QUICKSILVER SCIENTIFIC®

Powering Natural Health®

METALS TESTING SUPPORT GUIDE

Welcome to Quicksilver Scientific®!

Quicksilver Scientific®, the leader in liposomal delivery systems, advanced detoxification protocols, and dietary supplements was founded by Dr. Christopher Shade, an environmental metals chemist. Early in his career, he developed and patented the game-changing analytical technology for mercury speciation. Wanting to bring this innovative testing to the public, the Mercury Tri-Test® was born providing the only clinical test on the market that utilizes mercury speciation analysis - separating methyl mercury from inorganic mercury and measuring each directly to assess total body burden. Quicksilver Scientific's CLIA-certified laboratory offers practitioners access to the most comprehensive, in depth measurement of human mercury exposure available today.

TESTING SERVICES

Mercury Tri-Test®

The Mercury Tri-Test® is a clinical test that utilizes mercury speciation analysis, a patented advanced technology that separates methyl mercury (MeHg) from inorganic mercury (HgII). It utilizes samples of blood, urine, and hair to assess the body's magnitude and source of exposure as well as the body's ability to excrete each form of mercury. Quicksilver Scientific's instruments are sensitive enough to measure ambient mercury levels in the body without the need for challenge testing and helps build an informed picture in order to plan a rational approach for successful detoxification.

Will it pick up on Thimerasol mercury from vaccines?
Yes. The form of mercury used as an adjuvant in vaccines is Ethylmercury, a synthetic organomercury. Once in the body it is relatively quickly converted to Inorganic mercury

Blood Metals Panel

The Blood Metals Panel screens a total of 16 elements to show elevated exposure or imbalances in whole blood. The analysis uses state-of-the-art inductively coupled plasma/mass spectroscopy. The elements are categorized as follows: Eight nutrient elements - calcium, copper, lithium, magnesium, manganese, molybdenum, selenium, and zinc; five toxic elements - antimony, arsenic, cadmium, lead, and mercury; and three potentially toxic elements - cobalt, silver, and strontium. Additionally, the Blood Metals Panel measures the ratios of Ca/Mg and Cu/Zn which, when out of balance, can present clinically as heavy metal toxicity.

What makes the BMP test superior to the hair testing for heavy metals?
Blood tests are the most accurate way to assess toxic levels of metals. Past testing may not have been sensitive enough to see lower levels which led to using hair, but that isn't the case anymore. Hair tests show excretion of the metals so if the liver and bile flow is poor, then the hair may not accurately reflect the level. Hair could be useful for some metals like Aluminum though since they are difficult to test for in the blood.

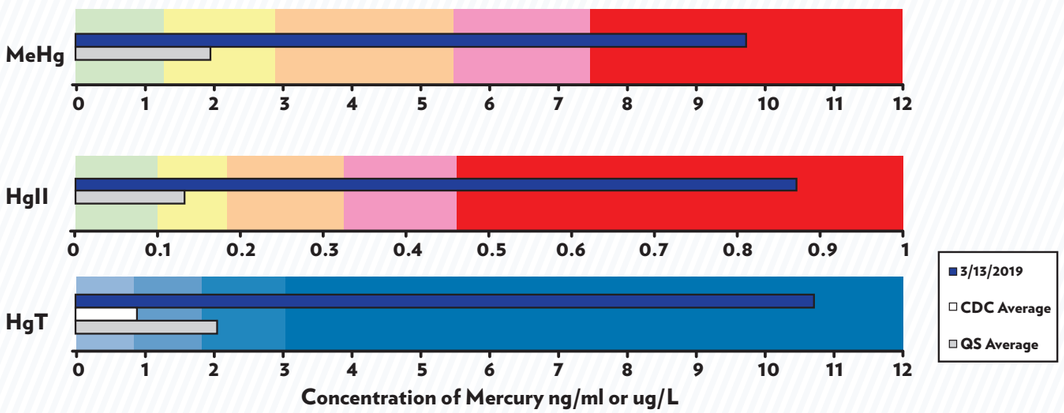
Mercury Tri-Test® Sample Report

MERCURY TRI-TEST®

Jane Doe					
Practitioner	John Doe	**Dates**	**Taken**	**Arrived**	**Analyzed**
			3/13/2019	3/15/2019	3/19/2019
Date of Birth	8/10/1951		NA	NA	NA

Blood Results

BLOOD MERCURY COMPARISON



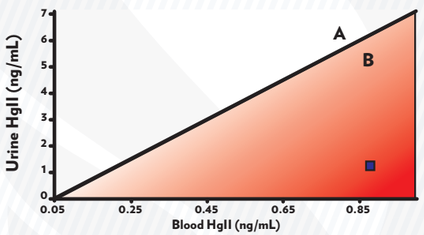
	JANE DOE Results (ng/mL)			REFERENCE RANGES QS n=1011; n=1928			Percentile			
	3/13/2019	NA	% Change	Source	Range	Average	50th	75th	90th	95th
Methylmercury - MeHg	9.76	NA	NA	QS	<0.003 to 23.3	1.95	1.2	2.9	5.4	7.4
Inorganic Mercury - HgII	0.870	NA	NA	QS	<0.007 to 1.75	0.139	0.10	0.19	0.32	0.46
Sum - HgT	10.63	NA	NA	CDC	<0.038 to 9.96	0.833	0.7	1.7	3	4.6

When a follow up test is administered, results will show here.

Blood Reference Values: Quicksilver Scientific (QS) Data represents 1011 males and females that have utilized our testing. CDC data represents 1928 females ages 16 to 49. QS blood Hg concentrations are higher than CDC because QS analyzes blood from a population that already suspects mercury toxicity.
Data and Analysis Information: Mercury speciation was performed at Quicksilver Scientific, and all values are in concentrations of ng Hg per mL of blood

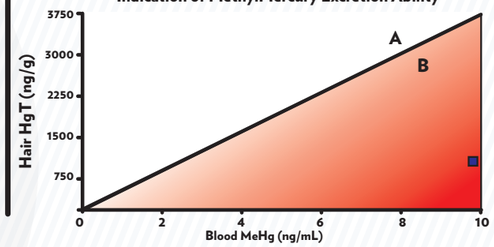
Urine Results

Indication of Inorganic Mercury Excretion Ability



Hair Results

Indication of MethylMercury Excretion Ability



Legend
A) Average Excretion: Mercury output is average or above average when at a ratio of at least 375:1 HgT in hair to MeHg in blood and 6:9:1 HgT in urine to HgII in blood.
B) Below Average Excretion: Mercury output is below average when the tissue Hg comparisons are below ratios mentioned above (red area)

	JANE DOE Urine Results (ng/mL)			Hair (ng/g)
	3/13/2019	NA	% Change	3/13/2019
Methylmercury - MeHg	0.60	NA	NA	NA
Inorganic Mercury - HgII	1.23	NA	NA	NA
Sum - HgT	1.83	NA	NA	1087

NOTE: This sample report reflects levels and excretion abilities before treatment. A follow up test is recommended after detoxification support. These test results will be added to the original results to reflect reduction percentages in mercury and excretion improvements.

Mercury Tri-Test® Interpretive Guide

MERCURY TRI-TEST®

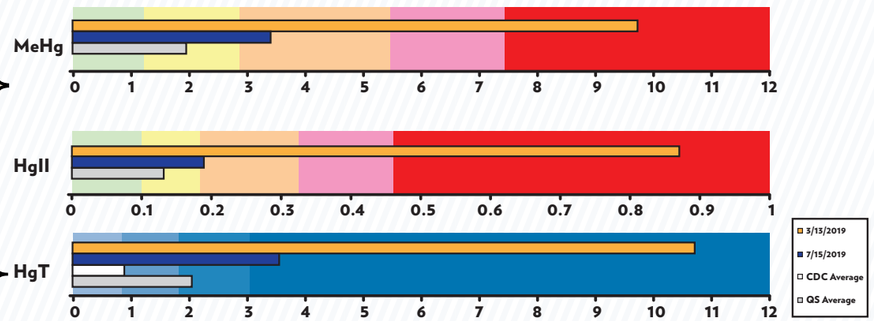
Jane Doe					
Practitioner	John Doe	**Dates**	**Taken**	**Arrived**	**Analyzed**
		Present	7/15/2019	7/17/2019	7/23/2019
Date of Birth	8/10/1951	Previous	3/13/2019	3/15/2019	3/19/2019

Blood Results

BLOOD MERCURY COMPARISON

Blood results of mercury speciation. If patient tests twice, like in this example, the first results are in gold, the second results in blue and Quicksilver's test averages are in gray.

Centers for Disease Control averages are in white.



Another view of both results in table format with the change percentage noted.

	JANE DOE Results (ng/mL)			REFERENCE RANGES QS n=1011; n=1928			Percentile			
	7/15/2019	3/13/2019	% Change	Source	Range	Average	50th	75th	90th	95th
Methylmercury - MeHg	3.33	9.76	-66	QS	<0.003 to 23.3	1.95	1.2	2.9	5.4	7.4
Inorganic Mercury - HgII	0.192	0.870	-78	QS	<0.007 to 1.75	0.139	0.10	0.19	0.32	0.46
Sum - HgT	3.52	10.63	-67	CDC	<0.038 to 9.96	0.833	0.7	1.7	3	4.6

Blood Results

Methylmercury (MeHg) and inorganic mercury (HgII) are directly measured via mercury speciation analysis (Liquid Chromatography coupled with Cold-Vapor Atomic Fluorescence Spectrometry). The total mercury (HgT) result is calculated as the sum of measured methylmercury and inorganic mercury. All values are in concentrations of nanograms of Hg per milliliter of blood. Notable values:

Methyl Mercury: <4.5 lower risk; >4.5 moderate to high risk

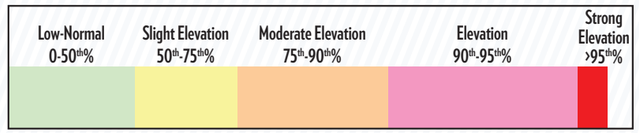
Inorganic Mercury: <0.15 lower risk; >0.15 moderate to high risk

Blood Reference Values

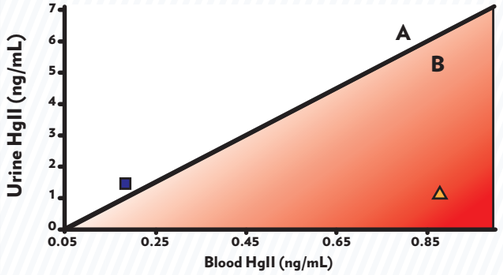
Quicksilver Scientific® (QS) data represents 1011 males and females that have utilized our testing. CDC data represents 1928 females, ages 16 to 49. Quicksilver Scientific blood Hg concentrations are higher than CDC reflecting values closer to population studies in Europe.

Color Reference Ranges

The colors in the bar chart are based on percentiles of the tested QS population and can be interpreted for either methyl or inorganic mercury. The sum of mercury forms (HgT) is provided for comparison to U.S. averages of blood mercury percentiles from the Center for Disease Control.

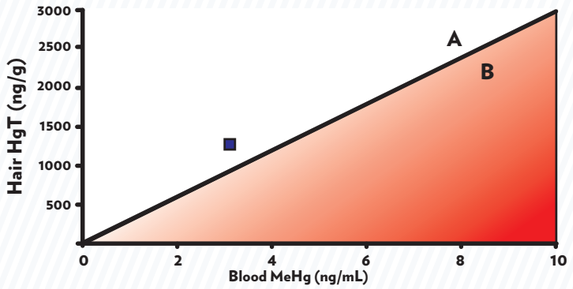


Urine Results



In this example, where the patient has tested twice, the first result is the yellow triangle and the second result is the blue square. Excretion ability has improved.

Hair Results



Legend

Patient data point: Represents urine to blood ratio and hair to blood ratio.
Diagonal line: Represents optimum excretion of mercury in urine and hair as determined by histograms of QS population.
A area (in white): Indicates healthy rate of Hg excretion.
B area (in red): Indicates inefficient removal of Hg from the blood.

JANE DOE

	Urine Results (ng/mL)			Hair (ng/g)
	7/15/2019	3/13/2019	% Change	7/15/2019
Methylmercury - MeHg	0.38	0.60	-37	NA
Inorganic Mercury - HgII	1.47	1.23	20	0.0
Sum - HgT	1.85	1.83	1	1368

Urine to Blood Ratio Interpretation

The dominant form of mercury excreted by the kidneys is inorganic mercury (HgII). Mercury output is average or above average at a ratio of at least 6.9:1 HgT in urine to HgII in blood for levels above 0.05 ng/mL.

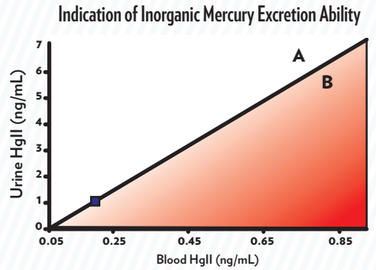
- **Results ABOVE the line:** Indicates a sufficient, healthy rate of mercury excretion through the kidneys. Mercury blood levels typically decline rapidly once exposure to mercury is removed (such as amalgam removal).
- **Results BELOW the line:** Indicates inefficient excretion of mercury through the kidneys. Typically, this results in bodily stores of inorganic mercury. Blood levels of mercury are slow to drop once exposure to mercury is removed.

Hair to Blood Ratio Interpretation

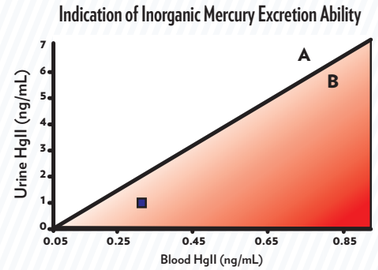
The hair to blood ratio reflects MeHg excretion. Essentially all Hg in hair begins as methylmercury, thus speciation analysis is unnecessary, and results will be listed as HgT.

Mercury excretion is average or above average at a ratio of at least 375:1 HgT in hair to MeHg in blood. This ratio is sensitive to recent changes in fish consumption since hair results are reflective of blood levels 1-3 months prior to the hair being cut. A recent reduction of fish consumption may cause the ratio to appear high, whereas a recent increase in fish consumption may cause the ratio to appear low - especially fish consumed within 2-3 days of the blood draw. Thus, this ratio needs to be interpreted with more flexibility and leniency than the urine to blood ratio.

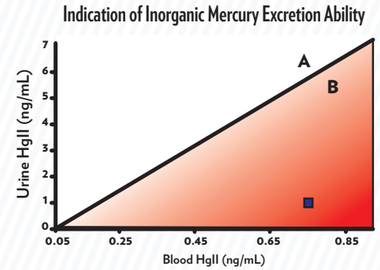
- **Results ABOVE the line:** Indicates sufficient, healthy metabolism of methylmercury.
- **Results BELOW the line:** Indicates inefficient metabolism of methylmercury.



Good Ratio



Slightly Depressed Ratio



Strongly Depressed Ratio

Considerations

In the body, methylmercury from fish can demethylate and convert into inorganic mercury. If the patient does not have amalgams and has both elevated methylmercury and elevated inorganic mercury, this is the likely scenario.

Exposure

- **Methylmercury:** Consumption of fresh saltwater fish and seafood. A small amount of amalgam derived mercury may be methylated by bacteria in the gut, but this is typically negligible.
- **Inorganic mercury:** Inhalation of mercury released by dental amalgams, airborne mercury, demethylation of methylmercury, and from certain cosmetics (e.g. skin whitening creams).

Note on Amalgam Fillings

If a patient currently has amalgam fillings, the only way to fully resolve high mercury is to remove the source (amalgam), complete a properly designed detoxification program, and retest in order to assess progress. Intensive, cellular-level detoxification protocols are not recommended for patients who currently have amalgams. For these patients, a gentle, less aggressive detoxification protocol may be appropriate.

Blood Metals Panel Sample Report

Elemental Analysis - Whole Blood

Inductively Coupled Plasma/Mass Spectrometry

Patient

		Dates	Taken	Arrived	Analyzed
Practitioner	Practitioner	Present	mm/dd/yyyy	mm/dd/yyyy	1/0/1900
Date Of Birth	mm/dd/yyyy	Previous	NA	NA	NA

Nutrient Elements

Element	Results	Prior	Recommended Limit	Units	Percentile Rank by Quintile 10 20 30 40 50 60 70 80 90	Percentile
Calcium (Ca)	**0.00**	NA	4.7 - 6.4	mg/dL		#N/A
Copper (Cu)	**0**	NA	63 - 113	µg/dL		#N/A
Lithium (Li)	**< 0.1**	NA	< 0.1 - 21	µg/L		#VALUE!
Magnesium (Mg)	**0.00**	NA	2.93 - 4.17	mg/dL		#N/A
Manganese (Mn)	**< 0.1**	NA	4.26 - 14.3	µg/L		#VALUE!
Molybdenum (Mo)	**< 0.2**	NA	< 0.2 - 1.9	µg/L		#VALUE!
Selenium (Se)	**0**	NA	79 - 362	µg/L		#N/A
Zinc (Zn)	**0**	NA	454 - 745	µg/dL		#N/A

When a follow up test is administered, results will show here.

5th - 95th percentile of QS test population.

Results below or above the percentile range will flag red to indicate concerning levels.

Whole Blood Element Ratios

Element	Results	Prior	Recommended Limit	Units	Percentile Rank by Quintile 10 20 30 40 50 60 70 80 90	Percentile
Ca/Mg Ratio	**#DIV/0!**	NA	1.20-1.99	NA		#DIV/0!
Cu/Zn Ratio	**#DIV/0!**	NA	0.09-0.21	NA		#DIV/0!

5th - 95th percentile of QS test population.

Results below or above the percentile range will flag red to indicate concerning ratios.

Toxic Elements

Element	Results	Prior	Recommended Limit	Units	Percentile Rank by Quintile 10 20 30 40 50 60 70 80 90	Percentile
Antimony (Sb)	**< 0.04**	NA	< 7.0	µg/L		#VALUE!
Arsenic (As)	**< 0.2**	NA	< 6.3	µg/L		#VALUE!
Cadmium (Cd)	**< 0.1**	NA	< 0.74	µg/L		#VALUE!
Lead (Pb)	**< 0.03**	NA	< 2.34	µg/dL		#VALUE!
Mercury (Hg)	**< 0.1**	NA	< 5.8	µg/L		#VALUE!

Potentially Toxic Elements

Element	Results	Prior	Recommended Limit	Units	Percentile Rank by Quintile 10 20 30 40 50 60 70 80 90	Percentile
Cobalt (Co)	**< 0.1**	NA	< 2.0	µg/L		#VALUE!
Silver (Ag)	**< 0.1**	NA	< 2.6	µg/L		#VALUE!
Strontium (Sr)	**< 1**	NA	< 470	µg/L		#VALUE!

**Arsenic, cadmium, lead and mercury are considered the four most toxic elements. Optimally, levels should fall below 50th percentile.*

These test results are not intended for the diagnosis of disease. They are intended for interpretation by qualified healthcare professionals with a full knowledge of patient history to assist in their administration of an appropriate healthcare regimen.

Nutrient & Toxic Element Levels & Symptoms Guide

BLOOD METALS PANEL

Nutrient Element	Cause of Imbalance	Signs and Symptoms
Calcium	**LOW LEVELS:** Malnutrition and poor calcium intake, dietary intolerance, hormonal changes (especially in women), genetic factors, medications that decrease absorption. **HIGH LEVELS:** Overactive parathyroid gland, thyroid disease, chronic kidney problems, adrenal dysfunction, fungal infections, certain medications, too much vitamin D, cancer.	**LOW:** Confusion or memory loss, muscle spasms, numbness and tingling in hands, feet and face, depression, hallucinations, muscle cramping, weak and brittle nails, fracturing of bones, slow hair growth and fragile, thin skin. **HIGH:** Poor bone health, kidney stones, abnormal heart and brain function, excessive thirst and frequent urination, abdominal pain, lethargy, anxiety and depression.
Copper	**LOW LEVELS:** May occur secondary to malnutrition or intestinal malabsorption. Measurement of ceruloplasmin is a mandatory prerequisite to supplementation of copper when it is low in erythrocytes. **HIGH LEVELS:** Wilson's disease (a genetic disease where the accumulation of copper in tissues leads to liver and brain damage). High levels may occur during inflammatory responses, with redistribution of copper from the liver to peripheral tissues. In females, some increase may result from estrogen therapy or use of oral or copper IUD contraceptives.. Copper excess can occur when zinc is displaced from functional binding sites. It may also displace molybdenum. Conversely, zinc or molybdenum deficiencies may allow accumulation of copper as does liver disease or biliary insufficiency/obstruction. Most copper is excreted via bile and biliary dysfunction may cause excessive red blood cell copper.	**LOW:** Copper insufficiency signs include fatigue, maldigestion, hair loss, poor night vision and reduced taste. **HIGH:** Fatigue, anemia, dermatitis, metallic taste and loss of appetite, and discoloration of teeth. Decreased zinc and molybdenum serum levels.
Lithium	**LOW LEVELS:** Low absorption and/or impaired uptake is a possibility. **HIGH LEVELS:** Excessive intake of lithium supplementation or medication.	**LOW:** Mood swings, bipolar, mania, high blood serum of B12 (Lithium is needed to get B12 into cells). **HIGH:** Kidney and thyroid damage, diarrhea, vomiting, stomach pains, fatigue, tremors, uncontrollable movements, muscle weakness, drowsiness, weakness, seizures, agitation, rapid heartbeat, hyperthermia, low blood pressure, confusion.
Magnesium	**LOW LEVELS:** Low RBC magnesium can be a result of a poor quality diet, fasting or anorexia, intestinal malabsorption, alcoholism, renal/urinary wasting of magnesium, stress, chronic diarrhea or hyperparathyroid function. **HIGH LEVELS:** Poor renal clearance or renal insufficiency, parenteral overdose and excessive use of oral magnesium salts together with impaired renal clearance.	**LOW:** Fatigue, lack of physical endurance, muscle twitches or tremor, hypertension, constipation, and low mood. **HIGH:** Hypotension, hypothermia, vasodilation, nausea and diarrhea with oral Mg excess, and CNS depression with sleepiness.

Nutrient Element	Cause of Imbalance	Signs and Symptoms
Manganese	**LOW LEVELS:** Poor quality diet, maldigestion or malabsorption. Profuse sweating or diarrhea can reduce body retention of manganese; relatively little manganese is excreted via urine. **HIGH LEVELS:** Drinking water (usually private wells), contaminated foods, and occasionally from therapeutic medications taken over a long period. Biliary insufficiency or obstruction can cause abnormally increased retention and levels of manganese. Documented cases of intoxication from industrial mining, and chemical process industries. Used in paints and coatings, some batteries, industrial catalysts, gasoline (MMT), metal alloy fabrications and glass manufacturing. Street drugs may be contaminated.	**LOW:** Increased allergic or inflammatory responses, fatigue (can become chronic), abnormal blood glucose levels, impaired growth of bone, nails or hair, weight loss, poor blood clotting, hyperaminoacidemia/ hyperaminoaciduria with nitrogen excess, possible hyperammonemia, and arthritic joint symptoms. **HIGH:** Fatigue, headache. Acute intoxication may cause bradykinetic-rigidity syndrome (like Parkinson's disease), 'Manganese Madness' with euphoria and hallucinations. Clinical evidence connects excess to inappropriate aggressive or violent behaviors.
Molybdenum	**LOW LEVELS:** Possibly due to absorption issues. Genetic mutation of CBS enzyme. **HIGH LEVELS:** Exposure to piping and welding materials. Excessive dietary supplementation or dietary intake.	**LOW:** Sulfite intolerance and low uric acid are consistent with molybdenum insufficiency. Also, fatigue, somnolence and amino acid intolerance. Sensitivity to sulfur containing foods like onions and garlic. May cause increase in serum copper. **HIGH:** An increase in serum levels of uric acid and ceruloplasmin may occur; xanthine oxidase, gout-like symptoms, acute psychosis with hallucinations, seizures and neurologic symptoms. Change in copper metabolism.
Selenium	**LOW LEVELS:** Poor quality diet, intestinal malabsorption, or urinary wasting of selenium. **HIGH LEVELS:** Contaminated drinking water and electronic components including photovoltaic cells, batteries and semiconductors. Some inorganic pigments and glazes and vulcanized rubber, metal blueing solutions (gun blues). Dithiocarbamate insecticides and insect repellents may contain selenium. Incorrectly formulated nutritional supplements.	**LOW:** Muscle aches, hypothyroid function, sclerosing of tissue, anemia, increased dental caries, inflammatory response, oxidative stress due to lowered antioxidant activity of glutathione. **HIGH:** Mild elevations of selenium are usually of no clinical significance. Very excessive selenium can have toxic effects and include the following symptoms: fatigue, garlic-like breath, metallic taste, yellowish-to-pink-red discoloration of nails, skin, teeth and eyelids, unstable blood pressure, irregular menses, hair loss, anorexia, or lymphocytosis.
Zinc	**LOW LEVELS:** Intestinal malabsorption, alcoholism, chronic ingestion of highly-processed foods, chronic diarrhea, overuse of diuretics, and nephrotic syndrome. Excess copper interferes with zinc binding in blood plasma and reduces zinc retention. Excess iron intake may impair zinc absorption in the small intestine. **HIGH LEVELS:** Overuse of nutritional zinc supplements, eating or drinking from galvanized containers, zinc-contaminated water or food, continual diet of high-zinc foods (mostly shellfish, mushrooms, yeasts), and industrial exposures.	**LOW:** Incomplete digestive proteolysis, food reactivities, reduced taste, reduced night vision, muscle aches, slowed wound healing, hair loss, dermatitis or sexual impotency. In children, slow growth or stunted growth may occur. May cause increase in serum copper. **HIGH:** Weakness, lethargy and fatigue, impaired fine motor skills, and signs of iron or copper deficiency. Anemia.

Toxic Element	Exposure	Signs and Symptoms
Antimony	Antimony is a toxic element widely used in alloys to increase hardness or strength. **SOURCES:** Solders, metal type (printing), antifriction alloys, ammunition and powders, lead batteries, paints, enamels, glass and pottery glazes, flame retardants, tobacco, rubber agents, mines/smelting operations.	Antimony interferes with cellular metabolism, commonly deposits in erythrocytes and the liver and is mostly excreted via bile and liver. Symptoms are variable and may include metallic taste, anorexia, fatigue, myopathy, gout-like symptoms, MAO dysfunction, hypertension, erythrocyte fragility and angina. Inhalation of Sb may result in nosebleeds, rhinitis, and pneumonitis.
Arsenic	Arsenic is a natural component of the earth's crust and is widely distributed throughout the environment in the air, water and land. It is highly toxic in its inorganic form. **SOURCES:** Drinking contaminated water, using contaminated water in food preparation and irrigation of food crops, industrial processes, eating contaminated food and smoking tobacco, rodent poisons, contaminated seafood (especially shellfish), treated wood products, some fungicides and pesticides, fireworks, leather tanning and taxidermy, and lead/copper alloys.	Arsenic deposits quickly in liver, kidney, spleen, skin, bone and muscle. In tissues, it binds to selenium, phospholipids or phosphatides, and to sulfur in sulfhydryl groups on proteins, peptides and metabolic cofactors. Excessive arsenic symptoms include garlic breath and increased salivation, fatigue, chest pain, diarrhea, and hypotension. Chronic signs may include hair loss, skin hypopigmentation, white-streaked fingernails, anorexia, peripheral neuropathy.
Cadmium	Cadmium is a cumulative toxin with a biological half-life of 10 to 30 years for the whole body. It is synergistic with lead and mercury and may worsen the toxic effects of either. It may also interfere with zinc functions (as an activator of enzymes). **SOURCES:** CD-plated hardware (nuts and bolts), electroplating processes, Nickel-Cd batteries, brazes and solders, Cd pigments (paints, inks, glazes), cigarettes, old copy machine drums, plastics containing Cd-compounds as heat stabilizers, photographic and engraving chemicals, sewage sludge and power plant exhaust plumes, metal costume jewelry.	Glucosuria, proteinuria, beta2-microblobulinuria, fatigue, hypertension, sexual impotency (males), and microcytic-hypochromic anemia. Increased aging and reduced telomeres. Acute Cd contamination may include increased salivation, nausea, abdominal pain, vomiting, diarrhea, and choking sensations. Acute inhalation leads to tightness of chest, dyspnea and cough, and pulmonary edema.
Cobalt	**SOURCES:** C cobalt/chromium metal-on-metal hip implants, alloys, batteries, drill bits, saw blades and machine tools, dyes and pigments, magnets, tires and is a component of vitamin B12 (cobalamin).	Inhalation of cobalt can lead to chronic lung problems. Chronic cobalt exposure may lead to serious health problems like cardiomyopathy, deafness, nerve problems, tinnitus, thyroid issues vision problems and thickening of blood.
Lead	Lead toxicity is a particularly insidious hazard with the potential of causing irreversible health effects. It interferes with several body functions primarily affecting the central nervous, hematopoietic, hepatic and renal system producing serious disorders. Acute toxicity is related to occupational exposure and is quite uncommon. Chronic toxicity on the other hand is much more prevalent. **SOURCES:** Water pipes and systems, chips from old lead paint, art supplies, colored glass kits, bullets, fishing sinkers, balance weights, radiation shields, lead-acid batteries, bearing alloys, contaminated herbal preparations and teas, certain ceramic glazes or pigments.	Calcium, zinc and/or iron deficiency conditions enhance uptake of ingested lead. In the body, absorbed lead rapidly leaves the blood plasma and accumulates in erythrocytes where it binds to hemoglobin and thiols and to the cell membrane. It can deposit in bone tissue, the aorta, kidneys and other organs. Lead interferes with enzymes that form heme, shortens erythrocyte lifespan, disrupts iron transport in erythropoietic cells, affects renal transport of uric acid, reduces cytochrome P-450 activity in children, and is synergistically toxic with cadmium and mercury. Adults and children may present with anorexia, metallic taste, insomnia, headaches, fatigue, anemia, reticulocytosis, and uricemia.

Toxic Element	Exposure	Signs and Symptoms
Mercury	Human toxicity varies with the form of mercury, the dose and the rate of exposure. The target organ for inhaled mercury vapor (inorganic mercury from amalgams) is primarily the brain, while methyl mercury chiefly damage the gut lining and kidney with wide distribution throughout the body. **SOURCES:** Contaminated shellfish or seafood, contaminated water supply (methylmercury), dental amalgams or working in the dental profession (inorganic mercury), laboratory equipment, barometers, thermometers, mining and smelting operations.	Variable symptoms that may include metallic taste, increased salivation, paresthesia with decreased senses of hearing, touch, and vision, hypertension, headaches, fatigue, insomnia, and fine muscle tremors. Common mercury toxicity symptoms include emotional disturbance, significant mood swings, anger outbursts, excitability and lack of focus and concentration.
Silver	Buildup of silver in tissue can occur over months or years of exposure. **SOURCES:** Colloidal silver products, food and drinking water, medicines, jewelry making, soldering, photography, silver-coated flatware are all possible sources of silver exposure.	Dust exposure causes breathing, lung, throat and stomach problems. Skin contact may cause discoloration, rash, swelling or inflammation. Kidney problems are possible.
Strontium	High blood levels may result from bone supplements containing strontium. While it increases bone density, the benefits are questionable partially due to calcium displacement. *Some "re-mineralizing" toothpastes use a form of fluoride and strontium that can cause that elevation.* For example: https://www.gskhealthpartner.com/en-in/oral-health/brands/sensodyne/science/strontium-acetate/ **SOURCES:** Ceramics and glass products, pyrotechnics, paint pigments, fluorescent lights, bone supplements, and medicines.	Increases the risk of venous thromboembolism, pulmonary embolism, and serious cardiovascular disorders, including myocardial infarction. Risk to kidneys as strontium bioaccumulates in the body.

Why the Mercury Tri-Test® Safely Replaces Challenge Testing

A BRIEF HISTORY OF CHALLENGE TESTING

In the 1990s, the sensitivity of analytical equipment was not advanced enough to measure ambient (steady-state) blood mercury levels. Challenge or provocation testing was developed, using high doses of strong chemical chelation agents like DMSA and DMPS to "pull" mercury out of organic cellular structures for urinary analysis. While mercury challenge testing was clinically relevant for the time, advances in technology and clinical study have proven challenge testing to be unreliable and even potentially damaging to patients.

A belief existed that metals were shunted out of circulation into tissues for storage to protect delicate organs, and therefore, blood measurements represented only acute exposure, not long-term burden1. The diagnostic premise of challenge testing was to show the lifetime accumulation of stored mercury and other metals, conceptualized as the "body burden" [7].

To fulfill that promise, a challenge agent would have to accomplish at least one of the following two parameters:

1. Enter into all body cavities in which mercury (and other metals) are stored and uniformly draw metals from the tissues in proportion to the amount stored4.

2. Remain in circulation long enough so that metals are proportionately released from tissues, chelated in circulation, and excreted in the urine[4]. The literature clearly demonstrates that neither of these conditions are met via challenge testing[1,4].

The idea that metals are static, or stored, in the tissues is a misconception[4]. There are a few cases in which some metals are tightly bound to proteins and other cellular structures. However, these cases are the exception and have more to do with individual detoxification defects than fluid dynamics and metals' behavior. Metals are not entirely immobilized in the tissues9,4. They behave in the body as they do in any aqueous environment separated by membranes. Metals migrate and are dynamic, moving from compartments of greater concentration to compartments of lesser concentration[9,4].

Risks and Flaws of Challenge Testing

1. Only total mercury is measured – there is no differentiation between the organic (methyl or meHg) and inorganic (HgII) forms of mercury from different sources and are excreted through different organs[2]. Therefore, no distinction can be drawn regarding the origin of exposure, and the efficacy of excretion cannot be evaluated.

2. The data does not support the hypothesis that challenge testing demonstrates 'the total body burden' of mercury premise[1]. No reliable evidence supports the diagnostic value of challenge testing[7].

3. Lack of standardization in testing conditions, compounds, dosing, and reference ranges leads to unreliable results and interpretation[7].

a. Different chelating agents have differing strengths, specificity for various metals, and variable absorption and renal elimination[6].

b. A non-challenged reference range to compare the challenge test does not exist. Therefore, challenge test results may always appear elevated, creating a risk for over treatment[7].

c. IV vs. oral administration has vastly different pharmacokinetics.

d. The use of adjuncts such as EDTA, glutathione, and glycine vastly changes the test's dynamics and output.

4. Redistribution of mercury into organs and the nervous system has been observed[5].

5. Results can be skewed in patients with renal insufficiency (common in HgII toxicity).

6. Chelating agents have side effects[7].

CONCLUSION

The measurement of mercury in the body and extrapolation to body burden and toxic conditions is a very complex field requiring acute clinical discernment, including integration of patient history, current exposures, symptomology, and effect of comorbidities. Challenge testing no longer serves the evolution of the field of clinical metals toxicity. Adoption of better diagnostic tools is beneficial for both the practitioner and patient.

For more information, view the whitepaper here.

QUICKSILVER SCIENTIFIC'S MERCURY TRI-TEST®

Specificity: The Mercury Tri-Test (MTT) differentiates (speciates) between the two different forms of mercury that exist in the body, methylmercury (MeHg) and inorganic mercury (HgII). These two forms come from different sources, are excreted through different organs, and have vastly different toxicities. This specificity allows the practitioner to identify the source of exposure and evaluate the toxicity level more accurately.

State of the Art Testing: Quicksilver Scientific uses state-of-the-art analytical equipment and patented speciation testing, making ambient (steady-state) blood mercury testing the new gold standard of precision.

Safety: No chelation necessary. The risk of side effects and redistribution of metals is eliminated.

Sample Requirements: The Mercury Tri-Test requires samples of whole blood, urine, and hair.

- Blood: A direct measure of metals in the body
- Urine: HgII excretes through the kidneys[10]
- Hair: MeHg passes through the liver. Hair mercury concentration is proportional to blood methylmercury concentration[10].

Thus, hair is used as a surrogate for bile in the evaluation of liver excretion.

Evaluating Excretion: By identifying the concentration in the blood (the source) and the concentration in the excretion product (the filtrate), the practitioner can determine the organ of excretion (the filter) compared to the average. This allows the practitioner to support excretion pathways as appropriate. If excretion is impaired, detoxification protocols often exacerbate symptoms, commonly called Herx or detox reactions.

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