



## Mysteries of the Thyroid

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## Disclosures

- Abbott/Abbvie
  - Levothyroxine/Synthroid®
- Novartis
  - Zoledronic Acid/Reclast®
- Eli-Lilly/Amylin
  - Lispro/Humalog®
  - Exenatide/Bydureon®/Byetta®
- Astra Zeneca
  - Dapagliflozin/Farxiga®
  - Exenatide/Bydureon®
- Novo-Nordisk
  - Detemir/Levemir®
  - Aspart/Fiasp®/Novolog®
  - Degludec/Tresiba®
  - Liraglutide/Victoza®, Liraglutide-Degludec/Xultophy®
  - Semaglutide/Ozempic®
- Janssen
  - Canigliflozin/Invokana®



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## Objectives

- Case based discussion of pitfalls of thyroid diagnosis and treatment of thyroid dysfunction
- Discuss web based resources and potential sources of patient misinformation
- Review non-thyroidal causes of symptoms that can mimic thyroid dysfunction



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## Case #1

- 56 y/o WF with hypothyroidism due to Hashimoto's, weight gain up to 200 lb, hair loss, goiter. Thyroid function studies look perfect on 50 mcg.
- The internet told her she cannot trust any of her thyroid lab results when they are normal but still has all the symptoms of her Hashimoto's. Wants your opinion...




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## Hypothyroidism symptoms




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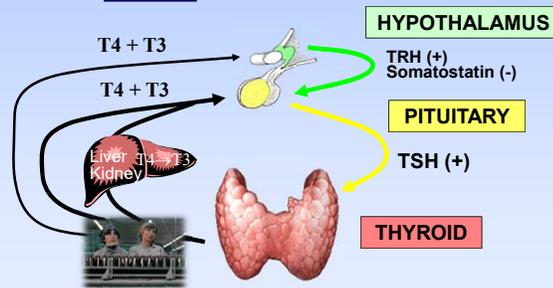
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## Physiology



Original illustration created by Diane Abekoff, 2002.




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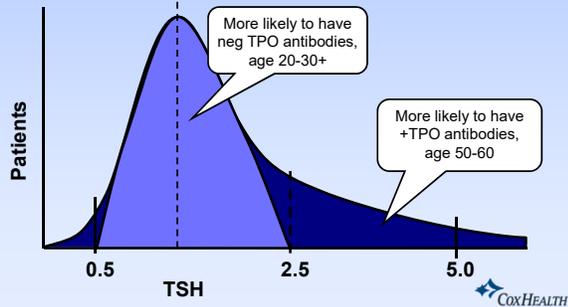
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## What's a normal TSH?




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## Thyroid Symptoms are Meaningless (but also very important)

### • The Colorado thyroid disease prevalence study.

- Carroll GF, Brownlee M, Hershman JD
- Participants in a statewide health fair in Colorado, 1995 (N = 25 862).
- **RESULTS:**
  - elevated TSH levels was 9.5%.
  - decreased TSH levels was 2.2%.
  - Forty percent of patients taking thyroid medications had abnormal TSH levels
  - Slight increase in cholesterol with uncontrolled hypothyroidism
  - Symptoms were reported more often in hypothyroid vs euthyroid individuals, but individual symptom sensitivities were low.
- **CONCLUSIONS:**
  - The prevalence of abnormal biochemical thyroid function reported here is substantial and confirms previous reports in smaller populations.
  - Among patients taking thyroid medication, only 60% were within the normal range of TSH.
  - Modest elevations of TSH corresponded to changes in lipid levels that may affect cardiovascular health.
  - Individual symptoms were not very sensitive, but patients who report multiple thyroid symptoms warrant serum thyroid testing.

Arch Intern Med. 2000 Feb 28;160(4):528-34.




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## Case #2

- 56 y/o WF with hypothyroidism due to Hashimoto's, weight gain up to 200 lb, hair loss, goiter. Thyroid function studies look perfect on 50 mcg.

- Tired of taking synthetic medication, the internet advised her to take something natural...




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### Top 10 Medications

Medication	Monthly Prescriptions
Synthroid (levothyroxine)	21.5 million
Crestor (rosuvastatin)	21.4 million
Ventolin HFA (albuterol)	18.2 million
Nexium (esomeprazole)	15.2 million
Advair Diskus (fluticasone)	13.7 million
Lantus Solostar (insulin glargine)	10.9 million
Vyvanse (lisdexamfetamine)	10.4 million
Lyrica (pregabalin)	10.0 million
Spinva Handihaler (tiotropium)	9.6 million
Januvia (sitagliptin)	9.1 million

<https://www.webmd.com/drug-conditions/news/2015/05/08/most-prescribed-top-selling-drugs>



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### Deadly chemical dihydroxy monoxide

- Death due to accidental inhalation of DHMO, even in small quantities.
- Prolonged exposure to solid DHMO causes severe tissue damage.
- Excessive ingestion produces a number of unpleasant though not typically life-threatening side-effects.
- DHMO is a major component of acid rain.
- Gaseous DHMO can cause severe burns.
- Contributes to soil erosion.
- Leads to corrosion and oxidation of many metals.
- Contamination of electrical systems often causes short-circuits.
- Exposure decreases effectiveness of automobile brakes.
- Found in biopsies of pre-cancerous tumors and lesions.
- Given to vicious dogs involved in recent deadly attacks.

[www.DHMO.org](http://www.DHMO.org)



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### Is Natural better?



#### Dosage Forms: US

- Armour Thyroid: 15 mg, 30 mg, 60 mg, 90 mg, 120 mg, 180 mg, 240 mg, 300 mg
- Nature-Thyroid: 16.25 mg, 32.5 mg, 48.75 mg, 65 mg, 81.25 mg, 97.5 mg, 113.75 mg, 130 mg, 146.25 mg, 162.5 mg, 195 mg, 260 mg, 325 mg
- NP Thyroid: 15 mg, 30 mg, 60 mg, 90 mg, 120 mg
- Westhroid: 32.5 mg, 65 mg, 97.5 mg, 130 mg, 195 mg [scored]
- WP Thyroid: 16.25 mg, 32.5 mg, 48.75 mg, 65 mg, 81.25 mg, 97.5 mg, 113.75 mg, 130 mg
- Generic: 15 mg, 30 mg, 60 mg, 90 mg, 120 mg

DRUGS	Armour Thyroid (Desiccated, Natural Thyroid)	Thyrostat (Liotin)	Cytomet (Liothyronine)	LevothyL, Levothyroid, Synthroid (Levothyroxine)
Approximate Dose Equivalent	1/4 grain (15 mg)	1/4		25 mcg (0.25 mg)
Approximate Dose Equivalent	1/2 grain (30 mg)	1/2	12.5 mcg	50 mcg (0.5 mg)
Approximate Dose Equivalent	1 grain (60 mg)	1	25 mcg	100 mcg (1 mg)
Approximate Dose Equivalent	1 1/2 grains (90 mg)	1 1/2	37.5 mcg	150 mcg (1.5 mg)
Approximate Dose Equivalent	2 grains (120 mg)	2	50 mcg	200 mcg (2 mg)
Approximate Dose Equivalent	3 grains (180 mg)	3	75 mcg	300 mcg (3 mg)

Synthroid.  
(levothyroxine sodium tablets, USP)



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## What is Synthesized?

- Synthetic
  - made by chemical synthesis, especially to imitate a natural product.
- Chemical synthesis
  - Process of using a chemical reaction to transform a chemical product to another
  - Physical reaction you can get the original product back (water to ice), chemical reaction you cannot (burn paper).
- Desiccated = Dehydrated
- Dehydration
  - Chemical reaction removing water molecule
  - When you make dehydrated banana chips you cannot get the original banana back
- Bioidentical definition
  - having the same molecular structure as a substance produced in the body
- Desiccated thyroid is just as synthesized as bioidentical Synthroid




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## Combination Ratios

- T4/T3 Dosing
  - Ratio T4:T3 is ~13:1-16:1
  - Each 25 mcg T4 = ~1.6-1.9 mcg T3
- T3 approximately 4x more potent effect on TSH than T4
  - 5 x 4 = 20
  - 10 x 4 = 40
  - 15 x 4 = 60
  - 20 x 4 = 80

T4 mcg	T3 mcg	Total
50	5 (2.5 BID)	70 mcg
75	5 (2.5 BID)	95 mcg
88	5 (2.5 BID)	128 mcg
100	10 (5 BID)	140 mcg
112	10 (5 BID)	152 mcg
125	10 (5 BID)	165 mcg
137	10 (5 BID)	177 mcg
150	10 (5 BID)	190 mcg
175	15 (10/5 BID)	235 mcg
200	15 (10/5 BID)	260 mcg
300	20 (10 BID)	380 mcg




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## Summary of combo studies

Study	N	Duration	T4/T3 Preference
Bunivicius	33	5 wks	Yes
Walsh	110	10 wks	No
Sawka	40	15 wks	NA
Clyde	46	4 mos	NA
Siegmund	26	12 wks	NA
Saravanan	697	3 mos	NA
Apelhof	141	15 wks	Yes
Escobar-Morreale	28	8 wks	Yes
Rodriguez	30	16 wks	NA
Regalbuto	20	6 mos	No
Stawik	29	5 wks	NA




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## Issues not Satisfied

- 12k Respondents to ATA online survey, people taking DTE - less likely to report problems with weight management, fatigue/energy levels, mood, and memory compared to those taking LT4 or LT4 + LT3.

Issue	Number	Percent
Weight Mgmt	7729	69%
Fatigue/Energy level	8597	77%
Mood	5059	45%
Memory	6433	58%

- ER satisfaction surveys worsened due to selection bias
  - Were only handed to people who walked out the front door, not to those who were admitted to the hospital

Peterson S. Thyroid 28(6): 707.




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## Causes of Fatigue

Psychologic	Infectious	Endocrine-Metabolic	Disturbed Sleep
Depression	Endocarditis	Hyper- and Hypo-thyroidism	Obstructive Sleep Apnea
Anxiety	Tuberculosis	Diabetes Mellitus	Non-restorative sleep
Somatization disorder	Mononucleosis	Pituitary Insufficiency	Sleep Disturbance
Malnutrition	Hepatitis	Hypercalcemia	Esophageal Reflux
Drug Addiction	Parasitic Disease	Adrenal Insufficiency	Postnasal drip/Allergies
<b>Pharmacologic</b>	HIV infection	Hepatic or Renal Failure	Psychologic causes
Hypnotics	Cytomegalovirus	<b>Idiopathic</b>	Chronic Pain
Anti-hypertensives	<b>Cardiopulmonary</b>	Fibromyalgia	
Anti-depressants	CHF	Idiopathic Fatigue	<b>General</b>
Drug abuse/Drug Withdrawal	COPD	Chronic Fatigue Syndrome	Stress
<b>Neoplastic-Hematologic</b>	<b>Connective Tissue Disease</b>	Drug abuse/Drug Withdrawal	Work-Life balance issue
Malignancy (Occult)	Rheumatoid arthritis		
Severe anemia	Lupus		




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## Listen to your patients

- Even crazy patients get sick
  - The last thing a person wants to do is pay you money to sit in your clinic room for a half an hour and have you not fix anything
- Affirm that their symptoms aren't normal
  - But also acknowledge you may not be able to fix them
- Outline what you can do for them and of course every provider they see would love to cure them
  - Review the differential diagnosis and workup process
  - Set expectations prior to starting the appropriate workup
  - Always make sure leave with a plan and all are on the same page




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## How do the levels respond?

- Document list of all their symptoms
- Check T4 and possibly T3 when the TSH is not at target
- Start LT4 therapy and fix their TSH
- Recheck all prior symptoms to determine which were thyroid and which weren't
  - If they feel great and levels look great you are done
  - If they feel poorly and TSH/T4 levels look great then check and possibly treat T3
- If levels are mildly off or suspect thyroiditis and patient relatively asymptomatic you can always recheck in 6 weeks.
  - TSH can say is low, T3 can say it is high, and T4 say is normal and they can all be correct due to different half lives




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## General Fatigue Recommendations

- Other thoughts for hypothyroid patients that are corrected with persistent symptoms
  - Sleep Hygiene: 7-8 hrs per night; screen for OSA, insomnia, etc Regular Exercise: 150 mins/week divided over 4-5 days Well Balanced Diet/ Optimal Weight: Nutrition Consultation
  - Address underlying medical conditions: (PCP role) Chronic pain, Rheumatologic conditions, Fibromyalgia, DM, HTN, COPD Vitamin deficiencies: Vits: D, B12 etc
  - Stress Reduction: relaxation, biofeedback, meditation, yoga, counseling, volunteer work Depression Management: counseling, medications, etc
  - Alternative Levothyroxine Brand (inert fillers and colors) Consider Combination LT4/LT3 Therapy in 14:1 Ratio

McDermott MT Endo Practice 2012

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## Thyroid Combo summary

- Recommend bioidentical thyroid hormone replacement
  - Levothyroxine T4, liothyronine T3
- 2014 American Thyroid Association (ATA) guidelines, which found insufficient evidence to support the routine use of a combination of T4 and T3 therapy in patients unhappy with T4 monotherapy
- Candidates for combined therapy include patients who have not felt well on T4 monotherapy:
  - Since thyroidectomy
  - Since ablative therapy with radioiodine
  - Who have serum T3 at or below the lower end of the T3 reference range

Thyroid. 2014;24(12):1670.

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## Case #3

- 56 y/o WF with hypothyroidism due to Hashimoto's, weight gain up to 200 lb, hair loss, goiter. Thyroid function studies look perfect on 50 mcg.
  - Gives you a sheet of labs she got off the internet to check including reverse T3




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## Three Truths



- Objective Truth
  - During my sleep study, my brainwaves showed I reached level 5 REM sleep
  - Can be measured and confirmed or repeated by independent people
- Subjective Truth
  - When I woke up, I realized I had a dream I wrecked my car and flew through the windshield
- Reflective Truth
  - I tell my wife, "Honey! We have to wear our seatbelts today. I dreamed I wrecked my car and I wasn't wearing my seatbelt, if I had only worn it..."
  - I feel so passionate about it that she believes it is a premonition and is essential we wear our belts and change our driving habits.




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## Confirmation Bias



A cognitive bias that causes people to search for, favor, interpret, and recall information in a way that confirms their preexisting beliefs.

- Biased *search* for information.
  - Search for information that confirms their preexisting beliefs, and ignore info that contradicts
- Biased *favoring* of information
  - Give more weight to information that supports their beliefs, and less weight to info that contradicts
- Biased *interpretation* of information.
  - Interpret information in a way that confirms their beliefs, even if the information could be interpreted in a way that contradicts
- Biased *recall* of information.
  - Remember information that supports their beliefs and forget information that contradicts them, or to incorrectly remember contradictory information as having supported their beliefs.

- Intelligent systems learn our preferences and feed us more of the same, over and over...

My wife and I were talking about getting an oil change, and an add for my car shows up on her FaceBook




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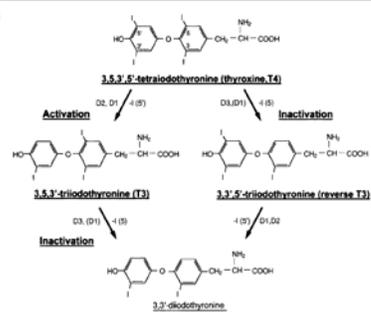
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## T4 Activation/Metabolism

TT3 levels decline as we age, likely through similar mechanism.



E. Chester Ridgway, M.D., University of Colorado Health Sciences Center  
Public Meeting for Levothyroxine Sodium Therapeutic Equivalence  
May 23, 2009, Washington, DC

Olsen. J Clin Endocrinol Metab. 1978;47(5):1111-5.  
Bianco et al Endo Rev 23:38, 2002



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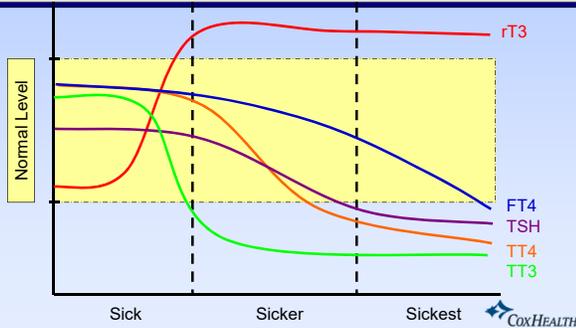
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## Nonthyroidal Illness (Sick euthyroid syndrome)



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## When to check a reverse T3

- Question of secondary hypothyroidism vs nonthyroidal illness in a critically ill patient
- Not an hour after they just took a giant dose of Armour
  - Reverse T3 will be sky high as they system is flooded, just like the sewers if we got 10 inches of rain in 10 minutes
- Not designed to help when a person is not inpatient
  - False negative and positive rates for reverse T3 outpatient setting?
  - I have no idea but they are high... or are they low.... Its like using an uncalibrated thermometer.
- If blood levels of other thyroid levels cannot supposedly be trusted, why does the internet trust this one?



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### Case #4

- 56 y/o WF with hypothyroidism due to Hashimoto's, weight gain up to 200 lb, hair loss, goiter. Thyroid function studies look perfect on 50 mcg.
- Pt is feeling OK, but states the internet told her the blood levels don't measure what is actually happening in her body, wants to know what you recommend.




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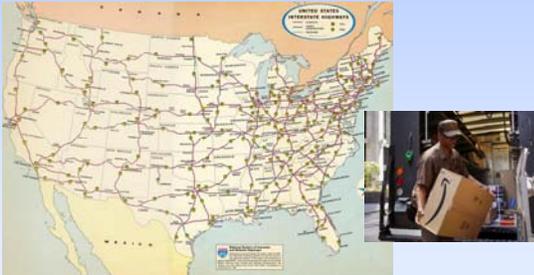
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### We don't need to travel to Seattle to show Amazon.com exists...




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### Case #5

- 56 y/o WF with hypothyroidism due to Hashimoto's, weight gain up to 200 lb, hair loss, goiter. Thyroid function studies look perfect on 50 mcg.
- They are still feeling terrible and the internet says they need low dose naltrexone for their Hashimoto's




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## Case #6

- 56 y/o WF with hypothyroidism due to Hashimoto's, weight gain up to 200 lb, hair loss, goiter. Thyroid function studies look perfect on 50 mcg.
  - Thyroid function has to be off because she has been checking her basal body temperature first thing in the morning prior to getting out of bed with a mercury thermometer and temperature is low




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## Wilson's Thyroid Temperature Syndrome

- Subnormal Body Temperature. Usually 1 - 1.5 degrees low
  - "If your temperature consistently averages below 98.6 then you may be suffering from Wilson's Thyroid Syndrome."
- Thyroid test often "Normal"
- Irregularities of T3 / T4 thyroid hormone conversion
- Survival adaptation
  - Lower metabolic processes to deal with famines and other problems
  - Body resumes normal functioning when food supply is restored and/or stress removed.
- State may be reset with proper therapy
  - Has T3 cycling protocol has developed

<http://www.wilsonssyndrome.com/PositionStatement.htm>




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## Diagnosis

- Accurate mercury thermometer
  - NOT electronic
    - Samples the temperature at specific intervals.
    - If one interval corresponds to the pulse of hot blood from the core of the body, the reading will be high.
    - If all the intervals occur shortly before those pulses, the readings will be low.
  - Temperature q3h beginning three hours after getting up
- Average over several normal days. (No menstrual periods, colds, etc.)
- If average body temperature is one or more degrees below normal, you may have Wilson's Syndrome.

<http://www.wilsonssyndrome.com>




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## Susceptible Patients

Most susceptible people include:

- Survivors or Descendents of Famine Survivors
- Scotch ancestry
- Irish Ancestry
- Russian Ancestry
- American Indian Ancestry
- Holocaust Survivors
- Chronic Dieters
- Survivors of high stress
- Divorced
- Death of loved one
- Extreme family or job stress
- Other acute or chronic occupational stress
  - Sufferers of Candida Albicans and Yeast problems
  - Persons having hypoglycemia
  - Persons with eating disorders
  - Persons with sleep disorders

<http://www.wilsonssyndrome.com>




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## Case #7

- 56 y/o WF with hypothyroidism due to Hashimoto's, weight gain up to 200 lb, hair loss, goiter. Thyroid function studies look perfect on 50 mcg.
  - Thyroid function has to be off because she has fingernail-pitting hair loss




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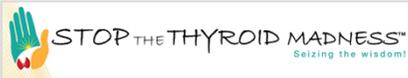
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107) Patient made an appointment months in advance to see a "superb" recommended Endocrinologist. After a 45 minute wait in his waiting room, she enters his office and he begins with 'memorized and irrelevant questions with a very rushed attitude'. She then asked him to look at her extreme hair loss (which has pushed her to wear a hat to cover her balding head due to her hypothyroidism). He examines her head for a total of 2-3 seconds, then he said the following: "Hmmmm, looks like you're losing your hair. Try using Extra Strength Rogaine and see if it works a bit. Hopefully sometime in the future they'll find a cure for hair loss." Says this thyroid patient: Ta-daaaa. That was it. That was what I waited for months to hear. That was the "holy grail" of wisdom from this esteemed hormone specialist. Consultation over. He was done. Off he went then, to his next "lucky" patient.

An additional realization about being on T4

Turns out that my Dysautonomia may not have been "caused" by T4, since Dysautonomia is related to Mitral Valve Prolapse (which I have), a benign heart condition that means this valve is a bit floppy. But there comes the realization in hindsight that being on the inadequate treatment of T4 worsens any condition you may already have. That was especially true for me.




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## Case #8

- 56 y/o WF with hypothyroidism due to Hashimoto's, weight gain up to 200 lb, hair loss, goiter. Thyroid function studies look perfect on 50 mcg.
  - Pt states they have researched Hashimoto's Encephalopathy and would like to know how to fix it




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## Hashimoto's Encephalopathy vs SREAT

- Hashimoto encephalopathy (HE) / "Steroid-responsive encephalopathy associated with autoimmune thyroiditis" (SREAT)
  - Uncommon syndrome associated with Hashimoto thyroiditis (HT).
  - Subacute onset of confusion with altered level of consciousness, seizures, and myoclonus.
  - Believed to be an immune-mediated disorder
  - High levels of TPO antibodies in serum
- Responsive to high dose steroid therapy
- Association vs Causation
  - Lupus Anticoagulant vs Antiphospholipid Antibody Syndrome
  - Neurology vs Endocrinology. The association is there, but is the causation?
  - Vitamin D Deficiency is associated with childhood obesity but doesn't cause it.

Arch Neurol. 2003;60(2):164.  
Neurology. 2003;61(8):1124.




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## Case #9

- 56 y/o WF with hypothyroidism due to Hashimoto's, weight gain up to 200 lb, hair loss, goiter. Thyroid function studies looked perfect on 50 mcg, but now TSH is elevated
  - The patient states I haven't changed anything of course I take it in the morning just like the label says! They have never been able to regulate my thyroid...




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## Biotin Interference

- Hold biotin 2 days prior to labs to be safe
- Biotin
  - May cause falsely low values in immunometric assays (eg, used to measure TSH)
  - Also falsely high values in competitive binding assays (eg, used to measure free T4, T3, and free T3, and TSH receptor-binding inhibitor immunoglobulin)

JAMA. 2017;318(12):1150.  
JAMA Intern Med. 2017;177(4):571.

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## How much residual thyroid function do they have?

- Weight based dosing
  - 1.7 x weight in Kg
  - 0.75% x weight in lbs
- How much do they weigh?
- Is TSH at 0.5-2.5 target?
- What dose LT4 are they on?
  - 200 lb = 150 mcg estimate
  - If levels look great on 50 mcg then they have ~66% thyroid function remaining
- Don't forget, thyroids can regenerate/heal.

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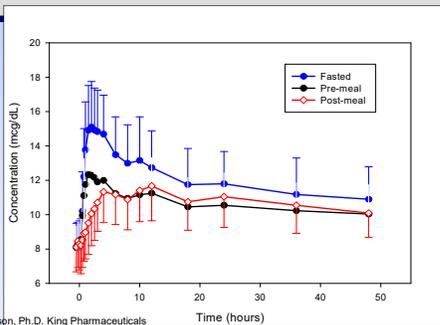
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## Effects of Food on T<sub>4</sub> Bioavailability

Corrected T<sub>4</sub> Concentration Profiles (0-48 h)



Michael J. Lamson, Ph.D. King Pharmaceuticals  
Public Meeting for Levothyroxine Sodium Therapeutic Equivalence  
May 23, 2005, Washington, DC

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## Brand vs. Generic

- Brand Names
  - Synthroid® AB1,AB2
    - Abbott
  - Levoxyl® AB1,AB3
    - Joens Pharma
  - Unithroid® AB1,AB2,AB3
    - Stevens J
  - Levotheroid® BX
    - Lloyd
  - Levo-T® AB2,AB3
    - Alara
  - Novothyrox® BX
    - GenPharm
  - Levolet® BX
    - Vintage
- Generic Levothyroxine
  - Sandoz AB2,AB3
  - Mylan AB1,AB2,AB3
  - GenPharm AB2
  - Lannett




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## Further discussion.



- Missing any doses?
  - 100 mcg taken 6 days a week
  - $100 \times 6 = 600$  mcg/7 days = 86 mcg average/day
    - Is just like going down a strength
- HAMA (Heterophilic Anti Mouse Antibody)
  - Anti-mouse gamma globulins can bridge the two mouse monoclonal antibodies and cause spuriously elevated readings for TSH
  - The check engine light is going off but the car is still driving 90 MPH without a problem
- TSHoma, thyroid hormone resistance
  - Check T3/T4's if don't trust TSH
  - Does the patient clinically match the thyroid tests

Clin Chem. 1998;44(3):440.




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## Case #10

- 28 year-old white male with newly diagnosed hypothyroidism with mild fatigue but otherwise feeling OK, with TSH of 29.
  - Started 50 mcg LT4, with 3 days of stomach pain
  - Stopped LT4 and stomach pain resolved
  - Went back to clinic 2 months later, TSH 32
  - Started LT4 again and exact same stomach pain came back and went away again after stopping
  - His question is why does LT4 make my stomach hurt when it was supposed to be a miracle drug?




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## Transitive property of equality

- Usually if  $a=b$ ,  $b=c$ , then it follows that  $a=c$
- Patient feels  $a=c$ 
  - LT4 causes abdominal pain, but what is the missing step?
- Thyroid levels are like lighter fluid
  - If you spray lighter fluid on a log it doesn't cause a fire, but if you spray it on a match can cause a forest fire
  - Abnormal thyroid levels may not cause an issue but can exacerbate an underlying issue the patient may be susceptible to
- Check his gallbladder, diagnose his gallstones
  - Restarts LT4 without any abdominal symptoms




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## Case #11

- 34 y/o WF with hypothyroidism due to Hashimoto's, weight stable at 140 lb, hair loss, goiter. Thyroid function studies look perfect on 100 mcg.
  - Pt states even though her thyroid levels look great it has to be thyroid. Has variable good and bad days.




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## Eat Less Chicken

- Has variable good and bad days.
  - Stopped OCP, didn't make any change
  - Thyroid levels right at target
- Recommend keep a dietary log on not only bad but also good days
  - Wrote down everything she ate at night the 24h prior on the four best and worst days both
  - Noted that on bad days ate chicken, good days didn't
- Ate chicken for a week and felt poorly, went off chicken and felt well again
  - Tried organic/range fed chicken and didn't reproduce symptoms
- Elimination diet
  - Gluten, dairy, corn, MSG, nightshades, beef, citrus




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## Case #12

- 56 y/o WF with hypothyroidism due to Hashimoto's, weight gain up to 200 lb, hair loss, goiter. Thyroid function studies look perfect on 50 mcg

– The patient states I eat like a bird, 1,200 calories a day ketogenic diet, exercising an hour a day, cannot los any weight, it HAS to be her thyroid...




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## You have to eat to lose weight

- Her target weight is 150, is 5'5"
  - Resting metabolic rate ~1,500 calories/d
  - Is net -300 plus working out
  - Metabolism shuts down to 1,000, which means 200 calorie excess
    - Cortisol increases, fat placed centrally
  - Recommend take in minimum of 1,500 (more on exercise days) but limit to <40 g total fat daily




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## Summary

- We are all lunatics of varying degrees of insanity running around outside the asylum...
  - But even crazy people get sick sometimes!
- If you can turn a stubborn mule a half a turn in the right direction
  - Once they are find the correct direction then they will go that way for rest of life
- At least if they are looking for answers it is better than sitting on the couch
- If the patient matches the labs, you are good to go.
- Treat everyone how you would like to be treated




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