


# Thyroid Function Tests Made Ridiculously Simple

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# Objectives

- ▶ Thyroid Physiology
  - ▶ 4 cases: each with common thyroid function test abnormalities
  - ▶ Summary
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# Thyroid Hormone Labs in Review



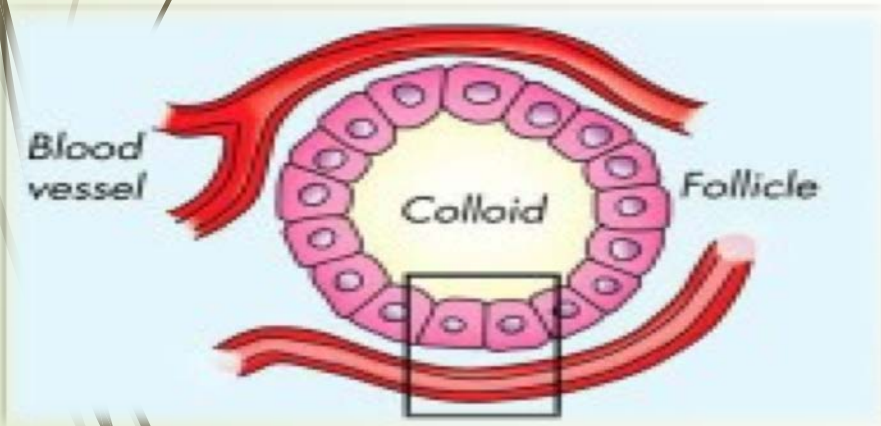
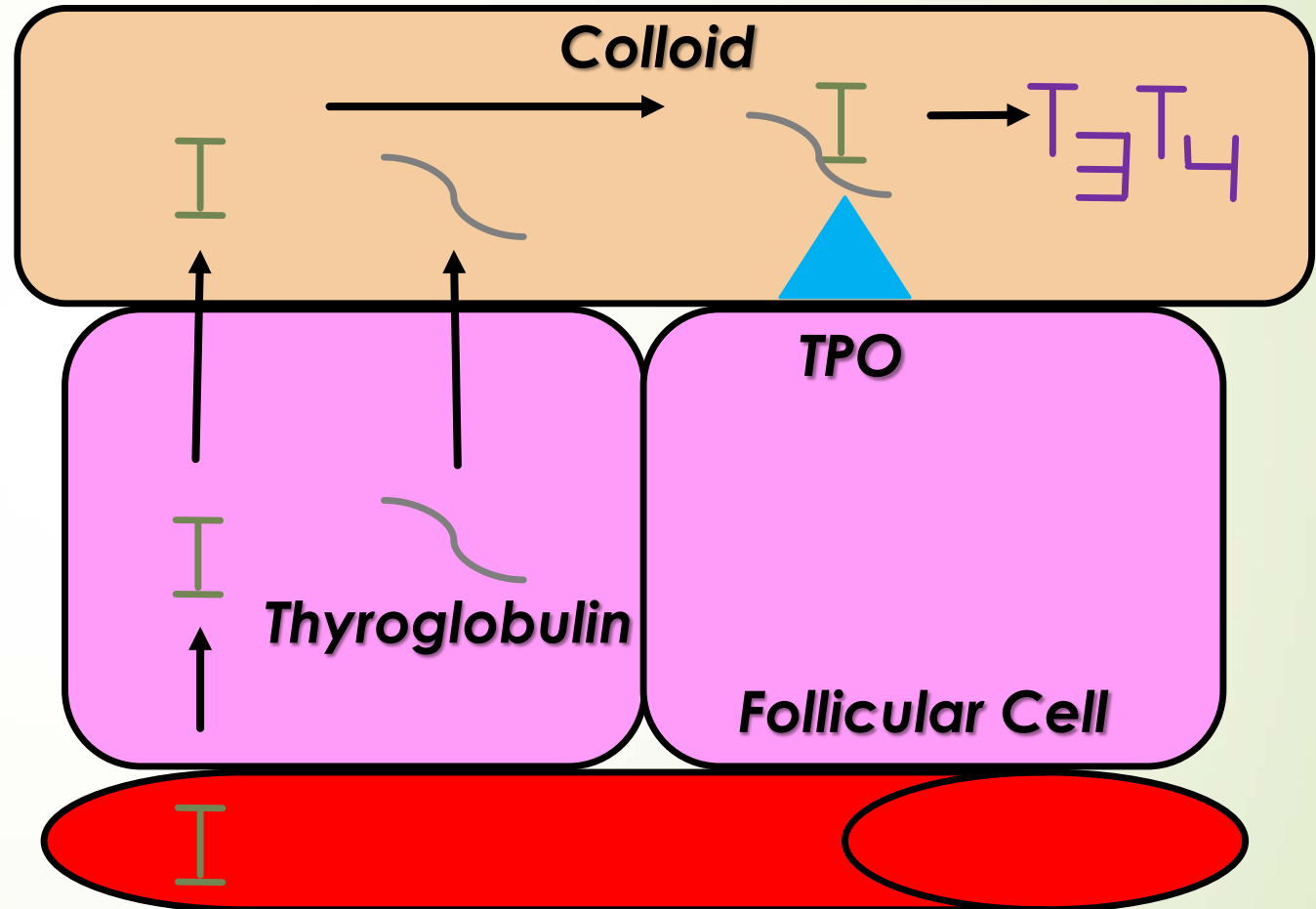
## Thyroid Hormone Labs:

- TSH (Thyroid Stimulating Hormone)
- T4 and T3 are released from the thyroid
  - Majority T4
  - T3 is more potent than T4
  - T3 is also made in periphery by conversion from T4
- Free vs Total Levels
  - Free levels are unbound and bioavailable.
  - The total level is measure of both bound and unbound hormone. These levels fluctuate based on binding protein levels.

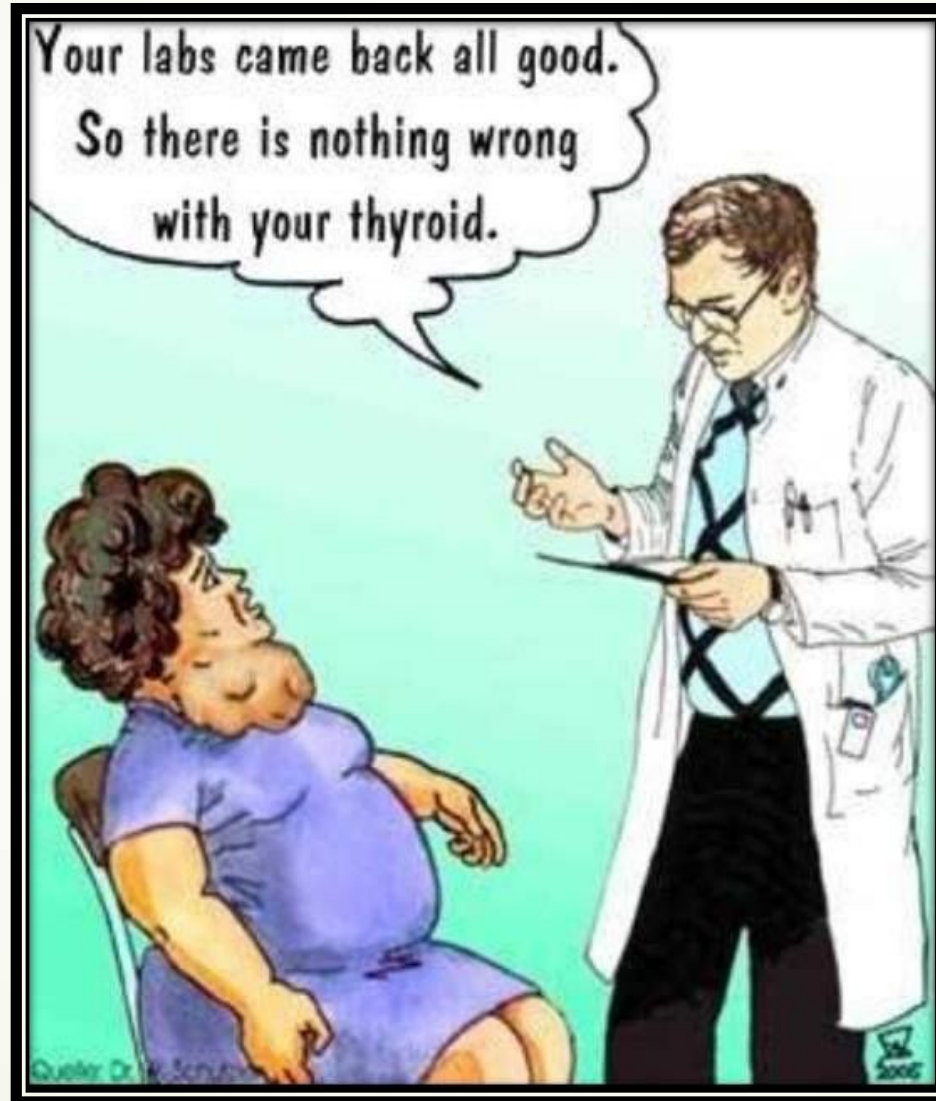
# Thyroid Physiology

## Thyroid Hormone Formation:

- Iodine transported into the colloid
- Thyroglobulin acts as assembly line
  - T4 and T3 are made from precursors (through iodination)
- Thyroid Peroxidase (TPO) catalyzes thyroid hormone production
- TSH binding releases hormone



Now lets get to some cases!!!



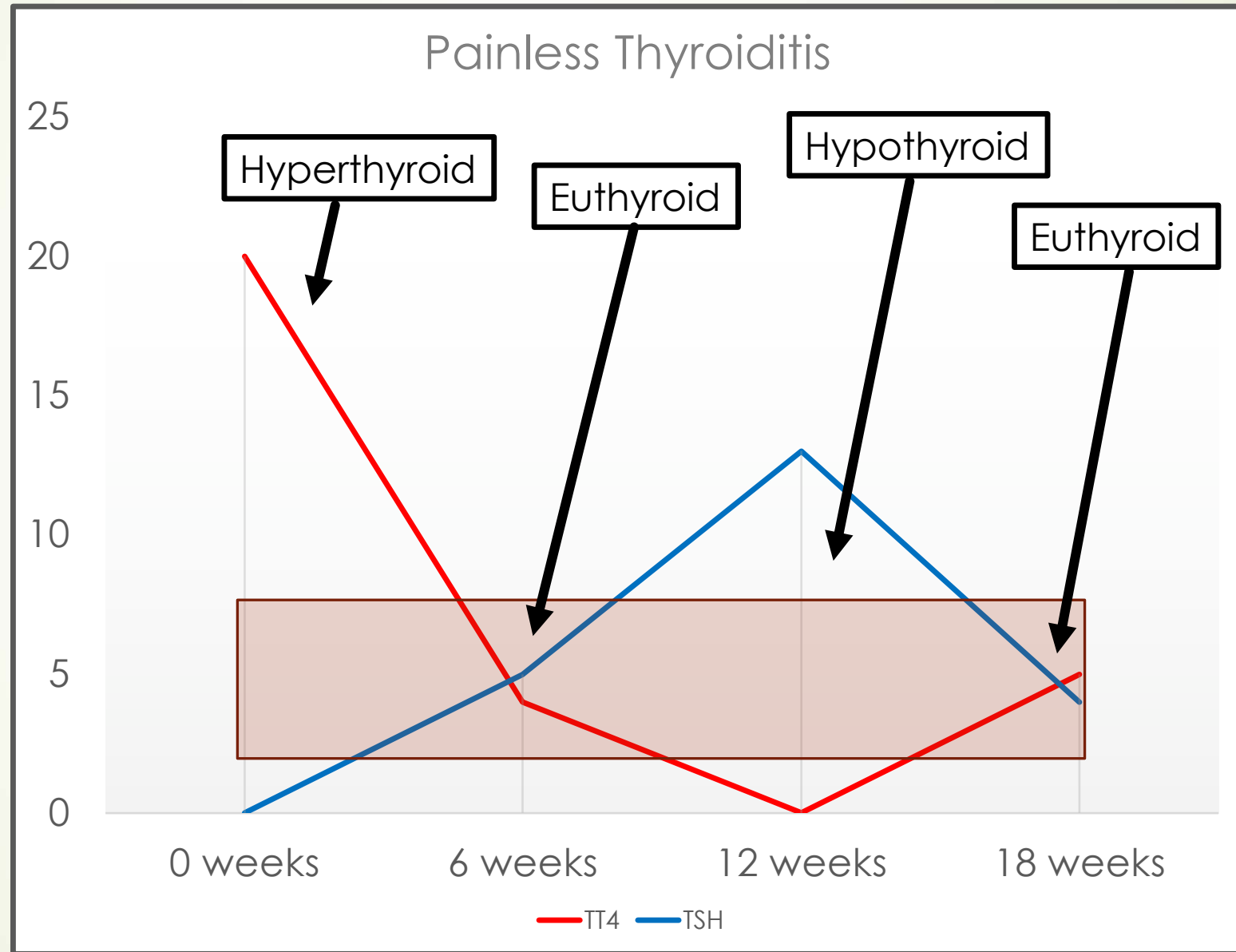
ORIGINAL ARTICLE

# Thyroid Hormone Therapy for Older Adults with Subclinical Hypothyroidism

## TRUST TRIAL:

- Randomized controlled trial
- Placebo vs Levothyroxine for the treatment of subclinical hypothyroidism in patients older than 65 years of age (737 adults)
  - Normal free T4
  - TSH 4.6 to 19.9 (Majority <10)
- No difference in outcomes with levothyroxine vs placebo

# Case 2



# Case 3

- "54" year old male physician with hypertension and untreated sleep apnea due to non-compliance.
- Presented to PCP for evaluation of chronic fatigue.
- Demands that the thyroid is the cause.
- Vitals are normal.
- Exam is unremarkable.

Medications:  
Amlodipine 5 mg

Initial Labs:  
TSH 0.02 (low)  
Free T4 1.1  
T3 0.9

Labs after holding biotin:  
TSH 2  
Free T4 1.1  
T3 0.9



Then it must  
be my  
Testosterone!



# Case 4

- 27 year old female who has routine labs including thyroid function tests.
- Found to have an elevated total T4 and T3. Otherwise her TSH and Free T4 are normal.
- Asymptomatic

Medications:  
OCP containing  
estrogen

## Drugs that cause hypothyroidism, hyperthyroidism, or changes in thyroid function tests

### Drugs causing hypothyroidism

Inhibition of thyroid hormone synthesis and/or release – thionamides, lithium, perchlorate, aminoglutethimide, thalidomide, and iodine and iodine-containing drugs including amiodarone, radiographic agents, expectorants (eg, guaifenesin), kelp tablets, potassium iodine solutions (SSKI), Betadine douches, topical antiseptics

Decreased absorption of T4 – cholestyramine, colestipol, colesevelam, aluminum hydroxide, calcium carbonate, sucralfate, iron sulfate, raloxifene, omeprazole, lansoprazole, and possibly other medications that impair acid secretion, sevelamer, lanthanum carbonate, and chromium; malabsorption syndromes can also diminish T4 absorption

Immune dysregulation – interferon alfa, interleukin-2, ipilimumab, alemtuzumab, pembrolizumab, nivolumab

Suppression of TSH – dopamine

Destructive thyroiditis – checkpoint inhibitors (eg, nivolumab, pembrolizumab)

Increased

T

High Serum TBG - Estrogens



# Summary



- ▶ Thyroid physiology is simple. TSH is the key for thyroid hormone production and secretion.
  - ▶ Don't forget about central hypothyroidism.
  - ▶ Free T3 and Free T4 is the bioavailable hormone
- ▶ Non-Thyroidal Illness
- ▶ Subclinical hypothyroidism in patients over 65 years old - TRUST trial
- ▶ Thyroiditis phases
- ▶ Biotin as a cause of laboratory interference
- ▶ Estrogen and its affect on thyroid function tests