - 35 gm) This is situated on either side of trachea below <sup>(present)</sup> larynx. It is bilobed and H-shaped. Both of its lobes are connected by non-glandular flap of a connective tissue called Isthmus. It is endodermal in origin.

Histologically

Histology! → Thyroid gland is composed of a mass of numerous small rounded follicles. These are held together by connective tissue, called stroma.

The follicles are lined with a single layer of cuboidal epithelium. Their cavity is filled with transparent, jelly like colloidal fluid, called iodothyroglobin. It is the iodine containing protein and represents the storage form of thyroid hormone. Cuboidal epithelium has 3 types of cells! →

- ① Typical follicular cells or chief thyrocytes! →

These cells produce tetraiodothyronin ( $T_4$ ) and tri-iodothyronin ( $T_3$ ) which collectively form thyroid hormone.

② Parafollicular cells !  $\rightarrow$  These cells secrete the hormone thyrocalcitonin.

③ Colloid cells !  $\rightarrow$  These are very few in number.

### Hormones

3 Important hormones are secreted from thyroid gland

① Thyroxin or Tetra-iodothyronin ( $T_4$ )  
It forms 80% of thyroid secretion. It is secreted by follicular cells of thyroid. It is formed of two molecules of di-iodothyrosine.

② Tri-iodothyronin ( $T_3$ ) !  $\rightarrow$  It forms 20% of thyroid secretion. It is formed of 3 molecules of iodothyrosine. It is also secreted by follicular cells.

Note:  $\rightarrow$   $T_3$  hormones is four times more effective than  $T_4$  hormones.  $T_4$  changes into  $T_3$  on reaching in tissues.

③ Thyrocalcitonin (TCT) !  $\rightarrow$  It is proteinaceous and non-iodinized hormone (iodine absent). It is secreted by parafollicular cells present in the stroma.



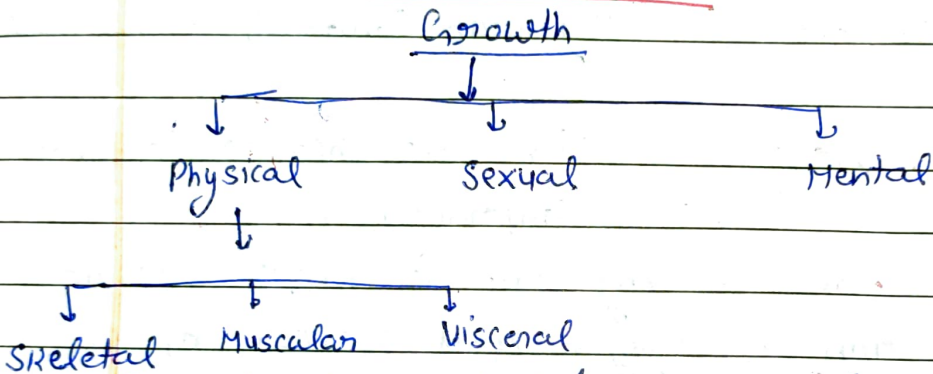
It is hypocalcemic factor and decreases the amount of  $Ca^{2+}$  in the blood. It is formed of 32 Amino acids.

## Functions of Thyroid Hormones

(In book)

T<sub>3</sub> and T<sub>4</sub> have the same functions. Thyroid hormones directly affect growth, development, reproduction, behaviour and metabolism.

### ① Growth and Development! →



Thyroxine is essential for growth. Growth

### ② Basal metabolic rate! → (BMR)

Thyroxine regulates the BMR in the body. It stimulates heart beat, breathing rate etc.

BMR increases → Body temp. increase → loses weight.

Note! → (The hormones enhances the oxidative metabolism of body cells as a result of it energy production is also increased in the form of calories so this hormones is also called calorogenic hormones.

### ③ Carbohydrate metabolism! → Thyroxine stimulates!

(1) Absorption of glucose by intestinal wall.

Glycogenesis → The breakdown of glycogen to generate glucose



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- (ii) Consumption of glucose inside the cells.
- (iii) Glycogenolysis in liver and muscles.
- (iv) Gluconeogenesis i.e. synthesis of glucose from non-carbohydrate sources.
- (4) Protein metabolism → Thyroid hormones increase synthesis of proteins and RNA which precedes increased metabolism.
- (5) Lipid Metabolism → Thyroxine increased synthesis as well as catabolism of lipids.
- (6) Body weight → Thyroxin controls body weight.
- (7) Heart rate → It stimulates heart rate and heart contraction.
- (8) Respiration → Thyroxin increases rate of utilization of oxygen and release of  $CO_2$ .
- (9) Development of central nervous system → Thyroid hormones are required for the normal development of CNS.
- (10) Feedback inhibition of Pituitary TSH secretion → Thyroxin level in blood influences the secretion of TSH by anterior pituitary.
- (11) Metamorphosis → Thyroxin is essential for metamorphosis in amphibian tadpoles.
- (12) Osmoregulation and moulting → In cold blooded vertebrates, thyroid controls osmoregulation and moulting.



Hyposecretion of thyroxine produces cretinism in children and myxoedema in adults.

(13) Mineral metabolism: → Hormone TCT secreted by parafollicular cells controls amount of calcium and phosphorus ions in the body fluid.

### Thyroid Disorders!

Hyposecretion of thyroid gland / Hypothyroidism  
(Deficiency of iodine in food)

In children: → The main symptoms <sup>in</sup> cretinism are <sup>at follicles</sup> ~~are~~ <sup>are</sup> ~~at follicles~~.

(1) Cretinism: → In this disorder the physical growth, mental growth and sexual growth in the children is retarded. Such a dwarf and sterile child is called cretin.

- Rough, thick, dry and wrinkled skin.
- Low blood sugar and low blood iodine but high cholesterol.
- Have pot-belly appearance due to enlarged abdominal viscera.
- Hands and feet are short.
- Low resistance to infections.

In Adult: → (It is commonly known as)

(1) Myxoedema: → Cretinism (Gull's disease)

This disease also known as Gull's disease.

Due to hyposecretion of thyroxine, the fat and protein metabolism is reduced and they get accumulated under the skin of the face.

- Lowered B.M.R.
- Low body temperature.
- Low blood pressure.

- Swollen face, parchment like cheeks, thick lips and eyelids.
- Mental and physical dullness
- Loss of memory.
- Degenerated sex organs

(2) Simple goitre! →

or Colloid goitre! → If there is deficiency of iodine in food then thyroid try to absorb more and more iodine from blood and increase its size it is called simple goitre. It causes enlargement of the neck. The no. of thyroid follicles <sup>increased.</sup> Hilly regions form goitre-belt because there is deficiency of iodine in water.

(3)

Hashimoto's disease! → This is special condition when thyroid secretion is too less. The medicines given to increase thyroxin secretion act as antigens and body produces antibodies to destroy them. These antibodies destroy thyroid also. It is described as 'suicide of thyroid' or anti-immune disease.

Hypersecretion of thyroid gland  
Hyperthyroidism

This produces following symptoms! →

→ Exophthalmic goitre - or Grave's disease  
or thyrotoxicosis

Exophthalmic goitre is a form of hyperthyroidism, characterised by enlargement of the thyroid gland.



Protrusion of the eyeballs, increased basal metabolic rate and weight loss also called Graves' disease.

- Osteoporosis → It is caused due to excessive loss of calcium and phosphate ions from bones.
- Increased heart rate, High B.P, damage to heart muscles, may lead to High body temperature
- Increased hunger, more food is consumed but there is loss of body weight and body fat.
- Increased BMR

Control Thyroid secretion → In book

① Anterior pituitary

↓ secreted TSH which control Thyroid Hormone

If ↑ TH in blood then reduces TSH secretion

whereas ~~and~~ ↓ " " " " increases " "

② Hypothalamus! → In book.

Due to cancer of thyroid gland or due to development of nodules of thyroid glands the rate of synthesis and secretion of thyroid hormones is increased.