3- thyroid gland

The thyroid gland is the largest endocrine gland; it weighs 20 to 25 g and receives one of the body's highest rates of blood flow per gram of tissue. It is wrapped around the anterior and lateral aspects of the trachea, immediately below the larynx. It consists of two large lobes, one on each side of the trachea, connected by a narrow anterior isthmus (just inferior to adams apple) where it is easily palpated during a physical examination. The thyroid gland makes two hormones , one called **thyroid hormone** and other called **calcitonin** (produced by para-follicular cells) , internally , the thyroid gland is composed mostly of sacs called **thyroid follicles w**hich store a sticky colloid material. Thyroid hormone is derived from this colloid. Thyroid hormone, often referred to as the body major metabolic hormone, is actually two active iodine containing hormones, **thyroxine**(T4)and **triiodothyronine** (T3) . thyroxine is the major hormone secreted by the thyroid follicles. Most the T3 formed at the target tissues by conversion of thyroxine(T4) to triiodothyronine(T3).these two hormones are very much alike. Each is constructed from two tyrosine amino acids linked

together , but thyroxine has four bound iodine atoms , whereas triiodothyronine has three (thus , T4 and T3, respectively).

Synthesis

The thyroid gland is unique among the endocrine glands in its ability to store its hormone extracellularly and in large quantities. A normal thyroid gland stores enough colloid to provide normal levels of hormone for two to three months.

When TSH from the anterior pituitary binds to receptors on follicular cells, their *first* response is to secrete stored thyroid hormone. Their *second* response is to begin synthesizing more colloid to "restock" the follicle lumen.

1. Thyroglobulin is synthesized and discharged into the follicle lumen. After being synthesized on the ribosomes of the thyroids follicular cells, thyroglobulin is transported to the Golgi apparatus, where sugar molecules are attached and the thyroglobulin is packed into transport vesicles. These vesicles move to the apex of the follicular cell, where they discharge their contents into the follicle lumen to become part of the stored colloid.

2. Iodide is trapped. To produce the functional iodinated hormones, the follicular cells must accumulate iodides from the blood. Iodide trapping depends on active transport. Once trapped inside the follicular cell, iodide then moves into the follicle lumen by facilitated diffusion.

3. Iodide is oxidized to iodine. At the border of the follicular cell and colloid, iodides are oxidized (by removal of electrons) and converted to iodine .

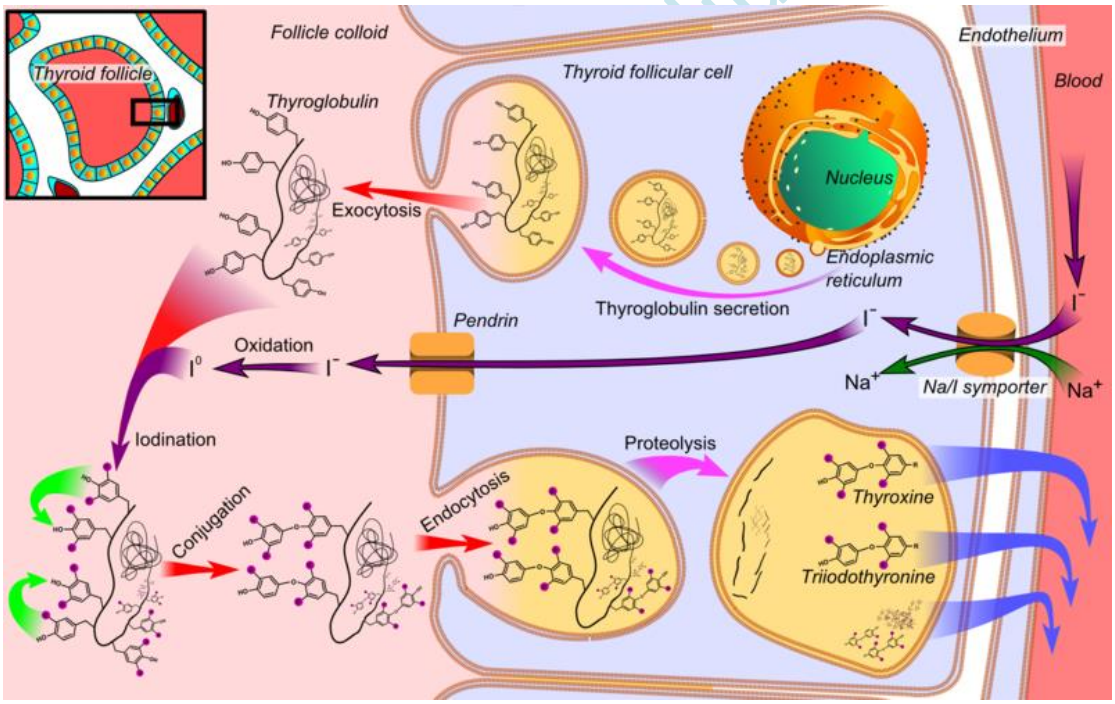
4. Iodine is attached to tyrosine. Once formed, iodine is attached to tyrosine amino acids that form part of the thyroglobulin colloid. This iodination reaction, mediated by peroxidase enzymes, occurs at the junction of the follicular cell and the colloid. Attachment of one iodine to a tyrosine produces **monoiodotyrosine** (**MIT**), and attachment of two iodines produces **diiodotyrosine** (**DIT**).

5. Iodinated tyrosines are linked together to form T3 and T4. Enzymes in the colloid link MIT and DIT together. Two linked DITs result in T4, and coupling of MIT and DIT produces T3. At this point, the hormones are still part of the

thyroglobulin colloid.

6. Thyroglobulin colloid is endocytosed. To secrete the hormones, the follicular cells must reclaim iodinated thyroglobulin by endocytosis and combine the vesicles with lysosomes.

7. Lysosomal enzymes cleave T4 and T3 from thyroglobulin and the hormones diffuse from the follicular cell into the bloodstream.



Thyroid hormone is secreted in response to TSH from the pituitary. The primary effect of TH is to increase the body's metabolic rate. As a result, it raises oxygen consumption and

has a **calorigenic effect**—it increases heat production. TH secretion rises in cold weather and thus helps to compensate for increased heat loss. To ensure an adequate blood and oxygen supply to meet this increased metabolic demand, thyroid hormone also raises the heart rate and contraction strength and raise the respiratory rate. It accelerates the breakdown of carbohydrates, fats, and protein for fuel and stimulates the appetite. Thyroid hormone promotes alertness, bone growth and remodeling, the development of the skin, hair, nails, and teeth, and fetal nervous system and skeletal development. It also stimulates the pituitary gland to secrete growth hormone.

Thyroid hormone controls the rate at which glucose is burned or oxidized and converted to body heat and chemical energy. Because all body cells depend on a continuous supply of energy to power their activities , every cell in the body is a target.

Homeostatic imbalance

Without iodine , functional thyroid hormones cannot be made. The source of iodine is our diet , and food richest in iodine are seafoods. Years ago many people who lived in areas with iodine deficient soil that were far from the seashore (and supply of fresh seafood), developed goiters. So, that region of the

country come to be known as the goiter belt. A goiter is an enlargement of the thyroid gland that results when the diet is deficient in iodine . TSH calls for thyroxine and the thyroid gland enlarges , but without iodine the thyroid makes only the peptide part of the molecule , which is nonfunctional and fail to provide negative feedback to inhibit TSH .if it is occurs in early childhood , the result is cretinism.

Cretinism results in dwarfism in which adults body proportion remain childlike. Together the head and trunk are about 1 and a half times the length of the legs rather than approximately the same length as in normal adult. Untreated individuals with cretinism are intellectually impaired. Their hair is scanty , and their skin is dry. If the hypo-secretion discovered early , hormone replacement will prevent mental impairment and other signs and symptoms of the deficiency. Hypothyroidism occurring in adult results in myxedema which is characterized by both physical and mental sluggishness (however mental impairment does not occur) other signs

1-puffiness of the face .

2-fatigue and poor muscle tone.

3-low body temperature.(the person always cold)

4-obesity.

5-dry skin.

Oral thyroxine is prescribed to treat this condition .

Hyperthyroidism generally results from a tumor of the thyroid gland. Extreme overproduction of the thyroxine result

1.high basal metabolic rate.

2.intolerance of heat.

3.tachycardia.

4.weight loss inspite of good appetite.

5.nervousness and agitated personality.

Graves disease is one form of hyperthyroidism . in addition to symptoms of hyperthyroidism the thyroid gland enlarges and the eyes may bulge , or protruded anteriorly (a condition called **exophthalmos**). Hyperthyroidism may be treated surgically or chemically with anti-thyroid drugs or radioactive iodine which destroy some of the thyroid cells.

The second important hormone product of the thyroid gland , **calcitonin** , decreases blood calcium levels by causing calcium to be deposited in the bone. It acts antagonistically to parathyroid hormone, the hormone produce by the para-thyroid glands. Whereas thyroxine is made and stored in follicles before it released to the blood , calcitonin is made by so-called parafollicular cells found in the connective tissue

between follicles . it released directly to the blood in response to increasing levels of blood calcium.

The Parathyroid Glands

The **parathyroid glands** are partially embedded in the posterior surface of the thyroid. There are usually four, each about 3 to 8 mm long and 2 to 5 mm wide. They secrete **parathyroid hormone (PTH)** in response to Hypoca lcemia. PTH raises blood calcium levels by promoting the synthesis of calcitriol, which in turn promotes intestinal calcium absorption; by inhibiting urinary calcium excretion; by promoting phosphate excretion (so the phosphate does not combine with calcium and deposit into the bones); and by indirectly stimulating osteoclasts to resorb bone.