

- 21 year old female is referred from her cardiologist for treatment of hyperthyroidism. She is followed for asymptomatic aortic insufficiency.
- Total T₄ = 15.6 (nl = 4-12)
- Free T₄ = 1.35 (nl = 0.8-1.9)
- TSH = 1.2 (nl = 0.4-5.0)

Thyroid Function Tests

- Total T₄
- Total T₃
- Free T₄
- TSH

Free T4

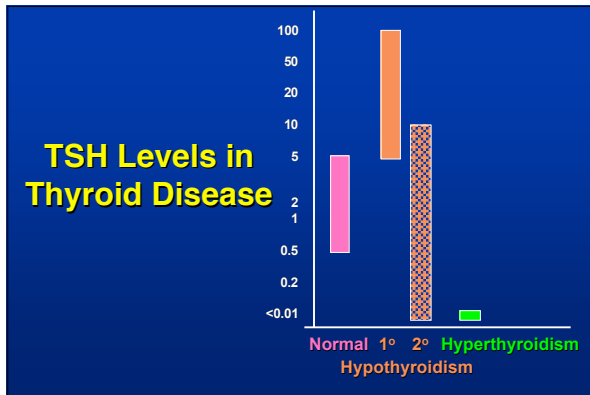
- Reflection of bioactive hormone
- Either measured directly or calculated
- Calculated Free T4 (using Total T4 and an estimate of thyroid hormone binding capacity, the resin T3 uptake) is called a Free T4 index
- Should order a Free T4 and not a total T4.

Total T₃

- Results from peripheral conversion from T₄ and thyroid production of T₃
- Bioactive hormone and is the major ligand for the thyroid hormone receptor
- Always elevated in hyperthyroidism
- Often normal in hypothyroidism

Thyroid Stimulating Hormone

- Gold standard-best overall indicator of thyroid disease
- Capable of separating hyperthyroid, euthyroid, and hypothyroid states



- ### Misleading TSH Values
- Patients with hypothalamic or pituitary disease
 - Patients hospitalized
 - Psychiatric
 - Intensive care units
 - During transition phase of hyperthyroidism

Summary of TFT's

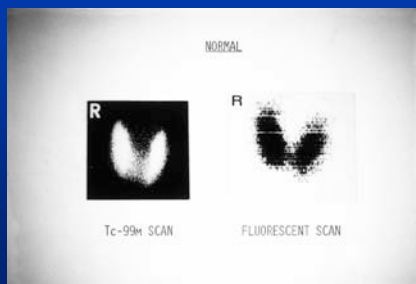
	<u>TT4</u>	<u>FT4</u>	<u>T3</u>	<u>TSH</u>
Hyperthyroidism	↑	↑	↑	↓
Primary Hypothyroidism	↓	↓	—	↑
Secondary Hypothyroidism	↓	↓	—	↓
Non-thyroid disease	↓	nl	↓	nl

Suggested Use of Thyroid Function Tests

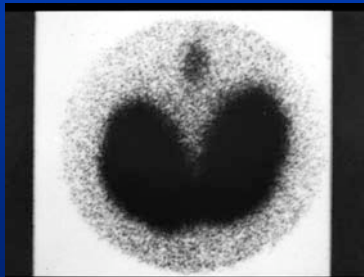
- Suspect thyroid disease -Free T4 and TSH
- Monitor T4 replacement -TSH
- If pituitary disease is present -Free T4

- 48 year old man from Shelbyville is referred by his primary care physician for weight loss, tachycardia, and tremor.
- Free T4 = 4.2 (nl = 0.8-1.9)
- TSH < 0.001 (nl = 0.4-5.0)
- How would you evaluate him?

Normal Thyroid Scan



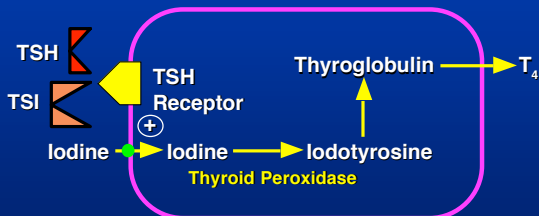
Thyroid Scan in Graves' Disease



Graves Disease

- Hyperthyroidism
- Ophthalmopathy
- Dermopathy (pre-tibial myxedema)

Thyroid Follicular Cell



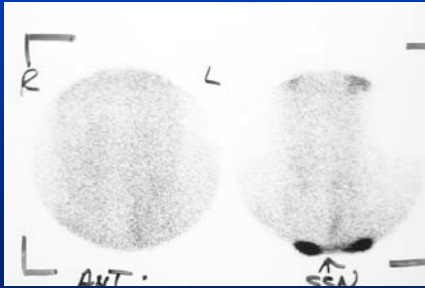
A 34 year old woman, who is 4 months post-partum (twin boys), reports a month long history of trouble sleeping, emotional lability, fatigue, and neck swelling. On examination, she is mildly tachycardiac and has a diffusely enlarged thyroid. She has no eye findings to suggest Graves' Disease.

Free T4 = 2.8 (normal 0.9 - 1.9)

TSH = <0.05 (normal 0.3 - 4.0)

HOW WOULD YOU EVALUTE HER?

Low Uptake on Thyroid Scan



Causes of Thyrotoxicosis

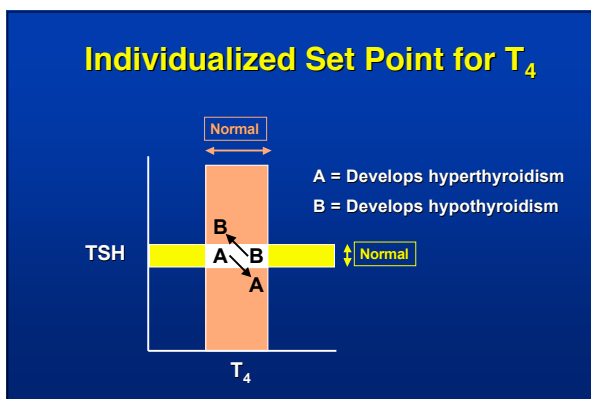
- Normal or Increased Activity on Thyroid Scan
 - Graves Disease
 - Multinodular Goiter or Hot Nodule
- Decreased Activity on Thyroid Scan
 - Thyroiditis
 - Iodine-induced thyrotoxicosis (amiodarone)
 - Exogenous thyroid hormone use

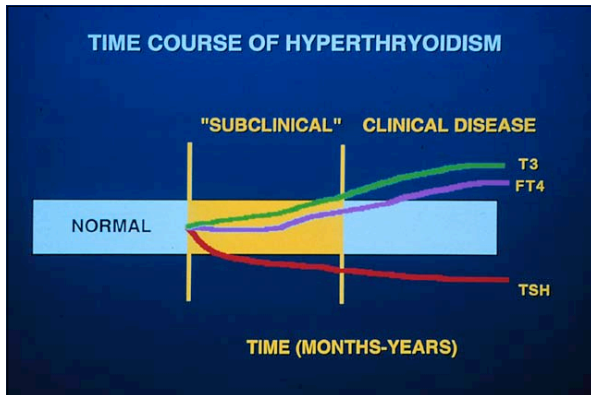


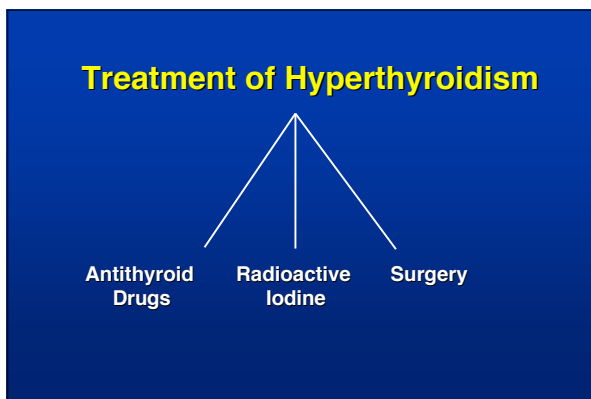
A 71 year old man comes for the evaluation of weight loss, poor appetite, and new-onset congestive heart failure (mild). His thyroid function tests show:

Free T₄ = 1.9 (normal 0.9 - 1.9)
TSH = <0.05 (normal 0.2 - 4.0)

IS HE HYPERTHYROID?

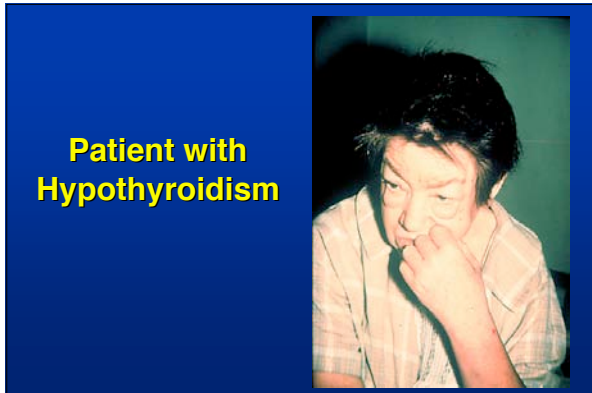


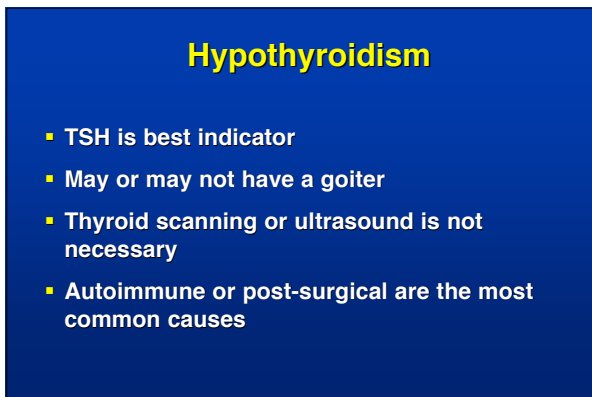


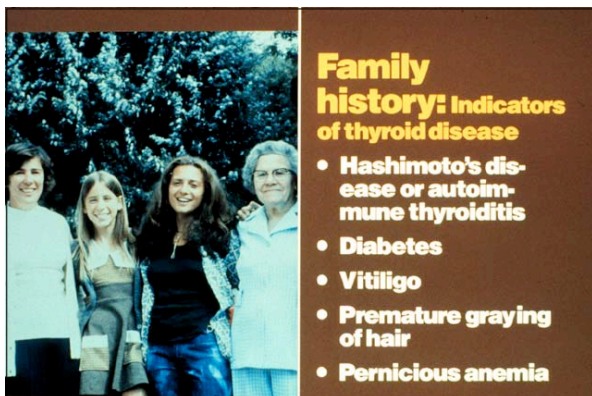


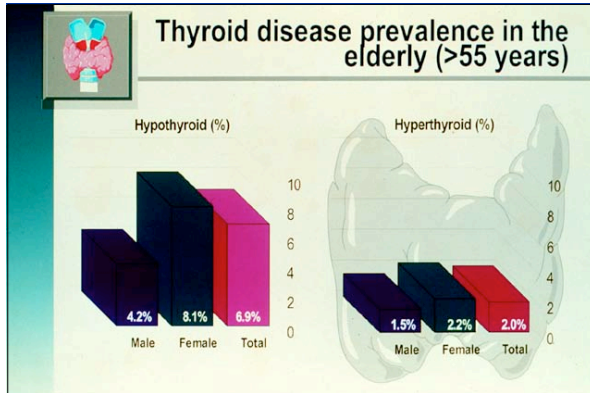
74 year old woman is brought by her son who has noticed:


- Decreased memory
- Fatigue
- Constipation
- She has the heat on in her house in the summer.





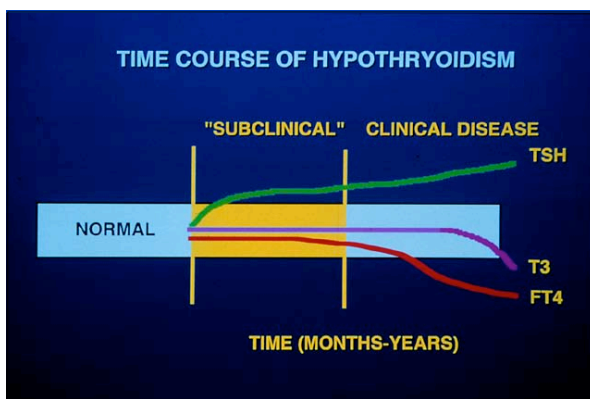






Behavioral symptoms

- Depressed mood
- Fatigue
- Poor concentration
- ↓ speech, mentation
- ↓ responsiveness to others



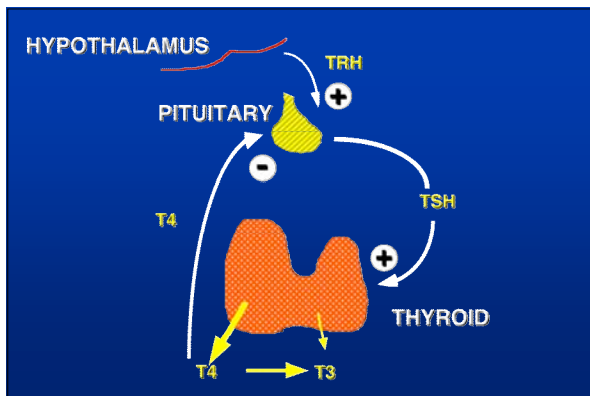
Treatment of Hypothyroidism

“You know the thyroid gland in your throat—the one that stokes the engine and keeps the old brain working. In some people the thing doesn’t work properly and they turn out to be cretinous imbeciles....., but feed ‘em the stuff and they come out absolutely all right.....”

Lord Peter Wimsey in Dorothy Sayers’ *Hangman’s Holiday*, 1933

Thyroid Hormone Supplements

- Well-tolerated; well-absorbed from GI tract
- One of most commonly prescribed medications
- Current preparations consist of synthetic T₄ (Euthyrox, Levothyroid, Levoxyl, Synthroid, Unithroid) and/or T₃
- New evidence does not support replacement with T₄ and T₃
- T₃ results from T₄ metabolism and is not routinely prescribed.



Thyroid Hormone Supplements

- Dose should be titrated to achieve a normal TSH level.
- Recheck TSH 4-6 weeks after a dose change because of the long half-life of T4 (7 days).
- Excessive levels (as evidenced by a suppressed TSH) cause iatrogenic hyperthyroidism and accelerated bone loss.

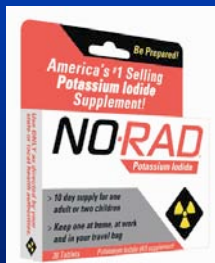
Drugs that Affect Thyroid Function

- Drugs that cause hypothyroidism
 - Inhibit T4 synthesis/release (lithium, perchlorate, iodine-containing drugs)
 - Amiodarone
 - Decrease T4 absorption
- Drugs that cause hyperthyroidism
 - Amiodarone/interferon-alpha

Iodides

- Inhibit thyroid hormone synthesis (autoregulation)
- Adjunctive therapy for severe hyperthyroidism

Iodides



- Saturated Solutions of Potassium Iodide (SSKI) is most common preparation; some countries have emergency stores of this in case of a nuclear accident.

- 19 year old Vanderbilt undergraduate is referred for a left sided thyroid nodule that was found in Student Health when she was seen for a sore throat.
- TFT's normal

Thyroid Nodules

- Most are benign.
- Hot nodules are benign; thyroid cancer is cold on scanning.
- Most are cold on thyroid scanning
- Ultrasound cannot confirm or exclude malignancy.
- FNA is required for all cold nodules.



