

THYROID GLAND

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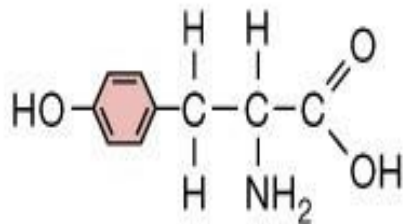
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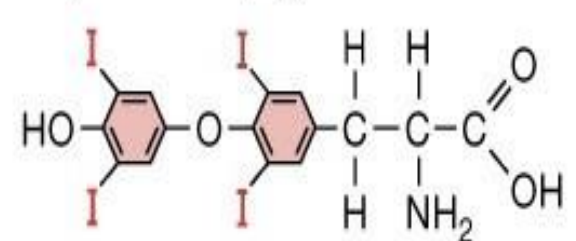
Introduction

- Produces
 - Thyroxine(T_4)
 - Triiodothyronine(T_3)
 - Cell differentiation during development
 - Maintain thermogenic and metabolic homeostasis in adult

Tyrosine



Thyroxine (T₄)

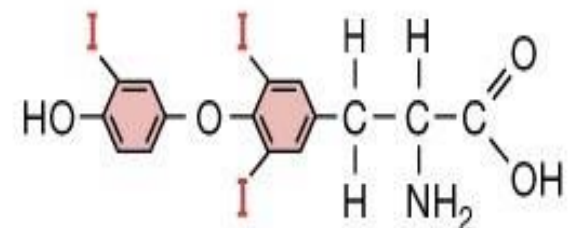


(2 tyrosine + 4 I)

Tyrosine



Triiodothyronine (T₃)

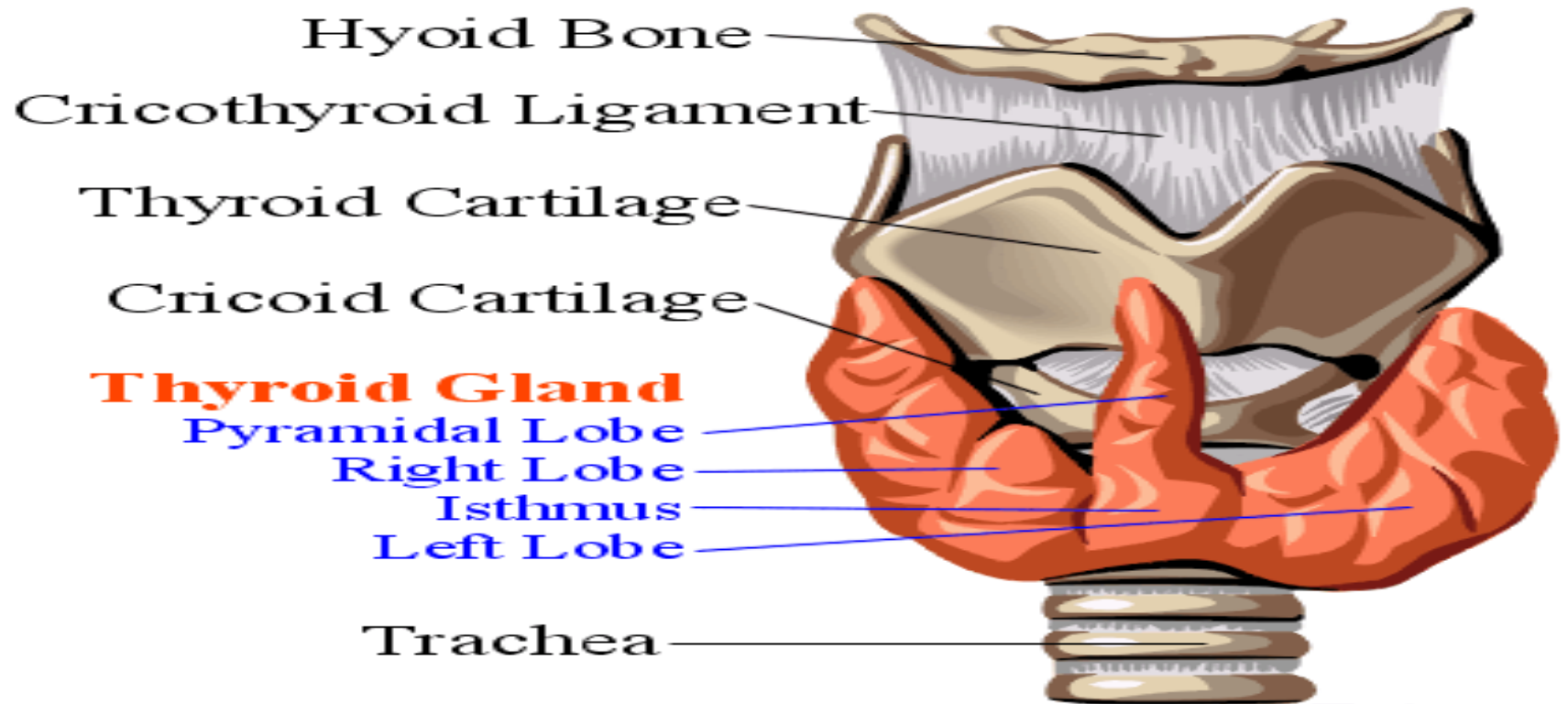


(2 tyrosine + 3 I)

- The thyroid secretes about 80mg of T_4 , but only 5mg of T_3 per day.
- However, T_3 has a much greater biological activity about 10 folds than T_4 .
- An additional 25mg/day of T_3 is produced by peripheral monodeiodination of T_4 by enzyme called 5' Monodeiodenase

Anatomy

- Two lobes connected by an isthmus
- Ant to trachea, between cricoid cartilage and suprasternal notch
- 12-20 gm in size
- Four parathyroid glands embedded
- Recurrent laryngeal nerves in proximity

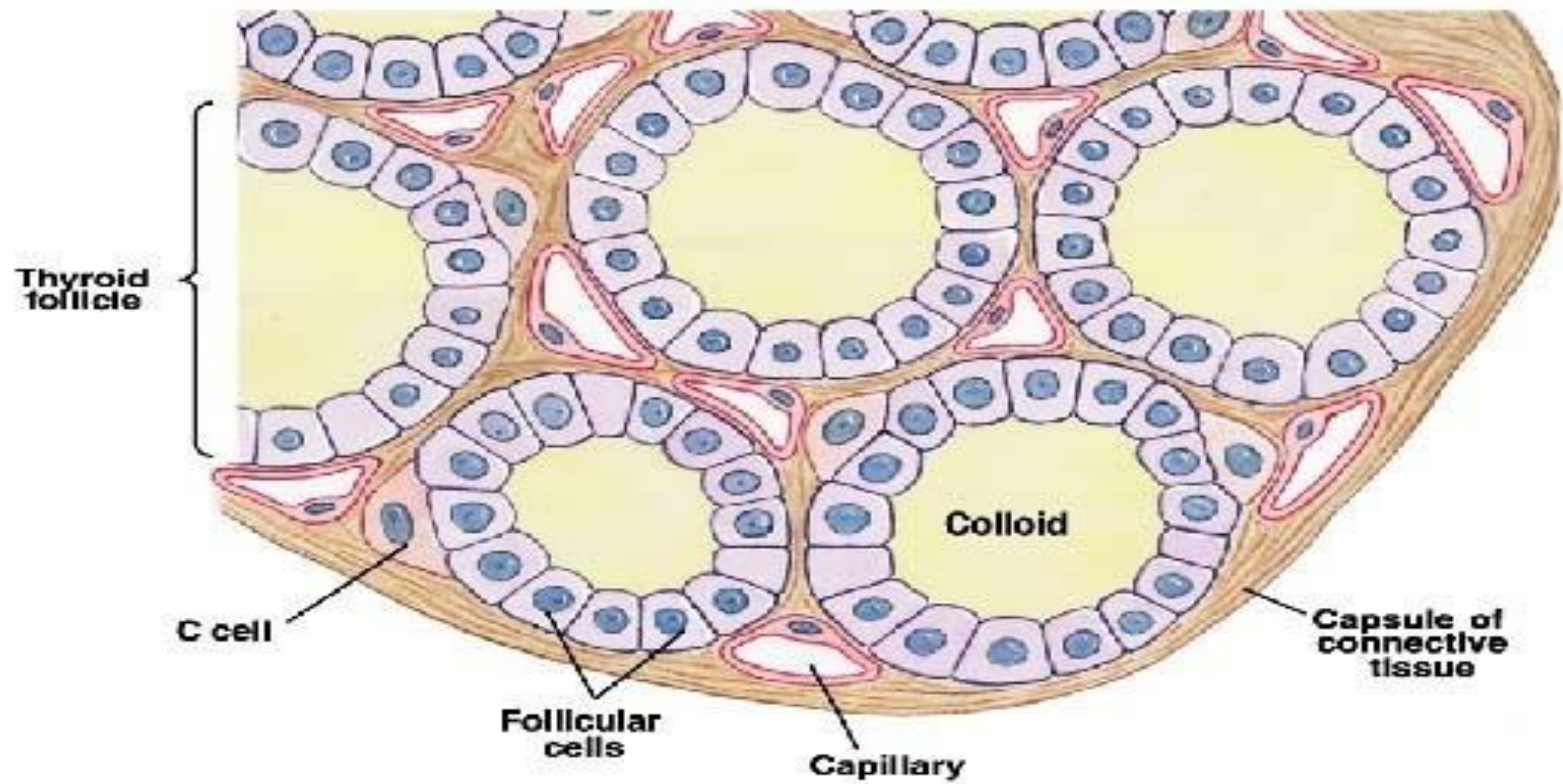


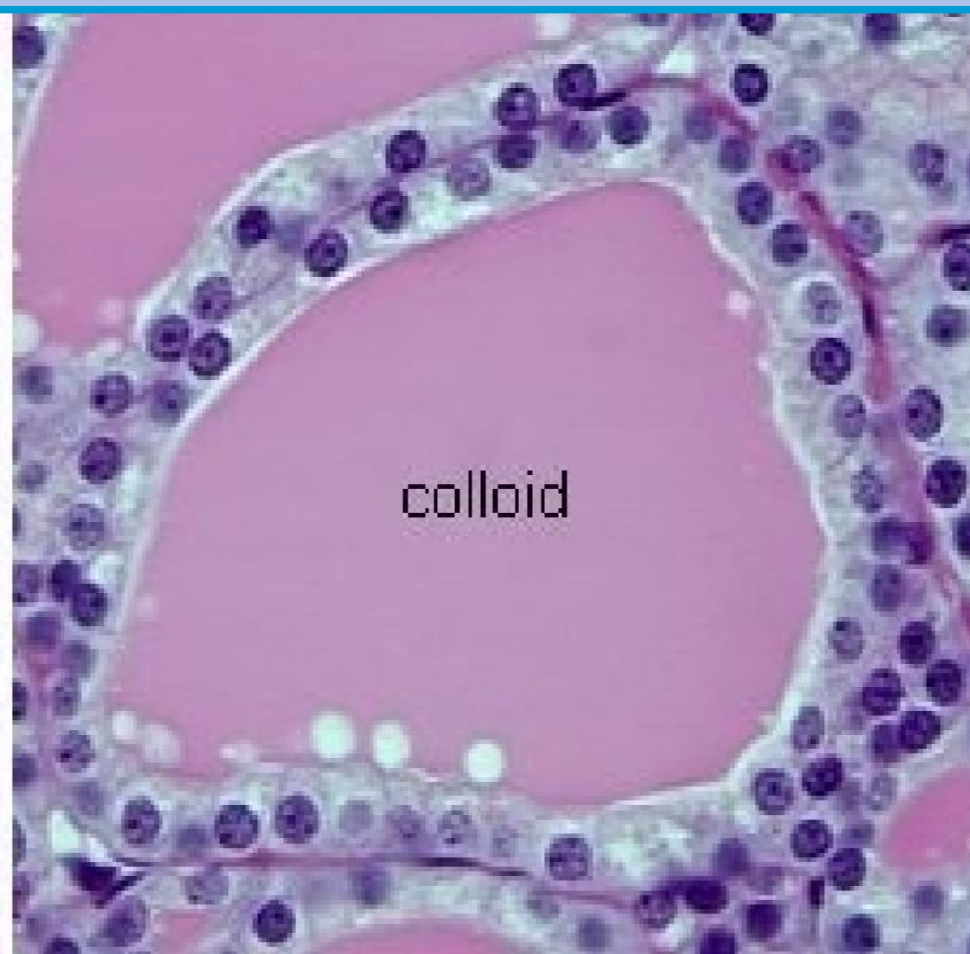
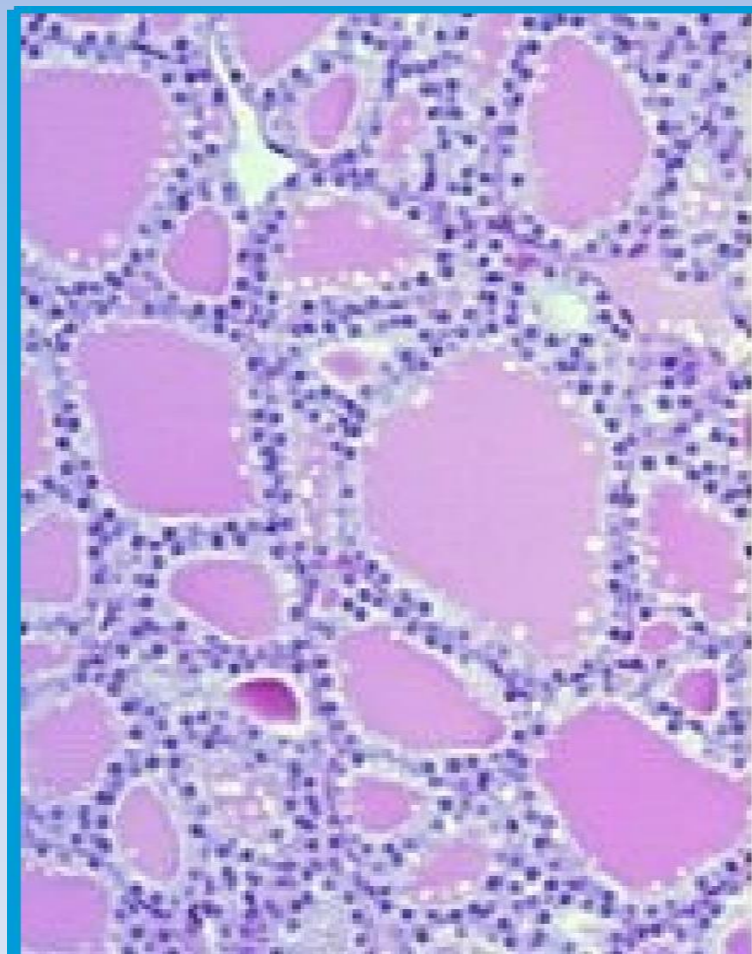
Adapted from Corel Draw 9

- Develops from floor of **primitive pharynx**, 3rd week of gestation
- Migrates with thyroglossal duct(Ectopic Thyroid)
- Neural crest at ultimobranchial body → Thyroid
medullary C Cell → CALCITONIN

- Contains numerous spherical follicles
- Thyroid follicular cells that surround secreted colloid, proteinaceous material containing thyroglobulin
- Regulated by TSH

Section of thyroid gland



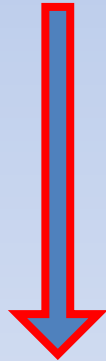


Thyroid Regulation

- **TSH** secreted by **ant pituitary** regulates thyroid axis.
- Useful marker of thyroid function
- **TRH** stimulates pituitary TSH.
- TSH stimulates T_3 , T_4 Synthesis and secretion
- Thyroid hormones inhibit secretion of TRH and TSH

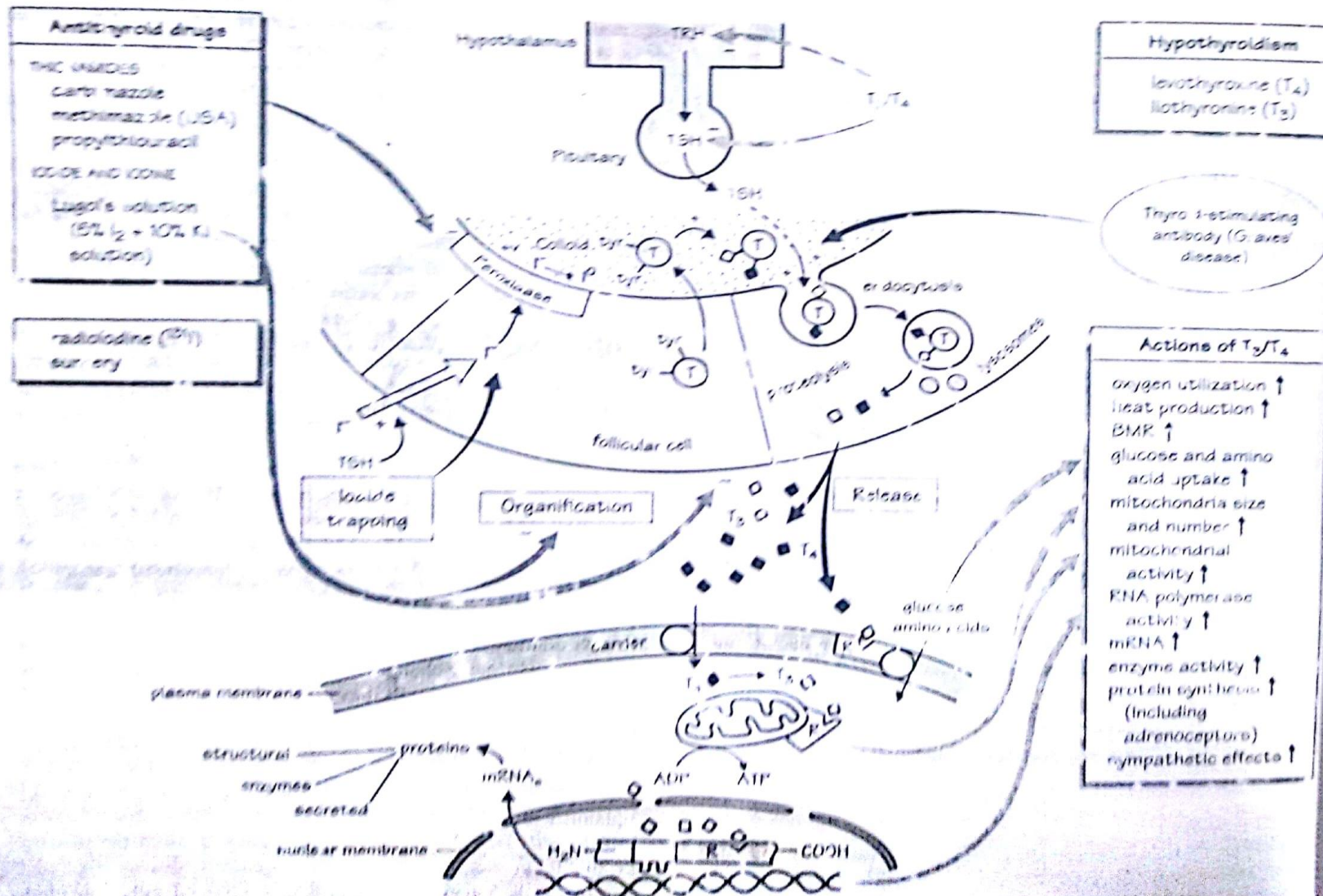
Metabolism and Transport

- Iodine uptake is the first step highly regulated
- Mutation of the **pendrin gene** (iodine transporter) leads to Pendred's syndrome



defective organification of iodine, **goitre** and **sensorineural deafness**

Thyroid and antithyroid drugs



- Iodine trapped, transported to apical membrane and oxidized that involve **TPO** and **Hydrogen Peroxide**
- Iodine is coupled with Tg, T_3 T_4 are formed
- Tg is taken back into the cell, processed by **lysosomes** to release T_3 T_4 .
- MIT and DIT are recycled by **dehalogenase**
- **T_4 is precursor to T_3**

- Bound to TBG, Transthyretin and albumin
- Unbound T_3 is less than T_4 in circulation
- Unbound fraction is active
- Deiodinase present in tissues convert T_4 to T_3
 - Located in pit, thy, liv, kid, brain, brown fat

Examination

- Thyroid Gland
- Ophthalmopathy
- Dermatopathy
- Neck: Scars, mass, distended veins
- Pemberton's sign for retrosternal goiter
- lymphadenopathy

Lab Evaluation

- TSH normal everything normal
 - TSH Abnormal
 - Decreased: Hyperthyroid
 - Increased: Hypothyroid
 - Do unbound T₃ T₄
- T₄ Toxicosis: free T₄ is increased TSH decreased
- T₃ Toxicosis: freeT₃ is increased, T₄ nor, TSH decreased

Etiology of Thyroid dysfunction

- **TPO Antibodies** : seen in autoimmune hypothyroidism and Graves disease
- **TSI Antibodies**: Stimulate TSH- R in graves disease, used for prediction of neonatal thyrotoxicosis
- Serum Tg level increased in all types of thyrotoxicosis

RAIU And Scanning

- ^{123}I , ^{125}I , ^{131}I , $^{99\text{m}}\text{Tc}$ **Pertechnate** allow thyroid imaging
- **Graves disease**: Enlarged gland and homogenous uptake
- **Toxic adenoma**: Focal uptake
- **Toxic MNG**: Multiple areas of increased and decreased uptake
- **Subacute thyroiditis**: Poor uptake

- **Thyroid scan** useful in follow up of thyroid cancer

USG THYROID :

Used for diagnosis of nodular thyroid disease

Cretinism

- Mental retardation
- Growth retardation
- Children living in iodine deficiency areas and untreated
- Mothers may be iodine deficient



Hypothyroidism

- Congenital
 - 1: 4000
 - Mom having TSH R blocking antibodies(5%)
 - Thyroid Gland dysgenesis(80- 85%)
 - Inborn errors (10-15%)

Clinical Features

- Normal at birth
- Later develop clinical features: Prolonged jaundice, feeding problems, hypotonia, enlarged tongue, delayed bone maturation , Umbilical hernia
- Permanent Neurologic Damage
- Congenital heart disease

Treatment

- Measure T₃ T₄ TSH Levels in heel prick sample
- T₄ given at 10-15 microgram/Kg per day

Hypothyroidism

- Goitrous Thyroiditis (Hashimotos)
- Atrophic
- Subclinical hypothyroidism
- Clinical hypothyroidism(**TSH > 10mIU/L**)

- Females 4:1000
- Males 1:1000
- More common in Japanese
- Mean age 60 years

- Hashimotos Thyroiditis:
 - Lymphocytic infiltration,
 - atrophy of thyroid follicles,
 - absence of Colloid,
 - Fibrosis
- Atrophic thyroiditis:
 - End stage of Hashimotos

- TPO Antibodies and TG Antibodies but mediated by T Cell
- Antibodies To TSH R (Prevent binding of TSH)

Clinical Features

- **Symptoms:**
 - Tired, fatigue, feel cold,
 - dry skin,
 - poor memory, lack of concentration,
 - constipation, weight gain, poor appetite,
 - Dyspnea, hoarse voice,
 - Menorrhagia, amenorrhea,
 - Paresthesia, Impaired hearing

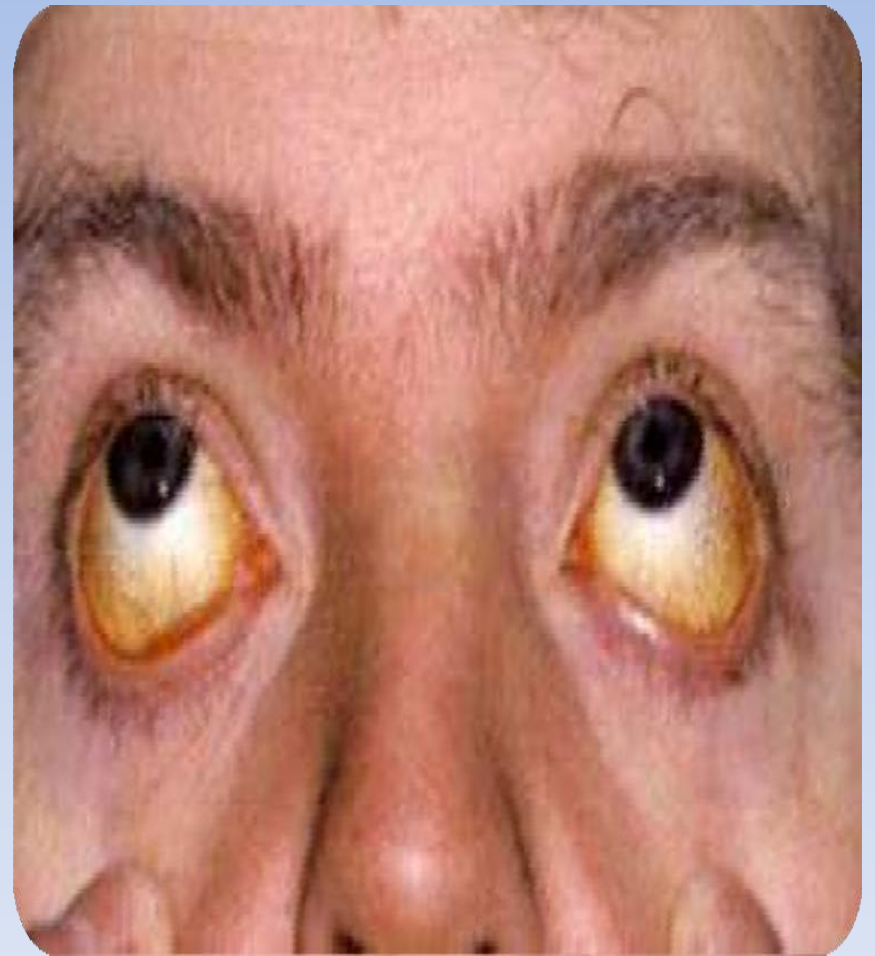
SIGNS

- Dry coarse skin
- Cool peripheral extremities
- Puffy face, hands and feet
- Diffuse alopecia
- Bradycardia
- Peripheral edema
- Delayed tendon reflexes
- Carpal tunnel syndrome
- Serous cavity effusions(pericardial effusions)

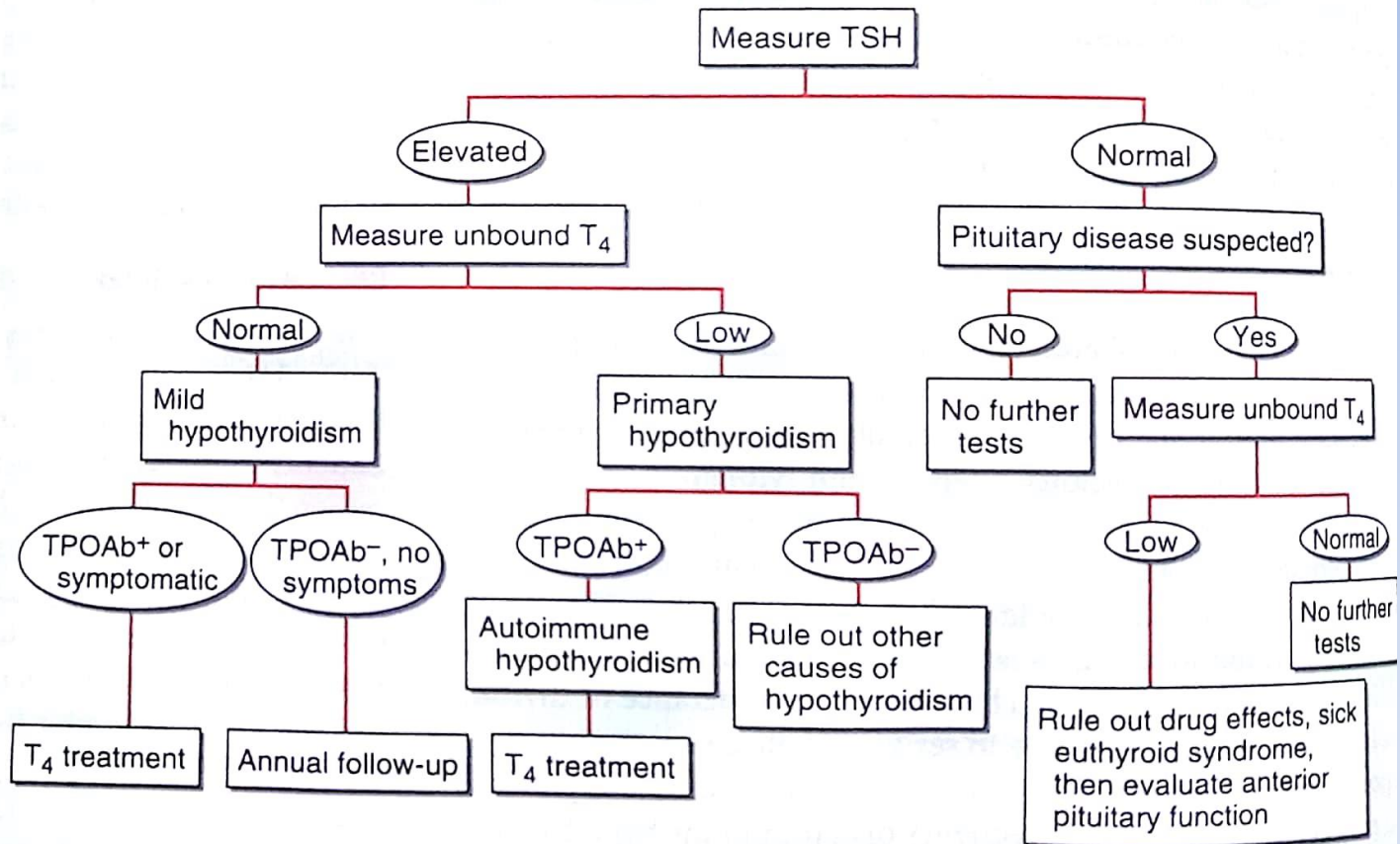
- May present with goitre
- Skin thickening (Glycosaminoglycans)
- Loss of libido
- Autoimmune disorders eg vitilgo, pernicious anaemia, Addisons disease, alopecia areata

Other causes

- Iatrogenic
 - Radiation therapy
 - Subtotal thyroidectomy
 - Chronic iodine excess intake
 - Secondary hypothyroidism



EVALUATION OF HYPOTHYROIDISM



Treatment

- 1.6 microgram per kg
- Post treatment of Graves disease 75-125 micro gram
- No heart disease, age < 60 start 50-100
- Rpt TSH every 2-3 mths .
- If reqd adjust dose by 12.5 or 25 micro

Myxedema Coma

- High mortality
- Decreased sensorium, seizures and other features
- Hypothermia
- History
 - Elderly
 - Drugs: Sedatives,
 - Pneumonia, MI, CVA

Treatment

- Levo T (500) micro IV
- Liothy 10-25 micro every 8-12 hrly
- Supportive therapy

Thyroiditis

- Acute thyroiditis
 - Rare
 - Suppurative inf of the thyroid
 - Risk factors
 - Long standing goiter
 - degeneration in thyroid malignancy.

- Pain : throat, ears, asymmetric goitre
- Fever, dysphagia and erythema over the thyroid
- Febrile illness
- lymphadenopathy

- Antibiotic treatment Gram Stain and culture
- May require surgery

Subacute thyroiditis

- Age 30-50 yrs
- Female: Male= 3:1
- Patchy inflammatory infiltrates with disruption of thyroid infiltrates
- Progresses to granulomas with fibrosis
- T_4 , T_3 increase, TSH Decreases
- Later T_4 decreases TSH increases

Clinical Features

- Painful enlarged thyroid, Fever
- Thyrotoxicosis or hypothyroidism

Lab inv

Thyrotoxic phase

Hypothyroid phase

Recovery phase

Treatment

- Aspirin 600mg every 4-6 hrly
- 40- 60mg of prednisolone tapered of in 6-8 weeks
- Beta blockers may be helpful

Silent thyroiditis : No thyroid tenderness,
postpartum, similar to subacute, No Steroids.
Beta blockers are used.

Drug Induced: IFN alpha, IL2

Chronic Thyroiditis: 20- 40%autopsy cases

F:M = 4-10: 1

Goitre

- Enlarged thyroid gland
 - Biosynthetic
 - Iodine deficiency
 - Autoimmune
 - Nodular disease
 - 5-7 % clinical
 - 25% usg

- Diffuse simple goitre : non Nodular
 - Filled with colloid
 - Asymptomatic
 - May cause tracheal or oesophageal compression
 - Retrosternal goitre: Pemberton's sign
- T₃ T₄ TSH should be done in all

- Iodine or thyroid replacement
- Surgery if tracheal compression or thoracic outlet obstruction

Non Toxic MNG

- 12% of Adults
- F > M
- Asymptomatic and euthyroid
- Measure TSH. Tracheal compression may occur
- USG, MRI CT Scan, Barium swallow

- Managed conservatively
- **Jod Basedow effect**: Autonomous nodules secrete excess T_3 T_4 when given iodine(Contrast And Medicines)
- Radioiodine may be used

Toxic MNG

- Functional autonomy
- Subclinical hyperthyroidism or mild thyrotoxicosis
- Features of thyrotoxicosis
- TSH is low
- Thyroid scan : heterogenous uptake

Treatment

- Antithyroid drugs with beta blockers
- Radioiodine
- Surgery

Toxic Adenoma

- Solitary Functioning nodule
- Pathology in TSH Receptor
- Palpable mass
- Thyroid scan shows focal uptake
- Radioiodine
- Surgery