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FOR FUNCTIONAL AND EVOLUTIONARY MEDICINE

Thyroid Hypofunction I - Part Five

The next patient is a 28-year-old male with celiac disease and Hashimoto's, both of which are autoimmune conditions.

Marker	Value	Functional Range	Lab Range
Glucose	75	75 – 85	65 - 99
Hemoglobin A1c	5.4	4.4 – 5.4	4.8 - 5.6
Uric Acid	4.7	3.2 - 5.5	2.5 - 7.1
BUN	14	13 – 18	6 - 24
Creatinine	0.81	0.85 – 1.1	0.57 - 1
Sodium	139	135 – 140	134 - 144
Potassium	4.2	4.0 – 4.5	3.5 - 5.2
Chloride	101	100 – 106	97 - 108
C02	25	25 – 30	18 - 29
Calcium	8.8	9.2 – 10.1	8.7 - 10.2
Phosphorus	3.8	3.5 – 4.0	2.5 - 4.5
Magnesium	1.9	2.0 – 2.5	1.6 - 2.6
Protein, total	6.2	6.9 – 7.4	6.0 - 8.5
Albumin	4.1	4.0 – 5.0	3.5 - 5.5
Globulin	2.1	2.4 – 2.8	1.5 - 4.5
A/G ratio	2.0	1.5 – 2.0	1.1 - 2.5
Bilirubin, total	0.8	0.1 – 1.2	0.0 - 1.2
Alkaline Phosphatase	32	42 – 107	39 - 117
LDH	123	140 - 180	119 - 226
AST	22	10 - 30	0 - 40
ALT	14	10 - 22	0 - 32
GGT	10	10 - 26	0 - 60
TIBC	231	250 – 350	250 - 450
UIBC	117	150 - 375	150 - 375
Iron	114	85 – 135	35 - 155
Iron saturation	49	15 – 40	15 - 55
Ferritin	79	10 - 122	15 - 150
Cholesterol, total	229	150 – 250	100 - 199
Triglycerides	38	50 – 100	0 - 149
HDL	85	55 – 85	> 39
LDL	136	0 – 175	0 - 99
Triglycerides / HDL Ratio	0.45	< 2	< 3.8
TSH	0.719	0.5 – 2.5	0.45 - 4.50
T4, total	8.3	6.0 – 12	4.5 - 12
T3 Uptake	37	28 - 35	24 - 39
T3, Total	65	100 – 180	71 - 180

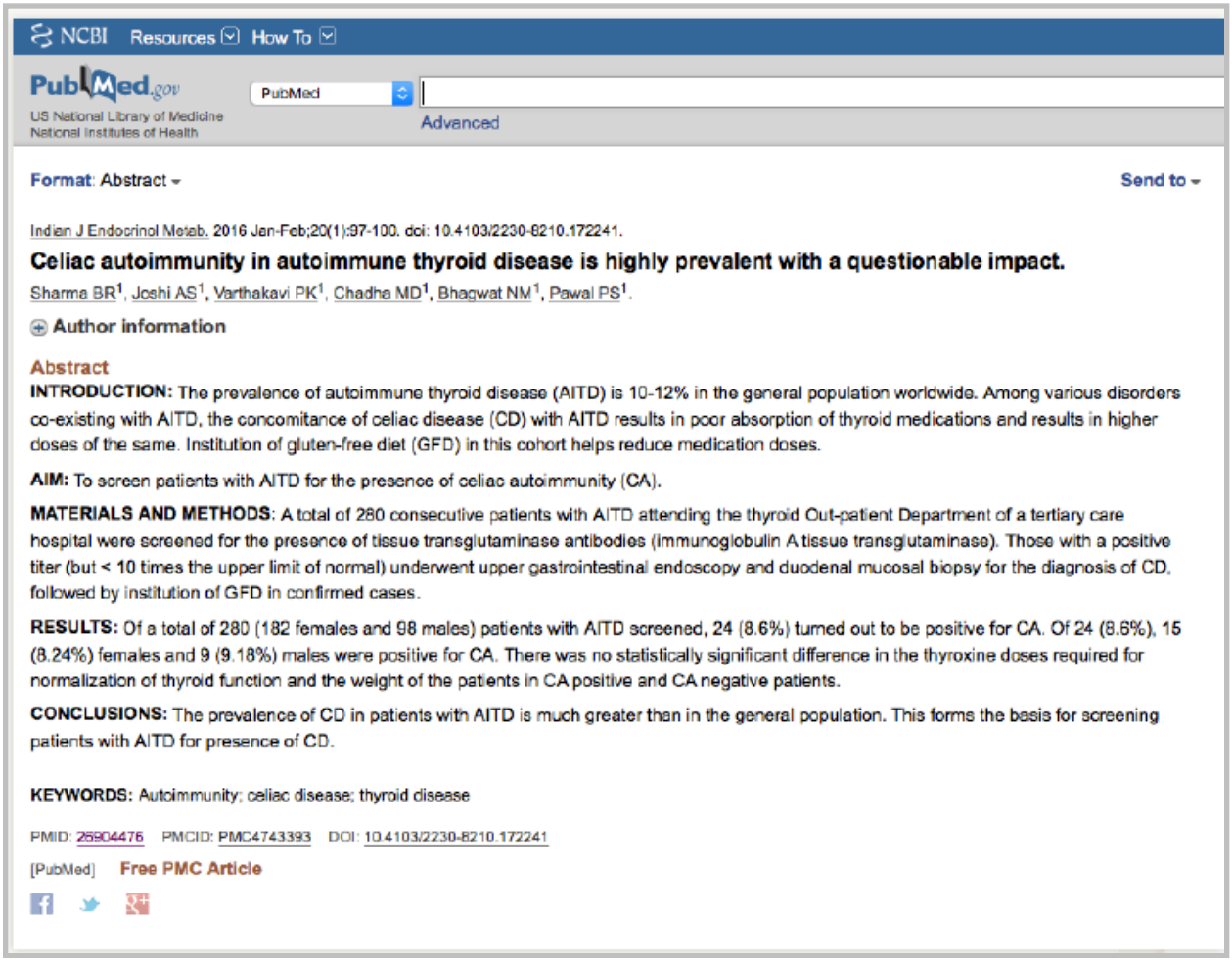
Marker	Value	Functional Range	Lab Range
Vitamin D, 25-hydroxy	28.4	35 - 60	30 - 100
WBC	5.4	5.0 – 8.0	3.4 - 10.8
RBC	4.68	4.4 – 4.9	3.77 - 5.28
Hemoglobin	13.8	13.5 - 14.5	11.1 - 15.9
Hematocrit	42.7	37 - 44	34 - 46.6
MCV	91	85 – 92	79 - 97
MCH	29.5	27.7 – 32.0	26.6 - 33.0
MCHC	32.3	32 – 35	31.5 - 35.7
RDW	13.5	11.5 – 15.0	12.3 - 15.4
Platelets	204	150 – 415	150 - 379
Neutrophils	60	40 – 60	
Lymphocytes	29	25 – 40	
Monocytes	7	4.0 – 7.0	
Eosinophils	3	0.0 – 3.0	
Basophils	1	0.0 – 3.0	
Additional Tests:			
T3, Free	2.5		2 - 4.4
T4, Free	1.84		0.82 - 1.77
Thyroid – TPO Ab	134		0 - 34
Thyroid – TGA	<1.0		0 - 0.9
CRP-hs	0.57		0.00 - 3.00
Homocysteine	7.7		0.0 - 15.0
Vitamin B-12	593	450 – 2000	211 - 946

Notice that his TSH and total T4 were normal. His free T4 was even borderline high, although probably not pathologically so, but total T3 is low, and free T3 is borderline. Also note that, again, iron levels are a little high. Alkaline phosphatase is low, as it often is in hypothyroidism, and 24(OH)D is low.

Vitamin D deficiency is common in Hashimoto's patients. One study showed it is low in 98 percent of those with subclinical hypothyroidism and 94 percent of those with clinical hypothyroidism, compared with 86 percent of the general population, but the difference was not statistically significant.

Vitamin D deficiency affects the thyroid in several ways. It plays an important role in balancing TH1, which is cell mediated, and TH2, which is humoral immunity. It does this by influencing T-regulatory cells, the TH3 cells that govern the expression and differentiation of TH1 and TH2 cells.

Vitamin D deficiency is also specifically associated with autoimmune thyroid disease and has been shown to benefit autoimmune-mediated thyroid dysfunction. It regulates insulin secretion and sensitivity and balances blood sugar. A recent paper showed that vitamin D deficiency is associated with insulin resistance, and insulin resistance and dysglycemia adversely affect thyroid physiology in several ways. This is a clear example here, this case study of inflammation reducing the conversion of T4 to T3.



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Celiac autoimmunity in autoimmune thyroid disease is highly prevalent with a questionable impact.

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Abstract

INTRODUCTION: The prevalence of autoimmune thyroid disease (AITD) is 10-12% in the general population worldwide. Among various disorders co-existing with AITD, the concomitance of celiac disease (CD) with AITD results in poor absorption of thyroid medications and results in higher doses of the same. Institution of gluten-free diet (GFD) in this cohort helps reduce medication doses.

AIM: To screen patients with AITD for the presence of celiac autoimmunity (CA).

MATERIALS AND METHODS: A total of 280 consecutive patients with AITD attending the thyroid Out-patient Department of a tertiary care hospital were screened for the presence of tissue transglutaminase antibodies (immunoglobulin A tissue transglutaminase). Those with a positive titer (but < 10 times the upper limit of normal) underwent upper gastrointestinal endoscopy and duodenal mucosal biopsy for the diagnosis of CD, followed by institution of GFD in confirmed cases.

RESULTS: Of a total of 280 (182 females and 98 males) patients with AITD screened, 24 (8.6%) turned out to be positive for CA. Of 24 (8.6%), 15 (8.24%) females and 9 (9.18%) males were positive for CA. There was no statistically significant difference in the thyroxine doses required for normalization of thyroid function and the weight of the patients in CA positive and CA negative patients.

CONCLUSIONS: The prevalence of CD in patients with AITD is much greater than in the general population. This forms the basis for screening patients with AITD for presence of CD.

KEYWORDS: Autoimmunity; celiac disease; thyroid disease

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I've written a lot over the years about the connection between autoimmune thyroid disease and gluten intolerance. The prevalence of celiac disease is much higher in patients with autoimmune thyroid disease, and patients with both autoimmune thyroid disease and celiac disease have common genetic backgrounds. Antigliadin antibodies are more likely to be present in patients with autoimmune thyroid disease as well. In fact, a connection is so strong, some researchers suggest that all patients with autoimmune thyroid disease be screened for celiac disease and non-celiac gluten sensitivity.

Marker	Value	Functional Range	Lab Range
Glucose	75	75 – 85	65 - 99
Hemoglobin A1c	5.4	4.4 – 5.4	4.8 - 5.6
Uric Acid	4.7	3.2 - 5.5	2.5 - 7.1
BUN	14	13 – 18	6 - 24
Creatinine	0.81	0.85 – 1.1	0.57 - 1
Sodium	139	135 – 140	134 - 144
Potassium	4.2	4.0 – 4.5	3.5 - 5.2
Chloride	101	100 – 106	97 - 108
C02	25	25 – 30	18 - 29
Calcium	8.8	9.2 – 10.1	8.7 - 10.2
Phosphorus	3.8	3.5 – 4.0	2.5 - 4.5
Magnesium	1.9	2.0 – 2.5	1.6 - 2.6
Protein, total	6.2	6.9 – 7.4	6.0 - 8.5
Albumin	4.1	4.0 – 5.0	3.5 - 5.5
Globulin	2.1	2.4 – 2.8	1.5 - 4.5
A/G ratio	2.0	1.5 – 2.0	1.1 - 2.5
Bilirubin, total	0.8	0.1 – 1.2	0.0 - 1.2
Alkaline Phosphatase	32	42 – 107	39 - 117
LDH	123	140 - 180	119 - 226
AST	22	10 - 30	0 - 40
ALT	14	10 - 22	0 - 32
GGT	10	10 - 26	0 - 60
TIBC	231	250 – 350	250 - 450
UIBC	117	150 - 375	150 - 375
Iron	114	85 – 135	35 - 155
Iron saturation	49	15 – 40	15 - 55
Ferritin	79	10 - 122	15 - 150
Cholesterol, total	229	150 – 250	100 - 199
Triglycerides	38	50 – 100	0 - 149
HDL	85	55 – 85	> 39
LDL	136	0 – 175	0 - 99
Triglycerides / HDL Ratio	0.45	< 2	< 3.8
TSH	0.719	0.5 – 2.5	0.45 - 4.50
T4, total	8.3	6.0 – 12	4.5 - 12
T3 Uptake	37	28 - 35	24 - 39
T3, Total	65	100 – 180	71 - 180

Notice that his alkaline phosphatase was low. Alkaline phosphatase is an enzyme that removes phosphate groups from a variety of molecules, and one of its roles is to detoxify lipopolysaccharide, or LPS, from Gram-negative bacteria. Alkaline phosphatase enzymes are anti-inflammatory and have evolved to help us tolerate our resident microbes by making us less reactive to them. Think of alkaline phosphatase as a marker of immune tolerance.

Although elevated alkaline phosphatase is found in conditions such as liver and bone disease, decreased levels are sometimes found in hypothyroidism and Hashimoto's. Thyroid hormone induces the production of alkaline phosphatase, so low thyroid hormone can mean low alkaline phosphatase levels. Also, malabsorption nutrient deficiency, which are nutrients that are cofactors required to make alkaline phosphatase, low-protein diets, and fasting will decrease alkaline phosphatase levels. This patient has low T3 as well as gut inflammatory conditions, so it makes sense that his alkaline phosphatase would be low.

Thyroid				
TSH	0.800		uIU/mL	0.450 – 4.500
Thyroxine (T4)	**4.2**	**Low**	ug/dL	4.5 – 12.0
T3 Uptake	**40**	**High**	%	24 – 39
Free Thyroxine Index	1.7			1.2 – 4.9
Triiodothyronine (T3)	**66**	**Low**	ng/dL	71 – 180

This next case is interesting. It's a 26-year-old patient with chief complaints of fatigue, tachycardia spells, and digestive distress, including intractable constipation. Notice that her TSH is on the low end, but her T4 and T3 are also low. In a classic hypothyroid presentation, you would expect to see high TSH when T4 and T3 are low, but that's not the case here.

This is a condition known as central hypothyroidism, which is hypothyroidism due to insufficient stimulation by TSH of an otherwise normal thyroid gland. It has a prevalence of approximately 1 in 80,000 to 1 in 120,000, so it's pretty rare. It can be secondary to hypothyroidism caused by pituitary malfunction or tertiary hypothyroidism caused by hypothalamic malfunction. In adults, it's usually due to pituitary macroadenomas, pituitary surgeries, or postirradiation, and it can be confirmed by a TSH stimulation test. However, this presentation can also occur in Hashimoto's, especially in the early stages when the immune attack is relapsing and remitting, and that was true for this patient.

Notice that her T3 uptake is high, and this can be caused by high testosterone, and chronic insulin surges and blood sugar problems can also lead to this, particularly in women. This patient had PCOS with high testosterone levels. Low T3 uptake can be caused by high estrogens, and you most often see this in women taking oral contraceptives.

Another possible cause of low TSH and low T4 to T3 is secondary hypothyroidism, and this is a problem with the hypothalamus or pituitary, as we just discussed. For example, in autoimmune hypopituitarism, the body attacks the pituitary gland, which is the central control center for hormone production. The onset is typically gradual and unfolds over a period of years, though it can happen more quickly. Generally, the production of growth hormone is lost first, and then luteinizing hormone deficiency follows. The loss of follicle-stimulating hormone, or FSH, thyroid-stimulating hormone, adrenocorticotropic hormones, or ACTH, and prolactin typically follow much later. In this situation, you'd not only see low TSH, you'd see low growth hormone, LH, FSH, and ACTH. However, this is quite rare, 46 cases out of 100,000 people, so you're less likely to see it in clinical practice.

TSH	1.570		uIU/mL	0.450 - 4.500
Thyroxine (T4)	***<0.5***	***Alert***	ug/dL	4.5 - 12.0
Verified by repeat analysis				
T3 Uptake	27		%	24 - 39
Free Thyroxine Index	**<.1**	**Low**		1.2 - 4.9
Triiodothyronine (T3)	**47**	**Low**	ng/dL	71 - 180
T4F+T3F				
Triiodothyronine,Free,Serum	**1.5**	**Low**	pg/mL	2.0 - 4.4
T4,Free(Direct)	**0.18**	**Low**	ng/dL	0.82 - 1.77
Thyroid Antibodies				
Thyroid Peroxidase (TPO) Ab	9		IU/mL	0 - 34
Thyroglobulin, Antibody	<1.0		IU/mL	0.0 - 0.9

The lab on this slide was the single case that I've seen. This person also had low GH, LH, FSH, and ACTH, but notice that her TSH was normal. This was the lowest level of T4 and free T4 that I've ever seen. It actually came back with an alert from the lab. She also had very low levels of T3, 47 for total T3, and free T3 was 1.5. Notice that her thyroid antibodies were normal.

Marker	Value	Functional Range	Lab Range
Glucose	91	75 – 90	65 - 99
Hemoglobin A1c	5.5	4.4 – 5.4	4.8 - 5.6
Uric Acid	4.9	3.2 - 5.5	2.5 - 7.1
BUN	13	13 – 18	6 - 20
Creatinine	0.69	0.85 – 1.1	0.57 - 1
Sodium	139	135 – 140	134 - 144
Potassium	4.6	4.0 – 4.5	3.5 - 5.2
Chloride	101	100 – 106	97 - 108
C02	22	25 – 30	18 - 29
Calcium	9.4	9.2 – 10.1	8.7 - 10.2
Phosphorus	4.6	3.5 – 4.0	2.5 - 4.5
Magnesium	2.0	2.0 – 2.6	1.6 - 2.6
Protein, total	7.1	6.9 – 7.4	6.0 - 8.5
Albumin	4.5	4.0 – 5.0	3.5 - 5.5
Globulin	2.6	2.4 – 2.8	1.5 - 4.5
A/G ratio	1.7	1.5 – 2.0	1.1 - 2.5
Bilirubin, total	0.8	0.1 – 1.2	0.0 - 1.2
Alkaline Phosphatase	56	42 – 107	39 - 117
LDH	138	140 - 180	119 - 226
AST	14	10 - 30	0 - 40
ALT	11	10 - 22	0 - 32
GGT	8	0 - 28	0 - 60
TIBC	304	250 – 350	250 - 450
UIBC	174	150 - 375	150 - 375
Iron	130	85 – 135	35 - 155
Iron saturation	43	15 – 45	15 - 55
Ferritin	29	15 - 120	15 - 150
Cholesterol, total	167	150 – 250	100 - 199
Triglycerides	53	50 – 100	0 - 149
HDL	34	55 – 85	> 39
LDL	122	0 – 175	0 - 99
T. Chol / HDL Ratio	4.9	< 3	0 - 4.4
Triglycerides / HDL Ratio	1.56	< 2	< 3.8
TSH	5.760	0.5 – 2.5	0.45 - 4.50
T4, total	6.4	6.0 – 12	4.5 - 12.0
T3 Uptake	25	28 - 35	24 - 39
T3, Total	110	100 – 180	71 - 180
Vitamin D, 25-hydroxy	29.9	35 - 60	30.0 - 100.0

Marker	Value	Functional Range	Lab Range
WBC	3.5	5.0 – 8.0	3.4 - 10.8
RBC	3.98	4.4 – 4.9	3.77 - 5.28
Hemoglobin	11.8	13.5 - 14.5	11.1 - 15.9
Hematocrit	35.6	37 - 44	34.0 - 46.6
MCV	89	85 – 92	79 - 97
MCH	29.6	27.7 – 32.0	26.6 - 33.0
MCHC	33.1	32 – 35	31.5 - 35.7
RDW	12.5	11.5 – 15.0	12.3 - 15.4
Platelets	266	150 – 415	150 - 379
Neutrophils	57	40 – 60	
Lymphocytes	31	25 – 40	
Monocytes	7	4.0 – 7.0	
Eosinophils	4	0.0 – 3.0	
Basophils	1	0.0 – 3.0	

Additional Tests:			
T3, Free	2.8	2.5 - 4.0	2 - 4.4
T4, Free	0.94	1 - 1.5	0.82 - 1.77
Thyroid – TPO Ab	810		0 - 34
Thyroid – TGA	7.4		0 - 0.9
CRP-hs	1.65	< 1.0	0.00 - 3.00
Homocysteine	8.2	< 9.0	0.0 - 15.0
Vitamin B-12	565	450 – 2000	211 - 946
Copper	144		72 - 166
Zinc	149		56 - 134
Zinc / Copper Ratio	1.03	> 0.85	
Serum Methylmalonic Acid (MMA)	76	0 - 325	0 - 378
Rheumatoid Arthritis Factor	40.3		0 - 13.9

The next patient is a 41-year-old female with chief complaint of neck and joint pain, palpitations. No other significant symptoms. Her TSH is lab high at 5.76. Her total T4, T3, and free T3 were completely normal, and her free T4 was borderline low in the functional range. Both TPO and thyroglobulin antibodies are elevated, as is her C-reactive protein, which is indicative of inflammation. Notice again her low 25(OH)D. It's a common finding in hypothyroid patients. Also notice her elevated rheumatoid factor. This patient has both Hashimoto's and rheumatoid arthritis, and it's important to note that patients with autoimmune thyroid disease are more likely to have another autoimmune disease than people without autoimmune thyroid disease.

One study showed that the frequency of another autoimmune disease with Hashimoto's was 14.3 percent, with rheumatoid arthritis being the most common; 4.2 percent of patients with Hashimoto's have rheumatoid arthritis. That statistic just accounts for autoimmune disease, where the body is actually acting on antibody production. I suspect the production of antibodies to tissue in patients with autoimmune thyroid disease is significantly higher.

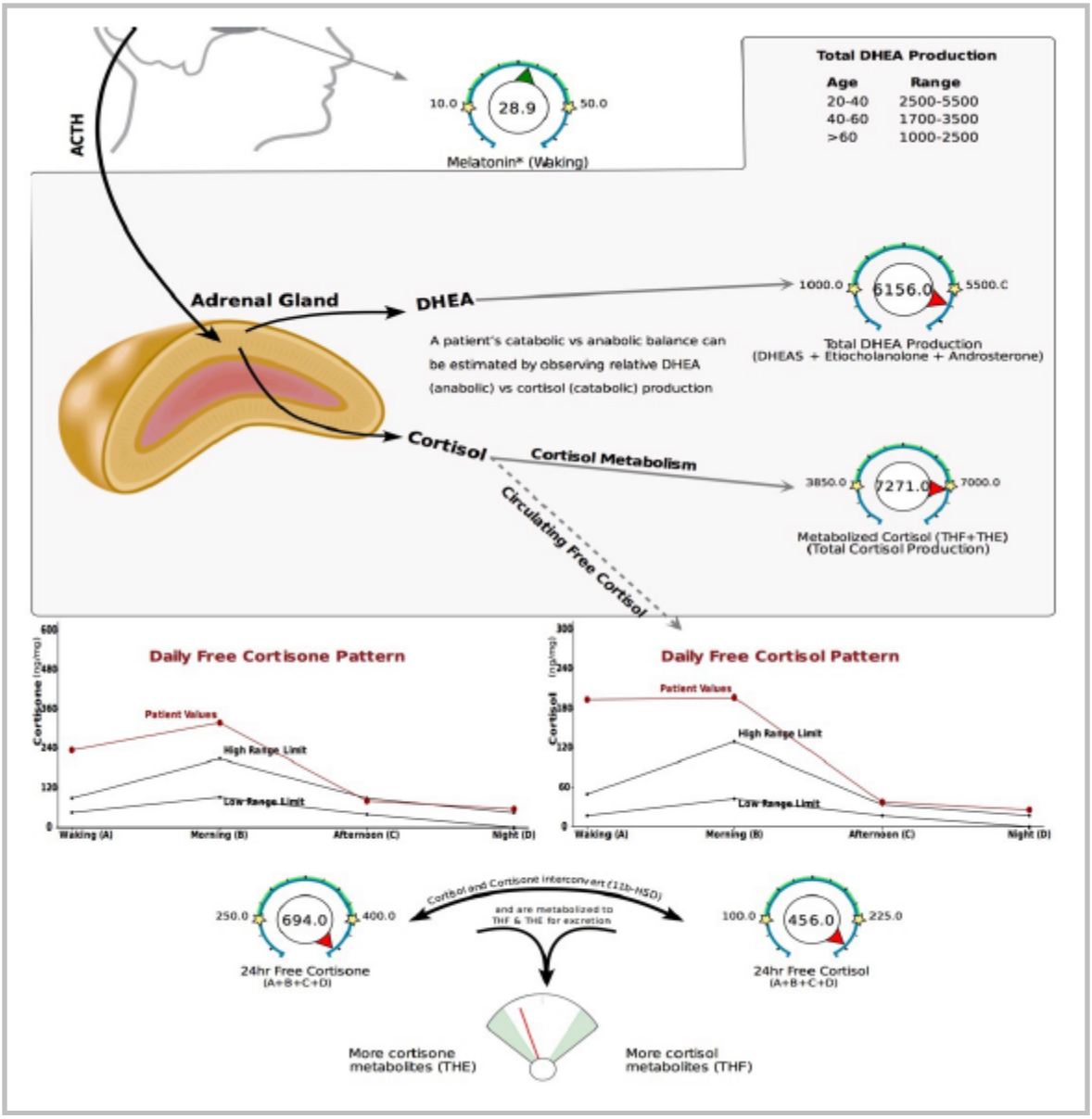
TEST	RESULT			
Array 5 – Multiple Autoimmune Reactivity Screen **	**IN RANGE (Normal)**	**EQUIVOCAL***	**OUT OF RANGE**	**REFERENCE** (ELISA Index)
Parietal Cell + ATPase			1.69	0.1-1.4
Intrinsic Factor		0.90		0.1-1.2
ASCA + ANCA	0.92			0.2-1.4
Tropomyosin			3.27	0.1-1.5
Thyroglobulin		1.30		0.1-1.3
Thyroid Peroxidase		1.01		0.1-1.3
21-Hydroxylase (Adrenal Cortex)		1.17		0.2-1.2
Myocardial Peptide	0.76			0.1-1.5
Alpha-Myosin	0.90			0.3-1.5
Phospholipid	0.81			0.2-1.3
Platelet Glycoprotein		1.14		0.1-1.3
Ovary/Testis ***	0.77			0.1-1.2
Fibulin	1.01			0.4-1.6
Collagen Complex			2.49	0.2-1.6
Arthritic Peptide	0.77			0.2-1.3
Osteocyte	1.05			0.1-1.4
Cytochrome P450 (Hepatocyte)	0.80			0.3-1.6
Insulin + Islet Cell			2.12	0.4-1.7
Glutamic Acid Decarboxylase 65			1.83	0.2-1.6
Myelin Basic Protein		1.15		0.1-1.4
Asialoganglioside			2.42	0.1-1.4
Alpha-Tubulin + Beta-Tubulin	0.71			0.4-1.4
Cerebellar	0.92			0.2-1.4
Synapsin		1.18		0.1-1.2

I ran Cyrex Array 5 on the patient from the last slide, and these were the results. She was producing antibodies to multiple tissues. This doesn't mean she has all of these autoimmune diseases, but it does mean she may be at higher risk for them later in life, especially if the immune dysfunction isn't addressed. This is why it is so crucial to do that in the treatment. In the conventional model, clinicians rarely test for antibodies to TPO or thyroglobulin because it doesn't change their treatment plan. They are just going to use replacement thyroid hormone no matter what. However, you now see why it's so important to test for antibodies. Our job as functional medicine clinicians isn't just to treat disease. It's also to prevent it.

Marker	Value	Functional Range	Lab Range
Glucose	88	75 - 90	65 - 99
Hemoglobin A1c	5.0	4.4 – 5.4	4.8 - 5.6
Uric Acid	5.2	3.7 – 6.0	3.7 - 8.6
BUN	12	13 – 18	6 - 20
Creatinine	0.88	0.85 – 1.1	0.76 - 1.27
BUN/Creatinine Ratio	14	8 – 19	8 - 19
Sodium	143	135 – 140	134 - 144
Potassium	4.5	4.0 – 4.5	3.5 - 5.2
Chloride	102	100 – 106	97 - 108
C02	25	25 – 30	18 - 29
Calcium	9.6	9.2 – 10.1	8.7 - 10.2
Phosphorus	4.0	3.5 – 4.0	2.5 - 4.5
Magnesium	1.9	2.0 – 2.6	1.6 - 2.6
Protein, total	6.7	6.9 – 7.4	6.0 - 8.5
Albumin	4.3	4.0 – 5.0	3.5 - 5.5
Globulin	2.4	2.4 – 2.8	1.5 - 4.5
A/G ratio	1.8	1.5 – 2.0	1.1 - 2.5
Bilirubin, total	0.4	0.1 – 1.2	0.0 - 1.2
Alkaline Phosphatase	73	42 – 107	39 - 117
LDH	116	140 - 180	121 - 224
AST	28	10 - 30	0 - 40
ALT	65	10 - 29	0 - 44
GGT	11	0 - 40	0 - 65
TIBC	230	250 – 350	250 - 450
UIBC	171	150 - 375	150 - 375
Iron	59	85 – 135	40 - 155
Iron saturation	26	15 – 45	15 - 55
Ferritin	552	30 - 150	30 - 400
Cholesterol, total	224	150 - 240	100 - 199
Triglycerides	49	50 – 100	0 - 149
HDL	71	55 – 85	> 39
LDL	143	0 – 175	0 - 99
T. Chol / HDL Ratio	3.2	< 3	0 - 5.0
Triglycerides / HDL Ratio	0.69	< 2	
TSH	2.980	0.5 – 2.5	0.45 - 4.50
T4, total	6.0	6.0 – 12	4.5 - 12
T3 Uptake	34	30 - 38	24 - 39
T3, Total	70	100 – 180	71 - 180
Vitamin D, 25-hydroxy	37.9	35 - 60	30.0 - 100.0

Marker	Value	Functional Range	Lab Range
WBC	6.9	5.0 – 8.0	3.4 - 10.8
RBC	5.38	4.4 – 4.9	4.14 - 5.8
Hemoglobin	16.1	14 - 15	12.6 - 17.7
Hematocrit	46	40 - 48	37.5 - 51.0
MCV	86	85 – 92	79 - 97
MCH	29.9	27.7 – 32.0	26.6 - 33.0
MCHC	35	32 – 35	31.5 - 35.7
RDW	13.8	11.5 – 15.0	12.3 - 15.4
Platelets	173	150 – 415	150 - 379
Neutrophils	56	40 – 60	
Lymphocytes	32	25 – 40	
Monocytes	9	4.0 – 7.0	
Eosinophils	2	0.0 – 3.0	
Basophils	1	0.0 – 3.0	
Additional Tests:			
CRP-hs	<0.10	< 1.0	0.00 - 3.00
Homocysteine	5.6	< 7.0	0.0 - 15.0
Vitamin B-12	1276	450 – 2000	211 - 946
Copper	73		72 - 166
Zinc	161		56 - 134
Zinc / Copper Ratio	2.21	> 0.85	
Serum Methylmalonic Acid (MMA)	74	0 - 325	0 - 378

The next case is a 28-year-old male with chief complaint of mild headaches, reduced stamina, severe food restrictions, allergies, and constant belching. He had a functionally high TSH, borderline-low T4 in the functional range, and lab-low T3. Also note very high ferritin at 552, which is out of the lab range, low TIBC, high ALT, and then a normal CRP, so this is suggestive of iron overload. His thyroid antibodies were normal.



Check out his cortisol. Very high levels of both free cortisol and free cortisone. Metabolized cortisol was a little bit high, as was DHEA. This is a significant hyperactivation of the HPA axis. Remember, the more accurate term is hypothalamic–pituitary–thyroid–gonadal–adrenal axis, so the thyroid has a bidirectional relationship with the HPTGA axis, and they affect each other. This patient had gut inflammation with elevated lactoferrin and calprotectin, as well as chronic inflammatory response syndrome. He'd been living in a moldy apartment in college.

TESTS	RESULT	FLAG	UNITS	REFERENCE INTERVAL	LAB
TSH+T4F+T3Free					
TSH	2.160		uIU/mL	0.450 - 4.500	01
Triiodothyronine,Free,Serum	2.2		pg/mL	2.0 - 4.4	01
T4,Free(Direct)	1.00		ng/dL	0.82 - 1.77	01

Here are his results after addressing the HPA axis dysfunction and CIRS, definitely better. TSH is closer to the optimal range, but free T3 and free T4 are still at the bottom of the range, so in this case, it might make sense to address his thyroid directly.

TESTS	RESULT	FLAG	UNITS	REFERENCE INTERVAL	LAB
TSH+T4F+T3Free					
TSH	1.780		uIU/mL	0.450 - 4.500	01
Triiodothyronine,Free,Serum	2.4		pg/mL	2.0 - 4.4	01
T4,Free(Direct)	**0.69**	**Low**	ng/dL	0.82 - 1.77	01
Thyroid Antibodies					
Thyroid Peroxidase (TPO) Ab	**184**	**High**	IU/mL	0 - 34	01
Thyroglobulin, Antibody	<1.0		IU/mL	0.0 - 0.9	01
Please Note:					01
Low positive Thyroglobulin antibodies are seen in a portion of the asymptomatic populations.					
Antithyroglobulin antibodies measured by Beckman Coulter Methodology					

Here is another presentation you'll need to be aware of. TSH is normal. Free T3 is normal in the reference range but borderline low in the functional range. Positive TPO antibodies and lab-low free T4. This patient had Hashimoto's and was taking Armour Thyroid. When the patient is taking medication with T3 in it, you'll often see lab-low T4 and normal T3. This is due to negative feedback inhibition. The body sees plenty of T3 in the bloodstream and reduces the output endogenously of T4. In this situation, most clinicians will treat to TSH and free T3 and ignore total T4 and free T4, and I think that is the right approach.

Thyroid				
TSH	0.800		uIU/mL	0.450 - 4.500
Thyroxine (T4)	**4.2**	**Low**	ug/dL	4.5 - 12.0
T3 Uptake	**40**	**High**	%	24 - 39
Free Thyroxine Index	1.7			1.2 - 4.9
Triiodothyronine (T3)	**66**	**Low**	ng/dL	71 - 180
Immunoassay				
Vitamin D, 25-Hydroxy	40.5		ng/mL	32.0 - 100.0
Recent studies consider the lower limit of 32.0 ng/mL to be a threshold for optimal health. Hollis BW. J Nutr. 2005 Feb;135(2):317-22.				
CBC, Platelet Ct, and Diff				
WBC	4.7		x10E3/uL	4.0 - 10.5
RBC	3.88		x10E6/uL	3.80 - 5.10
Hemoglobin	13.4		g/dL	11.5 - 15.0
Hematocrit	40.3		%	34.0 - 44.0
MCV	**104**	**High**	fL	80 - 98
MCH	**34.5**	**High**	pg	27.0 - 34.0
MCHC	33.3		g/dL	32.0 - 36.0
RDW	12.3		%	11.7 - 15.0
Platelets	216		x10E3/uL	140 - 415
Neutrophils	52		%	40 - 74
Lymphs	28		%	14 - 46
Monocytes	8		%	4 - 13
Eos	**10**	**High**	%	0 - 7
Basos	2		%	0 - 3
Neutrophils (Absolute)	2.5		x10E3/uL	1.8 - 7.8

The next patient is a 41-year-old female with chief complaint of tachycardia, night sweats, and gut distress. She wakes in the night with racing heart, drenched in sweat. Notice her low T4 and low T3 but with low-normal TSH. This is one of these cases that doesn't fit the textbook. Antibody testing was negative, but thyroid ultrasound revealed diffuse multinodular goiter, which is very sensitive for Hashimoto's. Also note that her MCV, or mean corpuscular volume, is high at 104. MCV can be used to distinguish between macrocytic and microcytic anemia, as we'll discuss in the anemia section, but studies have shown that MCV is often high in hypothyroid conditions as well. In my experience, this typically only happens in overt hypothyroidism, but I've seen it in subclinical hypothyroidism as well.