The Overlooked Role of Chronic Infection in Neurodegeneration and Its Reversal Using Nutraceutical Agents

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Introduction

All tissues of the human body are susceptible to degeneration, especially nerve tissue. This process is called neurodegeneration. Typical examples of neurodegenerative diseases which currently afflict Americans are Alzheimer's disease, Parkinson's disease, amyotrophic lateral sclerosis (ALS), multiple sclerosis (MS) and a whole host of symptoms related to impaired brain and nerve functioning such as poor memory, cognition, attention span, learning ability and physical incompetence.

The number of lives affected by neurodegenerative symptoms and the frequency of occurrence is currently the highest in U.S. history and can ultimately be a source of major physical and mental debilitation for many Americans.

Understanding this process and making intelligent decisions, including dietary, nutraceutical and lifestyle choices, may mean the difference between continuing a good quality of life or gradual loss of function from unchecked neurodegenerative processes.

Summary Overview

Chronic neurodegeneration is a progressive, relentless process. The following presentation will document:

- The overlooked role of infection as the primary driving force in most all chronic neurodegenerative disease,
- The necessity of eliminating infection(s) to achieve complete remission,
- The increased susceptibility to infection due to widespread nutritional deficiencies including a fifty percent reduction in antioxidant content in food in the last 25 years and consumption of hydrogenated oil containing foods which can weaken cellular membranes,
- The potential to rapidly reduce infection risk by eliminating nutritional deficiencies and supplying nutraceuticals in particular powerful antioxidants such as the newly available DHLA (dihydrolipoic acid) capable of quenching every known reactive oxygen and nitrogen species free radical,
- Identification of specific protective nutraceutical agents that counteract fifty known neurodegenerative compounds,
- The identification of whole food and special nutrient sources of protective nutraceuticals,
- The summary of prevention and treatment protocols for neurodegeneration distilled over years of practice and proven efficacious in hundreds of successful cases.

The Two-Interacting Forces Behind the Neurodegenerative Process

The process of neurodegeneration begins at the cellular level in which two main processes, oxidative stress and excitotoxicity, act relentlessly to inflict the majority of cell damage and death.

Although many factors can play a direct role in the initiation of neurodegeneration, the two forces which interact at the cellular level are free radicals formed by the reactive oxygen species and reactive nitrogen species, and secondly, excitotoxins, such as glutamate (monosodium glutamate or MSG), aspartate (i.e., NutraSweet) and homocysteine. Excitotoxins are neurotransmitters which can cause cell death when their actions are prolonged.

a) The Free Radical Phenomenon. In terms of reactive species, the superoxide anion (from the reactive oxygen species) + nitric oxide (from the reactive nitrogen species) react to yield peroxynitrite, a powerful free radical capable of damaging mitochondrial DNA.

A second free radical, the peroxyl radical, can lead to neuron, membrane and mitochondrial damage. It can result from a calcium excess with low magnesium at the neuron and can lead to the production of protein kinase C^2 which in turn, can increase inflammatory arachidonic acid.[3]

Another result of free radical activity is lipid peroxidation which can yield the toxic compound, 4-hydroxynonenal,[4] the most protein reactive product of lipid peroxidation. These compounds can increase the neurofibrillary tangles as seen in Alzheimer's disease. In every cell of the body, both the cell nucleus and the mitochondrial DNA are vulnerable to free radical damage. However, mitochondrial DNA is 10 times more sensitive to free radical damage.[5] As will be shown later, this extreme vulnerability of mitochondrial DNA can be elegantly protected by targeted nutraceutical agents, the most profound of which is DHLA (dihydrolipoic acid), the reduced form of alpha lipoic acid, which is now available in stable form for the first time in history. DHLA promotes a dramatic increase in cellular ATP (energy) and quenches every known free radical (both RNS and ROS species) that can occur in living tissue.

b) Excitotoxicity. When mitochondrial DNA is oxidized, cellular energy is reduced and the cell's sensitivity to excitotoxicity is greatly increased so that even normally occurring amounts of neurotransmitters, such as glutamate, can trigger cell death. As this process accelerates, the cell's P53 gene is activated to destroy itself.[6]

In Alzheimer's disease, the damage is directed at the neuron process such as the dendrites and synapses.[7] In

addition, the amount of Amyloid-beta peptides are increased, hydrogen peroxide levels[8] are increased and as a result, excitotoxicity is increased.[9]

Long before Parkinson's, ALS, Alzheimer's or Huntington's disease becomes active, the affected individual has typically been exposed to a varied host of heavy metals, toxic chemicals and/or inadequate nutrition. This individual has often experienced long-term distress that has finally led to nutritional deficiency, the essential underlying condition which allows infection to thrive.

The Infection Connection to Neurodegeneration

Chronic low-grade infection is often overlooked and frequently goes undiagnosed, especially in the elderly. It appears that the incidence of these infections have dramatically increased in recent years. Infections can become chronic due to the body's inability to clear invading pathogens, including infections from bacteria, nanobacteria, virus, mycoplasma, parasites and biofilms.[146-150, 173]

Chronic, unresolved infection may be seen as a critical player which gradually exhausts the nutritional resources of the body. In studying the literature (especially in light of Panjwani's research[154] which links autoimmune disease to viral infection), it appears clear that in chronic neurodegeneration, the process may often involve the immune system's relentless attack on the infected cells which provides a constant, damaging stream of oxidative stress and ever-escalating levels of excitotoxicity and free radical injury to nerve cells,[10] eventually leading to neurodegenerative disease.

What appears to be overlooked in the medical research on neurodegeneration is the powerful role that chronic infection plays in the ultimate destruction of neurological faculties. The infection connection to neurodegeneration is well established for numerous conditions of outright infection such as viral encephalitis, Lyme disease, AIDS, spongiform encephalitis (as seen in "Mad Cow Disease") and many degenerative brain disorders. Other conditions now appear to be linked to infection as well, such as dementia, stroke and so-called auto-immune disease.

The widespread use of hydrogenated oil in our food, which is known to reduce cell membrane fluidity,[167] makes the cell much more permeable to bacteria and viruses, and the cells become even more susceptible to cancer.[168] Certainly this is a factor in the risk of neurodegenerative disease and fortunately, an easily reversible risk factor. Simply by meticulous elimination of hydrogenated oils (trans fatty acids) from the diet and addition of phosphatidylcholine, phosphatidylserine, phosphatidylinositol and especially phosphatidylethanolamine, cell membrane permeability can be reversed.[166]

We will see that the therapy of choice for neurodegenerative disease which has stemmed from infection (which includes the majority of chronic neurodegenerative disease) is the use of effective anti-infective agents that are pinpoint-targeted to the sites of infection.

Inflammation

Infection or trauma can initiate the inflammatory process. The process of inflammation can increase free radical activity in neurons. When unresolved inflammation becomes chronic, high levels of free radicals are constantly being generated. Damage from this process can trigger the P53 self-destruct gene which then increases apoptosis (cell death).[19] Inflammation can also lead to a low cellular energy state which allows neurons to become hyper-sensitive to glutamate, aspartate and other neurotransmitters so that even normally occurring levels of these neurotransmitters can result in cell death.[20] Increased glutamate levels can stimulate the microglia (a CNS immune cell) to produce more cytokines than normal and to release stored glutamate and quinolinic acid, both excitotoxins. The microglia can also convert tryptophan to the excitotoxin, quinolinic acid.[21] Therefore, tryptophan supplements should not be given to patients with neurodegenerative disease.

A state of oxidative stress can trigger the production of a transcription factor, NF kappa B, which stimulates release of various inflammatory cytokines that are found to be increased in all neurodegenerative diseases.[22] Cytokines can induce the production of nitric oxide. If glutathione levels are low, peroxynitrite can form and concentrate in the mitochondria and then damage cellular DNA[27] and intracellular enzymes, resulting in nitrotyrosine buildup, a marker of peroxynitrite damage.

Microglial cells activated by Beta-amyloid can release protein kinase C, and thus prolong inflammation.[23] Microglial cells can also release large amounts of glutamate and stimulate the release of inflammatory arachidonic acid.[24] They can also release quinolinic acid, a powerful excitotoxin itself.[25] Thus, this degenerative process can feed upon itself, destroying massive amounts of neuronal tissue.

It is pause for thought to realize that this neurodegenerative process began, in most cases, from long-term nutritional deficiency, especially lack of basic minerals (magnesium, calcium and the trace elements) which then allowed chronic infection to take place.

Nutritional Deficiency and Imbalances

Ultimately, it can be shown that the immune system's ongoing attack in response to infection is the ultimate free radical and excitotoxic generator, especially when the body is in a state of nutritional deficiency (either in the quality or quantity of nutrients).

Consuming a diet that is inherently deficient in nutrient intake, especially lacking key, baseline nutrients such as minerals, vitamins and essential fatty acids can lead to an inadequate free radical defense, then the development of chronic infection and as a consequence, chronic neurodegeneration.

The Cholesterol-Antioxidant Connection

Deficiency of key antioxidants can lead to runaway lipid peroxidation. The most common end-product of lipid peroxidation is malondialdehyde. The most reactive end-prod-

uct of lipid peroxidation is 4-HNE (4-hydroxynonenal),[28] a compound that reacts with protein and is a major player in the type of neurodegeneration seen in Alzheimer's disease, Parkinson's disease and ALS. 4-HNE can rapidly inactivate glutathione reductase (the B2-dependent form), which is a key protective antioxidant.

Although LDL (low density lipoproteins) and HDL (high density lipoproteins) both exist in the brain, only LDL is a transporter of cholesterol and phospholipids to the central nervous system. Both HDL and LDL can be readily oxidized in the presence of inorganic iron such as found in "enriched" white flour products.[29, 130] Oxidized LDL can induce cell death which closely parallels the cell deaths seen in excitotoxicity.[30] Buildup of oxidized LDL represents a possible link to ALS. Oxidized HDL can also cause neuronal death.[130]

Homocysteine and Disordered Protein Transport

Homocysteine can be generated in response to a toxic or nutritionally deficient diet. When homocysteine is increased in the blood, it is linked to neurodegeneration. In Alzheimer's disease, we find a significant increase in homocysteine. Since homocysteine is a powerful excitotoxin,[31] elevated homocysteine levels have been found to make symptoms of Alzheimer's disease worse. The metabolic breakdown components of homocysteine alter the NMDA (N-methyl-D-aspartate) receptor sites,[164] leading to multiple negative effects: the generation of peroxynitrite, 4-HNE, hydroxyl and peroxyl radicals, and activation of the eicosanoid cascade and its inflammatory prostaglandins.

In Alzheimer's disease as well as Parkinson's disease and ALS, we also see an increase in disordered protein transporters[32, 33] which can be triggered by viral infection, mercury exposure, oxidative stress and/or hereditary S.O.D. (super oxide dismutase) mutants.[34]

The Sugar Connection

High dietary intake of simple sugars, especially fructose, can lead to glycation of numerous proteins in the cell.[26] Glycation is the process of a protein molecule binding to sugar molecules. Once combined with sugar, proteins are significantly more vulnerable to free radical damage which can then form AGEs (advanced glycation end products) that interfere with tyrosine and dopamine utilization.

For this reason, patients with any type of neurodegenerative disease should not consume foods that contain fructose or refined sugar. AGEs signal glia cells to produce superoxide and nitric oxide. This combination can then produce the powerful free radical, peroxynitrite, which can worsen neurodegenerative disease by damaging cellular DNA and mitrochondrial DNA.

Ascorbic Acid and Iron: A Dangerous Combination

In the brain, vitamin C in adequate amounts plays a critical role as a protective antioxidant and is clearly important for good brain function. Naturally occurring vitamin C as found in foods (which is always accompanied by natural co-factors and synergists) is not the same compound as synthetic ascorbic acid and behaves differently in the human body. Caution must be used in the consumption of ascorbic acid in supplement form, especially as the synthetic, isolated form of ascorbic acid, when consumed at the same time as inorganic iron, especially the added iron found in enriched white flour, such as refined pasta and white bread. When ascorbic acid is consumed with these iron-enriched foods, the iron can cause the oxidation of the ascorbic acid, forming dehydroascorbic acid, a free radical pro-oxidant that is dangerous to the brain's neurons.

Since iron-enriched, refined products are so ubiquitous in the American diet (often in hidden forms), the best protection would be to take synthetic ascorbic acid as a supplement only with the addition of ALA (alpha lipoic acid) or DHLA (dihydrolipoic acid), two antioxidants that protect against iron-induced damage. A better choice may be to consume foods high in natural vitamin C or food supplements rich in food-source vitamin C rather than its synthetic analog, thus eliminating the need to protect the body against the iron-ascorbic acid reaction.

DHLA is capable of regenerating the vitamin C molecule (by reduction) which can provide the broadest spectrum of antioxidant neuron protection[39] rivaled only by turmeric (a source of the potent antioxidant phytochemical, curcumin) in its antioxidant protection.

Nutrients combined together can promote the most effective antioxidant protection, as seen by the superior effect of vitamin C combined with vitamin E, which work together to reduce lipid peroxidation in the brain.[35] Another example of a protective nutrient combination is the neuroprotective effect of CoQ-10 teamed up with niacinimide; these two work together to protect against mitochondrial toxin activity.[36]

Table I lists the major neurodegenerative promoting agents and their corresponding protective systemic nutraceutical agents.

Neurotoxic Agents: Setting the Stage for Neurodegeneration

Exposure to neurotoxic agents, such as consumption of food contaminated with aluminum and fluoride compounds, organophosphate pesticide residues, heavy metals (i.e., mercury, cadmium, etc.), inorganic iron and/or toxic food additives, including glutamate (as monosodium glutamate, MSG) and aspartate act as major stress factors in initiating neurodegeneration. These neurotoxins can initiate free radical and excitotoxic responses, induce nutritional deficiency and create a downward spiral, setting the stage for chronic infection, leading to neurodegenerative disease.

Exposure to neurotoxic agents can deplete the body's antioxidant defenses while increasing oxidative stress and excitotoxicity, and thus accelerate neurodegeneration.

A Look at Aluminum Toxicity

To illustrate the role of a typical neurotoxic agent in initiating neurodegeneration, the effects of aluminum toxicity will be

examined. Aluminum toxicity refers to hydroxide and dioxide forms of aluminum -- not to be confused with harmless trioxide forms of aluminum as found in vegetables.

Exposure to aluminum has far-reaching consequences on human physiology. Aluminum exposure can increase generation of free radicals, while decreasing total lipids, glycolipids and phospholipids in the brain.[12] Aluminum can damage membrane-bound enzymes, sodium, potassium, ATP, acetylcholinesterase and 2, 3-cyclic nucleotide phosphohydrolase. In short, all enzymes necessary for normal neuron function can be damaged by aluminum.

Aluminum exposure at high levels can inhibit many types of antioxidants, such as catalase, S.O.D. and glutathione peroxidase (selenium-bound).[13] Aluminum can also interfere with phosphorylation.

When aluminum is bound to glutamate (MSG, a common food additive), its entry into the brain is significantly elevated.[14] Once in the brain, aluminum increases iron-induced free radical activity.[15] Those at highest risk for aluminum uptake are mineral-deficient, antioxidant-deficient and antioxidant enzyme-deficient. Aluminum uptake is enhanced in Down's syndrome,[16] which is characterized by antioxidant-enzyme deficiency.

The microglial cell (a CNS immune cell) can be activated by any event that increases the free radical excitotoxicity cascade. Aluminum exposure, as well as mercury or glutamate (as MSG) exposure, can all increase the formation of neurofibrillary tangles in the brain and increase the free radical, excitotoxic cascade which activates microglial cells, thus increasing neurodegeneration.[11]

Unfortunately, acquired aluminum toxicity can be a common experience for anyone consuming something as innocuous as orange juice or grapefruit juice (high in citric acid) coupled with an aluminum hydroxide antacid (a common OTC medication). This combination can increase aluminum absorption 11-fold.[17] To protect the brain, pyruvic and malic acid, which compete with aluminum for entry into the brain, can inhibit glutamate toxicity[18] and thus limit its associated damage.

Toxic Dental Restorative Materials

Dental restorative materials in the teeth are often a key source of chronic toxic metal and chemical exposure. Mercury, pallidum, aluminum and xeno-estrogenic agents, all frequently found in common dental restorative materials, can deplete glutathione, (both reductase and peroxidase forms), deplete food-based supplies of flavonoids and other critical phytoprotective nutrients, thus setting the stage for infection leading to chronic neurodegeneration.

Real Food: The Foundation For Protection Against Neurodegeneration

In the process of chronic illness, there are a host of symptoms that marker warning signs along the way to serious neurodegeneration. They may commence with symptoms such as fibromyalgia, anxiety, depression, memory problems, hypoglycemia, etc. All these conditions may improve by boosting the quality and quantity of nutrient intake.

Consumption of whole foods, in their unprocessed form, such as spinach, blueberries, carrots, broccoli, turmeric (curcumin), buckwheat, kale, strawberries, grapes and many more, have shown the ability to reduce the risk of neurodegeneration as well as age-associated cognitive decline[37, 38] beyond the sum of their measurable antioxidant and chemoprotective effects. This fact suggests that currently unknown factors contained in these foods may be responsible for this protective effect.

Contamination of Common Foods

In the U.S., it is difficult to obtain common fruits, such as grapes and strawberries, that are free of pesticide and chemical residues, even when organically grown. These two fruits often have significant pesticide/chemical residues and in particular, should not be consumed unless obtained from a known chemical-free source.

Another common source of contamination in fruits and vegetables is the use of tap water to irrigate crops, which often contains pesticide and chemical residues. Even if a crop is grown organically, unless the water supply is purified or clean well water is used, the final harvest can still contain chemo-toxins.

Naturally Occurring Toxins in Foods

Another factor to consider in consuming whole food sources is that some naturally-occurring compounds in plants can be toxic, such as oxalates. These can create digestive stress. For this reason, spinach (a rich source of oxalates) should not be consumed too frequently.

Radical Reduction of Antioxidant Levels in Food

Research shows that the U.S. has experienced *a 50% reduction in the antioxidant content* of our food over the last 25 years.[135, 136] Therefore, it is impractical to assume that all the body's antioxidant needs can be met by consuming typical foods. The best strategy is to supplement the diet with non-toxic nutraceutical agents, such as DHLA and fully reduced CoQ-10 (ubiquinol), which ensures above-average nutrient levels -- the best protection against nutrient depletion by common neurotoxic agents. This approach ensures the best defense against the development of neurodegeneration.

Conclusion

Clearly, a varied whole foods diet, rich in plant-based nutrients, as free of chemo-toxins as possible, is the wisest dietary strategy to ensure plentiful nutrient levels. Adopting a solid nutritional foundation in addition to the use of key nutraceutical agents can help avoid the development of nutritional deficiencies that later can allow infection to take hold in weakened body sites and thus, invite neurodegeneration.

Table I

Neurodegenerative-Promoting Agents vs. Protective Nutraceutical Agents

Table I below presents a quick reference list of major neurodegenerative-promoting agents (listed in the left column) and the countermeasures to inhibit, slow or halt this process using protective nutraceutical agents (listed in the right column) based on the latest research findings.

Neurodegenerative-Promoting Agents	Protective, Systemic Nutraceutical Agents
Acetylcholinesterase - degrades acetylcholine, the neurotransmitter critical to cognition	Huperzine inhibits acetylcholinesterase[155]
AGE (Advanced glycation end products) - signals immune cells to produce superoxide anions and nitric oxide which increase production of peroxynitrite, a powerful free radical	Inhibited by GSH (glutathione, reduced form), curcumin, SOD[89], carnosine[174], green tea[181]
Alcohol Intake - decreases antioxidant levels at synaptosomes and neuronal mitochondria; increases lipid peroxidation	• Inhibited by curcumin[43, 153] • Avoid alcohol intake[93]
Aluminum (AlO_2) Neurotoxicity - exposure to aluminum dioxide (AlO_2, toxic form of aluminum): common in dental composites, consuming food cooked in aluminum cooking utensils	AlO_2 uptake - inhibited by pyruvate, malate[18]and glutathione peroxidase (the selenium dependent form, the first line of defense against AL toxicity)[13]
Amyloid B-Protein Production - triggered by hippocampal cytotoxicity; increased by EMF exposure[172]	Inhibited by pine bark[109], testosterone can decrease amyloid B secretions[171]; vinpocetine inhibits glutamate receptors[49], carnosine[175]
Arachadonic Acid Inflammatory Cascade - excess of arachidonic acid is seen in over-consumption of red meat and dairy products	Inhibited by kaempferol, luteolin, quercetin, fisetin, apigenin[52], USP-grade cod liver oil[53], organic borage oil[54]
Apoptosis-associated DNA Fragmentation - a type of DNA damage common to Alzheimer's disease	Protected by B3A (niacinamide)[121]; rapid DNA repair promoted by the flavonoids[46]
Cell Energy Production, Low -greatly increases cell susceptibility to damage from excitotoxic agents (i.e. MSG, aspartame). Cholesterol-lowering drugs decrease cell energy; deplete CoQ-10.	• Cellular energy production - increased by CoQ-10, pyruvate, malate, creatine[18, 51], NADH • Eliminate cholesterol-lowering medications; take 300 mg. of CoQ-10 daily while transitioning or 1,224 mcg of ubiquinol (fully reduced CoQ-10)
Cholesterol, Oxidized (both LDL, HDL) - cholesterol becomes oxidized by free radicals	Regenerated by CoQ-10[90], turmeric[43]; oxidative protection by quercetin, other flavonoids, vitamin B12, tocotrienols, DHLA (dihydrolipoic acid), ALA (alpha lipoic acid). Most protection (80%) from oxidation by B12 and kaempferol[91]
Complex I Transport Defects Low cellular energy creates blocks in the cellular transport chain during cellular energy production.	Blocks bypassed by: CoQ-10, vitamin E[102], tocotrienols
CNS (Central Nervous System) **Excitotoxicity** - nerve cells damaged by excitotoxin exposure	CNS nerve cells - protected by the neuromodulator, taurine[116], carnosine[178, 179]
CNS Inflammation - seen in increased NF-kappa B transcription factor	Inhibited by curcumin, quercetin, apigenin[115] and resveratrol[138]
CNS Injury - injury from trauma, nutritional deficiency or toxic exposure (i.e., excitotoxins)	CNS nerve cells protected by: • Vitamin C: inhibits release of histamine from mast cell[114] • Quercetin: blocks histamine receptor[113]

Table I, Continued

Neurodegenerative-Promoting Agents	Protective, Systemic Nutraceutical Agents
COX II (cyclooxygenase II) Production COX II is an enzyme induced due to injury; associated with increased inflammation/pain.	Inhibited by kaempferol, apigenin, genistein, curcumin[98]; curcumin found equal in potency to NSAID drugs in inhibition of COX II enzymes[94]
Cytokine Production Cytokines are small proteins, esp. interleukin II, generated at sites of cell damage.	Inhibited by glutathione[85] and magnesium[88]
Dopamine Production, inadequate Dopamine is an essential neurotransmitter produced by conversion of L-DOPA via tyrosine hydroxylase; deficient in Parkinson's and other brain-associated degenerative disease.	• Protected by vitamin C: the preferred source of vitamin C is natural vitamin C as found in fresh fruits, vegetables and their concentrates, not synthetic sources[162] • NADH increases dopamine production • CoQ-10 protects dopamine-producing neurons[161]
Excitotoxins Excitotoxins are neuro-toxins that are often added to foods, such as aspartame, and MSG (monosodium glutamate, also known by other names such as "natural flavors", texturized protein, "spices", etc.).	Carnosine[178, 179], taurine[116]
Free Radicals:	Inhibited by:
• Hydroxyl radical	• DHLA (quenches broadest array of free radicals)[39]; ALA (can raise GSH 30-70% above normal levels)[40]; curcumin[43], GSH, melatonin[44]. Note: ALA regenerates oxidized CoQ-10 in oxidative stress[41]; ALA is rapidly converted to DHLA in the cell[42].
• H_2O_2 (hydrogen peroxide)	• DHLA, curcumin, ALA, melatonin, carnosine[176]
• O (singlet oxygen)	• DHLA, curcumin, ALA, melatonin, carotenoids (i.e. zeaxanthin, lutein, beta carotene, lycopene, etc.)
• Hypochlorous Acid	• DHLA, curcumin, ALA, melatonin
• Superoxide Anion	• DHLA, curcumin, SOD, carnosine[177]
• Peroxyl	• DHLA, curcumin, vitamin E, carotenoids, especially mixtures, carnosine[177]
• Peroxynitrite (nitric oxide + superoxide anion)	• DHLA, curcumin, ALA, olive oil (contains hydroxytyrosol)[45], melatonin, flavonoids in general protect DNA and initiate fast DNA repair[46]
Fluoride Cytotoxicity Typical form used: hydrofluosilicic acid, the most corrosive chemical agent known to man; derived from toxic gases produced in the manufacture of phosphoric acid and phosphate fertilizers; contains lead, mercury, arsenic, beryllium and high concentrations of radionuclides; used for water fluoridation in 2/3 of U.S. cities. Sodium fluoride, also toxic, sometimes used.	• Protection from toxic forms of fluoride by antioxidants (vitamins A, C, E and selenium). • Avoid drinking fluoridated water[152] and California wine[92] (high in sulfites, fluoride and organophosphates).

Table I, Continued

Neurodegenerative-Promoting Agents	Protective, Systemic Nutraceutical Agents
Glutamate (Monosodium glutamate or MSG) **and Aspartate Cytotoxicity** Glutamate (MSG) exposure frequently found in processed foods listed as "natural flavors," TVP, broth, etc., commercial food served in restaurants; aspartame found in soft drinks and used as a sweetener in many commercial foods	Protection by: • First line of defense: calcium, magnesium and trace elements • Vinpocetine (regulates Na channels)[49] • Pyruvate and malate: inhibit glutamate cytotoxicity by increasing cell energy generation[50] • Creatine[51] • Huperzine-A inhibits glutamate[155] • Carnosine[178, 179], taurine[116]
Glutamate Toxicity, at the N-methyl-D-aspartate (NMDA) neuron receptor Glutamates can lodge in the NMDA receptor to create excitotoxic damage; seen in Parkinson's disease	• Directly blocked by methylcobalamin (vitamin B12)[107] • DHLA, ALA – reduced size of lesions by 50%[108]
Hippocampal Neuron Damage Hippocampal neuron damage is identified by brain scan.	Hippocampal neurons protected by low-dose vitamin D (found in USP-grade cod liver oil)[110], DHEA-S[111], NADH[112]
Homocysteine, elevated - an amino acid formed from methionine, absorbed by the body via animal-derived foods. Homocysteine increased by l-dopa medications (Sinemet) and antibiotics, Bactrim and Septra	Decreased by vitamin B12, folate, vitamin B6[47, 48]
4-Hydroxynonenal (4-HNE) - the most reactive product of lipid peroxidation; deactivates glutathione reductase; seen in disordered protein transporters; common in amyotrophic lateral sclerosis (ALS or Lou Gehrig's disease)	Inhibited by glutathione reductase[55] (the B2- dependent form)[95]
Hydrogenated Oil - linked to increased cell membrane permeability[163] and therefore increased risk of bacterial/viral infection	• Inhibited by phosphatidylethanolamine (decreases cell membrane permeability – increases cell membrane fluidity[166, 167, 168]) • Avoid foods containing hydrogenated or partially hydrogenated oils (trans fatty acids)
Immune Response, hyper - commonly seen in allergies or infection	Immune response protected by aswagandha[101], bee pollen[156]
Infection, Bacterial/Viral	Resolved by coriolus[60, 61, 62], maitake[63-74], olive leaf[75, 76], reishi[137, 138], hyssop[157, 158], Soma latha, wild yew (taxol)[139], sutherlandia[140]
Infection, Mycoplasmic	Resolved by *Hyssop officinalis* [157, 158], Soma latha (*Sarcostemma acidum*)

Table I Continued

Neurodegenerative-Promoting Agents	Protective, Systemic Nutraceutical Agents
Infection, Parasitic	Resolved by *Holarrhena antidysenterica*[77-84], a powerful, broad-spectrum, anti-parasitic herb
Interleukin-12 (IL-12), excess IL-12 is a pro-inflammatory cytokine.	Inhibited by curcumin[94]
Iron (Fe) Intake, from inorganic sources Common forms of supplemental Fe, such as ferrous fumarate, when taken at the same time as ascorbic acid, increases the free radical, dehydroascorbate, the oxidized form of vitamin C	• Avoid taking supplemental iron with ascorbic acid. For example, avoid consuming enriched flour (which contains inorganic iron) when consuming vitamin C[151]. • In general, to prevent the risk of forming dehydroascorbate, use natural-source vitamin C as found in food and whole-food-source supplements in combination with ALA or DHLA, tocotrienols and/or vitamin E.
Lipoxygenase (LOX), excess LOX is an enzyme that catalyzes the oxidation of unsaturated fatty acids to yield peroxide, a potent free radical.	Inhibited by quercetin, curcumin[99]
LTP (long-termed potentiation) Changes, Age-Related LTP is responsible for impaired long-term memory.	Reversed by high dose DHLA and ALA[129]
Magnesium (Mg), low Low magnesium occurs in: poor dietary intake, uncontrolled catecholamine output, etc.	Increase calcium/magnesium[86] intake and adaptogenic herbal support since levels of Mg are shown to decline with increased adrenaline levels[87]
Malondialdehyde (MDA), excess MDA is the most common product of lipid peroxidation	Brain cells protected by: glutathione reductase (B2 dependent glutathione)[28], USP-grade cod liver oil[160], carnosine[180]
Mercury (Hg) Neurotoxicity Sensitivity to Hg is directly related to tissue levels of alpha tocopherol and selenium[56].	• Garlic binds to Hg efficiently to remove it from brain[57], active principle Glutathione peroxidase (the selenium dependent form) and ALA are effective Hg chelators[59]. • Cilantro (*Coriander sativum*) is effective as Hg chelator[169, 170].
Mitochondrial Damage, cumulative, due to excitotoxin exposure	Ginkgo biloba preserves mitochondrial function[127], carnosine[178, 179], CoQ-10[18, 51]
Mitochondrial Energy Production, low - creates global deficits in cellular protection and support; mitochondrial DNA 10 times more susceptible to damage than nuclear DNA[5]	Mitochondrial energy production increased by acetyl-L-carnitine, DHLA, ALA[104, 105]; supported by magnesium, vitamins B1, B2, B3, A, C, E, K and tocotrienols, folic acid[103], CoQ-10[18, 51].
Mitochondrial Toxicity, Lesions (striated), - induced by excitotoxin exposure	CoQ-10 restores energy production but does not prevent cellular death unless combined with vitamin B3, A (niacinamide)[106].

Table I Continued

Neurodegenerative-Promoting Agents	Protective, Systemic Nutraceutical Agents
Nervous System Lesions, (including sympathetic, parasympathetic and CNS lesions) - includes injury or pathologic changes in nerve cells	Nerve cells - protected by flavonoids which reduce histamine release and activity[113] (produces an indirect calming effect on nerve cells)
Neurodegeneration, the process of	• Protection by DHA[118] (docosahexaenoic acid) but only safe and effective if taken with antioxidant supplementation concurrently) • Significant protection by DHEA-S[119], genistein, quercetin[120]
Neuron Membrane Breakdown, hypoxia-related Seen in Alzheimer's[165]; hypoxia induced by frequent hypoglycemic episodes as seen in diabetes; mimics ALS symptoms	• Neuron membranes protected by ginkgo biloba against hypoxia breakdown[122] • Avoid enriched grain products, refined sugar and fructose to reduce hypoglycemic-induced episodes[123]
Nitric Oxide, excess - from production of iNOS (inducible nitric oxide synthease) - iNOS triggers production of peroxynitrite, a powerful radical	Protection by DHLA[39], ALA, olive oil, kaempferol, apigenin, genistein, curcumin[98]
Nitrotyrosine - end-chain marker of neurological destruction and elevated peroxynitrite, a deadly free radical	Inhibited by GSH[85], DHLA[39]
Protein Kinase C, elevated - an enzyme family that transduces signals from the cell's cytoplasm; magnesium deficiency elevates circulating levels of inflammatory cytokines, esp. protein kinase C[88]	Inhibited by kaempferol, luteolin, quercetin, fisetin, apigenin[46], USP-grade cod liver oil, borage oil, essential fatty acids[159]
Prostaglandins (Series II), activation of - pro-inflammatory leukotrienes, the end-chain inflammatory products of the arachidonic cascade	Inhibited by curcumin[100], USP-grade cod liver oil and borage oil[53, 54]
Quinolinic Acid, excess - a byproduct of serotonin metabolism and a known excitotoxin; can be increased by intake of serotonin precursors (such as 5-hydroxytrytophan and tryptophan)	Discontinue use of serotonin precursors in neurodegenerative conditions, since they can increase quinolinic acid, a powerful excitotoxin[117].
Sulfites - sulfur compounds added to wine or alcohol as preservatives; these are known neurotoxins that increase neuronal toxicity, especially in Parkinson's disease; may worsen asthma symptoms	• Inhibited by glutathione[92] • Avoid intake of sulfites, esp. sulfite-treated dried fruit, salads and most wine, especially California source[92].
Tumor Necrosis Factor-Alpha (TNF-alpha), elevated - a cytokine elevated in Alzheimer's disease, Parkinson's disease and ALS	Inhibited by organic green tea, curcumin, quercetin[96, 97]

Sources of Neuroprotective Compounds

The following sources of neuroprotective compounds have been used extensively in clinically tested combinations in our research to help the body overcome neurodegenerative disease.

Table II
Neurodegeneration: Sources of Neuro-Protective Compounds

Neuro-Protective Compound	Food Sources	Special Nutrient Sources
Acetyl Groups • **Acetyl-L-Carnitine**	Formed from good quality vinegar (rich in acetic acid) coupled with natural vitamin C (from fresh fruit) and lysine (as found in kefir, whey, fish, chicken)	• Plant-source enzymes: assist in protein breakdown for better bioavailability of lysine, which coupled with food-source vitamin C, can produce carnitine; the acetic acid base can be used to synthesize n-acetyl-l-cysteine as well
• **N-Acetyl-Cysteine**	Same as acetyl-l-carnitine, except formed from natural vinegar and cysteine (as found in beans)	• Acetyl-l-cysteine
Adaptogenic Herbs	Siberian ginseng	• Cordyceps (whole and fermented mycelial extract) • Chyavanprash (an ancient 40+-herb Ayurvedic tonic) • Siberian maral root (*Rhaponticum carthamoides*) • Arctic root (*Rhodiola rosea*) • Tibetan ginseng (*Rhodiola crenulata*) • Fo Ti Tieng (*Polygonum multiflora*) • Nopal cactus (*Opuntia ficus indica*)
ALA, DHLA	Potatoes	• Nanized DHLA • Nanized chlorella • Grade A, broken-cell wall chlorella • Young, air-dried grasses
Allicin, Stabilized	Garlic, leeks, chives, onions, shallots	• Stabilized allicin
Allium (allyl sulfides)	Garlic, leeks, chives, onions, shallots	• Nanized garlic
Apigenin	Organic celery[142, 143], fenugreek seeds, chamomile, organic green tea, pollen	• European propolis (mold-free) • European pollen (pesticide-free)
Ashwagandha (*Withania somnifera)*	None	• Chyavanprash (an ancient Ayurvedic 40+-herb formula which contains ashwagandha)
B12, Vitamin	Primary grown nutritional yeast (grown on molasses substrate), certain mushrooms, organic red meat	• Nanized B12 (highly bioavailable)
Borage Oil	None	• Organic borage oil

Table II, Continued

Neuro-Protective Compound	Food Sources	Special Nutrient Sources
Calcium, Magnesium and **Trace elements**	Natural calcium sources: home-made kefir, carrot juice Natural magnesium/trace element sources: organic green leafy vegetables	• Sango Reef marine coral minerals • Young grasses (barley, wheat, oat) • Grade A chlorella (whole) • Nanized chlorella • Wild blue green algae
Carnosine	Small amounts in chicken breast and red meat	• L-Carnosine
Catechins	Green tea, black tea, wine, coffee, apples	• Nanized green tea
Cod Liver Oil, U.S.P.-grade	Organic cod liver oil (USP)	• Organic cod liver oil (USP)
CoQ-10 ubiquinone (oxidized) or **CoQ-10** as ubiquinol (fully reduced)	Whole grains, oily fish, organ meats, spinach, broccoli, nuts, peanuts, sardines, mackerel	• CoQ-10 (ubiquinone) derived from natural sources (yeast grown; not synthetic) • Nanized fully reduced CoQ-10 (ubiquinol) produced via probiotic fermentation
Coriolus, fermented mycelial extract	None	• Organic coriolus mushroom (whole or fermented mycelial extract)
Coumestan	Alfalfa sprouts	• Red clover
Creatine	Manufactured in the liver from substrates of sulfur-containing amino acids (methionine, glycine, arginine) as found in milk, eggs, red meat, fish (cod)	• Natural-source creatine
Curcumin	Organic turmeric root	• Nanized turmeric
DHA (docosahexaenoic acid)	Organic cod liver oil (USP-grade), organ meats, eggs, chicken	• USP-grade Norwegian cod liver oil
DHEA-S, DHEA	No natural food sources	• European, solvent-free DHEA (wild yam derived)
DIM (diindolylmethane)	Broccoli, cauliflower, kale, turnips, collards, Brussel sprouts, cabbage, kohlrabi, rutabaga, Chinese cabbage, bok choy, horseradish, radish, watercress	• Broccoli concentrate • Food-source DIM (not synthetic)
Fisetin (a bioflavonoid)	Organic green tea, pollen, mango[144]	• European pesticide-free multiple pollens (18 European pollen sources, mold spores removed, allergy-free, chemo toxin-free) • European propolis • Himalayan pine pollen • Nanized green tea
Flavonoids	Organic fruits, vegetables	• European propolis (contains over 500 different bioflavonoids) • European pesticide-free multiple pollens (18 European pollen sources, mold spores removed, allergy-free, chemo toxin-free)
Folic Acid	Organic, green leafy vegetables, primary-grown nutritional yeast	• Nanized folic acid (the preferred form of folic acid), once-living source only

Table II, Continued

Neuro-Protective Compound	Food Sources	Special Nutrient Sources
Garlic, whole; garlic oil	Organic garlic or garlic oil	• Nanized garlic (whole and oil)
Genistein	Organic tofu (fermented soy); traditionally fermented miso	• Fermented isoflavone concentrate • Traditionally fermented miso
Ginkgo biloba	None	• Organic Gingko biloba
Glutathione Peroxidase	Primary grown nutritional yeast (molasses substrate) is rich in GSH; use together with foods high in selenium (richest food source is ashitaba) so the body can synthesize glutathione peroxidase	• Reduced glutathione • Ashitaba (whole) • Nanized ashitaba (highly bio-available; rich in selenium)
Glutathione Reductase	Primary-grown nutritional yeast (molasses substrate) delivers reduced (GSH). Glutathione together with B2 help the body form glutathione reductase.	• Primary-grown nutritional yeast
Green tea	Organic green tea	• Nanized green tea (organic, non-irradiated)
Holarrhena antidysenterica	None	• Holarrhena antidysenteria from India (pesticide-free)
Huperzine	None	• Chinese Club Moss
Hyssop herb	Organic hyssop tea	• Organic hyssop herb
Isoflavones, fermented	Miso, tofu, tempeh	• Fermented isoflavone extract (soy) • Traditionally fermented miso
Isothiocyanates (sulphorophanes)	Broccoli, cauliflower, kale, turnips, collards, Brussel sprouts, cabbage, kohlrabi, rutabaga, Chinese cabbage, bok choy, horseradish, radish, watercress	• Broccoli Concentrate
Kaempferol	Bee pollen, apples, black tea, onions	• European pollen sources (*avoid American pollen: typically too pesticided and rancid*) • European propolis (pesticide-free) • Himalayan pine pollen
Lignins	Flax seeds, flax oil	• Flax Oil
Luteolin	Organic celery[142, 143], fenugreek seeds, alfalfa seeds, chamomile, organic green tea[132, 133, 134], pollen	• European pollen (pesticide-free) • European propolis (pesticide-free) • Himalayan pine pollen • Nanized green tea
Maitake	Organic whole maitake mushrooms (contains bio-available water-soluble alkaloids)	• Fermented mycelial extract of maitake (contains immune-protective triterpenes)
Malic acid	Organic nuts, seeds, green leafy vegetables	• Nanized chlorella • Air-dried, organic grasses

Table II, Continued

Neuro-Protective Compound	Food Sources	Special Nutrient Sources
Melatonin	Very tiny amounts found in whole grains, fruits (such as oranges), vegetables (such as tomatoes)	• Nanized, solvent-free melatonin, once-living source (animal-free)
Methylcobalamin (B12)	Primary grown nutritional yeast (molasses substrate)	• Nanized B12
NADH (nicotinamide adenine dinucleotide)	Found in small amounts in most foods, especially poultry	• NADH (pH-balanced to prevent degradation)
Niacinamide (B3A)	Primary grown nutritional yeast (molasses substrate)	• Nanized niacinamide (once-living source)
Olive Leaf	Organic olive leaves	• Italian olive leaf extract
Olive Oil	Extra virgin, olive oil (alkali-free)	• European olive oil (alkali-free); be wary of commercial olive oil (often alkali contaminants)
Phosphatidylethanolamine, and associated phospholipids: **Phosphatidylcholine, Phosphatidylserine, Phosphatidylinositol**	Lecithin (non-GMO)	• Phosphatidylcholine (from non-GMO lecithin) • Phosphatidylserine (from non-GMO lecithin) • Phosphatidylinositol (from non-GMO lecithin) • Phosphatidylethanolamine (from non-GMO lecithin)
Pine Bark Extract	None	• French maritime pine bark extract
Polyphenols	Grapes, green tea	• Nanized green tea extract
Pyruvate	Organic red apples, golden delicious apples, spinach, bananas, garlic	• Calcium pyruvate
Quercetin	Organic brown onions, olives, lettuce[132], fenugreek seeds, chamomile, pollen	• European propolis (pesticide-free) • Himalayan pine pollen
Reishi (*Ganoderma lucidum*)	Organic reishi mushroom tea	• Wild, mountain-grown reishi from China (whole and fermented mycelial extract)
Resveratrol	Grapes, red wine, berries, pea-	• Nanized Giant Knotweed (rich in resveratrol)
Selenium	Chlorophyll-rich foods, beans, grains	• Nanized ashitaba
S.O.D. (Superoxide dismutase)	Many chlorophyll-rich foods, including deep-green or orange-yellow fruits and vegetables	• S.O.D. (Bifido bacteria base, highly bio-available)
Soma Latha, herb	None	• Soma latha (herb) from India (specially grown according to Ayurvedic herbal masters)

Table II, Continued

Neuro-Protective Compound	Food Sources	Special Nutrient Sources
Taurine	Organic beans, buckwheat	• Natural-source taurine

Testosterone	Royal Jelly (boosts testosterone production)	• Royal Jelly
		• Testosterone Precursors
		  ○ Velvet Deer Antler
		  ○ Epimedium Herb
		  ○ Long Jack root
		  ○ Muira puama bark
		  ○ Tribulus terrestris root
		  ○ Maca Root

Tocotrienols	Rice bran, natural vitamin E food (which contain tocotrienols): sunflower seeds, turnip greens, mustard greens, chard, almonds, papaya, broccoli, olives, kale	• Stabilized rice bran (non-rancid) • Rice bran oil (which contains tocotrienols)
Vinpocetine	None	• Periwinkle extract
Vitamin B6	Primary grown nutritional yeast (molasses substrate)	• Nanized vitamin B6 • Vitamin B-6 (P-5-P), a special form of highly bioavailable B6
Vitamin C (naturally occurring, not synthetic ascorbic acid)	Organic oranges, grapefruit, apples, leafy greens	• French maritime pine bark extract • Camu camu • Amla (berries) • Rosehips • Acerola berries
Vitamin D	Homemade kefir, sunshine exposure, Norwegian cod liver oil (USP-grade)	• Reishi mushroom (contains provitamin D) • Norwegian cod liver oil (USP-grade)
Vitamin K (menadione)	Organic, green leafy vegetables	• Nanized greens • Greens; young grasses
Wild Yew (contains taxane phytochemicals such as taxol)	None	• Pacific yew needles (excellent source of taxanes)

The Marshall Protocol for Prevention of Neurodegeneration

In order to prevent neurodegeneration or begin the reversal process, the following protocol has been developed, embodying over 30 years of practitioner research.

Medical Drugs

The patient should be encouraged to work with his/her physician to minimize the use of unnecessary medical drugs. Many types of medical drugs can suppress normal physiological processes, increase toxic metabolic residues and deplete critical nutrients.

Examples of Nutrient Depletion From Medical Drugs

- Cholesterol-lowering drugs can decrease CoQ-10 levels which may reduce cell energy and increase excitotoxicity (drug examples: Mevacor, Pravachol, Lovastatin).
  **If taking cholesterol-lowering drugs and/or a low cell energy state exists, add nanized, fully reduced CoQ-10: 1-3 tsp. in water at breakfast, which has been proven to resolve a low cell energy state.
- Sinemet, an L-dopa medication, as well as antibiotics, such as Bactrim and Septra, can increase homocysteine levels.
  **If homocysteine is elevated, take homocysteine-clearing nutrients (including trimethylglycine, folic acid, B vitamins, etc.).
- NSAIDS can reduce glutathione levels and can increase free radical damage and excitotoxicity.
  **Use nanized turmeric (highly bioavailable turmeric, a rich source of curcumin, shown equal to NSAIDS as an anti-inflammatory agent): ½ tsp./day in 4 oz. water, once or twice/day (3 or 4 times/day in special cases) for 2 to 3 months.

Electromagnetic Field (EMF) Exposure:

EMF (electromagnetic field) exposure has been shown to increase amyloid-beta protein, a powerful inflammatory compound that increases excitotoxicity.[172] To decrease/eliminate EMF exposure in home and office environments, install EMF protection devices that convert harmful EMFs to harmless ones.

Recommended Dietary Protocol (General Guidelines):

The following key dietary strategies are recommended for optimal nutrient uptake:

Salad Greens: Eat a rich organic, green leafy salad, grown with pure water such as well water (example: crops grown in rich soil that is watered with non-toxic well water), 3 to 5 times per week.

Natural Vinegar: Make a homemade salad dressing using good quality vinegar (not commercially made vinegar which is petroleum-based, synthetic acetic acid). Natural vinegar is a good nutrient source of naturally occurring acetic acid.

- Use authentic Italian vinegar (for example, a 50-year old vinegar naturally cultured in oaken kegs): 1-2 tablespoons daily mixed with olive oil on salads.

Moroccan Olive Oil: Use an organic salad oil daily containing pure Moroccan olive oil (alkali-free) or a blend of oils including organic olive oil, flax oil, sesame oil and borage oil.

- Use Moroccan Olive Oil: 1-2 tbsp/day or an essential fatty acid blend (with 4 key oils: olive, flax, sesame and bor age oils): 2 tsp. daily mixed in salads or food.

Nutritional Yeast: Primary grown nutritional yeast (grown on molasses, not petrochemicals): rich in glutathione, beta-1, 3-glucans, natural vitamin B-complex and 50% complete protein by weight.

- Use: 1-2 tablespoons/day, mixed in salads or food.

Organic Turmeric: Grade 10 (medicinal grade) fresh-ground, turmeric (immediately encapsulated after grinding) from India.

- Use Indian turmeric: 3-5 Vcaps/week, opened and sprinkled on food, 3 to 5 times per week.

Organic Garlic: Use one clove, once per week or more, especially raw.

Natural Sea Salt: Use unheated, unprocessed raw salt from non-toxic sea water sources.

- Use sea salt ground with a nontoxic, low-nickel stainless steel screen, unlike almost all other sea salt (which often contains nickel contaminants due to being ground with high nickel screens): use in place of regular salt.

Natural Food-Source Minerals/ Probiotics: To boost calcium, magnesium and other minerals and for high amounts of beneficial flora: consume homemade kefir (1/2 to 1 cup, several times per week). Kefir converts processed milk back to a highly bioavailable, probiotic-rich raw food and efficiently converts most lactose to galactose and natural glucose. Kefir kits are available to provide kefir granules to make homemade kefir.

Organic Fresh Fruit, such as apples, blueberries, blackberries, oranges. Eat often when in season.

Organic Tofu (Mori-Nu brand only; other brands often contain mold residues): 1 to 3 times per week.

Organic Green Tea

- Nanized green tea (organic): Use ½ teaspoon in 4 oz. water at breakfast and dinner.
- Use Green Tea leaves (organic, non-irradiated): Use 1 cup of tea, 2 to 4 times per week (1/2 tsp. tea per cup of hot water, not boiling; let steep 10 minutes before drinking).

Brain Phytonutrients

- Use a brain phytonutrient blend containing Ginkgo biloba, Chinese club moss (supplying huperzine A) and periwinkle (containing vinpocetine), all organic and nonirradiated, as a tea. Drink 1 cup tea, 4 to 5 times/ week (1/2 teaspoon total/cup of tea)

Limit Animal Protein: Limit red meat (all types) and eggs; eat none or maximum 1 to 2 times per week only. (Both are high in arachidonic acid which directly fuels the inflammatory free radical/excitotoxicity cascade in the human body. This applies even to organic sources.)

Avoid Toxic Foods: Avoid canned/processed foods, foods with hydrogenated oil, "natural flavors," TVP (textured vegetable protein), [the two previous items are both names for MSG], diet sodas and other foods containing aspartame, etc.

Advanced Nutraceutical Support

Since currently available food sources (even organically grown) are typically poor in mineral and antioxidant content, supplementation for best health should include many of the following nutraceutical agents. The amounts of each depend on each person's age, weight, special needs, etc.

Organic Grasses: Young, organic grass mixes (especially barley, wheat and oat grasses) contain all the essential nutrient cofactors and transporters necessary for life.

- Use young grasses: Take 1 to 2 tsp/day mixed in drinks or food or 10 Vcaps/day.

Pesticide-Free Colostrum: Use 1 to 2 Vcaps/meal or 1 to 3 teaspoon/day.

Digestive Support

- Use plant-based enzymes (highly purified to eliminate aspergillus residues) combined with essential cofactors and transporters: 1 to 2 Vcaps with cooked food meals.
- Use live-source HCL (hydrochloric acid) in vegetable capsules, not tablets; take 2 to 6 Vcaps at end of meals with a live-source potassium-rich concentrate (also 2 to 6 Vcaps) at the end of meals with cooked food.

Living-Source Minerals

- Use Sango Reef marine coral minerals: 1 to 2 Vcaps/meal.
- Norwegian cod liver oil (USP-grade) to ensure best calcium utilization: 3 Vcaps daily.

Organic Chlorella, organic broken cell wall chlorella for lipoic acid, chlorophyll and much more

- Use nanized chlorella: ½ to 1 tsp in 4 oz. water upon arising daily.

USP-Grade Cod Liver Oil

- Use U.S.P.-grade Norwegian cod liver oil: 3 Vcaps or ½ tsp liquid with breakfast.

Tocotrienols from stabilized rice bran, 6,000 times more potent than vitamin E as an antioxidant.

- Use stabilized rice bran: 1 to 3 tbsp/day alone or mixed in food.

Adaptogenic Herbal Support

- Use an adaptogenic herbal combination, including Soma Latha, Rhodiola, Tibetan Ginseng, and botanical synergists: 2 to 4 Vcaps at breakfast; helps regulate catecholamines and thereby control magnesium blood levels; helps stabilize/normalize hormone activity.

Organic Propolis, rich in phytonutrients; delivers over 500 different bioflavonoids.

- Use European Propolis (a chemotoxin-free source): 2 to 6 Vcaps/day.

Organic Pollen: European, multi-strain pollen concentrate gathered from very clean areas (pesticide and chemical-free), mold spores removed so it is allergen-free, with no use of mercury-based hive disinfectants; complete food that provides one of the most broad-spectrum range of elegant nutrients to meet the most specialized human requirements. (Be wary of American pollen sources, often high in pesticide residues).

- Use European pollen (pesticide-free): 2 to 6 Vcaps/day. This nutrient powerhouse, with kaempferol, secalosides A and B and over 400 bioflavinoids, can often balance female and male hormone activity.

NADH Support

- Use NADH (10 mg), a sublingual form for a reliable delivery source of NADH; increases cell energy and dopamine, great for athletes: 1 to 2 Vcaps emptied under tongue, early in the day.

DHLA for Maximum Antioxidant Protection: Nanized DHLA: 1/2 tsp. (80 mg.) in 2 oz. of water, 2 to 4 times daily.

Protective Brain Nutrients: When eating out: take an organic concentrate of all four phosphatidyls: phosphatidylcholine, phosphatidylserine, phosphatidylinositol and phosphatidylethanolamine to protect brain cells, the "antidote to eating out" (protects against effects of MSG/hydrogenated oils exposure): 2 Vcaps per meal.

Protective Antioxidants and Immune Compounds: Use a high-powered, antioxidant nutraceutical blend daily which contains: organic blueberry (rich in ellagic acid, a high-powered antioxidant), Himalayan pine pollen (for maximum chi and antioxidant protection), CLA (conjugated linoleic acid made from the superior glyceride vegetable source; enhances the PPAR [perioxisome proliferator-activated receptors], a class of internal cell receptors that are capable of suppressing inflammation), arabinogalactin (immune-boosting, stimulates natural killer cell activity, decreases ammonia production), pesticide-free whey protein (produced by ion-exchange yielding a whopping 25 – 28% glycomacropeptides for unparalleled hormone, immune and neurological support).

- Use an antioxidant, immune-supporting blend (which contains all of the above antioxidants and healing nutrients): 2 to 4 tablespoons daily mixed in homemade kefir or in a 50% kefir/50% purified water or organic juice blend for a hearty, immune-boosting breakfast.

The Marshall Protocol For Treatment of Neurodegeneration

Attempts to reduce neurodegeneration have focused on ways to inhibit the series of free radical and excitotoxic reactions indigenous to the process. This approach has merit; however, it focuses on merely treating the symptoms, not the cause.

In most all chronic neurological disease, the tissue-specific degeneration is the result of the immune system's natural killing process, utilizing free radicals and excitotoxicity, which has become a runaway freight train fueled by chronic infection that leads to large-scale neurodegeneration. It is not realistic to expect to stop the process of neurodegeneration by using compounds that only quench ROS or RNS free radicals and inhibit excitotoxicity. Boosting these compounds can, however, be expected to help buy time to determine the sites of infection to be targeted and the best phytonutrient complexes to use to help the body rapidly eliminate the infections. In viral infection (which frequently occurs in autoimmune disease and other conditions), as well as in bacterial and mycoplasmic infection, the ongoing process of infection can be rapidly eliminated using special nutraceuticals such as Maitake, Coriolus, Hyssop, Soma, Wild Yew, Sutherlandia, etc. In some cases, the use of live-source HCL and potassium orally can express healthy gene function at the cell level and suppress the aberrant gene's activity.

In addition, damage from infection can often be reversed using cutting-edge, new compounds such as Hericium (a fermented mycelial extract of monkey head mushroom, shown to help regrow nerve tissue), organic colostrum (shown to do significant DNA repair) and a host of many other nutraceuticals capable of DNA repair. Remember, any phytonutrient that has anti-viral properties is capable of DNA repair.

Even in parasitic infection, DNA repair is often possible, although when the infection has penetrated the peritoneal lymphs, the battle may rage on for up to two years, even with the best of nutraceutical intervention.

When the body does not have adequate nutritional support to rapidly eliminate infections and to correct the DNA cellular damage (as a result of infection), the immune system's efforts to kill the body's infected cells can often result in rapid runaway neurodegeneration. Often the infection is such that if the immune system were able to kill every infected cell, the resulting damage would cause significant loss of neurological function. Unfortunately, the process of neurodegeneration from infection is an everyday occurrence. Providing healing nutraceutical agents to repair the DNA of the cells that are infected and to suppress virus gene function while expressing healthy gene activity are the only real answers.

Using Effective Anti-Infective Nutraceutical Agents

There is an emerging group of powerful antiviral, antimycoplasmic nutraceutical agents, which include hyssop, Soma latha, Maitake mushroom, Coriolus Versicolor, Olive leaf, Sutherlandia, Pacific Yew, Gandoderma Lucidum (Reishi mushroom) and more. However, for these anti-infective nutraceuticals to be effective, they must be targeted at the infected tissue. In the case of neurodegenerative disease, every nutrient essential for life must be provided and in sufficient quantity so that anti-infective substances can be delivered to infected sites. Additionally, sufficient support for key organs, such as the liver and kidney, must be provided since they have greater nutritional requirements under the increased detoxification burden, when the body is experiencing a powerful detoxication via an anti-infective program.

The 5 Steps To Great Health

Working with thousands of chronically ill patients for over 30+ years, we have summarized our treatment protocols in 5 primary steps which we have found to be critical in establishing the return to great health. When neurodegenerative disease is active, the following clinically proven steps are recommended:

Step I: **pH Balance**: Aggressive, rapid correction of nutritional deficiencies, especially mineral repletion, leading to restoration of a near-alkaline first morning urine pH between 6.4 and 7.0.

Step II: **Hormone Balance**: Sustaining/re-establishing hormonal balance by replenishing the body's natural hormones, especially natural progesterone, DHEA and adrenal hormone support.

Step III: **Detoxification**: Systemic detoxification of the body's cumulative toxic burden via elimination of environmental and chemical toxicity; also, elimination of triggers to the body's biofield.

a) Specific internal and external detoxification of key target organs and restoration of their detoxification capacity: kidney, large intestine, liver, gallbladder.

b) Elimination of heavy metal sources, including external exposure to toxic elements in home products and personal care products.

c) Elimination of toxic food and beverage sources, such as pre-made foods, most commercial meal replacement protein drinks, food supplements containing "natural flavors" (MSG), tryptophan, cysteine, aspartic acid, glutamic acid, magnesium stearate (an immune suppressive binder used in supplements), fluoride, sulfites, etc.

d) Elimination of all toxic dental restorative materials. Toxic dental materials can promote and perpetuate viral, bacterial, mycoplasmic and parasitic infections in the mouth and surrounding body tissue.

Examples of Toxic Dental Materials

- Silver fillings (mercury amalgams) which contain approximately 50% mercury and other metals
- Dental materials which contain toxic metals, such as palladium, stainless steel (high nickel) and other toxic materials; stainless steel is a typical base of porcelain-jacketed crowns
- Most composite restorations (which are petrochemically based) are high in aluminum dioxide (highly reactive with other dental metals which releases toxic metal ions into the oral cavity)

e) Elimination of the inhibitory effects on the body's biofield from previous trauma, scars, etc. Repolarization of a disordered biofield using a new therapy called Biofield Repolarization (BRT) can help rapidly restore the bio-field to normal. BRT therapy can dramatically help promote uptake of nutrients and enhanced healing capacity. Strengthening the body's biofield is often the missing link to recovery in many chronically ill people. BRT can help strengthen deficient electromagnetic pathways as well as helping to clear the cellular memory of previous trauma. Repolarization via BRT is an essential step when:

- Previous trauma (physical or emotional) is present.
- Metabolic processes at various points, especially in the brain, are suppressed.
- Scars are blocking the body's normal bio-energetic communication and meridian energy flow.

Step IV: **Resolution of Infection**: Resolution requires efficient identification and elimination of chronic infection sites by pinpoint-targeting anti-infective nutraceutical agents to infected sites, coupled with broad-spectrum nutraceuticals to control ROS and RNS activity and to inhibit excitotoxicity (see Table I [Neurodegenerative-Promoting Agents vs. Protective Nutraceutical Agents] and Table II [Neurodegeneration: Sources of Neuro-Protective Compounds]); also upregulation of the immune system to support the rapid elimination of infection.

For the best clinical results, use nutraceutical agents that have been proven to rapidly restore/ maintain ideal cellular resonance to deliver a rapid quantum shift back to the best health status possible for each individual.

Step V: **Rejuvenation**: Once chronic infection sites have been eliminated (or concurrent with the anti-infective process), many rejuvenative nutraceutical agents can be used to promote repair of damaged nerve tissue. Use of Hericium and other nerve-regenerative compounds, such as pesticide-free colostrum, amla berry concentrate and other adaptogenic herbs, can help the individual regain lost neuromotor/brain function to varying degrees.

Summary

The wisest approach is to halt these devastating diseases before they are able to destroy the neurological functions of the host by adopting an aggressive program using highly effective, well chosen nutraceutical agents in clinically tested ratios which support the entire body's physiology (as outlined above).

After resolution of chronic neurodegeneration, when the individual has returned to a healthy state and his/her body has become infection-free, the protection for the entire body's intercommunicating organ/gland network is best provided by the continued daily use of a broad-spectrum of chemoprotective compounds that are free of solvent or chemical residues, and that are not synthetically isolated, but derived from exquisitely well-grown sources, free of toxic chemical or non-nutritive binders, flowing agents, fillers, preservatives or stabilizers.[131]

Note: For more details on "The 5 Steps to Great Health" or the Marshall Protocol for Neurodegeneration, a powerful, time-proven patient approach, please email: info@prlabs.com.

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