

## **NUTRITIONAL ELEMENTAL MINERAL-BASED COMPOUNDS**

Description of the TBA test kit from HCM I

**Primary Use:** identifying the underlying mineral elements needed to activate gene potential, which activates the building blocks responsible for cellular detoxification and regeneration.

### Bismuth

1. Bismuth citrate: Bismuth subcitrate
2. Bismuth subsalicylate

### Boron

3. Calcium fructoborate
4. Borate salts
5. Boric acid
6. Boromycin
7. Boron (elemental)
8. Boron aspartate
9. Boron citrate
10. Boron oxide

### Calcium

11. Calcium apatite
12. Calcium ascorbate
13. Calcium bisglycinate
14. Calcium carbonate
15. Calcium chloride
16. Calcium citrate
17. Calcium citrate malate
18. Calcium fluoride
19. Calcium L-5-methyltetrahydrofolate
20. Calcium lactate
21. Calcium malate
22. Calcium metaphosphate
23. Calcium orthophosphate
24. Calcium phosphate or monocalcium phosphate
25. Calcium sulfate
26. D-calcium pantothenate
27. Dicalcium malate
28. Dicalcium phosphate
29. Dicalcium triphosphate
30. Microcrystalline hydroxylapatite
31. Octacalcium phosphate
32. Tricalcium phosphate

### Chromium

33. Chromium bitartrate
34. Chromium chelavite,
35. Chromium citrate or chromium(III) citrate
36. Chromium glycinate or amino acid chelate
37. Chromium nicotinate
38. Chromium nicotinate glycinate
39. Chromium picolinate

40. Chromium polynicotinate

41. Chromium trichloride

### Cobalt

42. Adenosylcobalamine or cobamamide
43. Hydroxocobalamine or hydroxycobalamine
44. Methylcobalamine

### Copper

45. Copper bicarbonate
46. Copper citrate, copper(II) citrate or cupric citrate
47. Copper hydrosol
48. Copper lysinate HCl
49. Copper superoxide dismutase
50. Copper zinc superoxide dismutase
51. Sodium copper chlorophyllin

### Gold

52. Gold chloride
53. Gold colloid
54. Gold hydrosol (2ppm - 5ppm)

### Iodine

55. Lugol's elemental iodine
56. Potassium iodide
57. Sodium iodate
58. Sodium iodide

### Iridium

59. Iridium dioxide
60. Iridosmium or iridian osmium
61. Organoiridium compounds

### Iron

62. Catalase
63. IRE-BP = iron-responsive element-binding proteins
64. Iron amino acid chelate, iron glycinate
65. Iron(II) chloride or ferrous chloride
66. Iron(III) chloride or ferric chloride
67. Iron elemental or reduced iron
68. Iron (II) fumarate or ferrous fumarate
69. Iron(II) gluconate or ferrous gluconate
70. Iron(III)-hydroxide polymaltose complex (IPC)
71. Iron(II) sulfate
72. Iron sulfide
73. Lactoferrin aka lactotransferrin
74. Lactoferricin

75. Proteins: heme, myoglobin, cytochrome P450  
 76. Protein cofactors (ferritin, rubredoxin)

Lithium

77. Lithium aspartate  
 78. Lithium carbonate / Dilithium carbonate  
 79. Lithium chloride  
 80. Lithium citrate / Trilithium citrate  
 81. Lithium orotate

Magnesium

82. Magnesium amino acid chelate,  
 83. Magnesium aspartate  
 84. Magnesium chloride  
 85. Magnesium citrate  
 86. Magnesium fluoride  
 87. Magnesium gluconate  
 88. Magnesium glycinate  
 89. Magnesium hydroxide  
 90. Magnesium lysinate  
 91. Magnesium malate  
 92. Magnesium orotate  
 93. Magnesium phosphate  
 94. Magnesium stearate  
 95. Magnesium sulfate or magnesium(II) sulfate  
 96. Magnesium taurate

Manganese

97. Manganese ascorbate  
 98. Manganese aspartate  
 99. Manganese chloride tetrahydrate  
 100. Manganese citrate  
 101. Manganese gluconate  
 102. Manganese glycerophosphate  
 103. Manganese sulfate monohydrate

Molybdenum

104. Molybdenum aspartate  
 105. Molybdenum citrate

Phosphorus

106. Tetrasodium pyrophosphate

Potassium

107. Potassium alpha-ketoglutarate  
 108. Potassium aspartate  
 109. Potassium aspartate HCl  
 110. Potassium and magnesium aspartate  
 111. Potassium aspartate  
 112. Potassium bisulfate

113. Potassium bromated  
 114. Potassium chloride  
 115. Potassium citrate  
 116. Potassium fumarate  
 117. Potassium gluconate  
 118. Potassium glycinate  
 119. Potassium-Magnesium taurate  
 120. Potassium malate or dipotassium malate  
 121. Potassium orotate  
 122. Potassium phosphate  
 123. Potassium sodium tartrate aka Rochelle salt  
 124. Potassium succinate  
 125. Potassium sulfate

Selenium

126. Selenium aspartate  
 127. Selenocysteine  
 128. Selenomethionine  
 129. Methyl-selenocysteine

Silicon

130. Orthosilicic acid – choline stabilized  
 131. Silica

Silver

132. Silver hydrosol  
 133. Silver lactate aka Aragentum lacticum  
 134. Silver oxide

Sodium

135. Sodium chloride or Natrum Muriate  
 136. Sodium phosphate or Phosphasoda  
 137. Sodium sulfate aka sodium sulphate

Vanadium

138. Vanadium citrate  
 139. Vanadium glutarate  
 140. Vanadium glycinate  
 141. Vanadium nicotinate glycinate chelate  
 142. Vanadyl sulfate

Zinc

143. Zinc(II) acetate or zinc diacetate  
 144. Zinc aspartate  
 145. Zinc bisaspartate  
 146. Zinc citrate or trizinc dicitrate  
 147. Zinc gluconate or zinc di(D-gluconate)  
 148. Zinc glycinate or zinc bis(aminoacetate)  
 149. Zinc picolinate  
 150. Zinc sulfate

## Bismuth

1. **Bismuth citrate** aka Bismuth subcitrate is used to smother bacteria in the stomach.
2. **Bismuth subsalicylate** is used as an antidiarrheal; it is the active ingredient in such "Pink Bismuth" preparations as Pepto-Bismol, as well as the 2004 reformulation of Kaopectate. It is also used to treat other gastro-intestinal diseases.

## Boron

3. **Calcium fructoborate** (borate salt) is very water soluble and easily absorbed by bone tissue; since there are two boron atoms per compound, this form of Boron is a rich source of boron.
4. **Borate salts e.g.** 1) sodium borate 2) potassium borate 3) sodium tetraborate, aka Borax; 4) sodium tetraborate pentahydrate aka Borax pentahydrate. Borates are the name for a large number of boron-containing oxyanions. The term "borates" may also more loosely refer to chemical compounds which contain borate anions react readily with fluorine and fluoride compounds, therefore such salts act as fluoride toxicity modulators and detoxifiers. Since the thyroid gland is the most sensitive endocrine gland to fluorine toxicity, this is an effective way to save the thyroid and support its recovery. Borax is also used as a beetle repellent in agriculture.
5. **Boric acid** has antiviral, antiseptic and antifungal properties, particularly for the eyes.
6. **Boromycin** is a bacteriocidal polyether-macrolide antibiotic; effective against most Gram-positive bacteria, but ineffective against Gram-negative bacteria. Boromycin kills bacteria by negatively affecting the cytoplasmic membrane, resulting in the loss of potassium ions from the cell. Recent studies reveal potent anti-HIV activity. It was found to strongly inhibit the replication of the clinically isolated HIV-1 strain as well as the cultured strain *in vitro*.
7. **Boron (elemental)**
8. **Boron aspartate** (an amino acid chelate).
9. **Boron citrate** is best for women as it reduces excretion of calcium by 44%, and activates estrogen and vitamin D.
10. **Boron oxide** has much less bioavailable but also less potential for toxicity.

## Calcium

11. **Calcium apatite** one of the two primary components of bone structure; see calcium hydroxylapatite.
12. **Calcium ascorbate or L-ascorbate or diascorbate** is a form of Vitamin C which is predisposed to support muscles and structural elements in the body. This form would be counter-productive if a patient is taking Rx calcium channel blockers to control blood pressure.
13. **Calcium bisglycinate** (amino acid chelate salt) easily absorbed by muscle and used to form, build and control the geometric patterns of cell membrane surfaces.
14. **Calcium carbonate** is a good antacid although calcium also stimulates the stomach to produce gastrin. Poorly absorbed without the simultaneous presence of cholecalciferol (Vitamin D3). There is no calcium carbonate in human bone.
15. **Calcium chloride**, water soluble, very stimulating to the stomach feedback loop which causes gastrin to be released which in turn stimulates production of hydrochloric acid. Used extensively in food as a supplement and to keep fruits and vegetables firm whether frozen or canned.
16. **Calcium citrate**, rich source of water soluble calcium; used primarily by the blood.
17. **Calcium citrate malate**, water soluble very bioavailable mixture of organic calcium used by the blood, bone and muscle tissues.
18. **Calcium fluoride**, trace component of human bone, major component of dentine; trace component of elastin protein. Homeopathic dose has been used in Cell Salt form to treat sagging skin; fine creaking of the joints of the hands and feet; poor tooth enamel; and cracks in the palms of the hands and lips. With magnesium, it is helpful with hemorrhoids; can also be used in conjunction with caffeine-based enema to clear the blood vessels of the rectum.
19. **Calcium L-5-methyltetrahydrofolate** very bioavailable form of folate which easily merges into the Krebs' Cycle or TCA Cycle.
20. **Calcium lactate**. In medicine, calcium lactate is very water soluble and is most commonly used as an antacid and also to treat calcium deficiencies. Calcium lactate can be absorbed at various degrees of pH and does not need to

be taken with food for absorption. It is added to many Rx formulations as a base or filler. Calcium lactate is added to sugar-free foods to prevent tooth decay. When added to chewing gum containing xylitol, it increases the remineralization of tooth enamel; for this reason it is also added to OTC mouthwash products. It is also added to fresh-cut fruits such as cantaloupe to keep them firm and extend their shelf life, without the bitter taste caused by calcium chloride.

21. **Calcium malate**, food additive; absorbed by bone and muscle; modest source of calcium for cell membrane surface geometry.
22. **Calcium metaphosphate or pyrophosphate or dicalcium diphosphate** component of human bone and the liver.
23. **Calcium orthophosphate** component of human bone.
24. **Calcium phosphate or monocalcium phosphate** component of human bone.
25. **Calcium sulfate** as a trace mineral species, it is concentrated at the physis of a growing bone. Once the bone is capped, content of this calcium decreases over time. It is used topically to treat cracked skin of the heels of the feet. Homeopathic dose treats skin lesions which heal slowly or poorly including acne and herpetic blisters; used to treat forehead pain, and vertigo.
26. **D-calcium pantothenate or calpanate (Vitamin B-5 variant)**, very water soluble essential vitamin. It is required to synthesize coenzyme-A (CoA), as well as to synthesize and metabolize proteins, carbohydrates, and fats. It helps prevent skin ulcerations, aids with wound healing and it lowers blood lipid levels. Lipoic acid is known to help with conditions of peripheral neuropathy. A recent study of patients with diabetic polyneuropathy who did not respond solely to lipoic acid supplements, when lipoates were given in combination with pantothenic acid, 84.8% improved. Poor metabolism and/or conversion of pantothenic acid into bioactive forms are associated with skin issues and hair loss. Only the D-isomer has biologic activity. The L-isomer in synthetic mixtures actually antagonizes the ability of the D-form to carry out work. Coenzyme A may act as an acyl group carrier to form acetyl-CoA and other related compounds; this is a way to transport carbon atoms within the cell. CoA is important in energy metabolism for pyruvate to enter the tricarboxylic acid cycle (TCA cycle) as acetyl-CoA, and for  $\alpha$ -ketoglutarate to be transformed to succinyl-CoA in the cycle. CoA is also important in the biosynthesis of many important compounds such as fatty acids, cholesterol, and acetylcholine. CoA is incidentally also required in the formation of ACP, which is also required for fatty acid synthesis in addition to CoA. Pantothenic acid in the form of CoA is also required for acylation and acetylation, which, for example, are involved in signal transduction and enzyme activation and deactivation, respectively.
27. **Dicalcium malate** does not release gas in the stomach like calcium carbonate; does not stimulate release of gastrin or increase HCl production; absorbed by bone and muscle tissue; supports the Krebs and glyoxalate energy producing cycles.
28. **Dicalcium phosphate** a component of human bone.
29. **Dicalcium triphosphate** a component of human bone.
30. **Microcrystalline hydroxylapatite or calcium hydroxyapatite** the largest quantity of the primary structural form of calcium in human bone.
31. **Octacalcium phosphate**
32. **Tricalcium phosphate** a component of human bone.

### **Chromium**

33. **Chromium (III) 25 $\mu$ g - 35 $\mu$ g / day** cinnamon increases efficacy of chromium's effect on insulin resistance; has a synergistic effect with vanadium and molybdenum on glucose metabolism.
34. **Chromium bitartrate** water soluble bioavailable chromium organic salt.
35. **Chromium chelavite, chromium-niacin amino acid chelate or glucose tolerance factor (GTF) chromium chelavite** consistently effective at decreasing insulin resistance; inhibits synthesis of new fat from carbohydrates; highest bioavailability (57%); absorbs primarily in the lower small intestine as an amino acid rather than as a chromium salt in the upper small intestine.
36. **Chromium citrate or chromium(III) citrate** water soluble bioavailable chromium organic salt.
37. **Chromium glycinate or amino acid chelate** water soluble bioavailable chromium amino acid chelate; does not compete for absorption in the upper small intestine as it is absorbed as an amino acid in the lower small intestine; easily absorbed by muscle tissue.

- 38. Chromium nicotinate**, water soluble bioavailable organic salt which has a positive absorption at the level of the capillaries.
- 39. Chromium nicotinate glycinate**, superior absorption compared to chromium nicotinate.
- 40. Chromium picolinate** > 200µg / day can damage DNA in sensitive liver and kidney cells moderately decreases insulin resistance; 37% bioavailable.
- 41. Chromium polynicotinate or chromium trinicotinate** decreases insulin resistance and decreases essential hypertension due to availability of niacin released in the capillary bed; lessens free radical formation and DNA damage in the liver and kidneys. 30% bioavailable.

### Cobalt

- 42. Adenosylcobalamine or cobamamide**, natural form of Vitamin B12 in the human body; not available in an injectable form.
- 43. Hydroxocobalamine or hydroxycobalamine** produced by bacteria which are used to produce the vitamin commercially. It is not a form normally found in the human body, but is easily converted in the body to usable coenzyme forms of vitamin B<sub>12</sub>. Because of its affinity for the cyanide ion it is a treatment for cyanide poisoning; it is also a nitric oxide scavenger. This is the most water soluble form of Vitamin B12; readily absorbed in the distal half of the ileum. Vitamin B12 has a key role in the normal functioning of the brain and nervous system, and for the formation of blood. It is involved in the metabolism of every cell of the human body, especially affecting DNA synthesis and regulation, but also fatty acid synthesis (especially odd chain fatty acids) and energy production. Fungi, plants and animals are incapable of producing vitamin B12. Only bacteria and archaea have the enzymes required for its synthesis; many foods are a natural source of B12 because of bacterial symbiosis. Herbivorous animals store this vitamin in fat tissue as B12 is the most fat soluble of the B Vitamins.
- 44. Methylcobalamine or mecobalamine**, natural or normal bioactive form for humans. This is the most fat soluble form of Vitamin B12. Vitamin B12 refers to a group of compounds called cobalamins which are available in the human body in a variety of mostly interconvertible forms. Together with folic acid, cobalamins are essential cofactors required for DNA synthesis in cells where chromosomal replication and division are occurring—most notably the bone marrow and myeloid cells. As a cofactor, cobalamins are essential for two cellular reactions: 1) the mitochondrial methylmalonyl-CoA mutase conversion of methylmalonic acid (MMA) to succinate, which links lipid and carbohydrate metabolism, and 2) the activation of methionine synthase, which is the rate-limiting step in the synthesis of methionine from homocysteine and 5-methyltetrahydrofolate. Methylcobalamine corrects pernicious anemia. Methylcobalamine is also used in the treatment of peripheral neuropathy, diabetic neuropathy, and as a preliminary treatment for amyotrophic lateral sclerosis.

### Copper

- 45. Copper bicarbonate**, only exists in liquid state, i.e., it cannot be dried into a powder; most gentle and least toxic of all copper salts or it can be described as being the most compatible copper salt physiologically.
- 46. Copper citrate, copper(II) citrate or cupric citrate**, blood and bone marrow absorption preference.
- 47. Copper hydrosol**
- 48. Copper lysinate HCl** has absorption preference in connective tissue serving as a source of inflammation control.
- 49. Copper superoxide dismutase (CuSOD)** most powerful molecule for inflammation control in the body.
- 50. Copper-zinc superoxide dismutase.** This SOD is the second most powerful inflammation control compound in the body: a copper- and zinc-containing protein-enzyme which is present in the cytosol, nucleus, peroxisomes, and mitochondrial intermembrane space of human cells acting as an antioxidant enzyme, lowering the steady-state concentration of superoxide radicals changing these radicals into molecular oxygen and hydrogen peroxide. Reactive forms of oxygen, such as superoxide, leak from the respiratory chain and wreak havoc on the cell. Superoxide is a powerful free radical molecule which readily accepts electrons. These free radicals can strip electrons from cellular molecules essential for proper cell function such as DNA, amino acids or other enzymes, causing dysfunction and possibly resulting in cell death. Cu, Zn superoxide dismutase is an important antioxidant defense in nearly all cells exposed to oxygen and oxygen radicals. It forms a crucial component of the cellular response to oxidative stress by

detoxifying the superoxide radical via a special reaction known as dismutation. Dismutation is a term which refers to a special type of reaction where two equal but opposite reactions occur on two separate molecules. SOD takes two molecules of superoxide radicals, strips the extra electron off of one, and places it on the other. So, one radical structure ends up with one less electron and normal oxygen forms, and the other radical ends up with an extra electron. The one with the extra electron then rapidly picks up two hydrogen ions to form hydrogen peroxide. One cell study showed that for every 10,000 electrons transferred down the respiratory pathway in *Escherichia coli* cells, about 3 electrons end up on superoxide radicals instead of the proper place. Excess CuZnSOD1 in chemical form levels can inactivate enzymes containing iron-sulfur clusters and can lead to the formation of other highly oxidizing species that are damaging to other cellular constituents. In the motor neuron disease known as amyotrophic lateral sclerosis (ALS), a familial subset of ALS or FALS is caused by dominantly inherited mutations of SOD1. This pathogenic mutation leads to aggregation of SOD1 proteins and these insoluble protein complexes accumulate in spinal cord neurons. Many of the FALS mutations fall directly at the dimer interface at the intrasubunit disulfide bond and in regions which affect metal binding.

51. **Sodium copper chlorophyllin**, water-soluble organic salt derived from chlorophyll. The green color is due to the copper rather than a magnesium atom as found in chlorophyll. Because chlorophyll is insoluble in water, food sources of chlorophyll do not bind to mutagenic or cancer-causing substances. Chlorophyllin, being water-soluble, can significantly bind to environmental mutagens such as the polycyclic aromatic hydrocarbons benzo[a]pyrene and dibenzo{a,i}pyrene. Chlorophyllin binds to mutagens twenty times better than resveratrol and thousands of times better than xanthines. Promotes wound healing especially wounds associated with radiation burns. With hygiene, ingested chlorophyllin reduces odors associated with incontinence, colostomies and similar procedures, as well as body odor in general.

**Gold** in general protects genetic material, especial reproductive genes from radiation damage and mutation; it is found in sea salt, pollen, royal jelly and certain sprouts such as alfalfa..., if gold is present in the soil or grow media.

52. **Gold chloride** is most concentrated in male seminal fluid; outside of seminal fluid, even small amounts can adversely affect cardiac tissue displacing the copper necessary for tone, thus, a cardiomyopathy can begin to form.
53. **Gold colloid** where n = particulates under 20nm can absorb best into the body wherever edema occurs along the lumen of the gut and these particulates are distributed primarily to the reproductive system.
54. **Gold hydrosol** concentrates in male seminal fluid, the ovaries, testes and the pineal gland. It promotes penile erection therefore helps to correct erectile dysfunction (ED). Used with lithium, it is a moderately strong mood leveling mixture. Used daily or regularly, there is a decrease in systemic inflammation and CNS inflammation; in turn, the need for sleep decreases.

**Iodine** is a non-metal, essential nutritional element, constituent of thyroid hormones, associated with the amino acid tyrosine, copper and selenium in the thyroid gland. Iodide is an antioxidant and because of its atomic size, iodide forms relatively weak bonds with most elements. Iodine is necessary for optimal function of a number of additional body systems, including lactating breast, gastric mucosa, salivary glands, oral mucosa, and arterial walls. Chronic insufficiency or deficiency is associated with the onset of mental retardation, cretinism, goiter, breast and stomach cancer and autism. Toxic levels of bromide will be displaced by iodides. There are 4 different forms of Iodine for the body to choose from.

55. **Lugol's iodine introduced in 1829** mixture of 5% elemental iodine (I<sub>2</sub>) and 10% potassium iodide (KI) in water, aka I<sub>2</sub>KI.
56. **Potassium iodide**
57. **Sodium iodate**
58. **Sodium iodide**

**Iridium** 20 parts per trillion of iridium in human tissue.

59. **Iridium dioxide**
60. **Iridosmium or iridian osmium**
61. **Organoiridium compounds**

**Iron** absorption increases in the presence of Vitamin C; rheumatoid arthritics are often hypersensitive. Because one of the functions of elevated ferritin (an acute phase reaction protein) during acute infections is thought to be to sequester iron from bacteria, iron supplementation (which circumvents this mechanism) should be avoided in patients who have an active bacterial infection. Serious iron toxicity may result from ingestions of more than 60 mg/kg. Iron exerts both local and systemic effects: it is corrosive to the GI mucosa, it can have a negative impact on the heart and blood (dehydration, low blood pressure, fast and weak pulse, shock), lungs, liver, gastrointestinal system (diarrhea, nausea, vomiting blood), nervous system (chills, dizziness, coma, convulsions, headache), and skin (flushing, loss of color, bluish-colored lips and fingernails).

**62. Iron Catalase (Lipoxygenases)** catalyse the dioxygenation of polyunsaturated fatty acids in lipids containing a cis,cis-1,4- pentadiene structure. It catalyses the following reaction: fatty acid + O<sub>2</sub> = fatty acid hydroperoxide)

**63. IRE-BP or iron-responsive element-binding proteins** (iron transport and regulation of human iron metabolism) contained within the mRNA sequences.

**64. Iron amino acid chelate**, iron glycinate or iron bis-glycinate or ferrous bis-glycinate

**65. Iron(II) chloride** or ferrous chloride converts easily in stomach acid to ferric chloride

**66. Iron(III) chloride or ferric chloride** behaves as a corrosive acid. Used in veterinary practice to treat over-cropping of an animal's claws, particularly when the over-cropping results in bleeding. Used in municipal water treatment to precipitate phosphate as iron(III) phosphate.

**67. Iron elemental powder or "reduced iron"** is slowly absorbed [33% efficiency of iron sulfate] so it is added to foods such as breakfast cereals or enriched wheat flour.

**68. Iron (II) fumarate** or ferrous fumarate

**69. Iron(II) gluconate** or ferrous gluconate, used as an effective treatment of hypochromic anemia with a relatively rapid reticulocyte response with daily increases in hemoglobin. Ferrous gluconate is also used as a food additive when processing black olives and imparts a uniform jet black color to the olives. Children may show signs of toxicity with ingestions of 10–20 mg/kg ferrous gluconate.

**70. Iron(III)-hydroxide polymaltose complex (IPC)**

**71. Iron(II) sulfate** high incidence of adverse effects or hypersensitivities, men more than women.

**72. Iron sulfide or iron(II) sulfide** associated with DNA evolution or modified expression of DNA.

**73. Lactoferrin** aka lactotransferrin [apo-lactoferrin (metal free form) and holo-lactoferrin (iron-rich form)] reversibly binds two ions of iron, zinc, copper or other metals; its affinity for iron is 300 times higher than that of transferrin. Lactoferrin acts first as an antioxidant and in turn, serves as an immune support agent; it is an anti-inflammatory agent; inhibits cancer cell replication; inhibits development of obesity through inhibition of fat accumulation in adipocytes and inhibits formation of new fat cells; anabolic agent which stimulates bone growth and bone repair; may play a role in glucose control; stimulates the growth of several symbiotic bacterial species in the small intestine especially *bifidobacteria* species; suppresses gut toxin producing bacteria such as *Listeria*, *Clostridium*, *Staphylococcus aureus*, *Salmonella* and *Escherichia coli*. Binds with lipopolysaccharide, a proinflammatory endotoxin (metabolic endotoxemia) which is known to increase insulin resistance. Apo- and holo-lactoferrin forms are both effective but apo-lactoferrin appears to be more potent. It is a natural component of human mother's milk.

**74. Lactoferricin** is an amphipathic, cationic peptide with anti-microbial and anti-cancer properties. It can be generated by the pepsin-mediated digestion of lactoferrin.

**75. Protein heme cofactors** (hemoglobin and myoglobin to carry oxygen and carbon dioxide and cytochrome P450 to transfer electrons and build other enzymes in the liver to detoxify a wide range of substances and drugs)

**76. Protein cofactors** (ferritin and rubredoxin)

**Lithium** can be used in supplement form in small doses to treat certain medical conditions, such as stress, bipolar disorder, depression, suicidal ideations, alcoholism (especially when mixed with bioavailable gold compounds), ADHD, attention deficit disorder, aggression, Post-Traumatic Stress Disorder, Alzheimer's and to improve memory. Intake of lithium has well documented positive neurological effects, and appears to be effective even in trace amounts.

**77. Lithium aspartate** used most often to treat Alzheimer's disease.

78. **Lithium carbonate** / Dilithium carbonate. In 1843, lithium carbonate was used as a new solvent for stones in the bladder. In 1859, some doctors recommended a therapy with lithium salts for a number of ailments, including: urinary calculi, rheumatism, mania, depression, and headache. In 1949, John Cade discovered the anti-manic effects of lithium ions. This finding led lithium carbonate, to be used to treat mania associated with bipolar disorder. Lithium carbonate is used to treat mania, the elevated phase of bipolar disorder. Lithium ions interfere with ion transport processes (see “sodium pump”) that relay and amplify messages carried to the cells of the brain. Mania is associated with irregular increases in protein kinase C (PKC) activity within the brain. Lithium carbonate acts in the brain by inhibiting PKC’s activity and helps to produce other compounds which also inhibit PKC. Some studies have suggested therapeutic benefit of lithium carbonate in certain neuromuscular conditions like spinal muscular atrophy.

**79. Lithium Chloride**

80. **Lithium citrate** / Trilithium citrate used as a mood stabilizer in psychiatric treatment of manic states and bipolar disorder.

**81. Lithium Orotate**

**Magnesium** ions play a major role in manipulating important biological polyphosphate compounds like ATP, DNA, and RNA and metabolism of amino acids, fats, and carbohydrates. Hundreds (330+) of enzymes require magnesium ions to function. Intracellular magnesium is correlated with intracellular potassium and mitochondrial aging is directly related to organelle magnesium content. Magnesium also plays an important role in preventing stress and mood swings as the body releases magnesium into the bloodstream when stressed physically, mentally and emotionally. Caffeine, sodium intake, alcohol and high-fructose corn syrup all leach magnesium from the bloodstream. Insufficient or low levels of magnesium in the body have been associated with the development of a number of human illnesses such as asthma, diabetes, osteoporosis, venous degeneration (varicosities), sleep disorders, arterial hypertension, chronic renal diseases and increased DNA transcription error rates. High protein intake inhibit magnesium absorption, and other factors such as phosphate, phytate, and fat affect absorption. Excess dietary magnesium is excreted in feces, urine, and perspiration.

**82. Magnesium amino acid chelate**, e.g. Mg lysyl-glycinate

**83. Magnesium aspartate** (an amino acid chelate)

**84. Magnesium chloride**

**85. Magnesium citrate** probably the most bioavailable of common forms

**86. Magnesium fluoride** is a micro-trace element of living bone; the cell salt supports remineralization of the bone.

**87. Magnesium gluconate**

**88. Magnesium glycinate** (an amino acid chelate) used by myofibrils to relax tissues; most natural muscle relaxant; helps with induction of sleep when taken at bedtime; smooth muscle relaxant, therefore dilates veins and decreases peripheral vascular resistance or decreases blood pressure (essential hypertension) especially when taken with Vitamin D3.

**89. Magnesium hydroxide** very good antacid.

**90. Magnesium lysinate** (an amino acid chelate) has a preferential absorption in fascial tissue, therefore also helps to relax fascial tension or “contractures”; aids in tissue alkalization which helps to correct tissue stiffness.

**91. Magnesium malate** has a preference for muscle absorption; helps to counteract scar tissue formation (fibrosis).

**92. Magnesium orotate** helps with premature ventricular contractions (PVCs) a form of cardiac dysrhythmia.

**93. Magnesium phosphate** most soluble and bioavailable mineral salt form of magnesium.

**94. Magnesium stearate** can give rise to competitive absorption rates or absorption capacity; high doses have down-regulating characteristics on the immune system and T-lymphocytes which can be counter-acted with niacin and medium chain fatty acids.

**95. Magnesium Sulfate** or Magnesium(II) Sulfate is an acidic mineral salt.

**96. Magnesium taurate** preferential absorption by cardiac tissue, therefore helps to relax cardiac muscle; supports cardiac cell mitochondrial function and production of ATP.

**Manganese** is an essential trace mineral and assists absorption of calcium; it is concentrated in decreasing amounts in the following organs: 1) kidneys, 2) pancreas, 3) liver, 4) bones, and 5) CNS and neural tissues. Chronic insufficiency of manganese has been found to delay processing of cholesterol, slowed transformation of cholesterol into sex hormones (female infertility), may decrease the body's ability to use sugar (carbohydrates) properly and slows fat and protein metabolism, causes improper formation of bone and cartilage, is associated with severity of symptoms of premenstrual syndrome (PMS), chronic anemia or "tired blood", associated with chronic bronchitis and obstructive pulmonary disease (COPD) and causes growth problems. Deficiency is associated with decreased visual acuity, decreased auditory acuity, memory loss and tremors. Manganese is a cofactor for thyroxine in the thyroid. Manganese is an important cofactor in DNA transcription and a key cofactor component of DNA polymerase; therefore, it decreases transcription error rates. It is a catalytic cofactor in the absorption and metabolism of Vitamin B1 (thiamin) and Vitamin E. In the gut, manganese is a cofactor in the metabolism of glutamine. Because of its role in bone formation, manganese is sometimes included with chondroitin sulfate and glucosamine hydrochloride in multi-ingredient products promoted for osteoarthritis. When copper alone does not completely correct epilepsy in children, using copper and manganese together will correct another percentage of situations.

**97. Manganese ascorbate** is a very gentle source of manganese on the body.

**98. Manganese aspartate or manganous aspartate** (an amino acid chelate complex)

**99. Manganese(II) chloride tetrahydrate**

**100. Manganese citrate** very rich source of bioavailable manganese.

**101. Manganese gluconate**

**102. Manganese glycerophosphate**

**103. Manganese sulfate monohydrate or Manganese(II) sulfate**

### **Molybdenum**

**104. Molybdenum aspartate**

**105. Molybdenum citrate or molybdenum(IV) tetracitrate**

### **Phosphorus (non-metal element)**

**106. Tetrasodium pyrophosphate**

### **Potassium**

**107. Potassium alpha-ketoglutarate** or Potassium hydrogen 2-oxoglutarate (Krebs cycle)

**108. Potassium aspartate** or Dipotassium aspartate or Dipotassium 2-aminosuccinate (an amino acid salt) rich source of bioavailable potassium.

**109. Potassium aspartate HCl** helps with digestion and provides potassium to gastric cells; helps with stomach cramps.

**110. Potassium and magnesium aspartate** (1:1 ratio) very good combination for cramping and claudication symptoms.

**111. Potassium aspartate mixture:** potassium aspartate, citrate and orotate, very rich source of potassium especially helpful to cardiac muscle.

**112. Potassium bisulfate** non-meat food preservative

**113. Potassium bromate** used in food as a strong oxidizer and to improve dough strength and height of rising.

**114. Potassium chloride** [cell salt Kali Mur] primary electrolyte of the blood; used in oral rehydration treatment (ORT); used in conjunction with Rx diuretics; treats muscle cramps, especially calf cramping. This salt is more concentrated inside each cell in order to create electrical gradients. Homeopathic doses are known to treat lymph adenitis (swollen glands), white mucus and white discharges from the nose and eyes, white or gray coated tongue indicative of too much mucus and phlegm production and indigestion from rich food.

**115. Potassium citrate** (Krebs cycle)

**116. Potassium fumarate** or dipotassium fumarate (Krebs cycle)

**117. Potassium gluconate** or potassium D-gluconate

**118. Potassium glycinate** or potassium aminoacetate (amino acid salt)

- 119. **Potassium-Magnesium taurate** 2:1 ratio for the heart.
- 120. **Potassium malate or dipotassium malate** (Krebs cycle)
- 121. **Potassium orotate**
- 122. **Potassium phosphate**
- 123. **Potassium sodium tartrate** aka Rochelle salt
- 124. **Potassium succinate or dipotassium succinate** (Krebs cycle)
- 125. **Potassium sulfate** supports skin health and hair follicle health. With silica and sodium chloride, aids with congestion of mucus membranes. If supplement form is chosen, it can be used with greater efficacy with 50mg – 100mg of niacin to metabolize histamine while simultaneously making mucus more liquid.

**Selenium**, an essential micronutrient is a component of the antioxidant enzymes glutathione peroxidase and thioredoxin reductase which indirectly reduce certain oxidized molecules in animals and some plants. It is also found in three deiodinase enzymes, which convert one thyroid hormone to another. In its selenide form (H<sub>2</sub>Se) in the liver, it is the key cofactor in Phase II liver detoxification glutathione conjugation pathways to remove excess metallic elements, heavy metals and toxic heavy metals from the body. The glutathione peroxidase family of enzymes (GSH-Px), catalyze certain reactions which remove reactive oxygen species (ROS) such as hydrogen peroxide and organic hydroperoxides. Selenium inhibits Hashimoto's disease, in which the body's own thyroid cells are attacked as alien. Selenium aids the physiology and structure of the eye; chronic insufficiency may lead to retinal detachment; arcus senilis is directly linked to insufficiency. The physical integrity of the capillary bed and control of capillary inflammation is linked to selenium levels, therefore collapse of capillary beds is linked to chronic insufficiency of selenium. Topically, selenium sulfide (approximate formula SeS<sub>2</sub>) is the active ingredient in some anti-dandruff shampoos. This selenium compound kills the scalp fungus *Malassezia*, which causes shedding of dry skin fragments. The ingredient is also used in body lotions to treat Tinea versicolor due to infection by a different species of *Malassezia* fungus. A number of correlative epidemiological studies have implicated selenium deficiency (as measured by blood levels) in a number of serious or chronic diseases, such as cancer, diabetes, HIV/AIDS, and tuberculosis.

- 126. **Selenium aspartate** water soluble and bioavailable form of selenium.
- 127. **Selenocysteine** exists naturally in all kingdoms of life as a building block of selenoproteins. This is the most bioavailable water soluble form of selenium. It is present in several enzymes, for example, glutathione peroxidases, tetraiodothyronine 5' deiodinases, thioredoxin reductases, formate dehydrogenases, glycine reductases, selenophosphate synthetase 1, methionine-R-sulfoxide reductase B1 (SEPX1), and some hydrogenases. Selenocysteine has both a lower pKa (5.47) and a higher reduction potential than cysteine. These properties make it very suitable in proteins that are involved in antioxidant activity.
- 128. **Selenomethionine** is a naturally occurring amino acid containing selenium. It is a common natural food source of selenium found in Brazil nuts, cereal grains, soybeans and grassland legumes. Selenomethionine antioxidant activity arises from its ability to deplete reactive oxygen species (ROS). Chemically, it is 19% more bioavailable than the mineral salt "selenite"; selenite is irritating to the liver vs. selenomethionine causes no inflammatory irritation. The anticancer activity associated with selenomethionine is believed to be due primarily to enzymatic (methioninase) cleavage to methylselenol (CH<sub>3</sub>SeH), believed to be the critical metabolite involved.
- 129. **Methyl-selenocysteine** or Se-methyl-selenocysteine is the major form of selenium found in *Astragalus*, *Allium* and *Brassica* species. It has equal antioxidant properties as selenomethionine. It is the most fat soluble of the organic selenoamino acids.

### **Silicon**

- 130. **Orthosilicic acid** – choline stabilized
- 131. **Silica** [cell salt silicon dioxide] supports liver detoxification; helps strengthen hair, nails and skin; counters dry and sensitive skin; supports retention of hair (falling hair syndrome). Cosupportive of potassium sulfate [kalium sulphaticum]. With potassium sulfate and sodium chloride, aids with congestion of mucus membranes.

## Silver

132. **Silver hydrosol** in chemistry is a nanoparticulate suspension of silver clusters with broad-spectrum anti-microbial properties: virostatic, bactericidal, fungicidal, fungistatic, parasiticidal, effective at 10ppm. It is the least toxic of all bioactive forms of electrically charged silver.
133. **Silver lactate** aka Aragementum lacticum found naturally in human mother's milk and mammalian milk where it acts as a natural preservative, especially against bacteria. This form of silver is also bioavailable for support of myelin tissue in the peripheral nervous system. There are two forms, one where the silver cation interacts with the carboxylic acid group and one where the silver cation interacts with the central oxygen. The carboxylic group reaction results in a neutral organic salt of silver. The reaction with the central oxygen form remains a mild organic acid. In human mother's milk, there is approximately 97.5% of the carboxylic silver salt form and 2.5% the more reactive form.
134. **Silver oxide** can be particulate in suspension and if the clusters are 10nm in size or smaller, it is an effective silver hydrosol species. In bulk form powder, it is bacteriocidal.

## Sodium

135. **Sodium chloride** or Natrum Muriate [cell salt Nat Mur] used in oral rehydration treatment (ORT). Homeopathically it is used to treat dryness of body openings, clear thin mucus; effects of excess overheating; itching of hair at nape of neck; early stage of common colds with clear, running discharge. Used as a topical treatment for insect bites.
136. **Sodium phosphate** or Phosphasoda, are used in medicine for constipation and to prepare the bowel for medical procedures; used in foods as leavening agents and anti-caking agents. Cell salts Nat Phos treats simple morning sickness; acid reflux; crown-centered headache; eyes glued together / morning mattering; and grinding of teeth during sleep.
137. **Sodium sulfate** aka sodium sulphate [cell salt Nat Sulph] acts as a diuretic. If the actual supplement is used for diuresis, then potassium should be supplemented.

**Vanadium** essential ultra-trace mineral element; niacin increases absorption; in cells, V<sup>3+</sup> and V<sup>4+</sup> predominate because of largely reducing conditions; in plasma, V<sup>5+</sup> predominates. According to the WHO, Estimates of total dietary intake of humans range from 11 to 30 µg/day. Levels in drinking-water range up to 100 µg/litre [2001 **Concise International Chemical Assessment Document 29**VANADIUM PENTOXIDE AND OTHER INORGANIC VANADIUM COMPOUNDS]. Oral studies in rats and mice demonstrate greater toxicity of vanadium as oxidation state increases. During mitosis, vanadium interacts with cell replication during the spindle formation phase with a net inhibitory effect. Vanadium may be necessary for the formation of bones, teeth, and cartilage. The mineral may also play a role in growth and reproduction as well as affect the processing of cholesterol and insulin in the body. In studies of mice, vanadium has been shown to lower blood sugar and levels of low-density lipoprotein (LDL) cholesterol and triglyceride. Studies in animals with type 1 (insulin-dependent) and type 2 (non-insulin-dependent) diabetes indicate that vanadium can help to improve blood sugar levels. Several human studies suggest that vanadium may help to control blood sugar levels in diabetics. The mineral appears to work by increasing the body's sensitivity to the hormone insulin due to inhibition of the enzyme tyrosine phosphatase. Vanadium compounds may reduce gluconeogenesis and increase glycogen deposition. Use of vanadium by body builders has proven that vanadium does not mimic insulin or increase insulin's efficacy in healthy people. Vanadium is converted *in vivo* to a vanadyl cation where it can form complexes with substances such as ferritin and transferrin. Bone is the main area of vanadium storage in the body followed by the liver and kidneys. Excretion occurs through both the liver and the kidneys. A daily intake of 10-100 mcg is considered safe and adequate from food sources. The average diet supplies between 6-18mcg of vanadium daily. If the supplement version were to be used, a therapeutic dosage for management of type 2 diabetes is at least 50 mg vanadyl sulfate twice daily.

138. **Vanadium citrate** water soluble 51% bioavailable form.
139. **Vanadium glutarate** a mildly acidic amino acid chelate 77% bioavailable.
140. **Vanadium glycinate or vanadium trisglycinate** a neutral amino acid chelate 93% bioavailable.
141. **Vanadium nicotinate glycinate chelate** or vanadium chelavite a combination product with 99% bioavailability.

142. **Vanadyl sulfate** or vanadyl(IV) sulfate is 24% bioavailable with approximately a 3% absorption rate by adults when used in supplement form. Slightly stressful to the liver to transform into other forms with different anions. Often used in I.V. injections or with parenteral nutrition infusions.

**Zinc** is a heavy metal and an essential mineral; antioxidant; natural antimicrobial; cofactor in all structural protein pathways and 100+ enzymes; up-regulates fibroblast function and activity, therefore, can cause fibrotic tissue to form / scar tissue; regulated or governed by copper (scar prevention); accelerates tissue healing after injury; supports immune function; all granulocytes secrete zinc; leached from body with diarrhea, therefore supplementation is anti-diarrheal; deficiency associated with major depressive disorders; protects genetic material from microbes (seminal fluid); anti-proliferative effects in the prostate gland; protects the eyes. Zinc fingers form parts of some transcription factors, which are proteins that recognize DNA base sequences during the replication and transcription of DNA. Each of the nine or ten  $Zn^{2+}$  ions in a zinc finger helps maintain the finger's structure by coordinately binding to four amino acids in the transcription factor. The transcription factor wraps around the DNA helix and uses its fingers to accurately bind to the DNA sequence. Zinc effectively competes with copper for absorption, therefore, if these are going to be used in their chemical/supplement form, both minerals are best absorbed away from one another, i.e., one mineral supplement in the morning and the other in the evening. Used homeopathically it does not matter. Zinc deficiency is usually due to insufficient dietary intake, but can be associated with malabsorption, acrodermatitis enteropathica, chronic liver disease, chronic renal disease, sickle cell disease, diabetes, malignancy, and other chronic illnesses.

143. **Zinc(II) acetate or zinc diacetate** for treating pharyngitis and the common cold.

144. **Zinc aspartate** (amino acid chelate)

145. **Zinc bisaspartate** (amino acid salt)

146. **Zinc citrate** or trizinc dicitrate, very rich source of water soluble and bioavailable zinc. Very competitive at absorption channels in the upper small intestine, for example, with this form of zinc present, no copper species can be absorbed until this form of zinc has been absorbed first or is no longer present in the lumen of the gut.

147. **Zinc gluconate** or zinc di(D-gluconate).

148. **Zinc glycinate** or zinc bis(aminoacetate) highest bioavailability and is absorbed lower in the small intestine than other forms of zinc.

149. **Zinc picolinate** more bioavailable than gluconate or citrate.

150. **Zinc sulfate** for treating pharyngitis and the common cold.