

Available at the Registration Booth

"Dr. Ron Rothenberg is a talented, innovative, and compassionate doctor. He is setting the trend and is trail blazing holistic medicine for the middle-aged person and those beyond middle-age."

—William G. Washington, D.C.

"At the age of 58, I have 11% body fat and workout 7 days a week for two hours. My energy is amazing!! I attribute this to the care and hormone treatment I receive at CHL. I can't imagine my life without their help!! Thank you Dr. Rothenberg, and the entire CHI staff."

—Suzy D., San Diego, California



Ron Rothenberg MD. As a pioneer in the field of Preventive and Regenerative Medicine, Ron Rothenberg, M.D., (age 65) was among the first group of physicians to be recognized for his expertise in this rapidly emerging field. The 10th M.D. in the world to become fully board certified in by the American Board of Anti-Aging and Regenerative Medicine, Ron Rothenberg, MD founded California HealthSpan Institute in Encinitas, California in 1998 with a commitment to transform our understanding of preventive and regenerative medicine. Challenging traditional medicine's approach, California HealthSpan Institute's mission is to create a paradigm shift in the way we view the decline of fitness, cognition and quality of life treat the cause. California HealthSpan now treats and designs custom programs for patients in California and worldwide. (From every continent except Antarctica).

Dr. Rothenberg has always challenged traditional medicine's ability to embrace new paradigms. After graduating from Columbia University, College of Physicians and Surgeons, in 1970, Dr. Rothenberg practiced medicine and studied indigenous healing in the Amazon Basin for several years. He then performed his residency in Emergency Medicine at Los Angeles County-USC Medical Center. At the time, the specialty of Emergency Medicine (like Anti-Aging and Regenerative Medicine) was not widely recognized by the medical community. Dr. Rothenberg was passionate about the field, and went on to teach and practice Emergency Medicine. He is a former Full Clinical Professor of Preventive and Family Medicine at University of California, San Diego School of Medicine.

To be ready to offer patients the advantages of the next paradigm shift in medicine California HealthSpan Institute became the first collection center for Neostem where healthy people could collect and bank their own adult stem cells for future use. As a member of the Neostem Medical Advisory Board Dr. Rothenberg regularly meets with world leaders in the stem cell field.

Dr. Rothenberg has educated over 25,000 physicians who have attended his continuing education seminars. As the creator and director of the Postgraduate Institute for Primary and Emergency Physicians at University of California, San Diego, School of Medicine he helped create the specialty of Emergency Medicine by training physicians as this field emerged. Over the past 10 years he lectured worldwide on Preventive and Regenerative Medicine, Hormone Optimization and Stem Cells. In addition to his work in the field of Anti-Aging and Regenerative medicine, Dr. Rothenberg remains an Attending Physician and at Scripps Memorial Hospital in Encinitas, California. With the health and vitality that he had when he was much younger, Ron Rothenberg continues to enjoy his other passions: his wife, his three children, surfing, skiing, mountain biking, and Baja California.



Kris Hart, MN, FNP, R.N.-C. – Associate Medical Director, California HealthSpan Institute, Encinitas, CA Ms. Hart has been a health care provider since the 1970's. Ms. Hart has a Master's Degree in Nursing with Family Practice Nurse Practitioner certification from UCLA. She currently is working in Family Practice, Emergency Medicine and Preventive/Regenerative Medicine. She has completed the Certification and Fellowship program in Preventive/Regenerative/Functional medicine as an allied health professional. Ms. Hart's background in family practice, critical care and emergency medicine and natural hormone optimization is extensive. Ms Hart is married and has 5 children and 3 grandchildren and enjoys camping and spending time with her family.

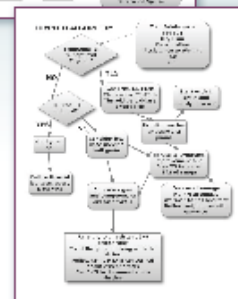
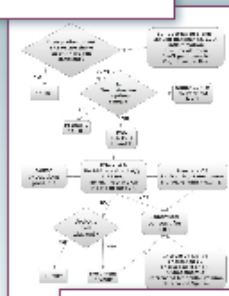


California
HealthSpan
Institute A.M.C.

Hormone Optimization in Preventive/Regenerative Medicine
A "Nuts and Bolts" Approach to Management

Ron Rothenberg, MD
Kris Hart, MN, FNP, RN-C

Hormone Optimization in Preventive/Regenerative Medicine



A "Nuts and Bolts" Approach to Management

Guidebook includes Treatment Algorithms and Abstracts

Ron Rothenberg, MD
Kris Hart, MN, FNP, RN-C

Thyroid Optimization

Ron Rothenberg MD

The following potential conflict of interest relationships are germane to my presentation.

Equipment: NA

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Status of FDA devices used for the material being presented
NA

Status of off-label use of devices, drugs or other materials that
constitute the subject of this presentation
NA

Thyroid Optimization

Ron Rothenberg MD

New Thyroid Concepts

- Lab tests lack sensitivity
- TSH not most sensitive test
- “Normal” TSH getting lower all the time
- Free T3 best clue
- Clinical correlation required!
- When all else fails, look at the patient.
- The wide range of “euthyroid” is not “optimal thyroid”

New Thyroid concepts

- T3 is needed for fat loss
- T3 protects against arrhythmias
- T3 decreases with stress or dieting
- T3 is active hormone and T4 is pro-hormone
- T4 does not necessarily convert to adequate T3
- Reverse T3 reverses T3

New Thyroid Concepts

- Replacing T3 + T4 = better quality of life than just T4
- Many factors decrease T4 to T3 conversion including
 - Dieting, Stress
 - Zinc, selenium deficiency
 - Amiodarone, Beta blockers, Dilantin and other drugs

Hypothyroidism is getting more common

• 1920	10%	Dr. Starr
• 1940	20%	Broda Barnes
• 1976	30%	Broda Barnes
• 1990	80%	Jacques Hertoghe
• 2011	???	Ron Rothenberg

Why?

- Hypothyroid children now survive and pass on genes (better sanitation, antibiotics)
- Attracted to hypothyroid mate (same low activity lifestyle) and reproduce....
- Environmental toxicity with heavy metals and other toxins.
- More autoimmune thyroiditis
- Under diagnosed

Causes of Hypothyroidism

- Failure of Pituitary control – low TSH
 - Secondary hypothyroidism
- Failure of Hypothalamic control – low TRH
 - Tertiary hypothyroidism
- Thyroid failure – Primary hypothyroidism
 - Most common
- Conversion failure of T4 to T3
- Receptor uptake failure – thyroid resistance
 - “Type 2” hypothyroidism like ‘Type 2’ diabetes
- Adrenal Insufficiency
 - Lowered cortisol affects thyroid production, conversion and receptor uptake

Thyroid - Adrenal

- Treat adrenal fatigue nutritionally or with bio-identical physiological hydrocortisone replacement
- Low thyroid output is a stress situation and increased cortisol is the response
- When treated with only T4 and lack of T3 conversion – stress situation can get worse
- This “works for a while” and eventually leads to adrenal fatigue

Hypothyroidism

Most Common Symptoms:

- Cold Intolerance, cold hands and feet
- Handshake test
- Fatigue
- Dry Skin
- Constipation
- Difficulty losing weight

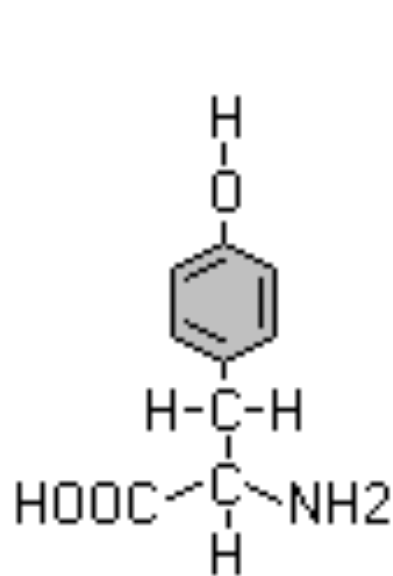
Hypothyroidism – The Symptoms

- Weight gain
 - Unable to metabolize calories
 - Too tired to exercise
- Lowered body temperature
 - May have heat intolerance as well as cold intolerance
- Lack of energy, tired
 - May also have adrenal component
- Fluid Retention
 - Periorbital, ankle edema, hypertension

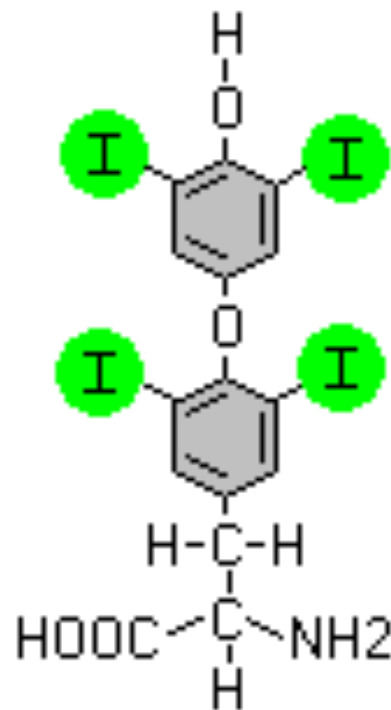
Hypothyroidism – The Symptoms

- Depression
- Memory loss – Cognitive dysfunction
- Anxiety, Insomnia
- Arthralgias, muscle aches, headache
- Dry rough skin, thinning hair
- Hoarseness

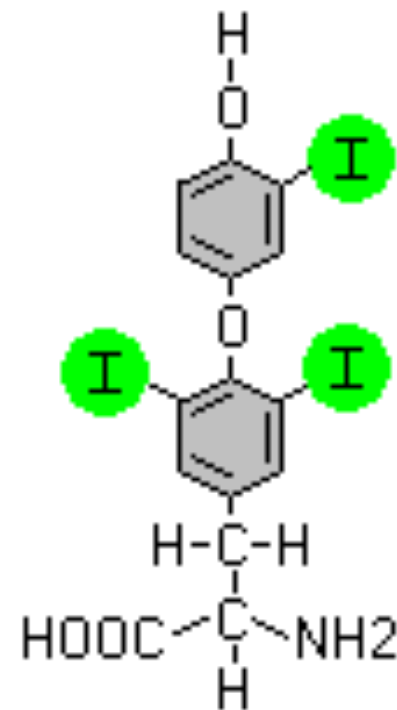
Thyroid Hormones



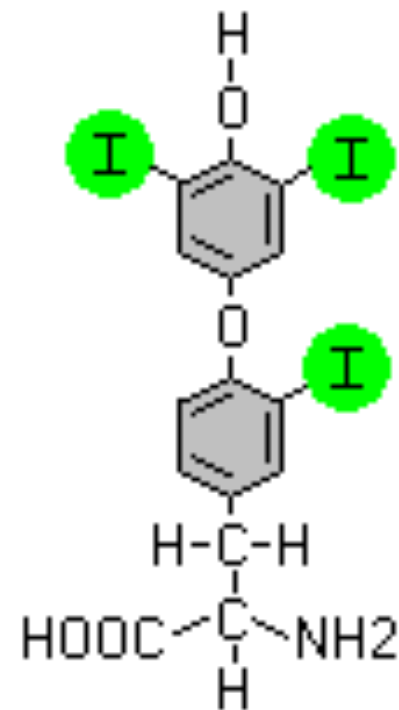
Tyrosine



Thyroxine (T₄)



**Triiodothyronine
(T₃)**



**"Reverse T₃"
(inactive)**

Thyroid hormones

- Daily production
 - Thyroxine=T4 100 micrograms per day
 - Triiodothyronine=T3=liothyronine
30 micrograms/day
 - 20% produced by thyroid gland
 - 80% by deiodination
 - 4 x as potent as T4
 - T1 and T2 in trace amounts
 - Function?

Diagnosis of Hypothyroidism

Elevated TSH, or...

- Clinical symptoms
- Free T3 below optimal range
- Free T4, TSH often normal

- Continuum between euthyroid and hypothyroid
- Continuum between normal and elevated TSH
- Distinction between normal and elevated TSH is arbitrary

What TSH is normal?

- In Americans

– Mean TSH	1.5	without known thyroid disease
	1.4	whole population
– TPO positive	13%	whole population
	11%	without known thyroid disease

- Hollowell JG et al. *J Clin Endocrinol Metab* 2002 87(2)489-499.

What TSH is optimal?

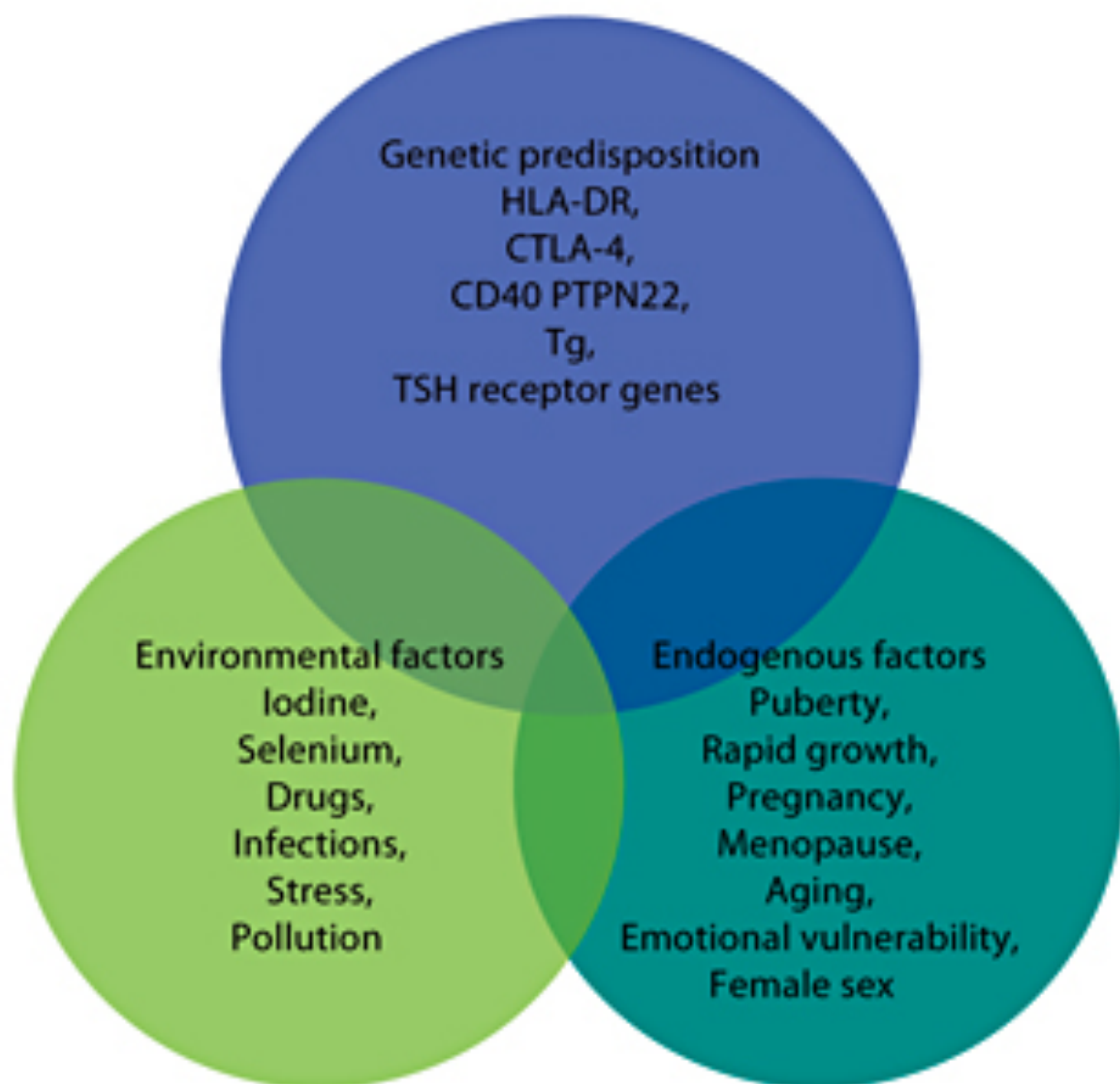
- .1-1.0
- Happiest, best cognitive function, best lipids, least adipose
- No adverse effects, no atrial fib, no bone loss

Thyroid tests

- Free T3
 - Normal 2.3-4.3 pg/mL
 - Optimal 3.5-4.3 pg/mL
- Reverse T3
 - Normal 90-350 pg/mL
 - Optimal < 200 pg/mL

Thyroid Autoimmunity

- TPO Positive in 85-100% of cases in Hashimotos
- “Subclinical” autoimmune disease incidence much higher
- Thyroglobulin antibodies (Tg Abs) and Thyroid Peroxidase (TPO Abs) often positive
- These antibodies can be present in non-thyroid autoimmune disease
- Sensitivity and Specificity low



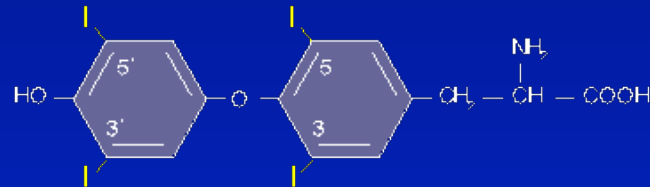
Hashimoto's and Vitamin D

- Active Hashimoto's Thyroiditis have vitamin D levels that are about half of unaffected controls
- 16 ng/ml versus 29 ng/ml
- 92% to 63% = $p < 0.0001$
- Tamer G. Relative Vitamin D Insufficiency in Hashimoto's Thyroiditis. *Thyroid*. 2011 Aug;21(8):891-6.

Iodine

- 150 micrograms/day is RDA and this amount is needed to stay alive
- Much higher doses may be beneficial up to 12.5 mg of iodine/iodide
- Iodized salt provides about 400 mcg per teaspoon.
- Available through seafood, iodized salt, or dietary supplements, lugol's solution
- Brownstein, D., Clinical experience with inorganic, non-radioactive iodine/iodide. *The Original Internist*, 12(3):105-108, 2005

Thyroid Activation and Inactivation Catalyzed by seleno deiodinases (D1-3)



3,5,3',5'-tetraiodoL-thyronine (thyroxine, T₄)

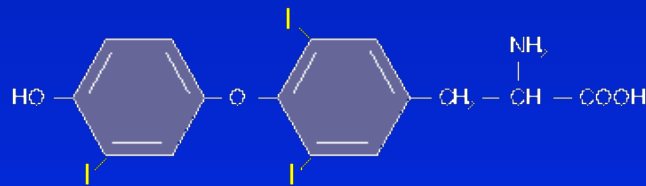
Activation

D2,

D1

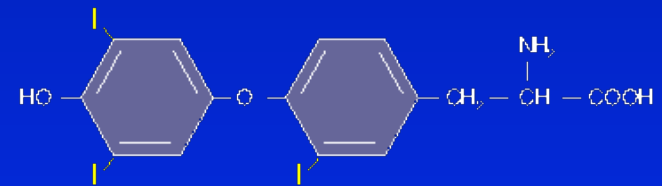
D3

Inactivation



3,5,3'-triiodoL-thyronine (T₃)

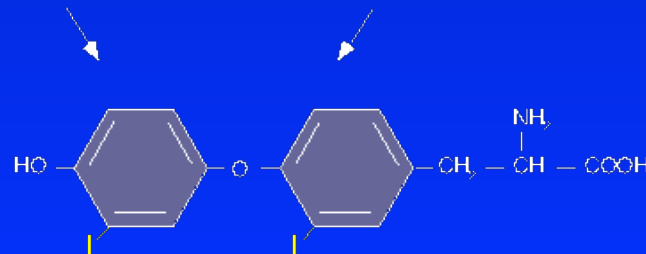
D3



3,3',5'-triiodoL-thyronine (reverse T₃)

D1 D2,

Inactivation



3,3'-diiodothyronine (T₂)

Factors That Impair Peripheral Conversion of T_4 to T_3

- Physiological
 - Fetal and early neonatal life
 - Old age
 - Decreased calories through dieting
- Pathologic
 - **Inflammation**
 - Fasting, malnutrition
 - Hepatic or renal dysfunction
 - Systemic illness, cancer
 - Trauma, postoperative state
 - Increased **Cortisol**

- Endocrine
 - Elevated Glucose and Insulin
 - GH deficiency
- Pharmacologic
 - Drugs:
 - glucocorticoids
 - **amiodarone**
 - **beta blockers**
 - Synthetic progestins
- Vitamin and mineral deficiencies
 - Zinc, selenium
- Jakobs TC et al. Proinflammatory cytokines inhibit the expression and function of human type I 5'-deiodinase in HepG2 hepatocarcinoma cells. *Eur J Endocrinol.* 2002 Apr; 146(4):559-66.

Reverse T3

- Fatigue
- Difficulty losing fat
- Brain Fog
- Muscle aches
- Increased with chronic illness CF/FM
- Increased with yo-yo dieting
- Increased with heavy metals, infections, mental and physical stress

Antagonistic Evolutionary Benefit

- What helped our Paleolithic ancestors make it to reproductive age...is killing us now
- **Insulin Resistance** – helped store fat and survive famine
- **Anti-inflammation resistance** – helped survive acute infectious disease and trauma
- **Thyroid resistance** – helped to survive famine and stress



How do you get less reverse T3?

- Increase activity of D2 and D1 or Decrease D3
 - Eliminate physical and mental stress
 - Treat with thyroid
 - GH increases D2 and D1 activity
 - Treat Selenium deficiency
 - Treat Iodine deficiency

T3 vs T4

- **Arguments against T3**

- Short half life, high then low levels
- "desiccated porcine thyroid" has 20% T3, humans produce 10%T3
- Lab tests not better on combo T3, T4

Arguments for combo T3/T4

- Patients prefer it
- T3 needed for adequate tissue levels of thyroid
- D1 expressed in liver, kidney, lung pituitary, thyroid
- D2 expressed in CNS
- Heart does not have D activity or transport T4 into cells, needs supply of T3

- Danzi S et al. Potential uses of T3 in the treatment of human disease. *Clin Cornerstone*. 2005;7 Suppl 2:S9-15.

Is T3 + T4 better than just T4?

- 50 micrograms of T4 replaced by 12.5 micrograms T3
- Cognitive performance mood and depression improved
- No adverse effects on combination
- Bunevicius R et al. Effects of thyroxine as compared with thyroxine plus triiodothyronine in patients with hypothyroidism. *N Engl J Med* 1999 Feb 11;340(6):424-9

T4 vs T3 + T4

- Editorial in NEJM
- “The ideal medication would contain approximately 100 µg of thyroxine and 10 µg of triiodothyronine”
- Toft A. Thyroid Hormone Replacement -- One Hormone or Two? *The New England Journal of Medicine* -- February 11, 1999 -- Vol. 340, No. 6

T4 vs T3 + T4

- Numbers were not better but patients felt better
- “CONCLUSIONS: Physiologic combinations of L-thyroxine plus liothyronine do not offer any objective advantage over l-thyroxine alone, yet patients prefer combination treatment.”
- Escobar-Morreale HF et al. Thyroid hormone replacement therapy in primary hypothyroidism: a randomized trial comparing L-thyroxine plus liothyronine with L-thyroxine alone. *Ann Intern Med*. 2005 Mar 15;142(6):412-24

Annals of IM patient handout

- **“What did the researchers find?”**

Of the 28 patients studied, 18 reported that they preferred the combination treatment. However, the researchers did not find any measurable differences in any of the other factors that they measured.

- **What are the implications of the study?**

Treatment of hypothyroidism with a combination of L-thyroxine and liothyronine does not appear to offer any clear benefit over treatment with L-thyroxine alone.”

- Everything counts except what patients prefer?????

- Comparison of Two Drug Regimens for Hypothyroidism 15 March 2005 | Volume 142 Issue 6 | Page I-55

“Desiccated porcine thyroid”

- Pig thyroid glands
 - Grain fed pigs
 - 38 mcg T4 + 9 mcg T3 per grain (60 mg)
 - Supplied in various dosage forms
- To convert from commercial (T4)
 - $T4 + 4 \times T3$
 - But probably higher dose would be optimal
- Best clinical response and least side effects
- Non-porcine synthetic equivalent possible

Porcine Thyroid with Autoimmune Thyroid Disease (AITD)?

- AITD - T4 only switched to desiccated thyroid vs. control group on T4
- Improved cellular immunity, no change in humoral immunity
- Possible immunospecific therapy for AITD
- Lee S. Induction of oral tolerance in human autoimmune thyroid disease. *Thyroid*. 1998 Mar;8(3):229-34

Other T3 options

- Liothyronine
 - 5, 25, 50 mcg
 - “Playing with T3 option”
- Compounded extended release T3
 - 7.5mcg, 10mcg, 12.5mcg, 22.5mcg, 37.5mcg
- T3
 - Short half life - 18 hours
 - Give BID or extended release
- T4 half life – 6.7 days
- Williams Textbook of Endocrinology, 2003

Compounded T4/T3

- 1 “grain” T3 9mcg & T4 38mcg
- 1/2 “grain” T3 4.5mcg & T4 19mcg
- Same ratios as “desiccated porcine thyroid”

T3 Treatment Alone vs. T4

- Improved weight loss
- Better lipids
- No adverse effect on cardiovascular function or insulin sensitivity.
- TSH remained stable
- Francesco S. Celi et al. Metabolic Effects of Liothyronine Therapy in Hypothyroidism: A Randomized, Double-Blind, Crossover Trial of Liothyronine Versus Levothyroxine. *J Clin Endocrinol Metab.* 2011 Aug 24.

Thyroid and immune

- Treatment with thyroid restores youthful immune response in old mice
- El-Shaikh KA. Recovery of age-dependent immunological deterioration in old mice by thyroxine treatment. *J Anim Physiol Anim Nutr* (Berl). 2006 Jun;90(5-6):244-54

Thyroid - cardiovascular

- T3
 - Increases cardiac contractility
 - Decreases systemic vascular resistance
 - Cardiac disease associated with low T3 syndrome
 - Patients with CHF may benefit from T3 replacement
-
- Danzi S and Klein I. Thyroid hormone and the cardiovascular system. *Minerva Endocrinol.* 2004 Sep;29(3):139-50. _

Symptoms and Signs of low T3 in Cardiovascular disease

- Bradycardia, narrowed pulse pressure, diastolic hypertension most common
- Dyslipidemia
- Endothelial dysfunction
- Elevated CRP and homocysteine

Low T3 syndrome, Diastolic Dysfunction, CHF

- Cassetti, G et al. Relationship between low T3 syndrome and NT-proBNP levels in non-cardiac patients. *Acta Cardiol*. 2007 Feb;62(1):19-24.
- Cassetti, G et al. Low T3 syndrome and left ventricular diastolic function. *G Ital Cardiol* (Rome). 2009 Aug;10(8):553-7.

Potential role of T3 in Rx of CHF

- Synergistic effect with other treatments
- Shortens QT interval – potentially anti-arrhythmic
- Improved cognitive and neuropsychiatric parameters
- Current data supports safety and lack of untoward effects

T3 and CHF

- 30% of patients with CHF low T3 syndrome
- Increased cytokine levels impair D1
- T4 treatment not effective in this setting
- T3 treatment needed with consideration of rapid fluctuations
- Danzi S et al. Potential uses of T3 in the treatment of human disease.
Clin Cornerstone. 2005;7 Suppl 2:S9-15.

Thyroid and CRP

- Hypothyroidism - premature atherosclerosis and cardiovascular disease
- CRP values increase with progressive thyroid failure
- Additional risk factor coronary heart disease
- Christ-Crain M et al. Elevated C-reactive protein and homocysteine values: cardiovascular risk factors in hypothyroidism? A cross-sectional and a double-blind, placebo-controlled trial. *Atherosclerosis* 2003 Feb;166(2):379-86

Thyroid and Homocysteine

- Homocysteine elevated in hypothyroid patients
- Mean, 16.3 micromol/L; 95% confidence interval [CI], 14.7 to 17.9 micromol/L) than in healthy controls (mean, 10.5 micromol/L; 95% CI, 10.1 to 10.9 micromol/L).
- Nedrebo BG et al. Plasma total homocysteine levels in hyperthyroid and hypothyroid patients. *Metabolism*. 1998 Jan;47(1):89-93.

Thyroid hormones and coronary artery vasodilation

- T3 and T4 produces coronary artery vasodilation
- No effect from RT3
- “Our results also suggest that thyroid hormones may play a role in preventing myocardial ischemia by inducing coronary artery vasodilation.”

- Yoneda K et al. Direct effects of thyroid hormones on rat coronary artery: nongenomic effects of triiodothyronine and thyroxine. *Thyroid* 1998 Jul;8(7):609-13

T3 and Tachyarrhythmia

- Chronic CHF
- V Tach associated with low T3 low ratio of T3/T4 and high reverse T3
- Shimoyama N et al. Serum thyroid hormone levels correlate with cardiac function and ventricular tachyarrhythmia in patients with chronic heart failure. *J Cardiol* 1993; 23(2) : 205-13

Low fT3 predicts AF -CABG

- Low fT3 predicts post op AF $p=.001$
- Cerillo AG et al. Free Triiodothyronine: a novel predictor of postoperative atrial fibrillation. *Eur J. Cardiothorac Surg* 2003 Oct, 24(4) 487-92

Low T3 and Death

- Low T3 < 3.1 Free T3
- Low-T3 syndrome is a strong predictor of death in cardiac patients and might be directly implicated in the poor prognosis of cardiac patients.
- Strongest independent predictor of death $>$ lipids or EF
- Iervasi, G et al. Low-T3 Syndrome, A Strong Prognostic Predictor of Death in Patients With Heart Disease *Circulation*. 2003;107:708

Reverse T3 and AMI mortality

- RT3 strongest predictor of mortality in first year post Acute MI
- Elevated rT3 = 3 x mortality if rT3 > .41 nmol/L = 27 ng/dl
 - To convert nmol/L triiodothyronine (T3) and reverse (r)T3 to ng/dl, multiply by 65.1.
- Friberg L et al. Association between increased levels of reverse triiodothyronine and mortality after acute myocardial infarction. *Am J Med*. 2001 Dec 15;111(9):699-703.

AMI, Thyroid, Survival

- Survival: Higher fT3
- Death: Higher TSH, low fT3, high Reverse T3
- “Euthyroid sick syndrome” occurs in AMI and Unstable Angina
- The degree of T3 decrease is proportional to the severity of cardiac damage
- Satar S et al. Prognostic value of thyroid hormone levels in acute myocardial infarction: just an epiphenomenon? *Am Heart Hosp J*. 2005 Fall;3(4): 227-33.
- Pavlou, HN et al. Euthyroid sick syndrome in acute ischemic syndromes. *Angiology*. 2002 Nov-Dec; 53(6):699-707

Treatment of Dilated Cardiomyopathy and CHF with IV T3

- IV T3 to maintain fT3 in normal range
- fT3 increased and stayed within normal range
- No side effects, no arrhythmias
- Heart rate decreased
- BNP improved
- Improved ventricular performance
- Pingitore A et al. Acute effects of triiodothyronine (t3) replacement therapy in patients with chronic heart failure and low-t3 syndrome: a randomized, placebo-controlled study. *J Clin Endocrinol Metab*. 2008 Apr; 93(4):1351-8

Thyroid rebuilds heart after MI

- Maladaptive cardiac remodeling takes place after acute MI
- Pantos C et al. Rebuilding the post-infarcted myocardium by activating 'physiologic' hypertrophic signaling pathways: the thyroid hormone paradigm. *Heart Fail Rev.* 2008 Sep 5.
- Pantos C et al. Thyroid hormone and "cardiac metamorphosis": potential therapeutic implications. *Pharmacol Ther.* 2008 May;118(2):277-94.
- Danzi S et al. Thyroid hormone treatment to mend a broken heart. *J Clin Endocrinol Metab.* 2008 Apr;93(4):1172-4

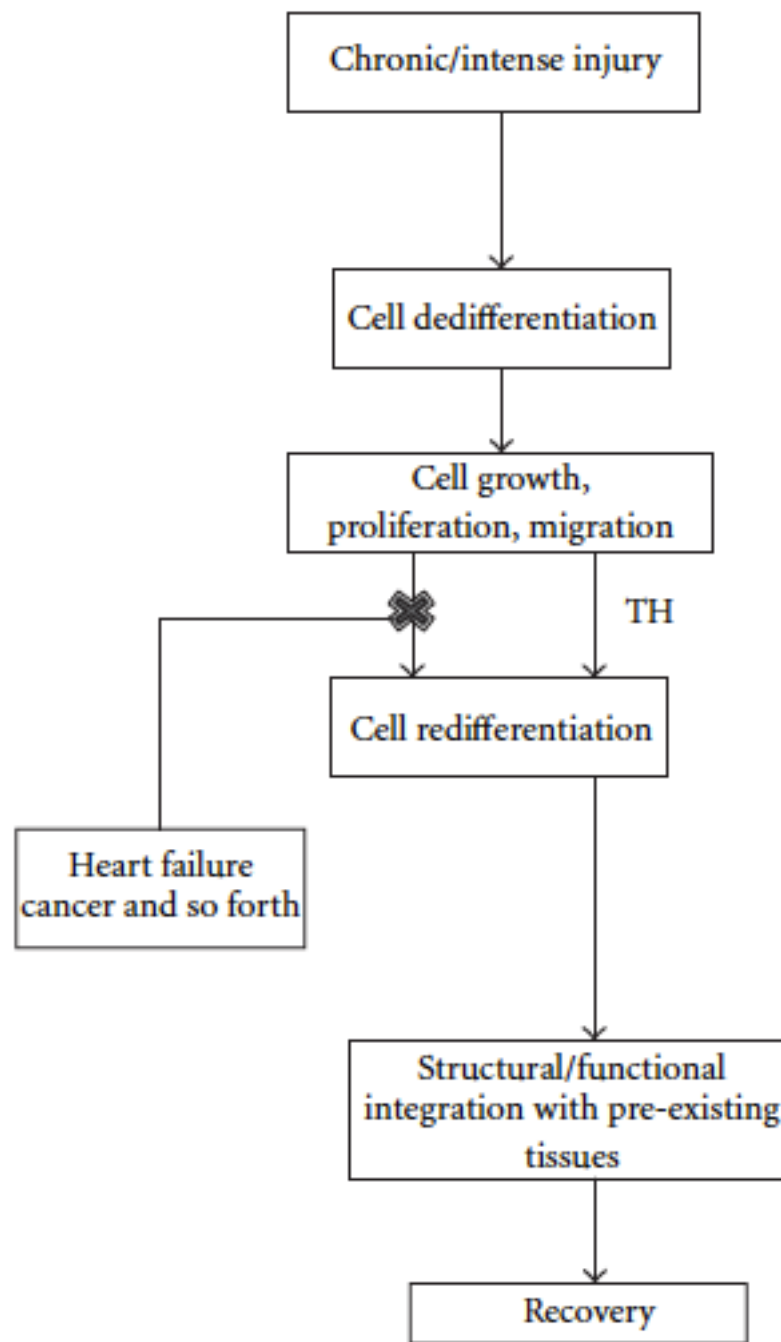
Post Ischemic Cardiac Remodeling

- Inflammatory cytokines (TNF alpha) + adrenergic signaling induces fetal like myosin  dysfunctional myocardium (Dedifferentiation)
- T3 prevents fetal-like pattern of myosin expression (Redifferentiation)
- Wall tension and chamber geometry normalized
- Cellular effects: Positive inotrope, apoptosis limited

T3 protects post MI

- Acute T3, but not T4 protects against reperfusion injury
- Protection via TR alpha 1 receptor
- Pantos C ,Mourouzis I et al. Acute T3 treatment protects the heart against ischemia-reperfusion injury via TR α 1 receptor. *Mol Cell Biochem* 2011 Jul; 353(1-2):235-41.

- T3 is critical in fetal heart maturation and in adult cardiac repair
- Low T3 post MI correlated with CHF, morbidity and mortality
- Patients with primary thyroid mild dysfunction- adverse cardiovascular events
- Cardiac pts have a significant drop in T3 and rise in RT3 – LowT3 syndrome
- Negative correlations between plasma Free T3 concentrations and myocardial damage post MI



THiRST study

- STEMI
 - Borderline or reduced T3
 - Treatment with T3 when stable – 6 months
-
- Mourouzis I et al. Thyroid hormone and cardiac disease: from basic concepts to clinical application.
J Thyroid Res. 2011:958626

Thirst Objectives

- Safety of T3 replacement post STEMI
- T3 replacement effects on post ischemic remodeling and LV function
- T3 replacement effects on clinical outcome
 - Death, re-infarction, revascularization, readmission

Low T3 Syndrome

Euthyroid Sick Syndrome

FT3	low normal
FT4	normal
rT3	high
TSH	normal

Patients will benefit from T3

TSH and BP

- 30,728 individuals without previously known thyroid disease
- Within the reference range of TSH (0.50-3.5 mU/liter), there was a linear increase in blood pressure with increasing TSH.
- TSH high compared to low
- OR for Hypertension: 1.98 men,
1.23 women
- Asvold BO et al. Association between blood pressure and serum thyroid-stimulating hormone concentration within the reference range: a population-based study. *J Clin Endocrinol Metab*. 2007 Mar;92(3):841-5.

TSH and Lipids

- 30,656 individuals without known thyroid disease
- Inversely correlated with favorable, HDL, LDL, Triglycerides
- Asvold BO et al. The association between TSH within the reference range and serum lipid concentrations in a population-based study. The HUNT Study. *Eur J Endocrinol*. 2007 Feb; 156(2): 181-6.

Treatment of SC Hypothyroidism and Metabolic syndrome and insulin resistance

- Improved:
 - Glucose, Insulin, Hemoglobin A1C
 - Lipids
 - CRP
- Velija-Asimi Z et al. The effects of treatment of subclinical hypothyroidism on metabolic control and hyperinsulinemia. *Med Arch.* 2007;61(1): 20-1.

Thyroid and CV summary

- Present use:
 - Measure Free T3 and Reverse T3 in cardiac patients
 - Don't be afraid of Optimizing thyroid
 - Treat mild hypothyroidism by optimizing free T3 to reduce obesity and syndrome X, and lipids
 - Optimize Free T3 in CHF and all cardiac patients
 - Don't rely on TSH, look at the patient, look at the active hormone T3
- Future use:
 - IV T3 in CHF, Acute MI

Does Thyroid Replacement cause osteoporosis?

- Suppressive therapy
- No decrease in BMD in pre or post menopausal women or men
- Gorres G et al. Bone mineral density in patients receiving suppressive doses of thyroxine for differentiated thyroid carcinoma *Eur J Nucl Med* 1996 Jun; 23(6):690-2

Does thyroid replacement cause osteoporosis?

- Most studies – No
- Premenopausal – No
- Postmenopausal – Probably not
- Prove it for yourself – follow
urine NTx

- What is the difference between a TSH of 4 and 0.4?

- 5.5 kg = 12.13 lbs.

Obesity within normal TSH

- Positive association between BMI and TSH ($P < 0.001$)
- Highest to lowest TSH 5.5 kg weight difference in women
- Negative association between BMI and free T4 ($P < 0.001$)
- Knudsen N et al. Small differences in thyroid function may be important for body mass index and the occurrence of obesity in the population. *J Clin Endocrinol Metab*. 2005 Jul;90(7):4019-24

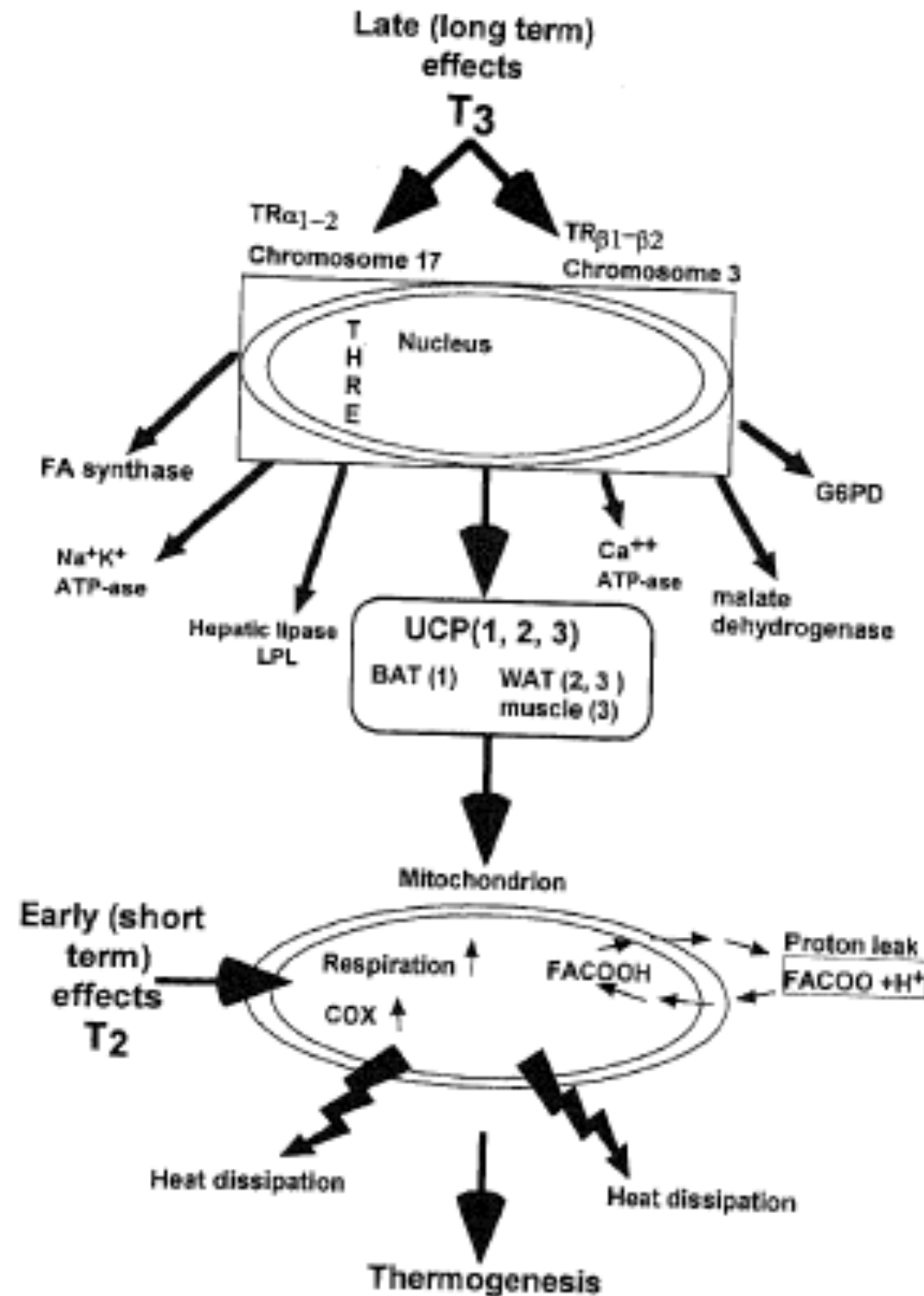
Thyroid and lipolysis

- Thyroid hormone necessary for NE stimulated lipolysis in sub-q fat
- Haluzik M et al. Effects of hypo- and hyperthyroidism on noradrenergic activity and glycerol concentrations in human subcutaneous abdominal adipose tissue assessed with microdialysis. *J Clin Endocrinol Metab.* 2003 Dec;88(12):5605-8.

T3 turns on family of UCP's

Uncouples oxidative phosphorylation

Obesity assoc. with blunted thermogenesis



Thyrophobia

- Disease frequently seen in physicians
- Endemic in Endocrinologists
- Symptoms
 - Treating on basis of lab tests not clinical
 - Prescribing only T4 and not enough
 - Inserts earplugs when patients talk
 - Screaming at advanced integrative colleagues in physicians lounge
- You can recover
- Support group meets here

THYROID ALGORITHM

