

Thyroid Function Tests (TFT)

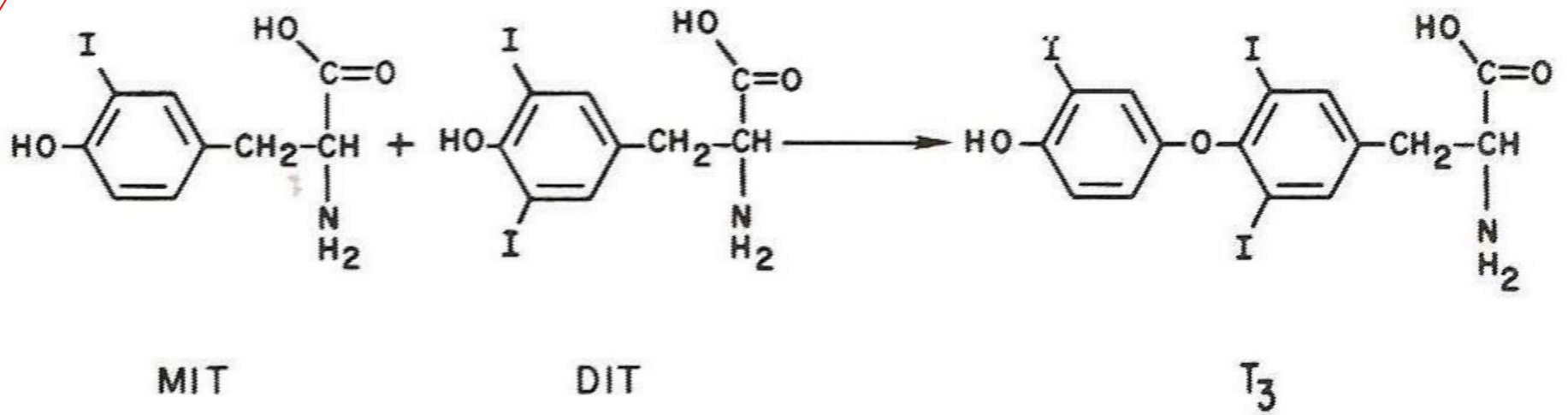


Thyroid Hormones

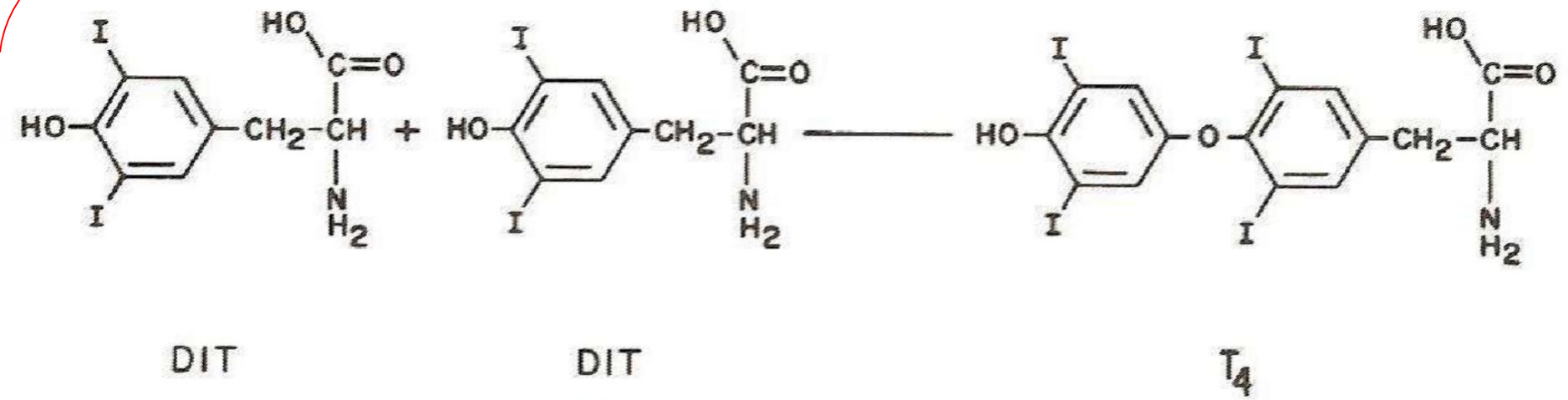
- ☐ Thyroxine (T4)
- ☐ Triiodotyronine (T3)
- ☐ Thyroid stimulating hormone (TSH)
- ☐ Free T4
- ☐ Free T3

- The Iodine is the most important element in the biosynthesis of thyroid hormones.
- Thyroglobulin acts as a performed matrix containing tyrosyl groups to which the reactive iodine attaches to form the hydroxyl residues of monoiodotyrosine (MIT) & diiodotyrosine (DIT).

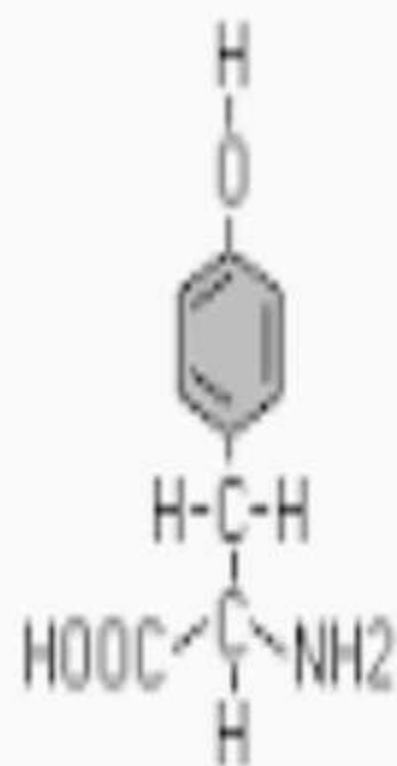
- The coupling of two DIT molecules forms T₄.
- The coupling of one DIT molecules & one MIT molecule results in the formation of T₃ or reverse T₃ (rT₃).
- Almost all circulating T₄ & T₃ hormones are bound to serum proteins (thyroid hormone-binding proteins).



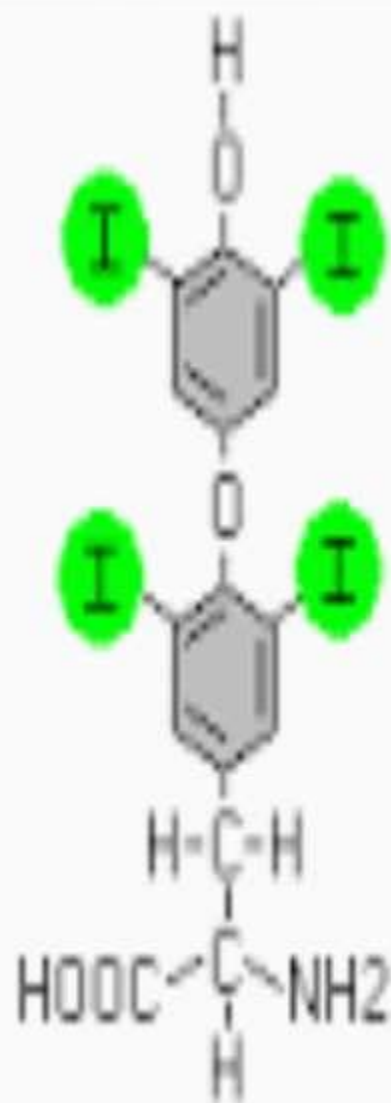
Formation of T₃



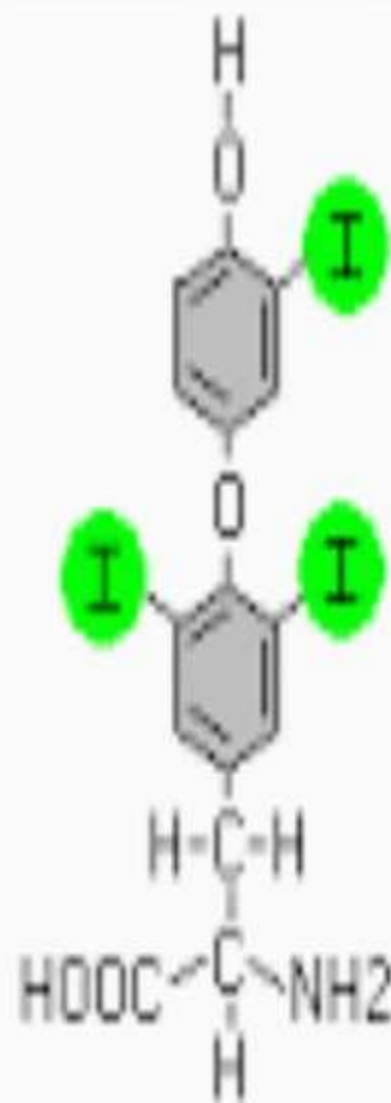
Formation of T₄



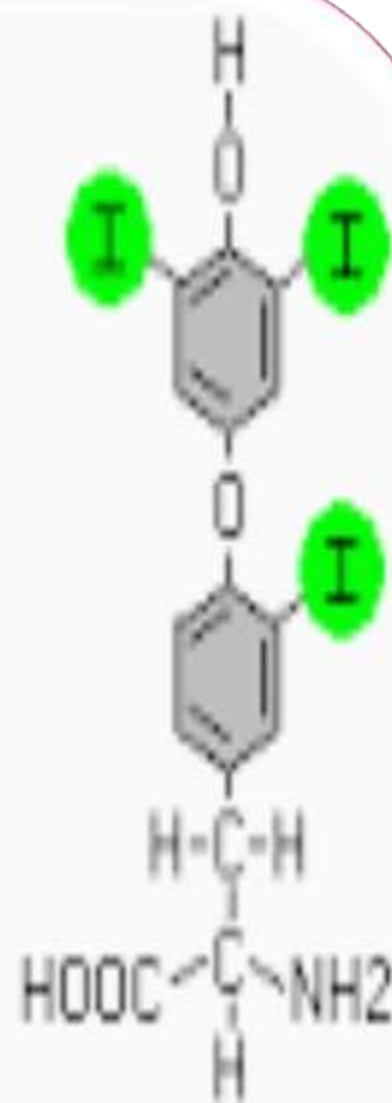
Tyrosine



Thyroxine (T4)



Triiodothyronine
(T3)



"Reverse T3"
(inactive)

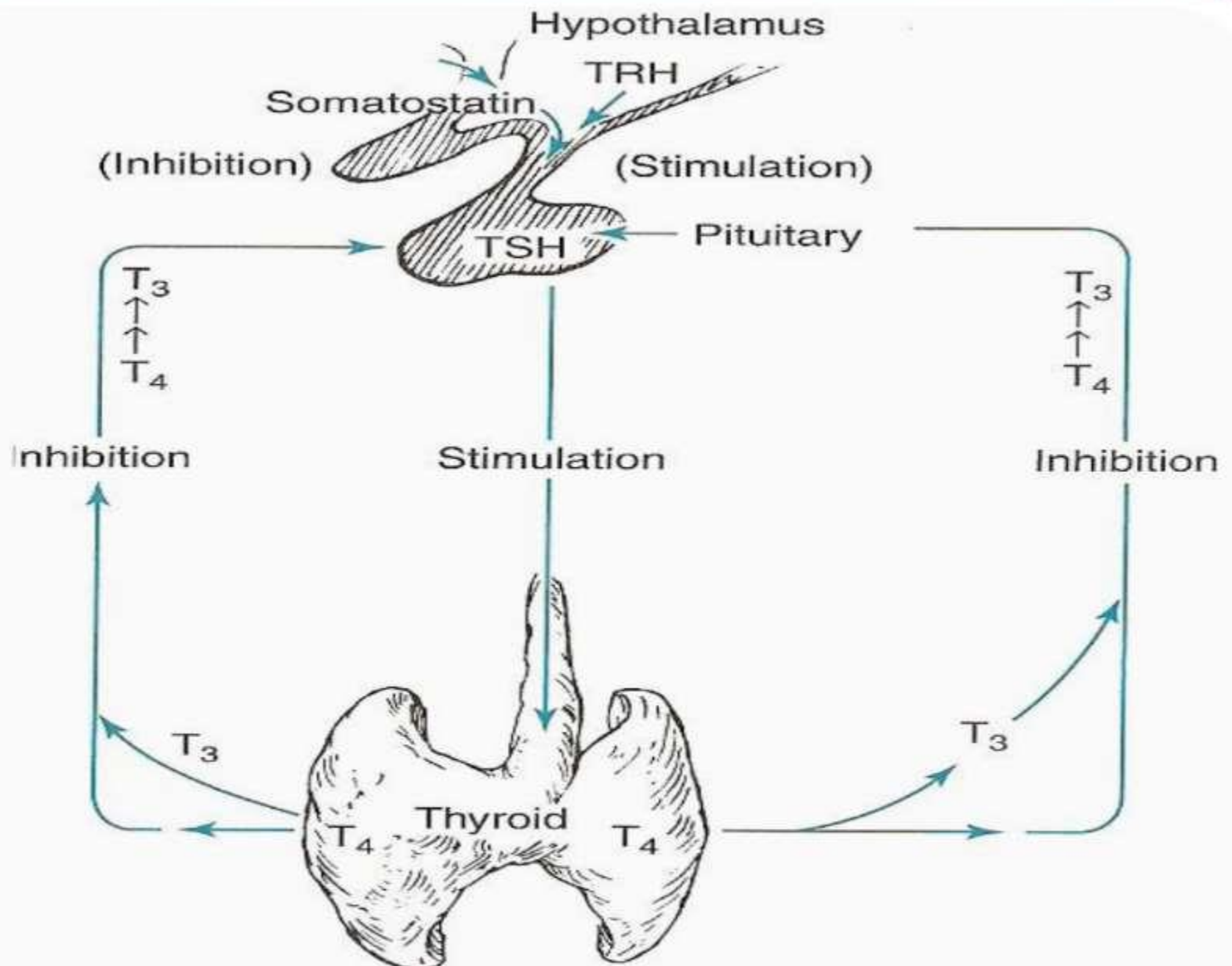
Free T₃ & Free T₄

- Only 0.03 % of T₄ & 0.3 % of T₃ are not bound to proteins.
- These fractions, called free T₄(FT₄) & free T₃ (FT₃), are the physiologically active portions of the thyroid hormones.

- T3 is the most biologically active.
- T3 is three to four times more potent than T4.
- T3 is more active because it is not as tightly bound to the serum proteins as is T4.
- T3 has a greater affinity to target tissue receptors.

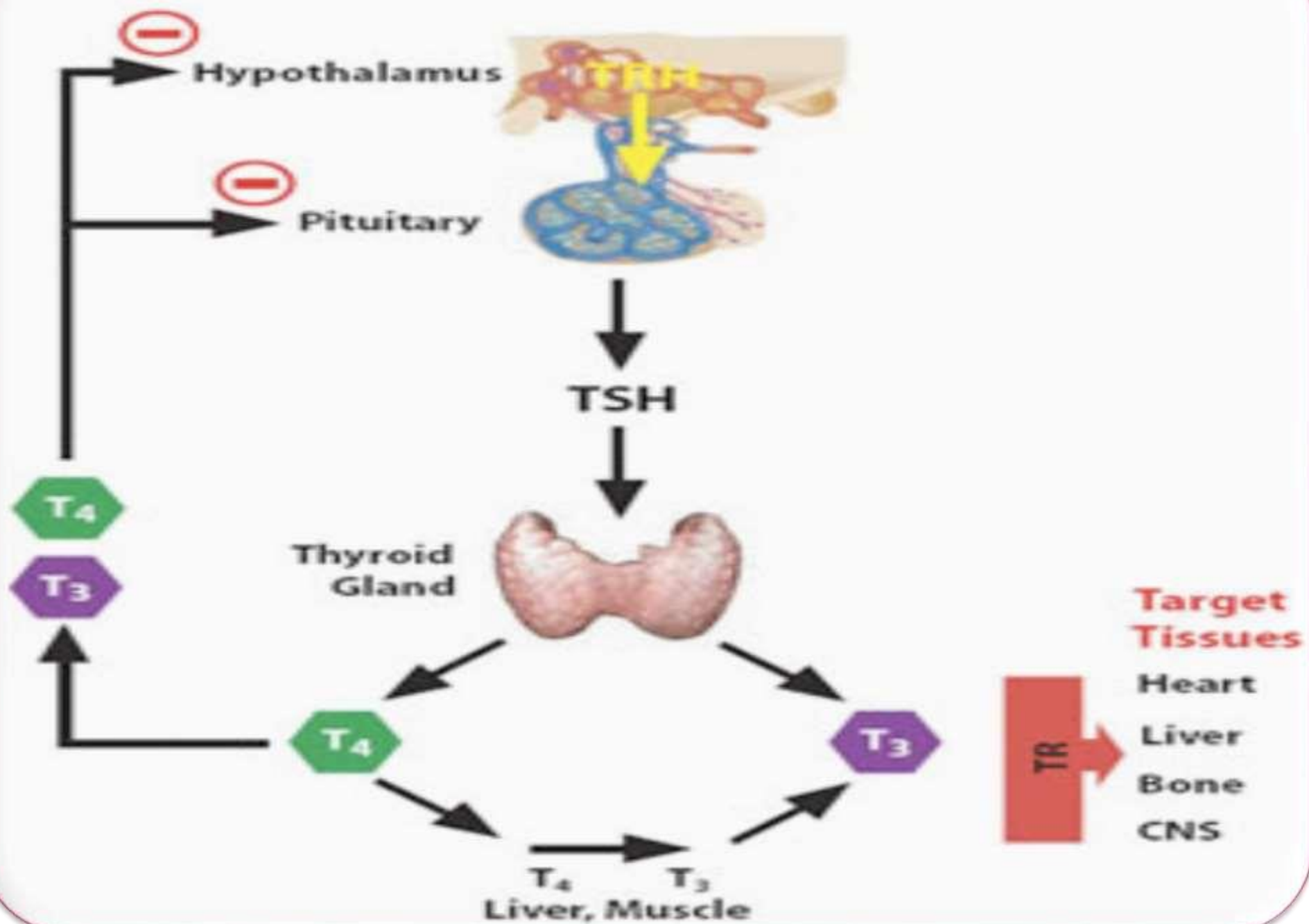
Functions of thyroid hormones

- Regulation of carbohydrate, lipid & protein metabolism.
- Central nervous system activity & brain development
- Cardiovascular stimulation
- Bone & tissue growth & development
- Gastrointestinal regulation



Synthesis & negative feedback regulation of thyroid hormones

Hypothalamic-Pituitary-Thyroid Axis



CLASSIFICATION OF TESTS BASED ON FUNCTIONS OF THYROID

❑ Tests measuring blood levels of thyroid hormones:

- Sr PBI
- Circulating T3 and T4 level
- Circulating TSH level
- Plasma tyrosine level

❑ Tests based on primary function of thyroid viz substrate input & hormone synthesis:

- RIU(Radioiodine uptake studies)
- PBI¹³¹
- T3 suppression test
- TSH stimulation test
- TRH stimulation test

❑ Tests based on metabolic effects of thyroid hormones

- BMR
- Sr cholesterol
- Sr creatine level
- Sr uric acid level
- Sr CK enzyme

❑ Scanning of thyroid gland

❑ Immunological tests to detect autoimmune diseases of thyroid gland:

- Agar gel diffusion test(PPT test)
- TRCH test: tanned red cell haemagglutination test
- Complement fixation test

Indications of TFT

- Diagnosing thyroid disorder in symptomatic person
- Screening newborns for hypothyroidism
- Monitoring thyroid replacement therapy in hypothyroidism patients
- Diagnosis & monitoring female infertility patients
- Screening adults for thyroid disorders

Thyroid functions tests

- The tests used to investigate thyroid function can be grouped into:
- Tests that establish whether there is thyroid dysfunction:
- TSH, total T4&total T3measurements.

- Tests to know the cause of thyroid dysfunction:
- Thyroid auto-antibody
- Serum thyroglobulin measurements.
- Thyroid enzyme activities, biopsy of the thyroid, ultrasound & isotopic thyroid scanning.

- TSH:
- The single most sensitive, specific & reliable test of thyroid status.
- In primary hypothyroidism:
- TSH is increased.
- In primary hyperthyroidism:
- TSH is decrease or undetectable.
- Reference Range: TSH 0.4 to 4mU/L

- Total T4 and Total T3:
- More than 99% of T4 & T3 circulate in plasma bound to protein
- Both TT4 & TT3 change if TBG alters, e.g. in pregnancy.
- Normal levels: T4 5 to 12.5 µg/dL, largely bound to transport protein esp TBG.
- Free T4 and Free T3:
- Free thyroid hormone concentrations are independent of changes in the concentration of thyroid-hormone binding proteins.
- More reliable for diagnosis of thyroid dysfunction.

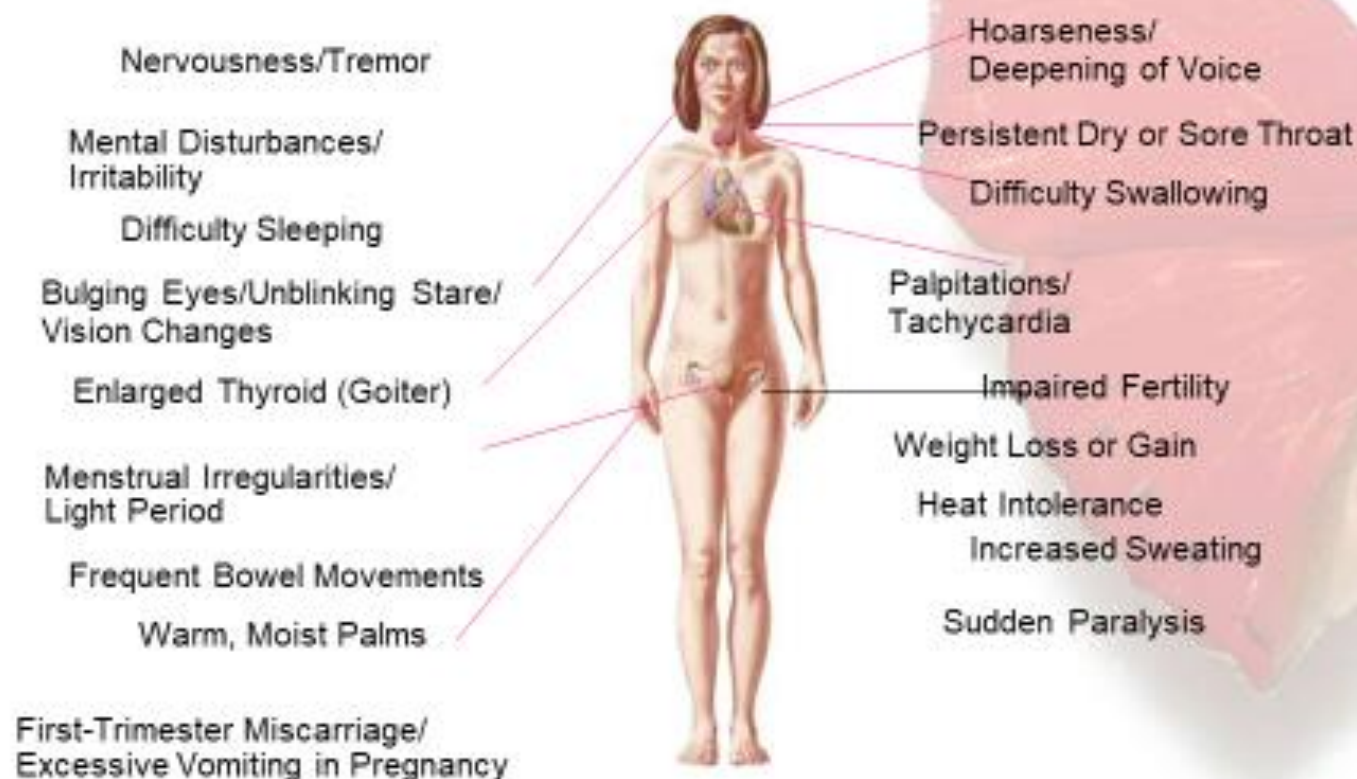
Analysis of thyroid hormones

- **Thyroid hormones are analyzed by:**
- **ELISA**
- **RIA**
- **Chemiluminescence**
- **Fluorescent immunoassay**

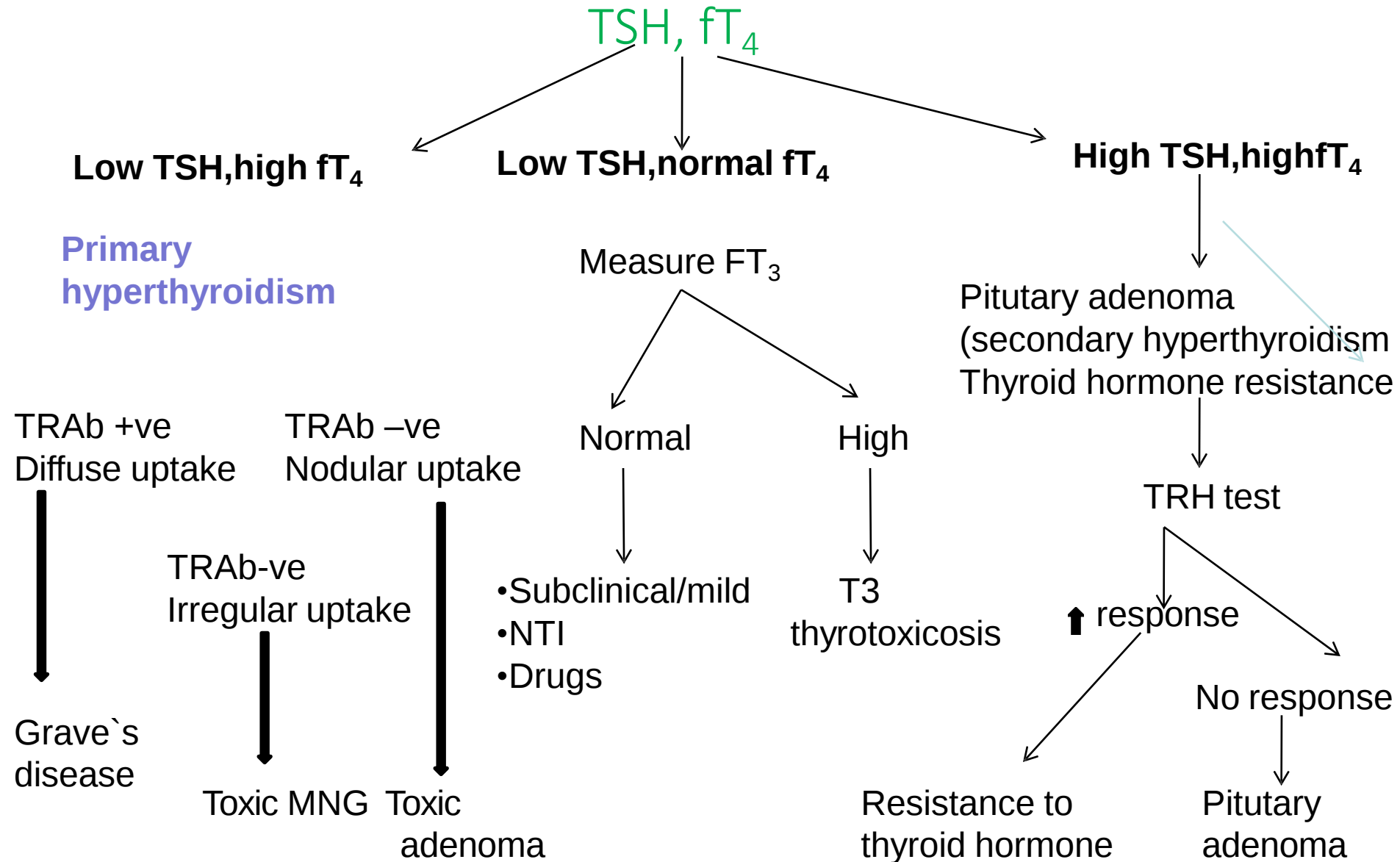
Interpretation of results

- Primary hyperthyroidism:
- Plasma TSH:
- Decreased due to feedback inhibition on the pituitary gland.
- Plasma free & total T4&T3 concentrations are increased.

Signs and Symptoms of Hyperthyroidism



Evaluation of hyperthyroidism

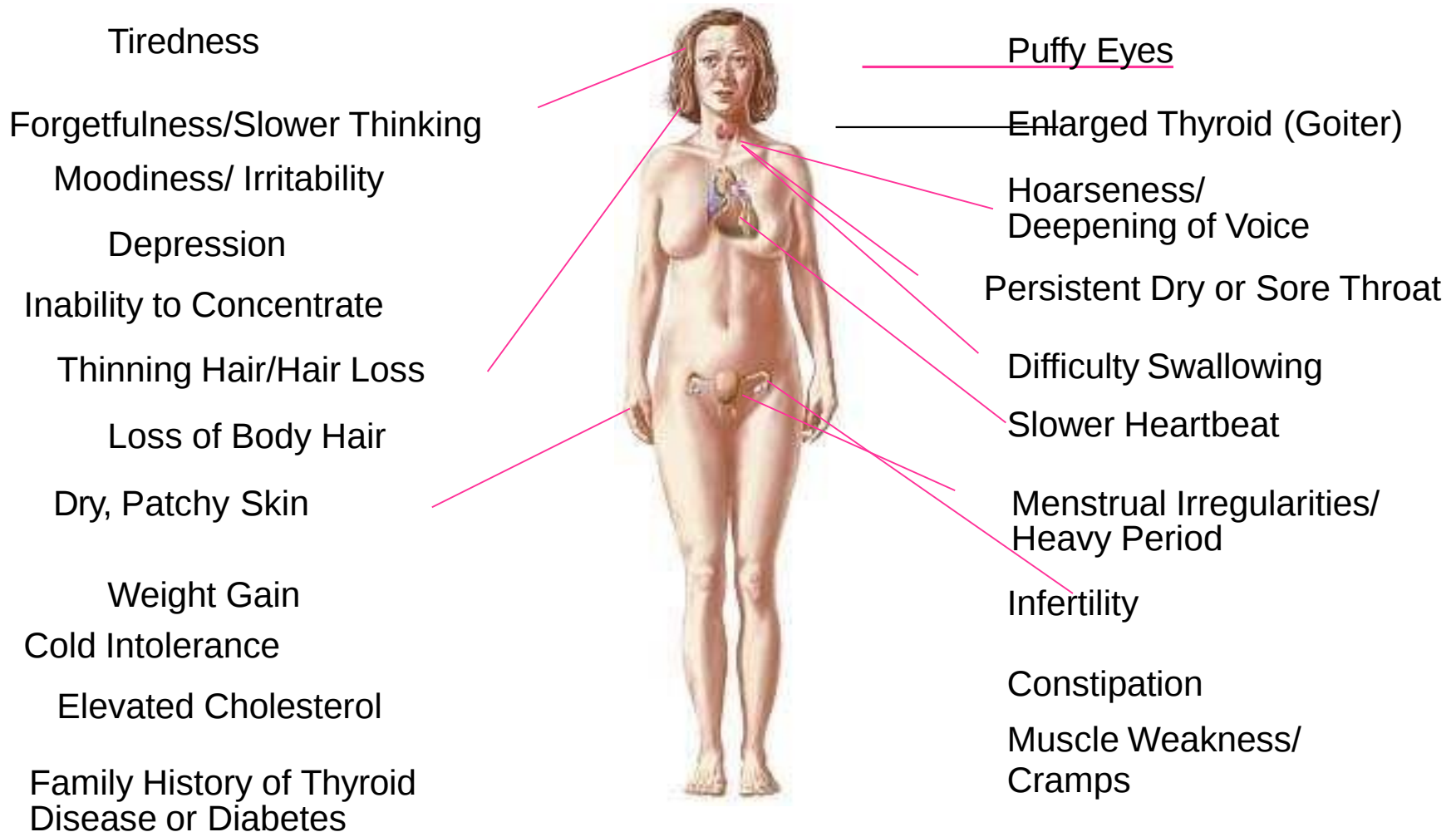


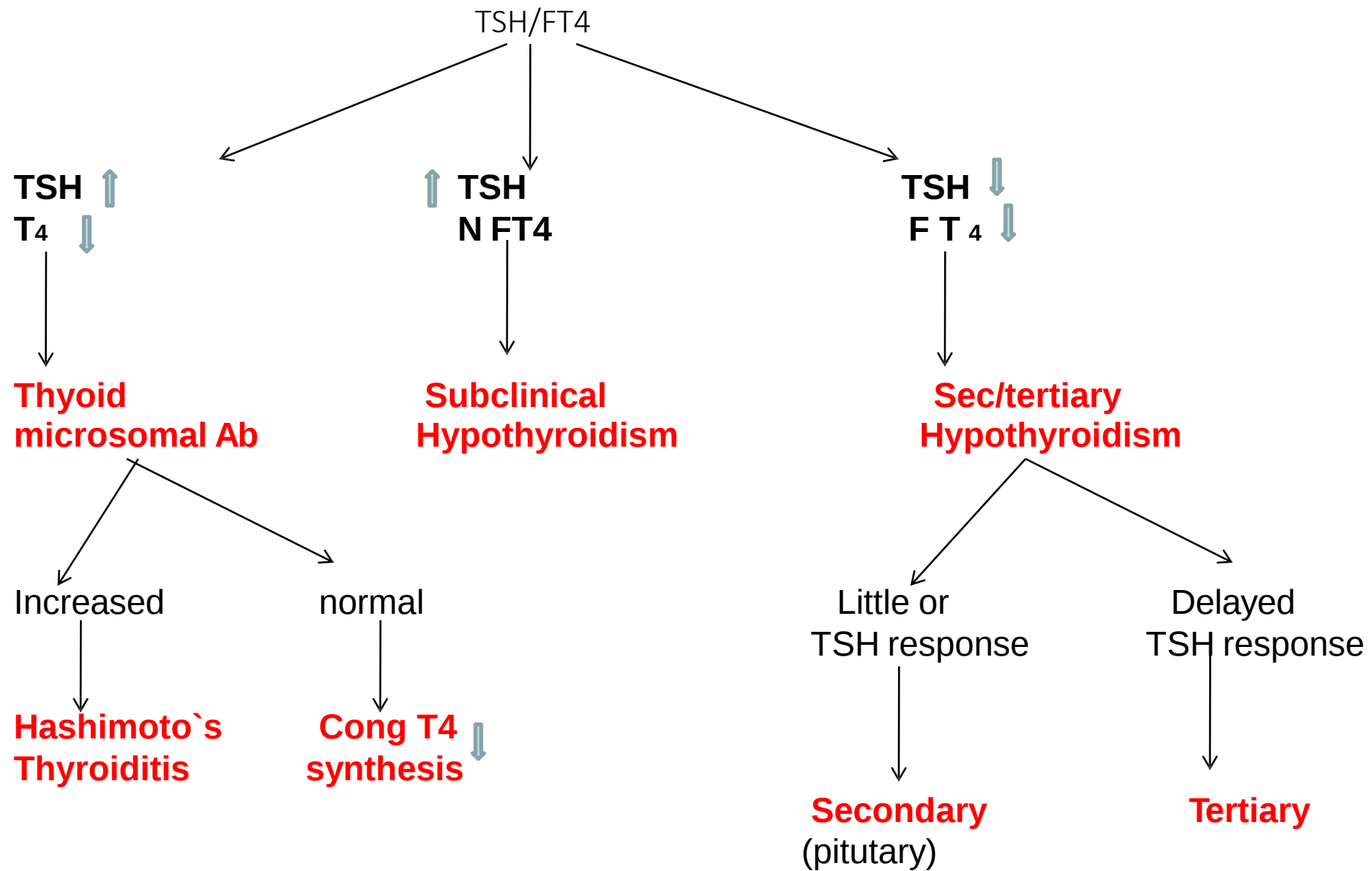
- In a very small percentage of hyperthyroid patients, plasma total T4&freeT4 are both normal, whereas both plasma total T3&freeT3 are increased; this condition is known as T3hyperthyroidism or T3thyrotoxicosis.

Primary hypothyroidism

- Plasma TSH: Increased.
- Plasma free T4&total T4: Decreased
- Plasma free T3&total T3 measurements are of no value here, since normal concentrations are observed.

Clinical Features of Hypothyroidism





Evaluation of hypothyroidism

Sub clinical Primary thyroid disease

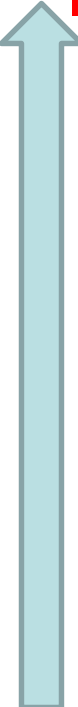
- Plasma TSH: Abnormal
- Thyroid hormone levels: Normal
- TSH: Low in sub clinical hyperthyroidism.
- TSH: Elevated in sub clinical hypothyroidism.

Secondary thyroid disorders

- Central (pituitary) hypothyroidism:
- TSH & thyroid hormone levels are low.
- Hyperthyroidism due to a TSH secreting tumor very rarely.
- Plasma TSH is widely used to screen for congenital hypothyroidism in the neonate.
- The incidence about one in 4000 live births.

TSH

Increase

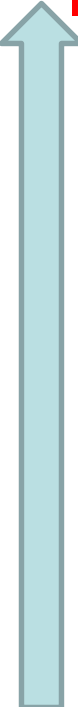
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- Primary hypothyroidism
 - Addison`s disease
 - Anti TSH antibodies
 - PreEclampsia
 - Hypothermia,fasting state
 - Pitutary adenoma
 - Postoperatively
 - Acute psychiatric illness
 - Thyroiditis
 - Drugs:Amiodarone,bensarazide,clomiphene, iopanoic acid,lithium, methimazole,metoclopramide,morphine,propylthiouracil,radiographic dyes

Decrease

- 
- Primary hyperthyroidism
 - Hashimoto`s thyroiditis
 - Hypothyroidism(2 or 3) sometimes
 - Organic brain syndrome
 - Drugs:
ASA,heparin,ketoconazole,T3,dopamine,
glucocorticoids,octreotide

TSH

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Thank you

