KRESSER INSTITUTE
FOR FUNCTIONAL AND EVOLUTIONARY MEDICINE

Iron Deficiency - Part Four

Marker	Value	Functional Range	Lab Range
Glucose	89	75 - 90	65 - 99
Hemoglobin A1c	5.6	4.4 – 5.4	4.8 - 5.6
BUN	11	13 – 18	6 - 20
Creatinine	0.77	0.85 – 1.1	0.57 - 1.00
BUN/Creatinine Ratio	14	9 – 23	9 - 23
Sodium	138	135 – 140	134 - 144
Potassium	4.5	4.0 – 4.5	3.5 - 5.2
Chloride	100	100 – 106	97 - 108
C02	20	25 – 30	18 - 29
Calcium	9.6	9.2 – 10.1	8.7 - 10.2
Protein, total	7.0	6.9 – 7.4	6.0 - 8.5
Albumin	4.6	4.0 – 5.0	3.5 - 5.5
Globulin	2.4	2.4 – 2.8	1.5 - 4.5
A/G ratio	1.9	1.5 – 2.0	1.1 - 2.5
Bilirubin, total	0.3	0.1 – 1.2	0.0 - 1.2
Alkaline Phosphatase	77	42 – 107	39 - 117
AST	12	10 - 30	0 - 40
ALT	13	10 - 22	0 - 32
TIBC	290	275 – 425	250 - 450
UIBC	258	175 - 350	150 - 375
Iron	32	40 – 135	35 - 155
Iron saturation	11	17 – 45	15 - 55
Ferritin	16	30 - 100	15 - 150
Vitamin D, 25-hydroxy	36.5	35 - 60	30.0 - 100.0
Cholesterol, total	186	150 - 250	100 - 199
Triglycerides	116	50 – 100	0 - 149
HDL	48	55 – 85	> 39
LDL	115	0 - 175	0 - 99
T. Chol / HDL Ratio	3.9	< 3	0 - 4.4
Triglycerides / HDL Ratio	2.42	< 2	< 3.8
CRP-hs	2.07	< 1.0	0.00 - 3.00
Homocysteine	8.2	< 7.0	0.0 - 15.0

Marker	Value	Functional Range	Lab Range
TSH	0.051	0.5 – 2.5	0.45 - 4.500
T3, Free	3.7	2.5 - 4.0	2 - 4.4
T4, Free	1.15	1 - 1.5	0.82 - 1.77
Thyroid – TPO Ab	6		0 - 34
Thyroid – TGA	<1.0		0 - 0.9
WBC	7.6	5.0 – 8.0	3.4 - 10.8
RBC	4.87	4.4 – 4.9	3.77 - 5.28
Hemoglobin	13.2	13.5 - 14.5	11.1 - 15.9
Hematocrit	41.2	37 - 44	34 - 46.6
MCV	85	85 – 92	79 - 97
MCH	27.1	27.7 – 32.0	26.6 - 33.0
MCHC	32	32 – 35	31.5 - 35.7
RDW	14.4	11.5 – 15.0	12.3 - 15.4
Platelets	345	150 – 415	150 - 379
Neutrophils	69	40 – 60	
Lymphocytes	25	25 – 40	
Monocytes	4	4.0 – 7.0	
Eosinophils	2	0.0 – 3.0	
Basophils	0	0.0 – 3.0	
Cortisol-AM	27.1		6.2 - 19.4

The next patient is a 40-year-old female who had been vegan for 10 years and vegetarian for 26 years, since she was 14 years old. She wasn't doing this for health or ethical reasons but mostly because she didn't like the taste of meat and was a very picky eater. Her serum iron and iron saturation are out of the lab range. Ferritin, hemoglobin, and MCH are out of the functional range. In theory, ferritin should be the first marker to go out of range, but although it is out of the functional range here, serum iron and transferrin saturation are lower on a relative basis, so again, patients don't always present with the textbook combination of markers.

Note that her TSH is low. In this case, it was facetious hyperthyroidism, which is hyperthyroidism that is induced by taking too much thyroid medication. Also, her A1c is 5.6. Even though her fasting glucose is normal at 89, this could suggest a dysglycemia condition. Further testing would be required to figure that out. Her CRP is 2.07, which is in the normal range but higher than what I like to see. I prefer it to be below one. She also had SIBO; gut inflammation; B12 and folate deficiencies, which is another relatively common consequence of a vegan diet; high metabolized cortisol and low free cortisol, which happens in hyperthyroidism; and then high DHEA.

I myself have done many diets over the years. I was a macrobiotic vegan at one point. I don't have a lot of judgment toward people about what dietary choices they make, but I do believe it's my job as a clinician to educate them about the potential consequences of their dietary choices. If you look in the scientific literature, you'll find that iron deficiency and deficiency of several other nutrients are significantly more common in people following plant-based diets than they are in

people following omnivorous diets, and I've certainly seen that to be the case in my clinical experience as well. So, it's just something you need to be aware of as a clinician, and there is a way of talking about it with patients that is nonjudgmental, and it respects their choices but also gives them the information they need to make effective choices that support their health, whether that is a change in their diet, if they are open to it, or whether that is supplementing with the nutrients that they are deficient in.

Marker	Value	Functional Range	Lab Range
Glucose	99	75 - 90	65 - 99
Hemoglobin A1c	5.5	4.8 – 5.4	4.8 - 5.6
Uric Acid	3.1	3.2 - 5.5	2.5 - 7.1
BUN	6	13 – 18	6 - 20
Creatinine	0.47	0.85 – 1.1	0.57 - 1.00
BUN/Creatinine Ratio	13	9 – 23	8 - 20
Sodium	138	134 – 140	134 - 144
Potassium	4.6	4.0 – 4.5	3.5 - 5.2
Chloride	97	100 – 106	97 - 108
C02	25	25 – 30	18 - 29
Calcium	8.8	9.2 – 10.1	8.7 - 10.2
Phosphorus	3.0	3.5 – 4.0	2.5 - 4.5
Magnesium	1.9	2.0 – 2.6	1.6 - 2.3
Protein, total	5.9	6.9 – 7.4	6.0 - 8.5
Albumin	3.3	4.0 – 5.0	3.5 - 5.5
Globulin	2.6	2.4 – 2.8	1.5 - 4.5
A/G ratio	1.3	1.5 – 2.0	1.1 - 2.5
Bilirubin, total	<0.2	0.1 – 1.2	0.0 - 1.2
Alkaline Phosphatase	77	42 – 107	39 - 117
LDH	109	140 - 180	119 - 226
AST	13	10 - 30	0 - 40
ALT	9	10 - 22	0 - 32
GGT	18	0 - 28	0 - 60
TIBC	159	275 – 425	250 - 450
UIBC	144	175 - 350	131 - 425
Iron	15	40 – 135	27 - 159
Iron saturation	9	17 – 45	15 - 55
Ferritin	162	30 - 100	15 - 150
Vitamin B-12	654	450 – 2000	211 - 946
Vitamin D, 25-hydroxy	28.7	35 - 60	30.0 - 100.0
Cholesterol, total	135	150 - 250	100 - 199
Triglycerides	94	50 – 100	0 - 149
HDL	45	55 – 85	> 39
LDL	71	0 - 175	0 - 99
T. Chol / HDL Ratio	3.0	< 3	0 - 4.4
Triglycerides / HDL Ratio	2.09	< 2	< 3.8
CRP-hs	158.87	< 1.0	0.00 - 3.00
Homocysteine	7.1	< 7.0	0.0 - 15.0

Marker	Value	Functional Range	Lab Range
TSH	1.010	0.5 – 2.5	0.45 - 4.500
T4, total	6.5	6.0 – 12	4.5 - 12.0
T3 Uptake	27	28 - 35	24 - 39
T3, Total	121	100 – 180	71 - 180
Copper	134		72 - 166
Zinc	68		56 - 134
Zinc / Copper Ratio	0.51	> 0.85	
Serum Methylmalonic Acid (MMA)	80	0 - 325	0 - 378
WBC	7.3	5.0 – 8.0	3.4 - 10.8
RBC	4.04	4.4 – 4.9	3.77 - 5.28
Hemoglobin	11.8	13.5 - 14.5	11.1 - 15.9
Hematocrit	36.1	37 - 44	34 - 46.6
MCV	89	85 – 92	79 - 97
MCH	29.2	27.7 – 32.0	26.6 - 33.0
MCHC	32.7	32 – 35	31.5 - 35.7
RDW	13.6	11.5 – 15.0	12.3 - 15.4
Platelets	417	150 – 415	150 - 379
Neutrophils	66	40 – 60	
Lymphocytes	18	25 – 40	
Monocytes	14	4.0 – 7.0	
Eosinophils	2	0.0 – 3.0	
Basophils	0	0.0 – 3.0	

Next patient is a 31-year-old female who was diagnosed in 2007 with ulcerative colitis and was mostly able to manage it with diet, but in 2009 had a flare when her son was born. More recently, she was having a flare that began about seven weeks ago. This is about eight months postpartum. As you can see by her result on this slide, there is a lot going on here. Her iron and iron saturation were lab low. Red blood cells, hemoglobin, and hematocrit were functionally low, which is suggestive of iron-deficiency anemia at first glance. However, take a look at her ferritin. It's actually high at 162, and then her TIBC and UIBC are low, which, again, are inverse markers, so that would indicative of iron overload.

So what's going on here? This is a condition that is known as anemia of chronic disease or inflammation, and we will discuss this. We're going to spend an entire week on it later in the ADAPT course, but the basic gist of it is that all life on Earth needs iron, including pathogens, and when a pathogen is present, the body in its wisdom attempts to sequester iron and ferritin to prevent worsening of the infection. This is a new patient, and I was still testing her for infections at the time of this recording. She did have Klebsiella on her stool panel, but I think Klebsiella itself would be unlikely to cause this pattern.

Check our her C-reactive protein. It's nearly 160, which is 50 times the upper end of the range. Her total protein and albumin were low. Her blood sugar was high. Her platelets are high. Zinc-to-copper ratio is high. This patient is not iron deficient, and if you give her iron, you could likely make

her infection worse, and in some cases, this has been fatal. There have been situations where people were taking iron who had Yersinia pestis infection, and they died of plague, so it's a real consideration. Unfortunately, few clinicians are aware of this. Again, the iron panel is rarely run, and they just see low hemoglobin and red blood cells and give iron. This is a good example of why that is not a safe approach.

COMPLETE BLOOD COUNT (CBC) WITH AUTOMATED DIFFEREN 03/14/2016

Results	Value	Reference Range	Status	Flag	Date
WBC	11.8 10x3/uL	(4.0-11.0)	completed	High	03/14/2016
RDW	16.1 %	(11.7-14.4)	completed	High	03/14/2016
RBC	3.89 10x6/uL	(3.93-5.22)	completed	Low	03/14/2016
PLATELET COUNT	264 10x3/uL	(146-430)	completed		03/14/2016
NEUT %	72.7 %	(34.0-71.1)	completed	High	03/14/2016
NEUT #	8.58 10x3/uL	(1.56-6.13)	completed	High	03/14/2016
MPV	10.8 fl	(9.4-12.3)	completed		03/14/2016
MONO %	12.4 %	(4.7-12.5)	completed		03/14/2016
MONO #	1.46 10x3/uL	(0.24-0.86)	completed	High	03/14/2016
MCV	88 fl	(79-99)	completed		03/14/2016
MCHC	32 g/dL	(32-36)	completed		03/14/2016

Results	Value	Reference Range	Status	Flag	Date
MCH	28 pg	(25-33)	completed		03/14/2016
LYMPH %	13.8 %	(19.3-51.7)	completed	Low	03/14/2016
LYMPH #	1.63 10x3/uL	(1.18-3.74)	completed		03/14/2016
HGB	10.8 g/dL	(11.0-15.2)	completed	Low	03/14/2016
HCT	34.2 %	(34.0-46.0)	completed		03/14/2016
EOS %	0.8 %	(0.7-5.8)	completed		03/14/2016
EOS #	0.09 10x3/uL	(0.04-0.36)	completed		03/14/2016
BASO %	0.3 %	(0.1-1.2)	completed		03/14/2016
BASO #	0.03 10x3/uL	(0.01-0.08)	completed		03/14/2016

This patient is a 37-year-old female in the 30th week of pregnancy. She had these labs done through her primary care provider. Her hemoglobin, RDW, red blood cells, and MCHC suggested anemia. Note that during pregnancy, especially in the second and third trimesters of pregnancy, blood volume expands, and the normal range for hemoglobin drops to 10 to 14, although most labs still list it as 11 to 15. It is unfortunate that this is poorly understood as well, even among obstetricians. They will often prescribe iron when they see hemoglobin drop below 12. This wouldn't be an issue if prescribing iron during pregnancy were harmless, but there are many studies that show that excess iron supplementation during pregnancy leads to worse outcomes, and we'll again discuss this more in the anemia unit later. In this case, however, the fact that RDW is high suggested that iron deficiency is likely and that this patient may benefit from iron supplementation.

Marker	Value	Functional Range	Lab Range
TIBC	560	275 – 425	250 - 450
UIBC	528	175 - 350	150 - 375
Iron	32	40 – 135	40 - 155
Iron saturation	6	17 – 45	15 - 55
Ferritin	8	30 - 100	15 - 150

TESTS	RESULT	FLAG	UNITS	REFERENCE INTERVAL	LAB
Fe+TIBC+Fer					
Iron Bind.Cap.(TIBC)	***560***	***Alert***	ug/dL	250 - 450	
UIBC	**528**	**High**	ug/dL	131 - 425	01
Iron, Serum	32		ug/dL	27 - 159	01
Iron Saturation	***6***	***Alert***	%	15 - 55	
Ferritin, Serum	**8**	**Low**	ng/mL	15 - 150	01

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As we discussed before, it's never safe to assume that low hemoglobin is a sign of iron deficiency without actually checking iron levels, so I ran an iron panel on the previous patient, and this is what came back. Indeed, she was severely iron deficient. You'll sometimes get an alert like this from the lab with red underline markers. It can be pretty scary for a patient to see, but it definitely gets the point across. Her iron-binding capacity was at an alert level at 560. Her iron saturation was extremely low at 6. Her ferritin was very low at 8. Her serum iron, interestingly enough, was low but within the reference range, so again, this is why you cannot trust serum iron as a marker. Her UIBC was very high at 528. I immediately started her on a course of iron supplementation and increased her intake of iron-rich foods.

Marker	Value	Functional Range	Lab Range
Glucose	83	75 - 90	65 - 99
Hemoglobin A1c	5.3	4.4 – 5.4	4.8 - 5.6
Uric Acid	3.5	3.2 - 5.5	2.5 - 7.1
BUN	14	13 – 18	6 - 20
Creatinine	0.90	0.85 – 1.1	0.57 - 1.00
BUN/Creatinine Ratio	16	9 – 23	9 - 23
Sodium	138	135 – 140	134 - 144
Potassium	4.1	4.0 – 4.5	3.5 - 5.2
Chloride	103	100 – 106	97 - 108
C02	24	25 – 30	18 - 29
Calcium	9.3	9.2 – 10.1	8.7 - 10.2
Phosphorus	3.5	3.5 – 4.0	2.5 - 4.5
Magnesium	1.9	2.0 – 2.6	1.6 - 2.6
Protein, total	7.0	6.9 – 7.4	6.0 - 8.5
Albumin	4.5	4.0 – 5.0	3.5 - 5.5
Globulin	2.5	2.4 – 2.8	1.5 - 4.5
A/G ratio	1.8	1.5 – 2.0	1.1 - 2.5
Bilirubin, total	0.3	0.1 – 1.2	0.0 - 1.2
Alkaline Phosphatase	74	42 – 107	39 - 117
LDH	233	140 - 180	119 - 226
AST	23	10 - 30	0 - 40
ALT	12	10 - 22	0 - 32
GGT	15	0 - 28	0 - 60
TIBC	344	275 – 425	250 - 450
UIBC	260	175 - 350	150 - 375
Iron	54	40 – 135	35 - 155
Iron saturation	17	17 – 45	15 - 55
Ferritin	24	30 - 100	15 - 150
Vitamin B-12	952	450 – 2000	211 - 946
Vitamin D, 25-hydroxy	33.5	35 - 60	30.0 - 100.0
Cholesterol, total	160	150 - 250	100 - 199
Triglycerides	56	50 – 100	0 - 149
HDL	61	55 – 85	> 39
LDL	88	0 - 175	0 - 99
T. Chol / HDL Ratio	2.6	< 3	0 - 4.4
Triglycerides / HDL Ratio	0.92	< 2	< 3.8
CRP-hs	0.16	< 1.0	0.00 - 3.00
Homocysteine	8.1	< 7.0	0.0 - 15.0

Marker	Value	Functional Range	Lab Range
TSH	1.520	0.5 – 2.5	0.45 - 4.500
T4, total	6.7	6.0 – 12	4.5 - 12.0
T3 Uptake	27	28 - 35	24 - 39
T3, Total	116	100 – 180	71 - 180
T3, Free	2.8	2.5 - 4.0	2 - 4.4
T4, Free	1.08	1 - 1.5	0.82 - 1.77
Thyroid – TPO Ab	19		0 - 34
Thyroid – TGA	<1.0		0 - 0.9
Copper	95		72 - 166
Zinc	85		56 - 134
Zinc / Copper Ratio	0.89	> 0.85	
WBC	5.5	5.0 – 8.0	3.4 - 10.8
RBC	4.44	4.4 – 4.9	3.77 - 5.28
Hemoglobin	13.5	13.5 - 14.5	11.1 - 15.9
Hematocrit	41.9	37 - 44	34 - 46.6
MCV	94	85 – 92	79 - 97
MCH	30.4	27.7 – 32.0	26.6 - 33.0
MCHC	32.2	32 – 35	31.5 - 35.7
RDW	13.0	11.5 – 15.0	12.3 - 15.4
Platelets	242	150 – 415	150 - 379
Neutrophils	53	40 – 60	
Lymphocytes	27	25 – 40	
Monocytes	8	4.0 – 7.0	
Eosinophils	11	0.0 – 3.0	
Basophils	1	0.0 – 3.0	

The next patient is a 30-year-old female with a chief complaint of severe eczema. She had also done lab testing with a previous clinician, indicating hormonal genetic thyroid and vitamin and mineral deficiency issues. Her iron markers indicate borderline or very early-stage iron deficiency. Ferritin is 24, which is just barely out of the functional range, and iron saturation is right on the lower end of the functional range at 17. She may also have a deficiency of active B12. High B12 levels without supplementation, which was true for her here, may be an indicator of inadequate levels of active B12, and she has borderline high levels of MCV, which can also be a sign of B12 or folate deficiency. Vitamin D and magnesium are also functionally low, indicating a possible problem with nutrient absorption. Her other test results suggested dysbiosis, gut mucosal immune activation, and very low free and metabolized cortisol, which is a sign that inflammation may be present because cortisol is a potent anti-inflammatory hormone, and when it's low, we're unable to resolve the inflammatory response.

Marker	Value	Functional Range	Lab Range
Glucose	83	75 - 90	65 - 99
Hemoglobin A1c	5.5	4.4 – 5.4	4.8 - 5.6
Uric Acid	3.3	3.7 – 6.0	1.9 - 5.8
BUN	11	13 – 18	5 - 18
Creatinine	0.49	0.85 – 1.1	0.76 - 1.27
BUN/Creatinine Ratio	22	8 – 19	8 - 19
Sodium	140	135 – 140	134 - 144
Potassium	4.2	4.0 – 4.5	3.5 - 5.2
Chloride	100	100 – 106	97 - 108
C02	21	25 – 30	17 - 27
Calcium	10.3	9.2 – 10.1	9.1 - 10.5
Phosphorus	5.4	3.5 – 4.0	2.5 - 5.6
Magnesium	2.0	2.0 – 2.6	1.6 - 2.6
Protein, total	7.9	6.9 – 7.4	6.0 - 8.5
Albumin	5.2	4.0 – 5.0	3.5 - 5.5
Globulin	2.7	2.4 – 2.8	1.5 - 4.5
A/G ratio	1.9	1.5 – 2.0	1.1 - 2.5
Bilirubin, total	0.2	0.1 – 1.2	0.0 - 1.2
Alkaline Phosphatase	206	42 – 107	134 - 349
LDH	211	140 - 180	155 - 280
AST	27	10 - 30	0 - 40
ALT	12	10 - 29	0 - 29
GGT	15	0 - 40	0 - 65
TIBC	362	275 – 425	250 - 450
UIBC	310	175 - 350	150 - 375
Iron	52	40 – 135	40 - 155
Iron saturation	14	17 – 45	15 - 55
Ferritin	32	30 - 100	16 - 77
Vitamin B-12	692	450 – 2000	211 - 946
Vitamin D, 25-hydroxy	37.2	35 - 60	30.0 - 100.0
Cholesterol, total	145	150 - 240	100 - 199
Triglycerides	43	50 – 100	0 - 89
HDL	63	55 – 85	> 39
LDL	73	0 - 175	0 - 109
T. Chol / HDL Ratio	2.3	< 3	0 - 5.0
Triglycerides / HDL Ratio	0.68	< 2	< 3.8
CRP-hs	0.51	< 1.0	0.00 - 3.00
Homocysteine	6.4	< 7.0	0.0 - 15.0

Marker	Value	Functional Range	Lab Range
TSH	4.960	0.5 – 2.5	0.60 - 4.84
T4, total	7.3	6.0 – 12	4.5 - 12
T3 Uptake	26	30 - 38	24 - 33
T3, Total	178	100 – 180	92 - 219
Copper	124		72 - 166
Zinc	107		56 - 134
Zinc / Copper Ratio	0.86	> 0.85	
WBC	11.3	5.0 – 8.0	3.7 - 10.5
RBC	4.98	4.4 – 4.9	3.91 - 5.45
Hemoglobin	14.5	14 - 15	11.7 - 15.7
Hematocrit	42.8	40 - 48	34.8 - 45.8
MCV	86	85 – 92	77 - 91
MCH	29.1	27.7 – 32.0	25.7 - 31.5
MCHC	33.9	32 – 35	31.7 - 36.0
RDW	14.1	11.5 – 15.0	12.3 - 15.1
Platelets	388	150 – 415	176 - 407
Neutrophils	48	40 – 60	
Lymphocytes	33	25 – 40	
Monocytes	13	4.0 – 7.0	
Eosinophils	6	0.0 – 3.0	
Basophils	0	0.0 – 3.0	

The next patient is an 11-year-old male with behavioral and emotional issues, diagnosed on the autism spectrum. He was adopted from Russia at the age of four, and he was born into extremely challenging circumstances there. The only iron marker that is out of range, as you can see, out of the lab range is iron saturation. Ferritin is normal for his age, but it's borderline low in the functional range. The other issues on his blood chemistry were low creatinine, possibly indicating inadequate muscle development; high white blood cell count, possibly indicating infection; hypothyroidism—his TSH was 4.96, which was out of the lab range, but interestingly enough, both his T4 and T3 were in the normal range, so this is known as subclinical hypothyroidism, and we'll be talking more about this in the thyroid unit.

Other tests that we had for him included heavy metal toxicity. He had very high levels of arsenic and lead. He had severe dysbiosis; fungal overgrowth; two parasites, Blastocystis hominis and D. fragilis; and severely impaired methylation.

TESTS	RESULT	FLAG	UNITS	REFERENCE INTERVAL	LAB
Fe+TIBC+Fer					
Iron Bind.Cap.(TIBC)	379		ug/dL	250 - 450	
UIBC	355		ug/dL	150 - 375	01
Iron, Serum	**24**	**Low**	ug/dL	35 - 155	01
Iron Saturation	***6***	***Alert***	%	15 - 55	
Ferritin, Serum	18		ng/mL	15 - 150	01
TSH+T4F+T3Free					
TSH	2.270		uIU/mL	0.450 - 4.500	01
Triiodothyronine,Free,Serum	2.2		pg/mL	2.0 - 4.4	01
T4,Free(Direct)	1.12		ng/dL	0.82 - 1.77	01
HNK1 (CD57) Panel					
% CD8-/CD57+ Lymphs	3.0		%	2.0 - 17.0	02
This test was developed and its performance characteristics determined by LabCorp. It has not been cleared or approved by the Food and Drug Administration. The FDA has determined that such clearance or approval is not necessary. Results of this test are for investigational purposes only. The result should not be used as a diagnostic procedure without confirmation of the diagnosis by another medically established diagnostic product or procedure.					
Abs.CD8-CD57+ Lymphs	87		/uL	60 - 360	
This test was developed and its performance characteristics determined by LabCorp. It has not been cleared or approved by the Food and Drug Administration. The FDA has determined that such clearance or approval is not necessary. Results of this test are for investigational purposes only. The result should not be used as a diagnostic procedure without confirmation of the diagnosis by another medically established diagnostic product or procedure.					
WBC	9.0		x10E3/uL	3.4 - 10.8	01
RBC	4.67		x10E6/uL	3.77 - 5.28	01
Hemoglobin	**10.8**	**Low**	g/dL	11.1 - 15.9	01
Hematocrit	35.3		%	34.0 - 46.6	01

TESTS	RESULT	FLAG	UNITS	REFERENCE INTERVAL	LAB
MCV	**76**	**Low**	fL	79 - 97	01
MCH	**23.1**	**Low**	pg	26.6 - 33.0	01
MCHC	**30.6**	**Low**	g/dL	31.5 - 35.7	01
RDW	**16.4**	**High**	%	12.3 - 15.4	01
Platelets	**490**	**High**	x10E3/uL	150 - 379	01
Neutrophils	59		%		01
Lymphs	33		%		01
Monocytes	8		%		01
Eos	0		%		01
Basos	0		%		01
Neutrophils (Absolute)	5.3		x10E3/uL	1.4 - 7.0	01
Lymphs (Absolute)	2.9		x10E3/uL	0.7 - 3.1	01
Monocytes(Absolute)	0.7		x10E3/uL	0.1 - 0.9	01
Eos (Absolute)	0.0		x10E3/uL	0.0 - 0.4	01
Baso (Absolute)	0.0		x10E3/uL	0.0 - 0.2	01
Immature Granulocytes	0		%		01
Immature Grans (Abs)	0.0		x10E3/uL	0.0 - 0.1	01

The next patient is a 40-year-old female engineer at Google. She had a history of childhood Kawasaki's and Lyme disease diagnoses. She had also several autoimmune conditions, including

uveitis and Hashimoto's thyroiditis. She had liver issues, joint issues, skin problems, and IBS, so she was in pretty bad shape when she came to see us. She had very low serum iron and iron saturation. Again, the lab issued an alert here. Her iron saturation was 6, which is among the lowest that I've seen. This is the final stage of iron deficiency here, manifesting as anemia. You see the low hemoglobin at 10.8, and then you see the low MCV, MCH, MCHC, and the high RDW, so this is a pretty textbook case.

She also has thrombocytosis, and her platelet count was high. That can actually be caused by severe iron deficiency and also by infections and inflammation in autoimmune conditions, so it could have been any or all of the above in this particular case.