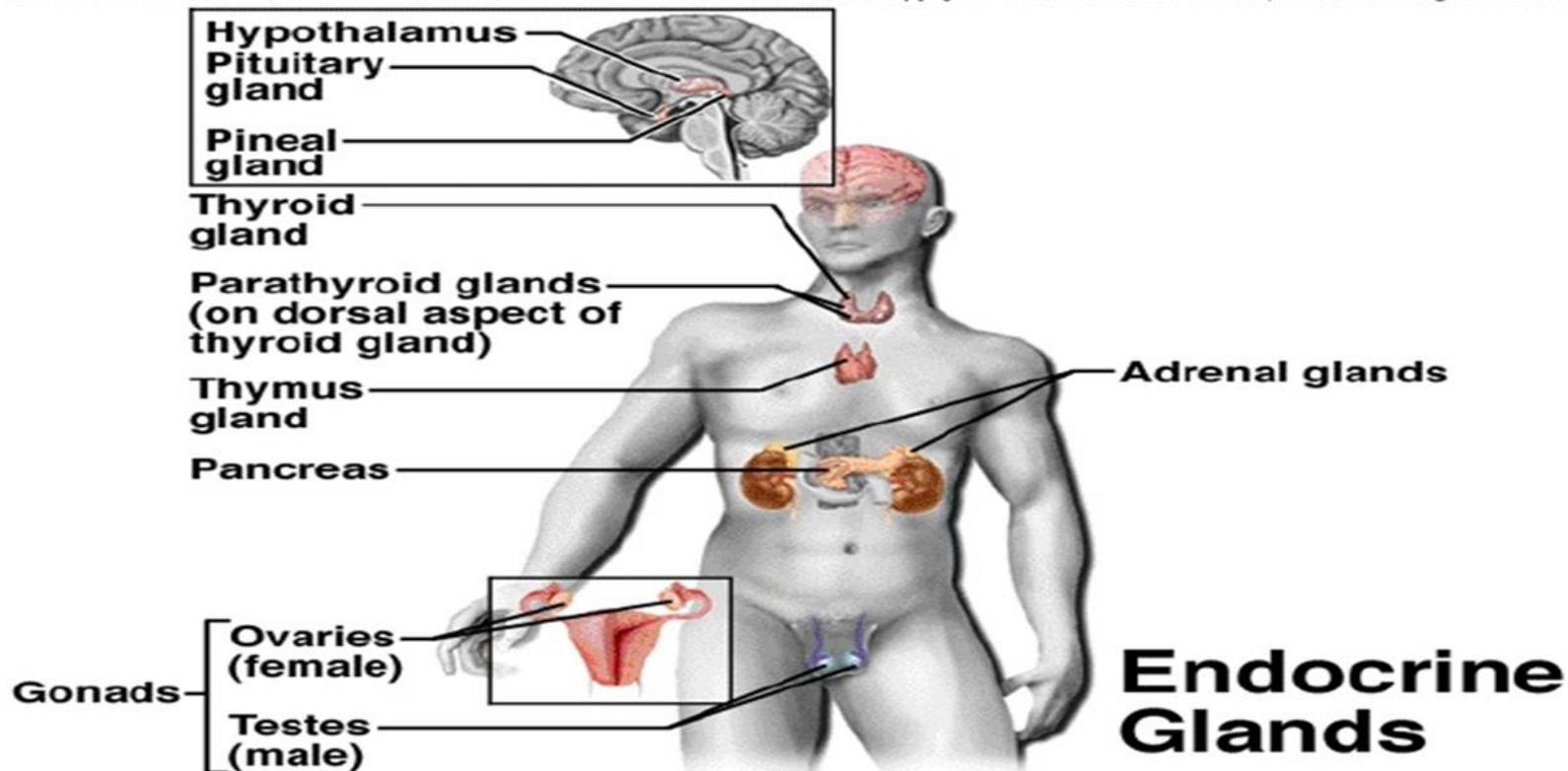


Physiology of Endocrine System(2)

Second Stage/ University of Anbar-College of Dentistry
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Dep. Basic Science



2. PITUITARY GLAND: PARTS

Neurohypophysis

Small posterior lobe

Stores hormones

Oxytocin

Anti Diuretic hormone
(ADH)

Adenohypophysis

Large anterior lobe

Releases hormones

Growth hormone (GH)

Thyroid Stimulating hormone
(TSH)

Adenocorticotrophic hormone
(ACTH)

Lutenizing hormone (LH)

Follicle stimulating hormone
(FSH)

Melanocyte stimulating
hormone (MSH)

Prolactin (PRL)

Pituitary Gland

Disorders of Pituitary Gland

Anterior pituitary

Hyperactivity

- 1. Gigantism**
- 2. Acromegaly**
- 3. Acromegalic Gigantism**
- 4. Cushing's disease**

Hyperactivity

Acromegaly



Gigantism



Hypoactivity

Anterior pituitary

1. Dwarfism



2. Acromicria



3. Simmond's disease

Pituitary Gland

Gigantism (Hyperactivity)



1- Gigantism is the pituitary disorder characterized by excess growth of the body.

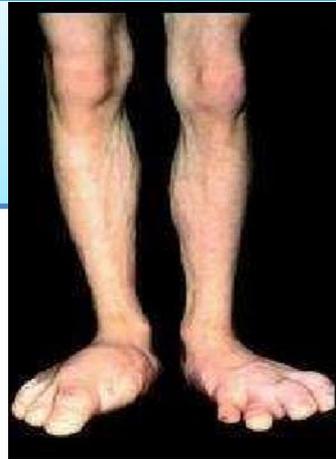
2- Cause Gigantism is due to hypersecretion of GH in childhood or in the pre-adult life before the fusion of epiphysis of bone with the shaft.

3- It appears due to pituitary tumors.

Pituitary Gland

Acromegaly

(Hyperactivity)

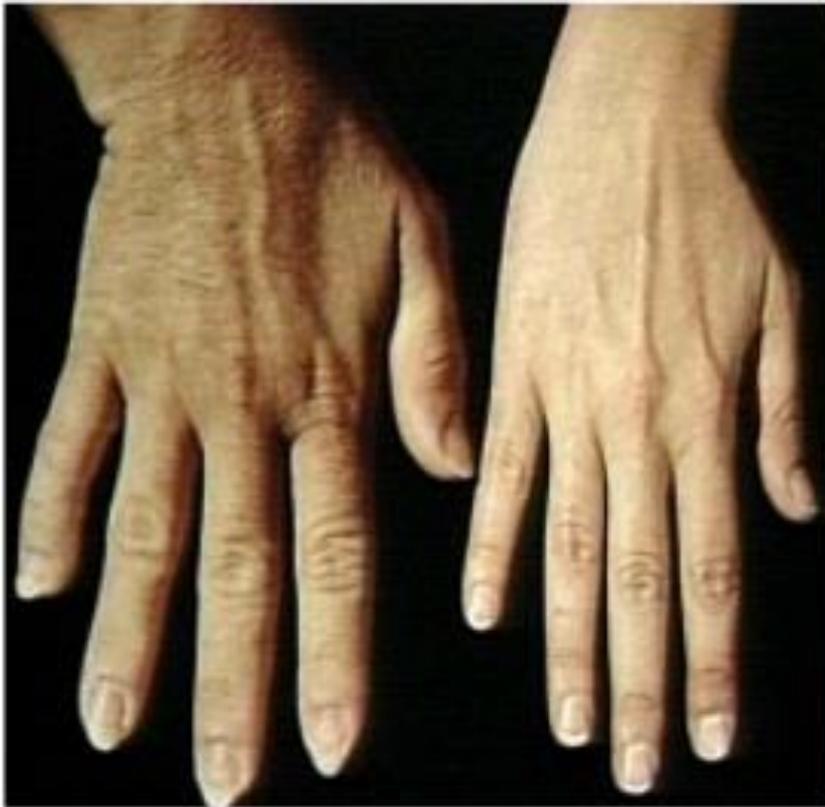


1- disorder characterized by the enlargement, thickening and broadening of bones, particularly in the extremities of the body.

2-Cause Acromegaly is due to hypersecretion of GH in adults after the fusion of epiphysis with shaft of the bone.

3-Hypersecretion of GH is due to adenomatous tumor of anterior pituitary involving the acidophil cells.

Acromegaly (Hyperactivity)



Pituitary Gland

Acromegaly Gigantism (**Hyperactivity**)

Hypersecretion of GH in children, before the fusion of epiphysis with shaft of the bones causes gigantism.

And, if hypersecretion of the GH is continued even after the fusion of epiphysis, the symptoms of acromegaly also appear

Cushing syndrome

An array of symptoms as a result of abnormally high levels of cortisol or other glucocorticoids in the blood

•Cushing's Syndrome

- Excess cortisol due to any cause

•Cushing's Disease

- Excess cortisol due to pituitary micro-adenoma

Cushing's Disease / HYPERACTIVITY OF ANTERIOR PITUITARY

1-Cushing syndrome appear when your body is exposed to high levels of the hormone cortisol for a long time.

2-The condition can also appear when your body makes too much cortisol on its own.

3-may be caused by the use of oral corticosteroid medication.

4-Cushing syndrome, sometimes called hypercortisolism

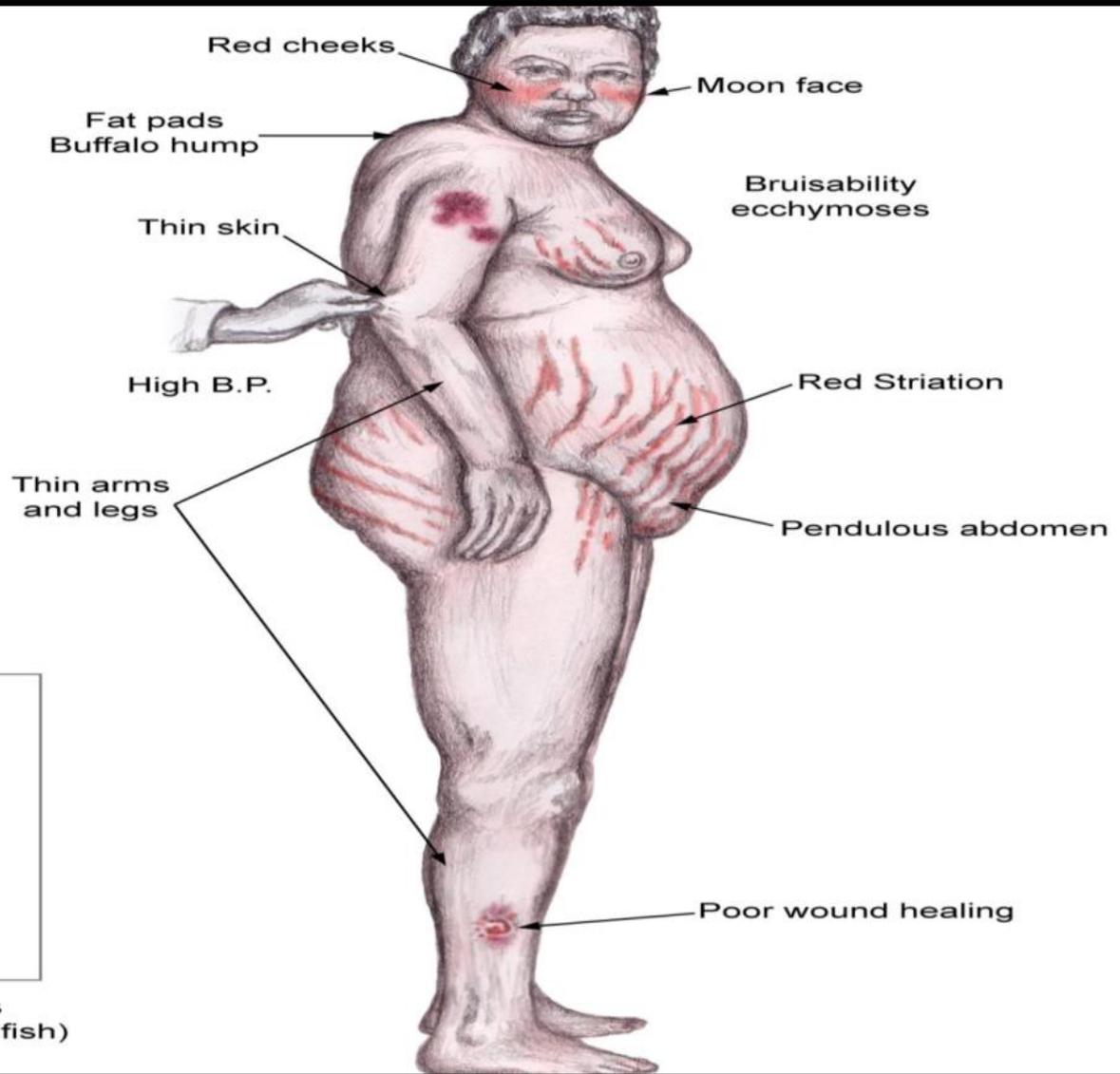
The hallmark signs:

- **a fatty hump between your shoulders,**
- **a rounded face(moon face).**
- **pink or purple stretch marks(striae) on the skin,abdomen,breast,thighs and arms.**
- **Thinning , fragile skin, bone loss and, on occasion, type 2 diabetes**

CUSHING Syndrome

Background

Cushing syndrome is caused by prolonged exposure to elevated levels of either endogenous glucocorticoids or exogenous glucocorticoids



Osteoporosis
compressed (codfish)
vertebrae

Cushing's Disease

Dwarfism/ Hypoactivity of anterior pituitary

Reduction in the GH secretion in infancy

The reasons

1- Deficiency of GHRH from hypothalamus

2- Deficiency of somatomedin-C

3- Atrophy or degeneration of acidophilic cells in the anterior pituitary

4-Tumor of chromophobes: It is a nonfunctioning tumor, which compresses and destroys the normal GH secreting cells.

Panhypopituitarism: In this condition, there is reduction in the secretion of all the hormones of anterior pituitary gland

Simmond's Disease Hypoactivity of anterior pituitary

- **It is a rare pituitary disease. It is also called pituitary cachexia.**

Causes:

mostly in panhypopituitarism, i.e. hyposecretion of all the anterior pituitary hormones due to the atrophy or degeneration of anterior pituitary

Pituitary Gland

Posterior pituitary

Hyperactivity

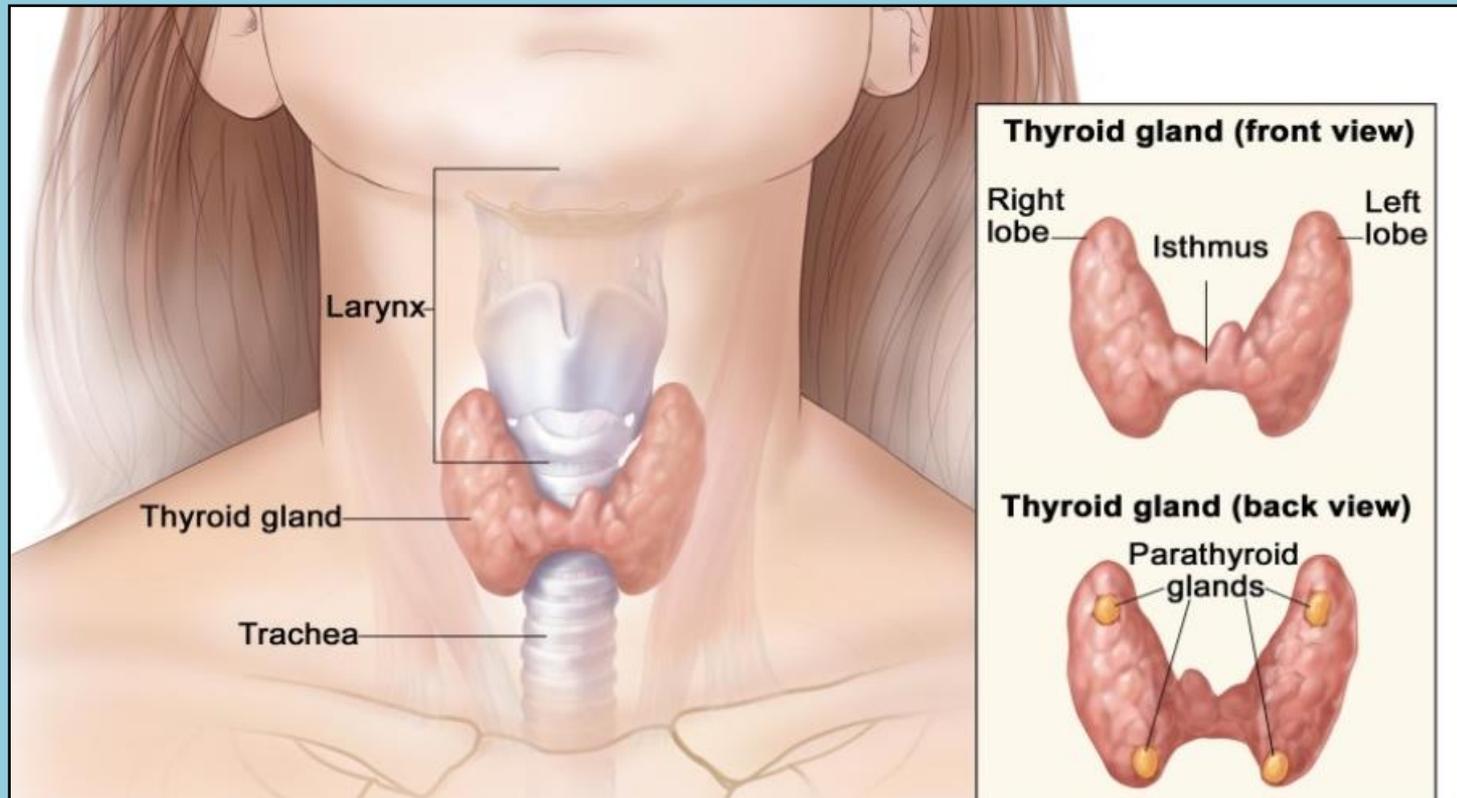
Syndrome of inappropriate hypersecretion of ADH

Hypoactivity

Diabetes insipidus

Thyroid Gland

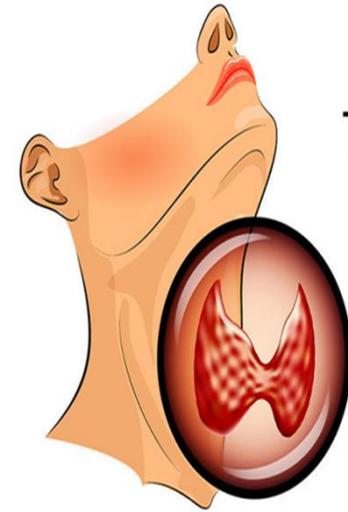
Thyroid is an endocrine gland situated at the root of the neck on either side of the trachea.



Thyroid Gland

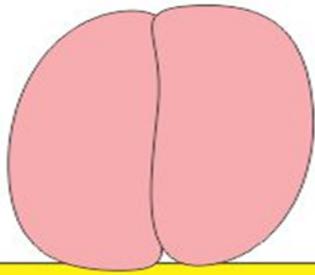
Hormones of Thyroid Gland

Thyroid gland secretes
three hormones:



THE
THYROID
GLAND

- 1. Tetraiodothyronine –T4 (thyroxine)**
- 2. Tri-iodothyronine – T3**
- 3. Calcitonin**



Thyroid gland functions

Thyroid gland



Functions

- **Thyroid Hormone:**
 - Role/Function: Help regulate growth and the rate of chemical reactions (metabolism)
- **Calcitonin:** a hormone secreted by the thyroid gland that lowers blood calcium
 - Role/Function: Lowers the concentration of calcium in the blood when it rises above normal value—this is done by inhibiting the osteoclasts in bone tissue

Disorders of Thyroid Gland

Hyperthyroidism

Graves' disease

1- Graves' disease is an autoimmune disease. Normally, thyroid stimulating hormone (TSH) combines with surface receptors of thyroid cells and causes the synthesis of thyroid hormones.

2- In Graves' disease the B lymphocytes produce autoimmune antibodies called **thyroid stimulating autoantibodies**. These antibodies act like TSH by binding with membrane receptors of TSH and activating cAMP system of the thyroid follicular cells. This results in hypersecretion of thyroid hormones.

Thyroid Gland

Thyroid adenoma:

Sometimes, a localized tumor develops in the thyroid tissue. It is known as thyroid adenoma and it secretes large quantities of thyroid hormones.

Goiter:

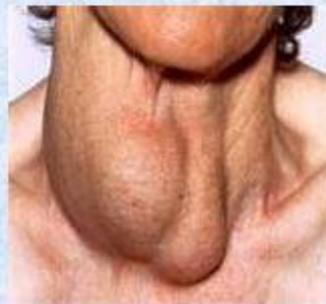
Goiter means enlargement of the thyroid gland. It occurs both in hypothyroidism and hyperthyroidism.

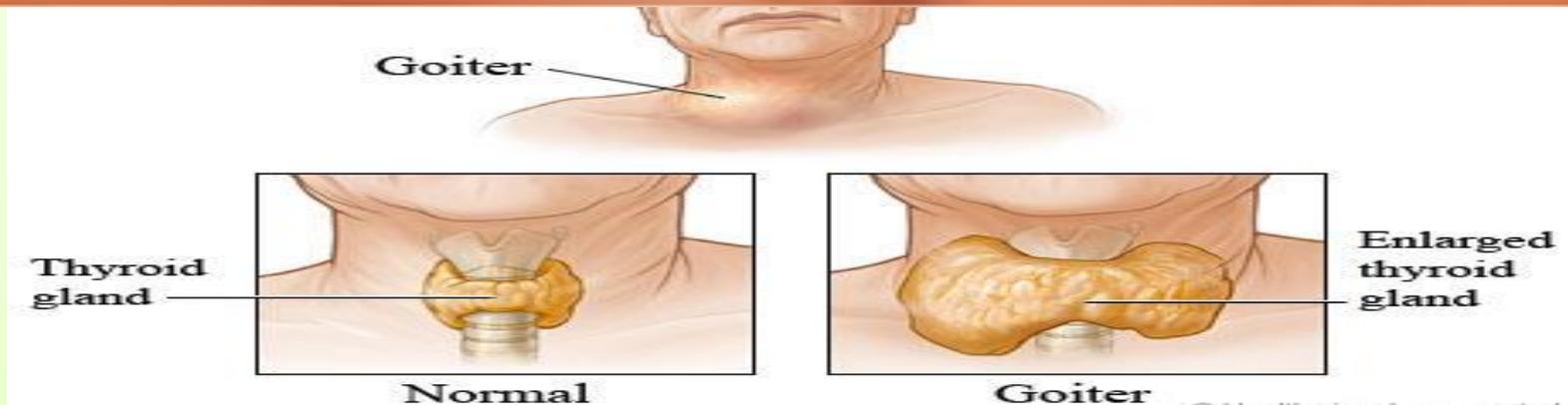
The Causes of Goiter

A goiter is an enlarged thyroid gland.

The thyroid gland is a butterfly-shaped gland in the neck, slightly below the Adam's apple.

Hormone changes or other symptoms can cause the gland to swell and become enlarged.





A goiter is often **painless, but it can cause **hoarseness**, a **cough**, a feeling of **tightness** in the throat, **difficulty swallowing**, or even **difficulty breathing**.**

Thyroid Gland

Goiter in Hyperthyroidism — Toxic Goiter

Toxic goiter is the enlargement of thyroid gland with increased secretion of thyroid hormones caused by thyroid tumor.

Goiter in Hypothyroidism — Nontoxic Goiter is the enlargement of thyroid gland **without increase in hormone secretion**. It is also called hypothyroid goiter.

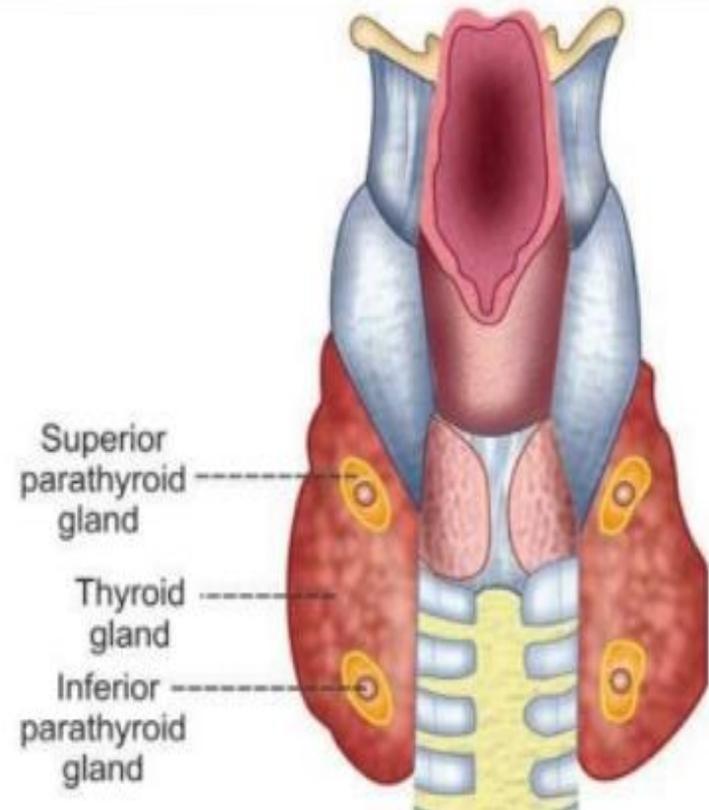
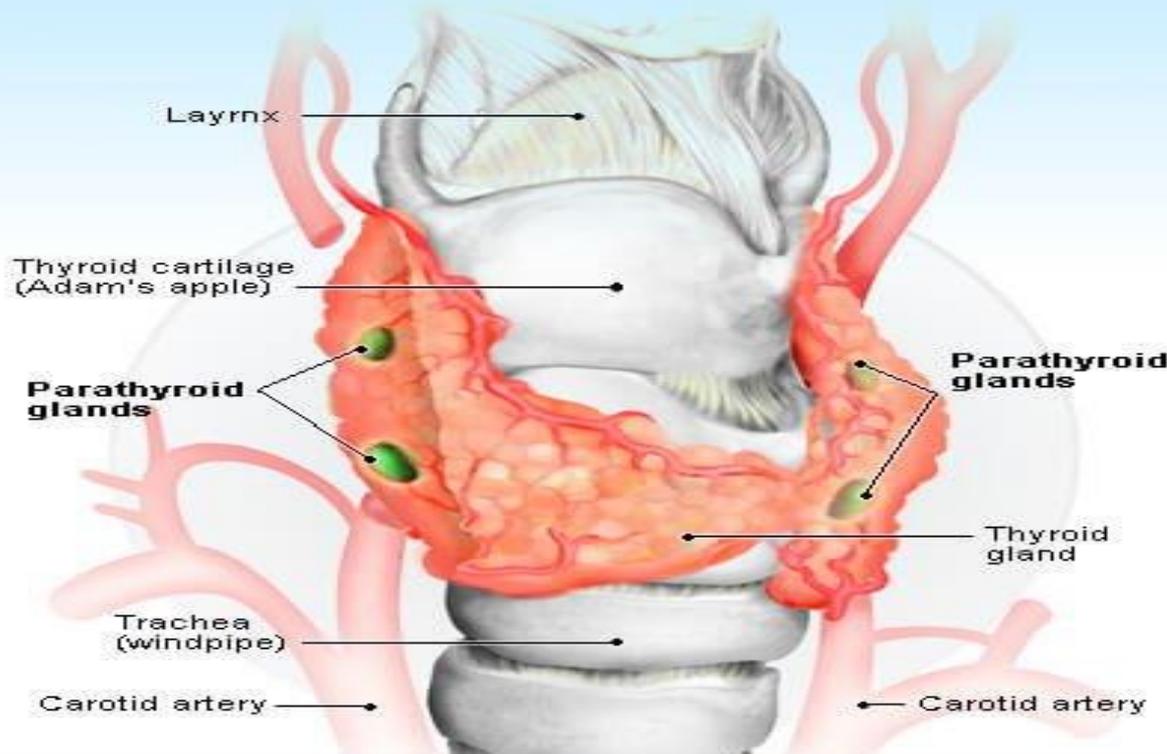
Based on the cause, the nontoxic hypothyroid goiter is classified into two types:

- 1- Endemic colloid goiter .
- 2- Idiopathic nontoxic goiter

Parathyroid Glands

There are four parathyroid glands located immediately behind thyroid gland at the upper and lower poles.

Parathyroid Glands



Parathyroid Glands

Parathormone(PTH)

- 1- is essential for the maintenance of blood calcium level within a very narrow critical level.**
- 2- Parathormone (PTH) is secreted by the chief cells of the parathyroid glands. It is protein in nature having 84 amino acids**

Parathyroid Glands

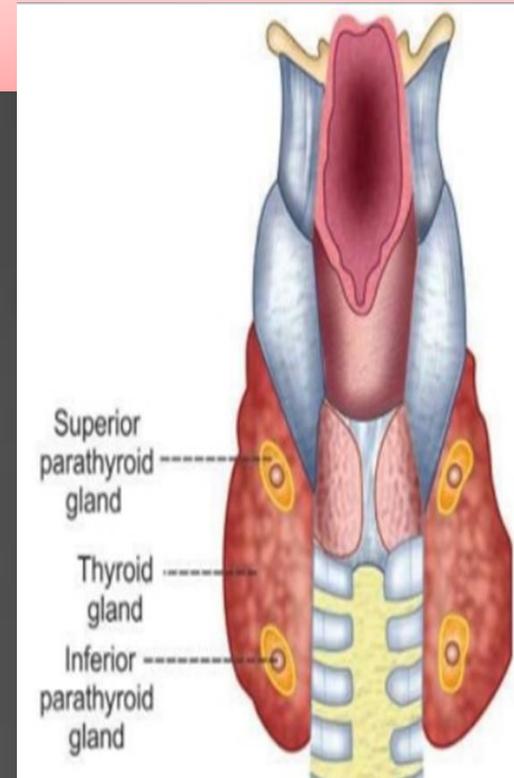
- ▶ Made up of chief cells and oxyphil cells.

1. Chief cells:

- ▶ Secrete parathormone.

2. Oxyphil cells

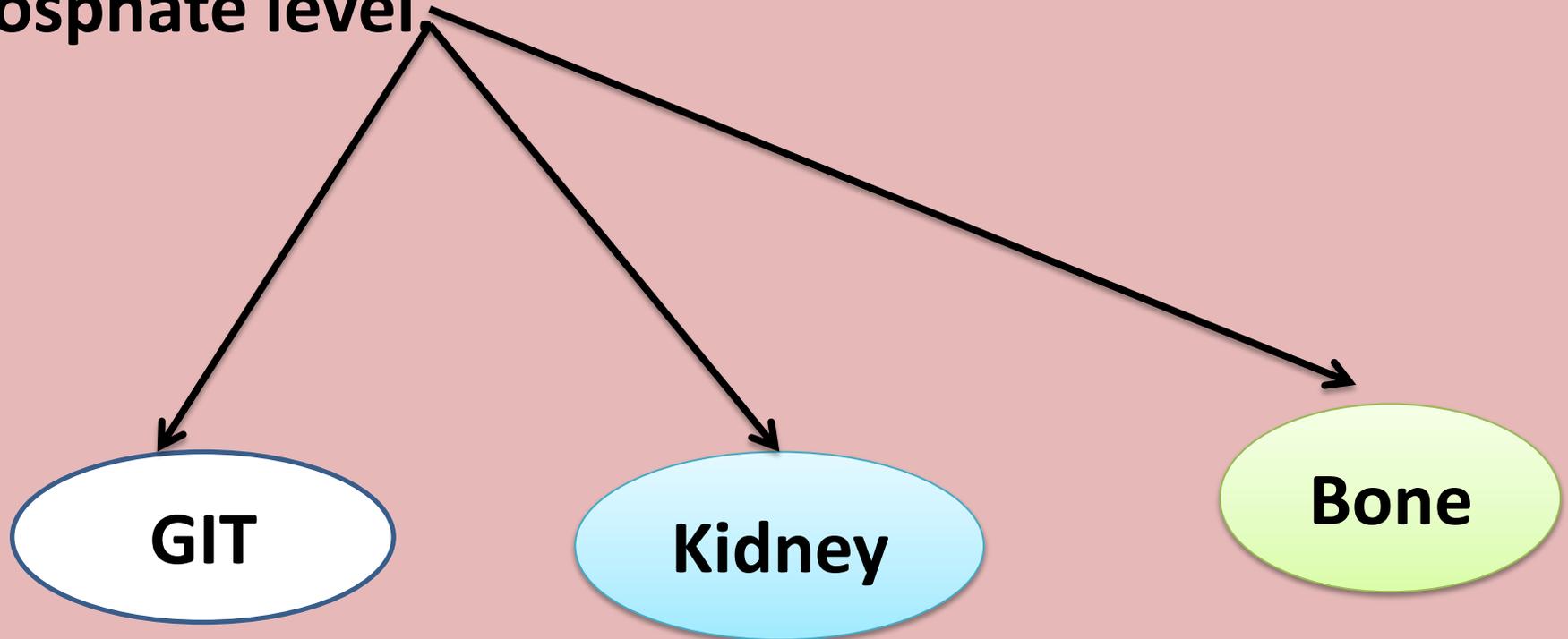
- ▶ Degenerated chief cells and their function is unknown.
- ▶ May secrete parathormone during pathological condition called **parathyroid adenoma**.



Parathyroid Glands

Actions of Parathormone PTH

maintains the blood calcium level and blood phosphate level



Parathyroid Glands

Bone

PTH increases resorption of calcium from the bones by acting on osteoblasts, osteocytes and osteoclasts of the bone.

PTH increases the permeability of the membranes of osteoblasts and osteocytes for calcium ions. So calcium ions move from these bone cells into the blood.

PTH stimulates osteoclasts and causes release of proteolytic enzymes and some acids such as citric acid and lactic acid.

All these substances digest or dissolve the organic matrix of the bone, releasing the calcium ions into the plasma

Parathyroid Glands

Kidneys

PTH increases the reabsorption of calcium from distal convoluted tubule and proximal part of collecting duct into the plasma.

It also increases the formation of 1,25-dihydroxycholecalciferol (activated form of vitamin D) from 25-hydroxycholecalciferol in kidneys which is necessary for absorption of calcium from GI tract.

Parathyroid Glands

Activation of vitamin D:

There are various forms of vitamin D but, the most important one is vitamin D3. It is also known as cholecalciferol.

Vitamin D3 is synthesized in the skin from 7-dehydrocholesterol by the action of ultra-violet rays from the sunlight

The activation of vitamin D3, appear in two steps :-

First step, cholecalciferol (vitamin D3) is converted into 25-hydroxycholecalciferol in the liver. This process is limited and is inhibited by 25-hydroxycholecalciferol itself by feedback mechanism

second step, 25-hydroxycholecalciferol is converted into 1,25-dihydroxycholecalciferol (calcitriol) in kidney. And, it is the active form of vitamin D3. This step needs the presence of PTH.

Disorders of Parathyroid Glands

Hypocalcemic Tetany

Tetany is an abnormal condition characterized by painful muscular spasm (involuntary contraction of muscle or group of muscles) particularly in feet and hand.

It is because of hyperexcitability of nerves and skeletal muscles due to calcium deficiency.

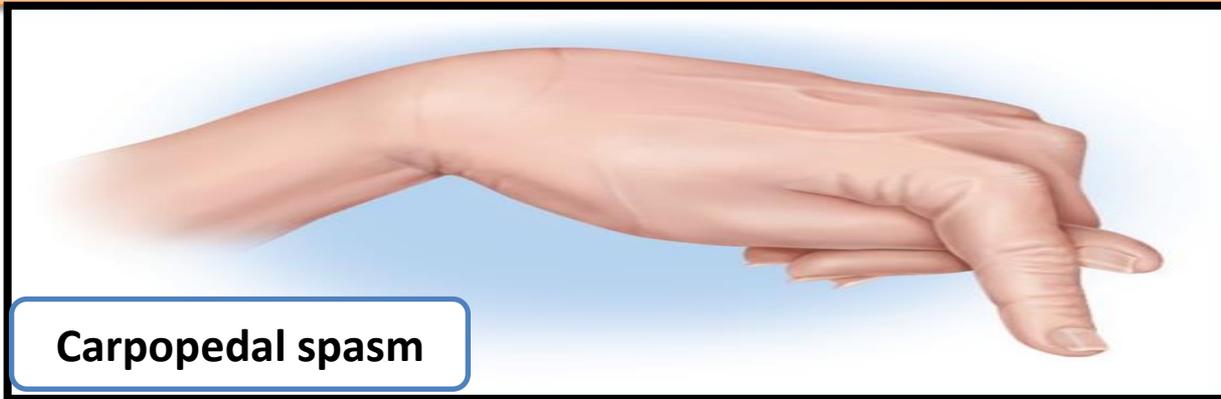
The signs of hypocalcemic tetany

1- Hyper-reflexia and convulsions

The increased neural excitability results in hyperreflexia (overactive reflex actions) and convulsive muscular contractions

2- Carpopedal spasm

Carpopedal spasm is the spasm (violent and painful muscular contraction) in hand and feet that appear due to hypocalcemia



During the spasm, the hand shows a peculiar attitude with flexion at wrist joint and metacarpophalangeal joints, adduction of the thumb, and extension of interphalangeal joints

Calcitonin

calcitonin is secreted by the parafollicular cells or clear cells (C cells) situated amongst the follicles in thyroid gland. It is a polypeptide chain with 32 amino acids. Its molecular weight is about 3,400. Plasma level of calcitonin is 1 to 2 ng/L.

On Blood Calcium level

Calcitonin plays an important role in controlling the blood calcium level. decreases the blood calcium level and there by counteracts parathormone. Calcitonin reduces the blood calcium level by acting on bones, kidneys and intestine

On Blood Phosphate level

With respect to calcium, calcitonin is an antagonist to PTH. But it has similar actions of PTH with respect to phosphate. It decreases the blood level of phosphate by acting on bones and kidneys



1-Essentials of Physiology for Dental Students. K Sembulingam and Prema Sembulingam ,2016, four Edition , Jaypee Brothers Medical Publishers.

2- Human Physiology. Stuart Ira Fox., TWELFTH EDITION,2017. Published by McGraw-Hill

Thank You!