

# DIET FOR ALS

(Lou Gehrig's Disease ~ Amyotrophic Lateral Sclerosis)

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## *HOMEOSTASTIS*

The damage that is going on in ALS ranges from the complex to the unknown. Scientific studies abound and a devout researcher would be both enlightened by them while simultaneously confounded. In the meantime, where does that leave someone who was diagnosed with ALS, and all they know is that they are scared and getting worse, and nobody seems to fully understand? They don't have *time* to weather the scientific debates. Truly, even someone with ALS would tell you that until they were diagnosed, they had absolutely *no idea* how their entire world view would change. They would tell you that going to bed at night, once a pleasant experience, is now terrifying – all symptoms are amplified and while the rest of the world sleeps, they are left alone to deal with the indescribable pain and fear. Thoughts that once meditated on family and friends, career and vacation plans, now disintegrate into hopelessness. *But there is hope.*

More than 30,000 people in the U.S. have ALS. Approximately 500,000 Americans suffer from Parkinson's. There are about 400,000 U.S. citizens with Multiple Sclerosis [MS], with 200 new diagnoses each week! Likely these statistics are low, as many people have not yet been diagnosed, or have been incorrectly diagnosed. In addition, a very frightening factor has emerged ~ more than ever, youngsters are being diagnosed with neurological diseases like Parkinson's! No doubt about it, neurological diseases are on the rise and will continue to rise until man focuses on the *underlying factors* that cause a seemingly normal human body to suddenly go horribly awry. In fact, the rate of MS has *doubled* in the past 10 years. The rate of autism (another neurological disorder) has increased by *ten* times that of 30 years ago! To discern what is going wrong, man has to look to a wisdom higher than himself – a wisdom that created dogs to consume meat and cows to consume grass without any debate over blood types, genetics, or ethnicity.

Homeostasis means physiological balance and equilibrium. Some of this balance and equilibrium we all have quite a bit of control over, by making “right” choices with diet and lifestyle. Other aspects of balance and equilibrium occur deep within the 57 or so trillion cells that make up your body and *respond* to being given the proper tools to repair and equilibrate, while also responding nicely to *not* being poisoned. Homeostasis requires eliminating toxins and pathogens. When you do, your body has some uncanny and powerful mechanisms given at birth to right the wrongs caused by whatever happens to you after (and even before) birth.

The term *homeostasis* is a critical one in true healing because the trend in conventional medicine is *not* towards physiological balance and equilibrium – but one of merely (and dangerously) attacking symptoms. Even physicians who *claim* to practice “natural medicine” can fall victim to straying from the path to physiological balance and equilibrium by confusing underlying causes of a particular disease with *factors that occur along the path to the disease* but are not the underlying *cause*. Imagine if a ship is sinking because of an unknown hole in the hull and everything inside is getting wet. Imagine the ship's mates running around madly trying to dry off all the wet objects by using a toxic “drying spray” – but the objects just keep getting wet – leading to need for

more of the spray. Of course you can quickly see how there would be a much different outcome if the ships' mates would quickly *plug up the hole causing the problem* and then allow the items to dry naturally on their own. Or, if wisdom prevailed, *and* they plugged up the hole *first* they could apply a safe, natural drying modality (like sunshine) to expedite the drying process. *Why can't all human beings, including scientists and healthcare practitioners apply this same wisdom to healing?* Some do, or are trying to – others just don't seem to grasp the concept. In fact, it seems as if more human beings have difficulty with the fact that “underlying causes” are most important, and I have a theory.

For many years the “norm” for a cholesterol level has been 220-230. This “norm” has been based upon an average of what most people's cholesterol levels *are not* what they *should* be. Most people now realize that their cholesterol level should be much lower, but many *still* do not. This leads me to this point: People have a very difficult time wrapping their mind around the fact that a *horrific* diagnosis of ALS, Parkinson's, Multiple Sclerosis, Huntington's Disease, or Autism, for example, that is causing them so much expense, grief, physical pain and may even plummet them to an early death, could be caused by (for example) the pesticides on those luscious fruits and vegetables they consume daily; mercury their beloved dentist or doctor is applying or injecting into their body; and glutamates that the FDA is allowing to be hidden in their foods and treated as a harmless “seasoning”. These have “always” been a “normal” part of life! These highly damaging toxins aren't seen, smelled, tasted or even “felt”. And the argument I hear is: *Everybody* is getting pesticides or eats glutamates or has mercury fillings - so why am I sick, and not my neighbour. But the truth is, *we're all potentially a “day away” from any horrific diagnosis*. If it's not a neurological disease, it may be cancer, heart disease or diabetes. The truth is that where not too long ago only one in 2,000 children “got” autism, now it's 1 in 150. And the other 149 who don't get autism from the pesticides, heavy metals and glutamates, get epilepsy or attention deficit disorder, depression, childhood Parkinson's and God only knows what else.

That science can't see the “whole picture” is never more powerfully seen than in studies that look at only one facet of a complex disease. In ALS for example, there is excess glutamate activity in the central nervous system that the drug Rilutek® - a “glutamate-blocking” drug addresses. Rilutek® works by delaying the onset and progression of the *symptoms* because it blocks the excessive neurological activity and destruction caused by glutamate toxicity! Estimates on how long it extends life varies according to the drug's manufacturer, Aventis Pharma, who claims three to four months is average. They say that some patients get an extra 12 to 18 months ([www.rideforlife.com](http://www.rideforlife.com)). Why only months? I have a burning question or two: What if patients were put on a [added] glutamate-free diet *instead* of this drug? Would their life expectancy increase by years instead of months? And then what about addressing the issues of pesticides and other toxins as well as the heavy metal connection? Now can we extend life spans by 10, 20, 30 or more years? I believe the answer is yes, and I don't have to search far for some proof.

In his book, “Eric is Winning”, Eric Edney talks about beating the 2-5 year odds of ALS with organic, no MSG or other chemicals foods, avoiding all toxins, but especially heavy metals like lead and mercury. He is alive more than 14 years beyond his diagnosis and shares his experience in his book, where he talks about others who have lived over 30 years beyond diagnosis on detox programs. He speaks extensively of returning to the proper body balance and how it's all about knowing the underlying causes (toxins!!); no longer allowing them into the body; and taking measures to eliminate toxins that are there. He's the first to state that there is no *one* “right” way, but many paths to the same end. That said, however, he states that there is no getting around a 100% pure organic diet, free of chemical additives!

In fact, a story was told in Reader's Digest some years ago about a WWII soldier sent home to die with incurable cancer – the doctors said there's was nothing more that could be done. He lived on a farm in the Midwest and decided that he *was* going to live. He ate nothing but the produce that he grew himself (without chemicals) on his farm (he was what you might call a “poor dirt farmer” not today's high tech ways). Within a very short time when he returned to his doctor for a physical, the doctor was amazed that he could not find any trace of cancer anywhere in his body.

Getting back to looking to a wisdom higher than ourselves, call it God or call it Nature, but we need to “trust and obey”. Ask a classroom of 6 year olds which is better for them, a candy bar or an apple and suddenly they're all little nutritionists, and so are you. We simply *cannot* put peanut butter into the gas tank of an automobile and not expect disastrous results. Likewise, the human body, *all* human bodies, have certain common dietary and lifestyle rules that give their body the best possible chance to equilibrate or *return* to a physiological balance that gives their 57 trillion cells a chance to heal. Bud Curtis wrote *Remove The Thorn & God Will Heal* in 1996 (Belco). This book discusses health and pollution, primarily toxicity, which he pointed out to be the major cause of illness in bowels and liver. Bud was years before his time and suffered severe harassment with his message, but his successes prevailed and his book contains testimonials of healing from *removing the thorn*.

Hulda Clark, Ph.D., N.D, has written many books on curing various diseases. She is a brilliant and dedicated scientist. Her many years of research has caused her to come to a conclusion that many in the medical profession don't appreciate and have scoffed. That is, that *all diseases are caused by pollutants and/or parasites*. As simple as that sounds, if you read her work, and the many testimonies of people who have followed her advice, you cannot leave without a new awareness of the *initiation* of disease is what was once a healthy body. Not only that, but science is also replete with evidence where a pollutant or parasite is the underlying assailant in a disease. It is my hope that we can take the wisdom from many, like Dr. Clark, who have dedicated their lives to truth and combine it *all*, weeding out misinformation (often based upon the desire of a drug company or individual to sell something) and come up with the wisdom and healing of nature *combined* with gifts that we have in science and medicine to speed up healing where damage has been so great, and where speed is of utmost importance, as in ALS.

Indeed, some disease states, like ALS, are deeper and advancing at a more rapid pace and will require seemingly heroic measures to return to a state of homeostasis. This requires a deeper understanding of the factors that are occurring in this world [the toxicities mentioned] to cause these horrific diseases in the first place. But *trusting* means knowing that you *don't* have to panic and take every supplement known to man (the “shot-gun” approach). We must get to the core of the problem and *remove it*. Then we will discern the most important nutritional supplements to detoxify the body, assist the brain and nervous system in proper functioning, as well as supply needed nutrients for damage repair. To prevent having the impossible expense and task of taking every nutrient known to man, we will make use of the fact that a whole foods organic diet will supply much of the nutrients needed. The supplemental nutrients we will emphasize will be those that will have a *positive* “drug-like” effect.

There are also *modalities* that also have positive, drug-like effects. One example would be the use of your own bone marrow stem cells. Many people are *still* not aware that your body contains its *own* healing stem cells, residing mostly in your bone marrow. Your stem cells are there to go to the site of injury and heal it. And your stem cells are only one of many healing mechanisms within your body.

**KEEP IN MIND AT ALL TIMES the most important things to be addressed with ALS  
and all neurological diseases (so that the body can heal) REMOVE:  
EXCITOTOXINS  
PESTICIDES  
HEAVY METALS**

Diseases can each be like their own thousand piece puzzle. By carefully and painstakingly putting together as many pieces as possible, a clearer or even lucid picture emerges. Unfortunately the puzzle pieces are often obtained from so many diverse sources, that they are either hidden from us altogether, or “fed” to us in bits and pieces...and *no clear picture* is available. Imagine taking a thousand pieces of a puzzle, putting them in a bag, shaking the bag up, and simply removing a few pieces at a time and trying to discern what the entire picture is. All too often, this is what is happening when a doctor “tries” a drug on his patient; or a patient “tries” a supplement from a health food store – without any knowledge of or confidence in what you are doing.

Then there is the “what if” factor to medicine. This is where you have the story of two cancer patients. One lives years beyond her prognosis by changing her diet or trying some natural modalities – but when she dies, perhaps even years beyond expected, it makes front-page news – unfortunately the news is that “natural” medicine doesn’t work. The other goes the “medical route” 100%, trusting doctors, who may not even be completely sure that what they are doing will even work, but hope, of course, that it will. This woman, perhaps, dies without an fanfare in the expected number of years. Doctors say, “we did everything we could.” But did they?

In regenerative medicine, the goal is to get to the bottom, or underlying cause of a disease, utilize detoxification measures, and then rebuild the body. Utilizing safe and natural methods to combat pollutants and parasites is imperative. Currently, orthodox medicine does *not* look to the *underlying* factor so much as to the *effects* of these factors, and then most often employs a powerful drug or therapy (like cutting out damaged tissue) in an attempt to counteract symptoms. To those of us who are continuously looking for the underlying cause of a disease, this just doesn’t make sense. Yet the “what if” factor plays upon people’s fear of the unknown. “What if” I go “natural”, vs. “what if” I hand myself over to the medicine. Unfortunately too many, because of sheer ignorance, don’t at least try “Nature” first. All too often they come to me *after* medicine has failed, and it’s often too late. Yet a medical doctor can prescribe medicines that have been “sanctioned” by governing agencies, and be immune from any blame should the medicine not work – and worse, *cause damage or death*.

Truly, every human being needs to make up their own mind which way they want to go. One way puts complete faith in medicine and the medical profession; the other way necessitates that a person educate themselves as to how the human body works, what is and is not working according to scientific studies, as well as with groups of people or even individuals. In *Personalized Regenerative Medicine* we dare to go where “no

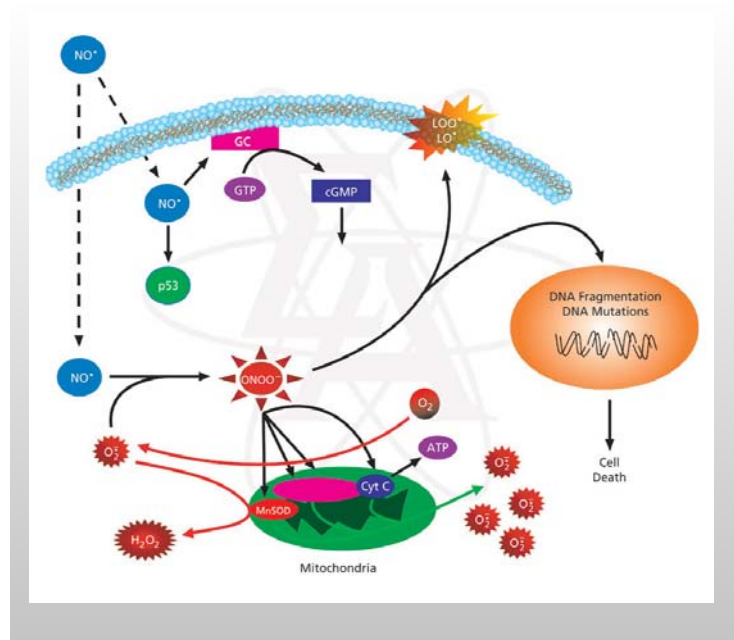
man has dared to go before” . We make every effort to pull together the **scientific** data (that which was done under controlled conditions, by sanctioned scientists); **clinical** data (that which was done with on a group of subjects usually, by health and science personnel, with careful collection of the results of their study); **anecdotal** data (that which is reported by individuals or groups stating what they have observed) and even **speculative** data (when anyone notes, for example, that if  $1+1 = 2$  over there, perhaps  $1+1$  will also equal 2 when we apply it in this different circumstance). With this information, it appears clear to us that we can generate a powerful picture of the underlying causal factors for ALS to generate a hypothesis (a proposal) as to what needs to be done to counteract that which *caused* and continues to cause ALS. At the same time we can be far more discerning as to why a certain drug or extreme diet may have “helped” ALS patients for a time, but may or may not be the way to a long term plan for living 14 to 30 years longer than the typical 2-5 year prognosis.

## ***START AT THE END: CELL DEATH***

### **Studies**

“ Our findings emphasize the importance of *defense responses* and cytoskeletal, *mitochondrial and proteasomal dysfunction*, reflect reduced neuronal maintenance and vesicle trafficking, and implicate impaired ion homeostasis and glycolysis in ALS pathogenesis. Contrary to expectations for a tissue under oxidative stress, nuclear-encoded *mitochondrial genes are uniformly down-regulated*. Moreover, the down-regulation of mitochondrial and glycolytic genes implies a combined reduction of mitochondrial and cytoplasmic energy supply, with a possible role in the death of ALS motoneurons. Lederer CW et al. **Pathways and genes differentially expressed in the motor cortex of patients with sporadic amyotrophic lateral sclerosis.** *BMC Genomics*. 2007 Jan 23;8:26.

“The results are consistent with previous data demonstrating that cytochrome oxidase, not iron-sulfur enzymes, is the primary target for NO inhibition of brain cell respiration” Brown, G.C., **Nitric oxide and mitochondrial respiration.** *Biochim. Biophys. Acta.*, 1411, 351-369 (1999).



## **DIETARY GUIDELINES**

- 1 – ELIMINATE EXCITOTOXINS: MSG [Glutamate], ASPARTAME [Nutrasweet®]**
- 2 – REMOVE FROM ENVIRONMENT AND BODY ALL TOXINS Mercury, Lead, Pesticides....**
- 3 - 100% CERTIFIED ORGANIC, MOSTLY VEGETABLES, WHOLE FOODS DIET This diet is *no pesticides*, low sodium, high potassium, high fiber, low glycemic, high bioavailable calcium.**
- 4 – FOR NOW AVOID EXCESSIVE PRECURSORS TO NITRIC OXIDE**
- 5 - SUPPLEMENTS Maximize Liver Function; Safely Chelate Out Heavy Metals; Naturally Squelch Excess Nitric Oxide [+Antioxidants in General]; Support Mitochondrial Energy + Re-establish Beneficial Flora in Gut**

### ***Medical Help***

After removal of cellular poisons with the use of proper diet, supplements and detox modalities, healing and rebuilding the structure and function of the damaged central nervous system is greatly enhanced by working with a ***Personalized Regenerative Medicine*** specialist. Repair of damage is best done by use of stem cells, growth factors and tissue building nutrients.

***ELIMINATE EXCITOTOXINS: MSG [Glutamate], ASPARTAME [Nutrasweet®]***

### **Studies**

“Amyotrophic lateral sclerosis” (ALS) is a fatal neurodegenerative disease which was thought to be untreatable for a long time. However, recent evidence in men indicates that antiglutamatergic strategies are the first to have an influence on its pathogenesis and slow down the disease process.” **Antiglutamate therapy of ALS – which is the next step?** A.C. Ludolph, T. Meyer, and M.W. Riepe. Dept. of Neurology. University of Ulm, Federal Republic of Germany

“Excitotoxicity mediated by glutamate has been implicated as a cause of this progressive degeneration.” **Altered AMPA and cannabinoid receptor trafficking in motor neurons of ALS model mice: Implications for excitotoxicity.** P. Zhao, M.E. Abood, E.C. Beattie. Research Inst., California Pacific Med Ctr., San Francisco, CA Oct. 2006.

“Defects in neurotransmitter glutamate transport may be an important component of chronic neurotoxicity in diseases such as amyotrophic lateral sclerosis...we developed a model of slow toxicity in cultured organotypic spinal cord slices...” By inhibiting glutamate transport they slowed the degeneration of motor neurons in the spinal cord. **Chronic inhibition of glutamate uptake produces a model of slow neurotoxicity.** Jeffrey D. Rothstein et al. John Hopkins University. *Proc. Natl. Acad. Sci. USA* Vol 90, pp 6591-6595, July 1993 Neurobiology.

“Along with ionotropic and metabotropic glutamate receptors, the cystine/glutamate antiporter, may play a critical role in CNS pathology. High levels of extracellular glutamate inhibit the import of cystine, resulting in the depletion of glutathione and a form of cell injury called oxidative glutamate toxicity.” **Oxidative Glutamate Toxicity Can Be A Component of the Excitotoxicity cascade.** David Schubert and Dana Piasecki. *The Journal of Neuroscience*, October 1, 2001. 21(19): 7455-7462.

“L-Glutamate is the major excitatory neurotransmitter in the mammalian central nervous system”...dysfunction of transporters [EAAT1 and EAAT2 in glial cells] in the brain are implicated in the pathology of neurodegenerative conditions such as amyotrophic lateral sclerosis. **Transporters for L-glutamate: An update on their molecular pharmacology and pathological involvement.** PM Beart and RD O’Shea. *British Journal of Pharmacology* (2007) 150, 5-17.

“Jeffrey Rothstein has uncovered an abnormality that seems to be widespread in patients with sporadic ALS.” Rothstein and his colleagues at Johns Hopkins University presented evidence that a brain protein called EAAT2 is improperly made in almost half of the patients they studied. This protein deactivates and recycles the neurotransmitter glutamate and a deficiency could lead to a glutamate build-up. Glutamate is toxic to cells in high concentrations and some thought by researchers to be the cause of neuron death that control muscles.

“...excessive glutamate was found to injure cultured neurons by stimulating Ca<sup>2+</sup> (calcium) influx, and this is thought to be involved in a variety of neurological diseases.” Glutamate neurotoxicity and diseases of the nervous system. Choi DW. *Neuron* 1988;1:623-634.

“Excitotoxicity is a common mechanism seen in many neurological disorders, including strokes, brain trauma, CNS infections, autoimmune disorders, multiple sclerosis, heavy metal toxicity, brain tumours, and the majority of neurodegenerative diseases...including Lou Gehrig’s disease (amyotrophic lateral sclerosis, ALS). In a recent series of papers, I argue that excitotoxicity is also the central mechanism of autism and the Gulf War Syndrome. **Excitotoxicity: A possible central mechanism in fluoride neurotoxicity.** Blaylock, R. *Fluoride* 2004;37(4); 301-314 Research Review 301.

“Glucose is a major precursor of glutamate and related amino acids. Other precursors of the small glutamate pool were found to include glutamate, aspartate, GABA, serine, leucine and sodium bicarbonate.” M.S. Starr. **Evidence for the compartmentation of glutamate metabolism in isolated rat retina.** *Journal of Neurochemistry* 23 (2), 337–344 (1974).

“Human ingestion of "chickling peas" from the plant *Lathyrus sativus*, which contains an excitatory amino acid, L-BOAA (L-beta-N-oxalylamino-L-alanine), leads to a progressive corticospinal neurodegenerative disorder...These results support the view that thiol oxidation and concomitant mitochondrial dysfunction (also implicated in other neurodegenerative disorders), occurring downstream of glutamate receptor activation by L-BOAA, are primary events leading to neurodegeneration.” Striam K et al. **Thiol oxidation and loss of mitochondrial complex I precede excitatory amino acid-mediated neurodegeneration.** *Journal of Neuroscience* 1998 Dec 15;18(24):10287-96

Glutamate induces cell death by upsetting the cellular redox homeostasis, termed oxidative glutamate toxicity, in a mouse hippocampal cell line, HT22 Suh HW et al **Curcumin attenuates glutamate-induced HT22 cell death by suppressing MAP kinase signaling.** *Mol Cell Biochem* 2006 Nov 25

**M**onosodium glutamate [MSG] was discovered in 1908 by Kikunae Ikeda, a chemistry professor at Imperial University of Tokyo. He discovered that it made foods taste better. It was discovered later that foods tasted better because MSG “excited” the taste buds [which are a “hot bed” of sensory neurons] into *tasting* the food more acutely. Unfortunately, that same excitation that occurred in the taste buds, can also occur anywhere in the body, including the brain. Normally, glutamate in the brain works by “exciting” neurons into connecting and doing their job. But all you need is manufactured by your body or obtained in whole foods, *and* all you need is miniscule.

Years ago, during World War II our soldiers got a taste of Japanese foods to which MSG had been added as a “seasoning” (though of itself, MSG has no flavor). American soldiers wanted *their* food to taste as good. This was the beginning of America’s love affair with MSG and it being brought to the United States. While there are very low levels of “free glutamate” found in foods of all kinds – *these* are not the problem – they are put there by Nature (or God) for a good purpose. Contrarily, hundreds of thousands of metric tons of MSG are produced and *added* to our food every year. To complicate matters, MSG is only required to be listed on the label if it is a separate ingredient in the food. Therefore, in most cases, MSG is hidden by including it as part of other ingredients on the label. Yet, it can make up as much as 60% of these other ingredients! Here, then is where MSG becomes a neurological poison: *In the brains of people who have the inability to “clear” MSG* [see “Jeffrey Rothstein” and EAAT2 above] *neuron damage inevitably ensues.*

Where are you getting glutamate? *Everywhere.* Even a Chinese restaurant boasting “We Don’t Use MSG” is either lying or ignorant. I went into one of these restaurants once posing as a student studying restaurant management. I asked to view the kitchen and took photos “to show how well-run the kitchen was” and while pretending to be taking photos of the “well organized supplies”, I took photos of product ingredients. *Every one of them had an MSG source.* The truth is, when you hydrolyze, modify or texturize soy, wheat, and corn, you *generate* high levels of MSG. In addition, sources that you don’t even realize are sources of MSG (like “yeast food” or “calcium caseinate”) would never let on that it was there for the glutamate. When you eat “out” and eat food that has been seasoned by someone else, you run a 99% chance of consuming high levels of added glutamates.

In a 2005 “blog” (<http://autisticconjectureoftheday.blogspot.com/2005/11/beware-chinese-food.html> ) the author has obviously done her homework on MSG and it’s affect on brain disorders. She states:

“MSG and its related ingredients have been found in increasing amounts in processed and fast foods. Almost every restaurant and most processed foods from snacks and soups to ready-made meals have glutamate in them in some form or another. MSG has no nutritional value. Scientific studies have shown that food laced with the MSG cause people to eat more of it, and faster, than food without it. Corporations use this knowledge to sell their products. Their competition uses MSG, so they keep adding it in larger amounts to keep up with them.”

Thanks to John Erb, a developmental disorder researcher and author of the book *The Slow Poisoning of America*, the cause of ADHD and Autism is no longer a mystery. "These diseases appear to be caused by a food additive commonly known as MSG or Monosodium Glutamate." John Erb explains, "MSG is added to food because of its addictive qualities, it is nicotine for food. It is highly reactive in the human brain and other

organs." John Erb comments: The FDA has no limits on how much MSG can be added to foods, even though as little as two tablespoons of it has been shown to cause epileptic convulsions and death in animals such as dogs."

Is the answer a drug to "block glutamate"? That's how the drug and medical industry think. When you go to your doctor does he tell you that a diet carefully excluding *added* glutamates would help you? No, if aware of glutamate, he would look in his PDR to see if there's a drug to block glutamates instead. In fact, the only drug approved by the FDA for the treatment of ALS is Riluzole®. Riluzole® blunts the effects of glutamate by decreasing glutamate release and blocking the ability of glutamate to bind to its receptors, which decreases the excitotoxicity that leads to cell death. It has been shown to prolong survival times in ALS patients by only two months. Some might say this is "progress". I say that you cannot completely block anything in the body and get away with it. What the body needs is balance – *homeostasis*.

As the third guideline above states, you need to consume organic foods, pure and whole – but you need to also make sure that no MSG has been *added*. Unfortunately you cannot simply eat at restaurants or buy anything off the shelf of your health store. Because "glutamate" is "natural" manufacturers have been duped into thinking it can be added to foods (arsenic is natural, too!) In fact, health stores have some form of MSG added to many of their foods, with soy products being among the worst. No matter where you get your food, at home, in a health store, and even in restaurants, you *must* read labels – and better still, eat foods that don't *have* labels, like fresh, whole foods.

### ***The Relationships of Glutamine, Glutamate, and Glutathione***

You've heard the term "no man is an island" or "the knee bone is connected to the shin bone"? The fact that nothing works alone is absolutely true in biochemistry. The *bottom line problem* with ALS, Parkinson's, Multiple Sclerosis and many other brain or neurological problems is *damage by oxidation*. Of that fact, we must remain acutely aware (and also that there are extraordinary factors, like heavy metal toxicity, that cause oxidation to be such a horrific problem in sufferers of neurological diseases). Why one neurological disease is different in symptoms from another would be due to degree of oxidation, location of oxidation, degree of body toxicity, body defense systems in place (or missing), etc.

In the field of *Personalized Regenerative Medicine* we look to remove offending toxins and supply everything the body needs for repair in as natural a way as possible. This is often diametrically opposed to pharmaceutical-medical folks who spend millions seeking that one magic pill to counteract any one of many aspects of a disease. Often, the underlying cause of a disease isn't even known when a drug is taken; neither are all the possible side-effects of a drug. Hence, we have historically witnessed many disastrous outcomes such as those with Fen-Phen® or Vioxx®.

That said, we can't simply remove, *nor excessively supply*, any one compound, especially not by using an extreme diet or toxic drug to do so. Amino acids and molecules are related, have a purpose, and of themselves are *not* the problem. Below is one example of three related molecules that are involved in neurological disease, but not "the problem", in and of themselves, as you'll see as you read on.

**Glutamine** is an amino acid synthesized by the astroglia from another amino acid, called glutamic acid or glutamate. Glutamine is referred to as a conditionally essential amino acid because under certain circumstances the body is unable to produce enough glutamine to meet its needs, so it becomes "essential" during these times to obtain glutamine from the diet. Someone with a neurological disorder would never want to *supplement* glutamine. And in fact, we would want to remain vigilant to avoid supplements that contain multiple ingredients. Glutamine can be hidden in the list of ingredients or be a component of an ingredient and is the precursor to the excitotoxin glutamate. In a whole foods organic diet, we will be supplying all the building blocks needed for the body to produce its own needed glutamine.

**Glutamate** (also glutamic acid or L-glutamate, which simply refers to the orientation of the glutamate molecule) is an amino acid (protein building block) neurotransmitter in the brain responsible for the ability of neurons to synapse (connect) and thus do their job. In *Synaptic Self*, 2002, Joseph LeDoux said "You are your synapses. They are who you are." So true. It is when something goes awry (like heavy metal toxicity) in neurons' ability to connect and do their job that we present with all the "neurological symptoms" of the various neurological diseases: Tingling, numbness, cramping, inability to think, depression, eyesight fluctuations, fatigue, muscle wasting, and more. You *need* glutamate. You consume glutamate present in natural foods in your diet, some "bound" some "free" (only the "free" glutamate behaves as an excitotoxin in excess). You consume from less than .3 gram (300 mg) to 1 gram of "free" glutamate daily in a whole foods organic diet. You *do not need* to add it to your diet in "supplemental" or "seasoning" form (MSG). In fact, be very cautious about accidental supplementation by taking any supplement that contains any soy or fermented products which, by nature, generate free glutamates. When you take them, you are taking free glutamates.

**Glutathione** is a "good guy" generally. The problem is when it breaks down into its component parts and releases free glutamate (see below). The average diet will take in approximately 100 milligrams of glutathione daily, but studies have shown that much of the oral intake is not even absorbed from the intestines into the blood. Glutathione deficiency has been seen in those who take Tylenol® (acetaminophen) above the recommended amount (either large amounts all at once, or smaller amounts over a longer period of time) – and, in fact, acetaminophen's toxicity to liver and kidneys has been shown to be due to a lack of protective glutathione (acetaminophen toxicity in emergency rooms is handled by administration of high doses of N-acetylcysteine (NAC), a precursor to glutathione).

Glutathione is made from the amino acids L-cysteine + L-glutamate + glycine. The glutathione the body needs is manufactured in the liver. Much ado is made about supplementing glutathione to counteract the oxidative reactions in the brain occurring in autism, ALS, MS and more. *But there are problems with supplementation of glutathione or its precursors.* Consider these factors:

- 1) When the body has excess nitric oxide it converts to peroxynitrite and this reacts with glutathione to make s-nitros glutathione (a molecule involved in inflammation and vasodilatation).
- 2) Since glutathione is poorly absorbed from the intestines into the blood (and this may be worse in people who have physiological problems, preventing it from doing so), taking the precursors glutamine or N-acetylcysteine in an attempt to manufacture glutathione can backfire. In fact, people working with autistic children have found that the children do *not* do well on supplemental NAC or glutamine. Migraneurs (known nitric oxide excess leading to excessive vasodilatation and inflammation) will find that intravenous glutathione will *cause* a migraine of the worst sort (see #1).
- 3) Gamma-Glutamyltransferase (GGT) is a glycoprotein that catalyzes the hydrolysis of glutathione to glutamate – and thus sufferers of neurological diseases like migraines and ALS are just as likely, because of *all* the factors wrong in their bodies, to break glutathione down into it's components, releasing *glutamate* (excitotoxin). [Characteristics of Alcohol Dependent Subjects with Very Elevated Levels of Gamma-Glutamyltransferase (GGT) Jean-Bernard Daeppen et al. *Journal of Studies on Alcohol*, Vol. 60, 1999.]
- 4) Such factors commonly present in ill and hurting people (and the population in general) are higher-than-normal insulin levels (alcohol or sugar consumption, diabetics, etc.) or when the liver has been damaged (as from heavy metals or acetaminophen) and cause the liver's "hepatocytes" to release the enzyme GGT (see #3)

All attempts with amino acids (and other nutrients) should be aimed at *balancing*, not depleting the body nor supplying an excess unnaturally of any one amino acid (with a few exceptions, like using a single amino acid to exert a safe pharmaceutical effect as opposed to resorting to a dangerous drug). Our list of foods to emphasize for ALS (low-arginine) are based upon balance and using human milk as the "standard" of balance of arginine to lysine (see arginine section).

### MSG Sources [man-made, added sources of "free glutamate"]

[Note: Assume that *all* of these contain a percentage of glutamate and dangerous to anyone with any neurological disease or wishing to prevent a neurological disease]

Glutamate	Glutamic acid	Gelatin
Monosodium glutamate	Calcium caseinate	Textured protein
Monopotassium glutamate	Sodium caseinate	Yeast nutrient
Yeast extract	Yeast food	Autolyzed yeast
Hydrolyzed protein (any protein that is hydrolyzed)	Hydrolyzed corn gluten	Natrium glutamate (natrium is Latin/German for sodium)

Carrageenan	Maltodextrin	Malt extract
Natural pork flavoring	Citric acid	Malt flavoring
Bouillon and Broth	Natural chicken flavoring	Soy protein isolate
Natural beef flavoring	Ultra-pasteurized	Soy sauce
Stock	Barley malt	Soy sauce extract
Whey protein concentrate	Pectin	Soy protein
Whey protein	Protease	Soy protein concentrate
Whey protein isolate	Protease enzymes	Anything protein fortified
Flavors(s) & Flavoring(s)	Anything enzyme modified	Anything fermented
Natural flavor(s) & flavoring(s)	Enzymes anything	Seasonings (the word "seasonings")

[Get more information and clarification: [www.truthinlabeling.org](http://www.truthinlabeling.org)]

***REMOVE FROM ENVIRONMENT AND BODY ALL TOXINS Mercury, Lead, Pesticides....***

## **Studies**

“The incidence of neurodegenerative disease...several environmental pollutants have been associated with neurodegenerative disorders. The present article focuses on results obtained in experimental neurotoxicology studies that indicate a potential pathogenic role of lead and mercury in the development of neurodegenerative disease. Both heavy metals have been shown to interfere with a multitude of intracellular targets, thereby contributing to several pathogenic processes typical of neurodegenerative disorders, including mitochondrial dysfunction, oxidative stress, deregulation of protein turnover, and brain inflammation.” **Involvement of environmental mercury and lead in the etiology of neurodegenerative diseases.** Monnet-Tschudi F et al. *Rev Environ Health*. 2006 Apr-Jun; 21(2): 105-17.

“A 54-year-old man had a syndrome resembling amyotrophic lateral sclerosis after a brief but intense exposure to elemental mercury. The syndrome resolved as his urinary mercury levels fell. Mercury toxicity must be considered not only in individuals with recent anterior horn-cell dysfunction but also with otherwise unexplained peripheral neuropathy, tremor, ataxia, and a gamut of psychiatric symptoms including confusion and depression.” C.R. Adams, D.K. Ziegler and J.T. Lin **Mercury intoxication simulating amyotrophic lateral sclerosis.**

“...inorganic mercury present in the brains, accumulating after long-term subclinical methyl mercury exposure, may be a proximate toxic form of mercury responsible for the changes within the astrocyte and microglial

populations.” **Changes in the number of astrocytes and microglia in the thalamus of the monkey *Macaca fascicularis* following long-term subclinical methyl mercury exposure.** Charleston JS et al. *Neurotoxicology*. 1996 Spring; 17(1):127-38.

“We studied the effect of mercury compounds on neuronal glutamate transport in primary cultures of mouse cerebellar granule cells. Immunoblots probed with an antibody against the *excitatory amino acid transporter* (EAAT) neuronal glutamate transporter, EAAT3 revealed the presence of a specific band in control and mercury-treated cultures. We suggest that a direct inhibition of glutamate uptake triggers an *imbalance in cell homeostasis, leading to neuronal failure* and Cl<sup>-</sup> regulated cellular glutamate efflux. Our results demonstrate that neuronal glutamate transport is a novel target to be taken into account when assessing *mercury-induced neurotoxicity*. **Mercury Compounds Disrupt Neuronal Glutamate Transport in Cultured Mouse Cerebellar Granule Cells.** Elena Fonfria et al. *Journal of Neuroscience Research* 79:545-553 (2005).

“In our study, ALS was associated with self-reported occupational lead exposure, with a dose response for cumulative days of exposure. ALS was also associated with blood and bone lead levels, with a 1.9-fold increase in risk for each µg/dl increment in blood lead and a 2.3- to 3.6-fold increase for each doubling of bone lead.” **Lead Exposure as a Risk Factor for Amyotrophic Lateral Sclerosis** F. Kamel *Neurodegenerative Diseases* 2005;2:195-201

“...methylmercury appear(s) to also act via an excitotoxic mechanism leading to elevated intracellular Ca<sup>2+</sup>, increased reactive oxygen species and ultimately impaired mitochondrial function” F. Fonnum, E. A. Lock **The contributions of excitotoxicity, glutathione depletion and DNA repair in chemically induced injury to neurones: exemplified with toxic effects on cerebellar granule cells** *Journal of Neurochemistry* (2004) 88 (3), 513–531.

No doubt about it, we live in a toxic world. Many scientists and writers have dedicated their life to understanding the environmental factors that can affect our quality of life. We live in a high tech, high stress, high profit world and "progress at any cost" is rapidly depleting the ability of our “natural” bodies to cope with the increasingly dangerous toxic load placed upon us. Perhaps credit can be given to Rachel Carson who in 1962, in her book, “Silent Spring” raised awareness as to how the toxins we were generating were leading to our demise as individuals as well as a society. *Silent Spring* facilitated the ban of the pesticide DDT in 1972 in the United States. In fact, it has been speculated that entire massive societies, like the high-tech Aztecs of Mexico in the 14<sup>th</sup> through 16<sup>th</sup> centuries were obliterated from the face of the earth due to technology that poisoned their world and ability to sustain life.

The incidence of ALS in Gulf War veterans (August 1990-March 1991) is more than twice as high as that of non-Gulf War veterans. In addition, though ALS rarely strikes before the age of 45, the Gulf War veterans were, and are now being diagnosed under age 45. There were five categories of pesticides approved by the EPA and FDA for use in the gulf to protect the armed personnel from being bitten by the regional insects. One of the pesticides was DEET which was used generously on the body to protect it from being bitten by insects. Studies continue to this day seeking to find a connection between these pesticides and the doubled incidence of ALS. Or perhaps more accurately, the studies are attempting to prove *no* absolute connection. Perhaps that is to be expected, because surely the government wouldn't want to be blamed for something so horrific (not to mention

something for which millions in lawsuits could be filed). Some studies even say that it must have been the pesticides in combination with “other factors”. I propose the other factors were the pre-pumping of mercury into the bodies of these men. Ask any military man and they will tell you that before deploying to any foreign region, they are given many series of immunizations, and immunizations contain mercury (Thimerosal®).

In July of 2006 the Muscular Dystrophy Association announced findings, published in the journal *Neurology* that “genetically-determined variations in enzymes required to handle toxins like pesticides, nerve gas and anti-nerve medications appear to increase susceptibility to ALS”. They said that this finding strengthened the causal relationship between the high level of pesticides and chemicals used in the Gulf War to the high incidence of ALS. What is missing again is *how those enzymes were damaged or modified* in the first place. I propose emphatically that they were damaged by mercury and other heavy metals, like lead, which has been proven to enhance calcium entry into neurons leading to the death of the neuron and thus a causative factor in ALS.

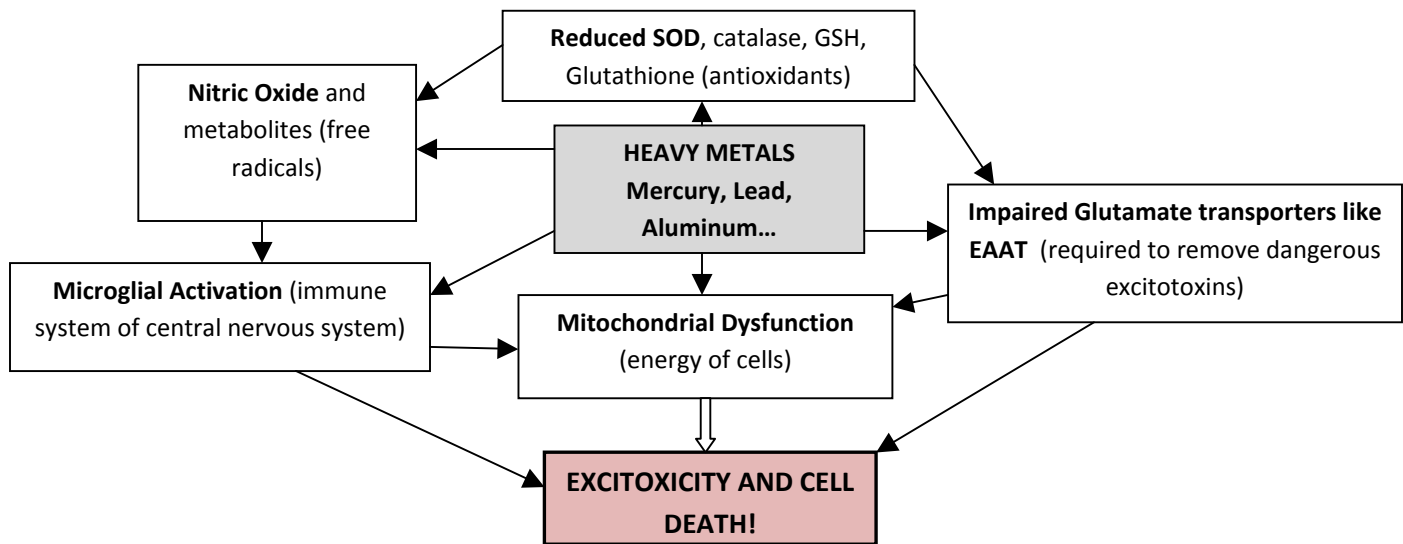
Mercury is one of many “heavy metals”. Heavy metals are defined as metallic elements with high atomic weights, like mercury, cadmium, arsenic and lead, and damage living things at *any* concentration and also tend to accumulate in the food chain. One example is elemental (inorganic) mercury. Mercury is released into the air or water when coal, wood or oil is burned and then the mercury falls to the ground with rain or snow. Mercury then becomes methylated in the environment where it accumulates in animal and plant tissues and *increases* in concentration the higher you get in the food chain. The resultant methylmercury has been shown to undergo a “biotransformation” in the body, leading to the accumulation of the even more reactive inorganic mercuric species in the brain and other tissues. Dangerous levels of mercury are found in fish, vaccines and dental amalgams. So even though fish should be a very healthy food, many types are simply not safe anymore, as there is *no safe consumption level* of mercury. With regard to vaccines, sadly, once immunized, the damage has already been done (such as having been immunized as an infant, as armed service personnel or by yearly flu shots). For all who have had any amount of mercury exposure, measures must be taken to chelate it and other heavy metals out of the body.

Recall that glutamate toxicity occurs because of a dysfunction in the protein systems of the brain and resultant inability to remove and dispose of the glutamate. Both lead and mercury (and it would follow that this would apply to all heavy metals) contribute to pathogenic processes that would lead to dysfunction in the glutamate clearing systems of the brain (see diagram below). Note that one of the articles above is entitled: *Mercury Compounds Disrupt Neuronal Glutamate Transport*. EAAT is just one of the neuronal glutamate transporters in the brain whose purpose is to remove excess amounts of glutamate. Glutamate is unable to leave the brain without the help of a protein transporter, such as EAAT. Glutamate transporters are “membrane-bound pumps” that resemble ion channels, like the calcium channels on membranes – which function to maintain a *homeostasis* within cells and their surroundings. When transporters and channels don’t work, a buildup occurs (in this case, of glutamate) that *kills cells*. With glutamate, the process is called *excitotoxicity*. But glutamate isn’t the only “excitotoxin” – the popular “aspartame” found as a sugar substitute in many foods is also an excitotoxin. To further confound matters, glutamate, or monosodium glutamate, by sanction of the Food and Drug Administration, doesn’t have to be notated on labels of foods, if “hidden” within another substance (hence the list above). But the problems are complex and numerous, the answer is easier – don’t trust foods full of man-made chemicals, instead stick to whole, natural foods.

As an aside, and before proceeding to the diagram below: Scientists have struggled to identify the cause of ALS. To date, two main forms of the disease have been identified: familial and sporadic. Of these, sporadic ALS is the most common, with 90 percent of cases this type. They continue to insist that the cause of ALS is unknown, although researchers are pursuing a number of theories, including oxidative stress, glutamate toxicity, and mitochondrial dysfunction. Here is where I'm shaking my head. A review of hundreds of studies plus commonsense tells me that *all three of those factors and more are going on at once* and "causing" ALS. I just want to say here, that the difference between what you are reading from my pen, and all of the speculations you might read from others, appears to be one thing. What appears to be missing is the acknowledgement or understanding that a heavy metal and/or toxin causes a "glitch" (e.g., damage to EAAT glutamate transporter being able to clear the brain of the excitotoxin) that leads to the many factors mentioned above (and more) going on at once. [I can't help but think of the story of a group of blind men who went to "experience" an elephant...each was "stationed" at a different area of the beast and came away with very different stories as to exactly what an elephant was. That same blindness seems to occur in science at times.]

Interestingly, a December, 2006 study: *Surface Chemistry of Mercury on Zinc and Copper* in Metallurgical and Materials Transactions by D. Rosebrough et al states: "...mercury may adsorb on the surface of zinc present on the surface of the galvanized automobile plates in scrap and copper..." Scientists in the Biology Department at Stanford University, published a February, 2007 study stating: Over 110 structurally diverse missense mutations in the superoxide dismutase (SOD1) gene have been linked to the pathogenesis of familial amyotrophic lateral sclerosis. Superoxide dismutase "1" is a copper-zinc enzyme (*Impaired post-translational folding of familial ALS-linked Cu, Zn superoxide dismutase mutants*. Bruns CK, Kopito RR. EMBO J. 2007 Feb 7;26(3):855-66. Epub 2007 Jan 25). Putting two and two together, if mercury "adsorbs" to zinc and copper in the environment, it follows it would do likewise in your internal environment. This, then, would cause the mutations or "folding" we see in SOD1 keeping it from doing it's job of protecting neurons from the extreme oxidative damage we see in ALS.

Russell Blaylock, author of "Excitotoxins: The Taste That Kills" and numerous scientific articles, lays out a diagram similar to mine below, showing the pathway from heavy metals to nitric oxide and glutamate's ability to behave as excitotoxins, resulting in the death of nerve and other cells. He rightfully states that mercury, lead, fluoride, aluminum, or any heavy metal is the underlying catalyst of all of the reactions within the central nervous system that lead to the death of neuronal cells, and thus cause neurological disorders such as strokes, Parkinson's, Multiple Sclerosis and ALS. One reason I am so sure of this, is that in my own practice, when patients with neurological diseases undergo a "heavy metal challenge" test, they *all* come back with very high levels of lead, mercury, cadmium and more.



I am thoroughly convinced about the need to eliminate heavy metals from the body. This begins with not adding more insult to injury, i.e., knowing sources of heavy metals and other toxins, and *eliminating* them from your environment, your food and your body. In my experience, once we clean the body of all of these noxious poisons present, and restore proper physiological processes, the disease is often stopped in its tracks. Indeed, all efforts towards creating for yourself a “Bio-Compatible Environment”, defined as an environment that is in harmony with the health of your body *and your world*, are efforts towards better health for you, and your family.

### ***Heavy Metal Sources***

ALUMINUM	ANTIMONY	ARSENIC	BERYLLIUM	BISMUTH
CADMIUM	LEAD	MERCURY	NICKEL	PLATINUM
THALLIUM	TIN	TUNGSTEN	URANIUM	MANGANESE

There are 35 metals we could be concerned with, because an overdose of any metal interferes with the normal functioning of the body. Twenty-three of the 35 are called the “heavy metals”. The box above lists the heavy metals that you would commonly find on a urine toxic metal test and are the ones most likely encountered in your daily environment. These metals can accumulate in the food chain (a larger animal consuming a smaller one and so on and so forth) to where we consume the heavy metal and it becomes lodged in our soft tissues. Heavy metal overload is actually *common* in all people in our industrialized nations, but rarely diagnosed or addresses because the blood tests to determine an overload are highly inaccurate. The reason is that heavy metals do not linger in the blood after ingestion, but are deposited and lodge in cells, tissues and organs throughout the body. Chelating agents are necessary to remove the metal, and bring it out of the body via the feces and urine where it can *then* be tested. Heavy metals have now been linked to the pathogenesis of cancer, neurological disorders such as Alzheimer’s, ALS, Parkinson’s, multiple sclerosis, autism, all autoimmune conditions, etc..

Toxic lead is found in old paint chips, drinking water (coming up from water tables under the ground), fertilizer, foods, auto and industrial emissions, and dust. Cadmium is found in regions with high emissions from

incinerators, coal plants, or cars, as well as in shellfish and cigarette smoke. Other common sources of cadmium include rural drinking water wells, processed food, fertilizer, and old paint. Aluminum is found in aluminum cookware, antiperspirants, cheese and other processed food. Nickel, which is highly toxic, is commonly seen in dental crowns and braces, along with jewelry, etc. (Nickel and inorganic mercury frequently produce allergic type autoimmune reactions and associated problems). Manganese and other metal exposure can come through welding or metal work.

By far the most common significant exposure of mercury for most people is mercury vapor from amalgam fillings. Dental amalgams can emit mercury vapor daily and the amount of mercury found in the brain is strongly correlated with the number of dental fillings. Researchers have shown that chewing gum can double the mercury levels in the blood and triple the levels in urine for those that have amalgam fillings. Seafood is often contaminated with mercury and generally larger fish have more mercury, due to bioaccumulation in the food chain. During the spring of 2001 the State Department of Health (DOH) issued a fish-consumption advisory for women of childbearing age and children under age six, due to high levels of mercury in certain breeds of carnivorous fish such as shark, swordfish, tilefish, king mackerel, and tuna. Another major exposure source to infants is from Thimerosal®, a water-soluble, cream-colored crystalline powder used as a preservative in vaccines that contain 49.6% mercury by weight. It is present in over 30 licensed vaccines in the US, in concentrations of 0.003% to 0.01%. In the human body, thimerosal is metabolized to ethyl mercury and thiosalicylate which are highly toxic substances. No doubt about it, we start our precious children off on the wrong foot! But if mercury is so bad for children, how do you suppose it affects already diseased and damaged brain tissues?

The EPA safe limit for mercury exposure is one-tenth of a microgram (0.1 mcg/kg) but it is common for most children to be vaccinated on the day of birth with the hepatitis B vaccine which contains 12 mcg of mercury (30 times the safe level). At 4 months, they are again vaccinated with the DtaP and HiB vaccine on the same day, which provides a further 50 mcg of mercury (60 times the safe level). At 6 months they receive the Hep B, Polio with a further 62.5 mcg of mercury (78 times the safe level). These figures are calculated for an infant's average weight in kilograms for each age. By age two, American children have received 237 micrograms of mercury through vaccines alone, which is thousands of times more than the EPA safe limit.

Mercury in the thimerosal preservative in vaccines is 50 times more toxic than liquid mercury because injected mercury is far more toxic than ingested mercury and converts to ethylmercury (the form found in vaccines a.k.a., *Thimerosal*®), which has a natural affinity for brain cells and nerves. The fact that babies and diseased and damaged brains do not have a fully-functioning blood-brain barrier makes penetration easier. Moreover, infants have difficulty excreting mercury, as they do not produce bile, which is required for proper excretion. If the nurse giving the injection did not shake the vial according to directions before drawing out the vaccine dose, there is a chance that the child receiving the last dose could get as much as 10 times the usual amount of mercury in one dose.

But now we find out that the flu vaccine and other adult vaccines (like Hep B) also contain mercury. Thimerosal® is routinely put into “multi-dose” vials, (those vials that contain more than one dose, or shot). In fact, there is a correlation of Alzheimer’s in elderly people who have received flu vaccinations over the years versus those who have not! Men in military service routinely receive multiple vaccinations, and multiple times!

Is this why men have a higher incidence of ALS than women? And if we find ALS increasing in women, is it because more and more women now serve in the military??

## ***Other Toxins To Be Aware Of And Avoid***

To list every possible toxin would be an impossibility - volumes of encyclopedic books would fill entire rooms in an attempt to do so. Our highly and *overly* technological world has many wonderful inventions that make our lives fuller, unbelievably enriched, more accomplished, and faster-paced... but at a price to our health. Below is a list of the most common toxins, but again, it is by no means a list of all the thousands of possible toxins circulating in our environment. The answer to counteracting toxins is one day, one item, one step at a time, for example, *insisting* on non-toxic laundry and household cleaning supplies; using glass, not plastic; using stainless steel, not Teflon; *not* using a microwave, etc.

**PCBs** These were commercially produced as complex mixtures containing multiple isomers at different degrees of chlorination. In the United States, commercial production of PCBs was taken over in 1929 by Monsanto from Swann Chemical Company. Manufacturing levels increased in response to the electrical industry's need for a "safer" cooling and insulating fluid for industrial transformers and capacitors. Risks: Cancer; impaired fetal brain development. Most Prevalent Sources: *Farm-raised salmon*. These fish absorb PCBs from the environment.

**PESTICIDES** According to the EPA, 60% of herbicides, 90% of fungicides and 30% of insecticides are *known* to be carcinogenic – but the EPA hasn't even scratched the surface. We now have a strong link between the ingestion of pesticides even in tiny amounts daily (imagine putting just a tiny drop of pesticides, herbicides and fungicides into your pet's water every day, assuming it wouldn't hurt him – this is as ludicrous as assuming the tiny drop you might get daily by eating a variety of fruits, vegetables as well as that in meats and dairy won't hurt you! Reports show that as much as 95% of America's food supply is tainted with pesticides and the like...so even if you *think* you're doing the right thing by frequenting Souplantation or Sizzler's salad bar *you're in grave danger*. Pesticides, herbicides and fungicides *cannot* simply be washed off as you may have believed. Risks: Cancer, Parkinson's disease, miscarriage, nerve damage, birth defects, blocking the absorption of food nutrients. Most Prevalent Sources: Food (fruits, vegetables and commercially raised meats and dairy) and bug sprays

**MOLD AND OTHER FUNGAL TOXINS** One of three people test allergic to mold, but mold isn't good for anyone. Mycotoxins in particular (toxins produced by fungus) can cause a range of health problems from asthma to cancer and everything in-between – even with exposure to a tiny amount. Risks Cancer, heart disease, asthma, multiple sclerosis, diabetes and more Most Prevalent Sources: Contaminated buildings. Do you have any brown spots on your ceiling from rain leaking through? You'll likely have mold in the walls!); Foods, like peanuts, wheat and corn that are stored in warm, moist places prior to being distributed to food manufacturers (in just 2-3 days can develop mold!); alcoholic beverages

**PHTHALATES** These chemicals are used to lengthen the life of fragrances as well as to soften plastics. When you leave plastics in the sun or heat (as in storing flat after flat of bottled water in warehouses) the phthalates and other chemicals get into the water and are consumed by us. Risks: Endocrine system damage Most Prevalent Sources: Plastic wrap; plastic bottles; plastic food storage containers.

**VOCs** (Volatile Organic Compounds) VOCs are a major contributant to ozone. Ozone is formed when nitrogen oxides (NOx) and volatile organic compounds (VOC) react with sunlight. NOx is a by-product of high-temperature combustion created by automobiles and power plants. VOCs include organic chemicals that vaporize easily, such as gasoline. Therefore, ozone is found in higher concentrations in urban areas. Ozone can be classified as both "good" and "bad", depending on where it is found. "Good" ozone is formed naturally in the stratosphere, , providing a protective layer from the sun's ultraviolet rays. This type of ozone serves to protect our health. "Bad" ozone is found at ground-level when it is sunny and hot. This type of ozone is harmful to our health. Risks: Cancer, eye and respiratory tract irritation, headaches, dizziness, visual disorders, and memory impairment Most Prevalent Sources: Drinking water, carpet, paints, deodorants, cleaning fluids, varnishes, cosmetics, dry cleaned clothing, moth repellants, air fresheners.

**DIOXINS** These are chemical compounds that are formed as a result of combustion processes such as commercial or municipal waste incineration and from burning fuels (like wood, coal or oil – *note* that heavy metals like mercury are also generated in like manner and put into our atmosphere to fall with rain and snow to get into our food chain!) Risks: Cancer, reproductive and developmental disorders, chloracne (a severe skin disease with acne-like lesions), skin rashes, skin discoloration, excessive body hair, mild liver damage Most Prevalent Sources: Animal fats (over 95% of exposure comes from eating *commercial* animal fats in fatty meats and butter, for example).

**ASBESTOS** This is a material used to insulate homes and businesses and was used from the 1950's to the 1970's, until it was discovered to be a carcinogen. In fact the horrible mesothelioma (a rare, and horrific form of lung cancer) is specifically linked to asbestos. Risks: Cancer, scarring of lung tissue, the aforementioned mesothelioma and more Most Prevalent Sources: Insulation on floors, ceilings, water pipes and heating ducts, but only from the 1950's to the 1970's when it was then banned.

**HOUSEHOLD PRODUCTS & TOILETRIES** You breathe in vapors, and your skin absorbs what you put on it. Start checking product labels, and eliminate any that have the following hazardous ingredients. Then check out lines of 100% natural, organic products at your healthstore.

**Propylene Glycol** penetrates the skin quickly. The EPA warns against contact to prevent brain, liver and kidney abnormalities, yet it is put into your stick deodorant and other toiletries!

**Sodium Lauryl Sulfate and Sodium Lauryl Sulfate** are foaming detergents. Animals exposed to them have experienced eye damage, depression, labored breathing, diarrhea, severe skin irritation and even death. They can be transformed into nitrosamines, which have proven carcinogenic.

**DEA** (diethanolamine) **MEA** (monoethanolamine) and **TEA** (triethanolamine) Hormone-disrupting chemicals that can form cancer-causing nitrates. Restricted in Europe, still used here, even though you may be exposed 10-20 times daily as it is in shampoos, shaving creams, bubble baths and more. Repeated applications of DEA-based detergents resulted in major increase in liver and kidney cancer.

**Sodium Hydroxide** This is a poison (caustic lye) found in drain cleaners. Found in drain cleaners and labeled as POISON, yet the cosmetic industry is not putting it in our skin and oral care products!

**Triclosan** A synthetic antibacterial with a chemical structure similar to Agent Orange! The EPA registers it as a pesticide with high human health risk scores and yet it's being put into your handsoaps!

**DMDM & Urea** (Imidazolidinyl) Two (of many) preservatives that often release formaldehyde which cause joint pain, skin reactions, allergies, depression, headaches, chest pains, ear infections and more. *Weakens the immune system.*

**Polyethylene Glycol (PEG)** Carcinogenic petroleum. Used in spray-on oven cleaners to dissolve the grease.

**Parabens** alkyl hydroxyl parabens, alpha hydroxyl benzoate as well as methyl-, ethyl-, propyl- and butyl-parabens are all weakly estrogenic meaning they mimic estrogen, which isn't good.

**Alcohol, Isopropyl (SD-40)** Promotes brown spots, premature aging, leaves you vulnerable to bacteria and viruses. The Consumer's Dictionary of Cosmetic Ingredients says it may cause headaches, flushing, dizziness, mental depression, nausea, vomiting and coma.

**Mineral Oil Baby oil** is 100% mineral oil. It's a petroleum by-product that coats the skin like plastic wrap, clogs pores, interferes with skin's ability to eliminate toxins!

**FD&C Color Pigments** Synthetic colors from coal tar that deposits toxins onto skin. Absorption of certain colors can cause depletion of oxygen in the body and death. Animal studies have shown almost all of them to be carcinogenic.

**Fragrances** Can contain up to four thousand ingredients, many toxic and carcinogenic. Use aroma-therapeutic, organic essential oils instead!

**CHLOROFORM** This is a colorless liquid that has a pleasant, even nonirritating odor. It is used to make other chemicals. It is also formed when chlorine is added to water, such as in the water processing plants of cities where chlorine and even fluorine (a toxic heavy metal) are added as disinfectants. Risks: Cancer, reproductive damage, birth defects dizziness, fatigue, headache, liver and kidney damage and more. Most Prevalent Sources: Anything to which chloroform is added or used along the way of manufacture can contain it, such as the air, drinking water and foods.

**CHLORINE** This is prevalent in the environment as it is used in laundry (Clorox Bleach!), in disinfecting water, household cleaners and more. It is *highly* toxic and unfortunately, one of the most heavily used chemical agents in homes, hospitals and industry. Risks: Sore throat, coughing, eye and skin irritation, rapid breathing, narrowing of the bronchi (lungs), wheezing, blue coloring (lack of oxygen) to the skin, fluid and pain in the lung and so much more. Most Prevalent Sources: Household cleaners, drinking water, air when living near industrial plants.

**Before** we leave this subject, just one more word about Teflon. The truth is, perfluorochemical (PFC) emissions from synthetic compounds in non-stick cookware and cleaning products (produced by DuPont) is implicated in cancer and other health problems – like neurological diseases. When you heat a Teflon pan, these emissions are released into your food and into the air and end up in your body. Perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS), cannot be further broken down, so they remain in the body to cause tumors in the pancreas, liver, testicles, thyroid, or mammary glands as shown in animal studies. Workers involved in manufacturing PFOA were also shown to be three times as likely to die of prostate cancer as those who weren't. PFC concentrations have been found in the bodies of fish, dolphins, seals, sea lions, minks, polar bears, gulls, albatrosses, bald eagles, sea turtles, and dozens more species. PFOA is present in the blood of 90 percent to 95 percent of U.S. residents and can even be passed along (as can most toxins) to infants in the womb.

## ***100% CERTIFIED ORGANIC, MOSTLY VEGETABLES, WHOLE FOODS DIET***

### **Studies**

“...pesticide exposure was associated with > 2-fold increase in ALS risk, with greater risk at higher levels of exposure. This study did not implicate specific pesticides in ALS etiology. However, a cohort study found increased risk of ALS among workers exposed to the herbicide 2,4-dichlorophenoxyacetic acid (2,4-D) compared to other company employees, although this result was based on only three deaths (Burns et al. 2001). Case reports have described ALS after exposure to OPs (Bidstrup et al. 1953) and organochlorines (Fonseca et al. 1993).” *Environ Health Perspect* 112(9):950-958, 2004. National Institute of Environmental Health Sciences Speaking about going to a Detox center: “This is where I learned the true value of an all-organic diet. Avoiding MSG and preservatives is just not enough.” Eric Edney, Eric is Winning pg 215.

“Glucose is a major precursor of glutamate and related amino acids in the retina of adult rats. <sup>14</sup>C from labelled glucose appears to gain access to a large glutamate pool, and the resulting specific activity of glutamate labelled from glucose is always higher than that of glutamine or the other amino acids. Starr MS. **Evidence for the compartmentation of glutamate metabolism in isolated rat retina** *Journal of Neurochemistry* Volume 23 Issue 2 Page 337 - August 1974

“All the onion, garlic and ketoconazole were found to be able to inhibit growth of all fungi tested in a dose-dependent manner with maximum of 100% at defined concentrations. The results indicate that onion and garlic might be promising in treatment of fungal-associated diseases from important pathogenic genera *Candida*, *Malassezia* and the dermatophytes.” Shams-Ghahfarokhi M et al. **In vitro antifungal activities of *Allium cepa*, *Allium sativum* and ketoconazole against some pathogenic yeasts and dermatophytes** *Fitoterapia* 2006 Jun;77(4):321-3.

**D**avid Steinman, a food and water expert, reports in his book *Diet for a Poisoned Planet: How to Choose Safe Foods for You and Your Family* (1990, Harmony Books), that 183 pesticide residues have been found in conventionally grown peanuts and 110 in raisins. Rating these foods as the most pesticide-saturated foods, Steinman advises eating only organic peanuts and raisins if possible. The truth about pesticides is that they are everywhere, they add up, and *no amount* is safe. The cumulative effects of consuming foods that are tainted with pesticides even though eating an otherwise healthy diet rich in fruits and vegetables is proving to be disastrous.

Studies have found that the human health effects of agricultural chemicals are numerous and range from respiratory problems in field workers to severe allergic and asthmatic reactions, reproductive disorders, cancer and degenerative diseases in both consumers and farm workers. But one of the most alarming aspects of the use of chemicals in conventional farming is that *most of them serve no real purpose*. According to research done at Cornell University in New York in the early 1990s, 500 million kilograms (1.1 billion pounds) of pesticide chemicals are applied in North America every year. Of that amount, *99.9 percent missed the target organism*. Another astonishing fact about pesticides comes from John Bede Harrison, author of *Growing Food Organically* (1993, Waterwheel Press): "In 1945, only 13 kinds of pests were found to be resistant to the pesticides then available. Forty-five years later, over 500 types of pests had developed resistance. Today there are over 50,000 commercial products manufactured to combat resistant pests." This is really scary stuff. But you can do your part to turn this around. How?

We *all* need to *insist* on organic. It's a bit more work for the farmers, but is the *only* way to ensure the health of our environment and bodies. In fact, we all need to show support for organic growers by purchasing their fruits, vegetables and other products in stores, at their farms and local farmers' markets, through community-shared agriculture programs and at restaurants that use organic ingredients. By doing this, you will be enjoying fresh and delicious food and will be making a difference to your health and the environment's.

When you eat organic fruits and vegetables (but meats, poultry, eggs and dairy can also be obtained having been produced organically) what you taste is the actual fruit or vegetable, pure and simple. There are no pesticides, fungicides or waxes to mask or contaminate the flavor, and nothing is genetically engineered, either. (Genetic engineering alters the genetic code of the plant or animal to achieve a desired result, and of course, is considered by organic advocates as unnatural and dangerous).

Contrary to what many people think, organic food is not synonymous with “vegetarian” i.e., only comprised of veggie burgers, salads and tofu. Today, almost any fresh, frozen or processed food has an organic counterpart. Also, organic food can be as beautiful and large as “conventional”, and *not* inferior in quality as many people

still imagine. In fact, many chefs now use organic ingredients in their kitchens because of its superior appearance, flavor, freshness and shelf life. Check out the label of organic milk and you'll find that the expiration date is months, not weeks away (as you'll find with conventional milk). While blemished and imperfectly shaped organic fruits and vegetables do exist because of not being sprayed or treated with chemicals to create perfect-looking produce, what you *don't* know is that such imperfections also exist in commercial produce — they just never reach the stores. Truckloads of commercial apples, for example, are rejected for size, shape and imperfections when they are sorted at the orchard. In organic orchards, because smaller volumes are produced and there is less emphasis on cosmetics, there is less waste - but the flavor and *health benefits* outshine any visual imperfections.

Another belief about organic food is that it's much more expensive than conventionally farmed food but in the peak of growing season, organic produce is comparable in price, and sometimes cheaper than commercial produce. This is especially true as consumers demand more and more organic foods. You can now find entire categories of organic foods at Costco, Vons, Henry's Market, Mother's, Trader Joe's, Whole Foods Market and *coming to a store near you!* As organics are more and more insisted upon, the prices will continue to drop! *Certified* organic food is grown and processed without the use of genetic engineering, synthetic or artificial fertilizers, pesticides, herbicides, fungicides, fumigants, growth regulators, antibiotics, preservatives, dyes, additives, chemical coatings or irradiation. To be "certified" is to not use any of the aforementioned. This means, for example, that a can of certified-organic chili is made exclusively from ingredients (beans, tomatoes, onions, chilies, etc.) grown without toxic chemicals but was also processed without additives such as xanthan gum, disodium guanylate or maltodextrin. It also means that if the organic chili contains beef, the cow was raised without using hormones, growth enhancers or antibiotics and was fed certified-organic grains throughout its life and then was butchered according to organic-certification regulations.

To be "certified" organic, the United States Department of Agriculture (USDA) requires that comprehensive production and processing standards be met and that farmers re-apply each year for certification. But before a farm is even allowed to apply, it must be managed organically for at least three years, the period that is deemed necessary to "detoxify" the land. An independent third-party inspection of the farm is also conducted annually, with professional inspectors examining everything from the farm's history and its future prognosis to crop information and field management.

Another assurance for consumers is that certified farmers must maintain a continuous paper trail so that their products can always be traced back to them. These records can also verify that the feed the farmers have been giving their livestock is indeed certified organic or that the botanical soaps used on the farms adhere to organic regulations. As consumers, we need to insist on certified organic, so that as the need for organic rises, fraudulence doesn't rise simultaneously. So look for certification logos or certifier names on your groceries to confirm that you are buying verifiable organic products.

### ***Twelve Riskiest and Twelve Best Non-Organic Foods***

**I**t is absolutely essential to keep pesticides and their residues off of your dinner plate, therefore, your best course of action is a diet based on organic foods 100%. Sometimes that's easier said than done if you live in an area where organic food is hard to find or prohibitively expensive. You can order a lot off the internet. But sometimes you'll be faced with the dilemma of only being able to purchase "non-organic". In that case, here is a list of the 12 least contaminated types of produce published by the Environmental Working Group. According

to the Environmental Working Group, when it comes to conventionally-grown produce, these are the 12 cleanest kinds you can buy:

### **The 12 "cleanest non-organic foods"**

- Asparagus
- Avocados
- Bananas
- Broccoli
- Cauliflower
- Corn (sweet) But **AVOID** anyway, unless organic, as most are now genetically modified
- Kiwi
- Mangos
- Onions
- Papaya
- Pineapples
- Peas (sweet)

Conversely (and sadly) here are the 12 most tainted with pesticides and their residues and should *never* be purchased:

### **The 12 "RISKIEST foods"**

- Apples
- Bell Peppers
- Celery
- Cherries
- Imported Grapes
- Nectarines
- Peaches
- Pears
- Potatoes
- Red Raspberries
- Spinach
- Strawberries

### ***Why Mostly Vegetable and Whole Foods?***

**W**hole foods means you choose foods as they are in nature, whole, nothing added, nothing taken away. To do this using the low arginine foods you simply utilize your list of acceptable foods, buy them organic, and mix and match in any way you desire. Many meals can simply be two foods you like, like a plate of beans and sweet potatoes. Or you can have a whole organic apple, and organic mozzarella cheese. You can have an organic yoghurt or two. One of your most substantial meals will be a huge organic salad with lots of greens, garbanzo beans, kidney beans, tomatoes, carrots...*any* organic vegetables and drizzled (or drenched for extra calories!) in organic extra virgin olive oil and an organic vinegar. Use organic herbs and pepper to season. If you use salt, use an organic mineral salt, like "Real Salt®" that you can obtain in a larger health store or on line.

Nature hasn't given us apple juice, but has given us whole apples with all the fiber, vitamins and minerals necessary to delay (for one thing) the natural (and beneficial) sugars from entering the bloodstream. In the section on supplements, we list some of the nutrients that have specifically been found to be beneficial in neurodegenerative diseases, and in particular ALS. Because new information is being generated daily, you need to keep the "bottom line" (factors that cause ALS) in mind, along with the fact that you are now consuming a whole, pure, organic diet that will supply much of the nutrients that may have been missing, in order to *carefully* plan a supplement regimen with the help of your personalized regenerative medical doctor.

Again, the *real* danger has been already elucidated: *Imbalance* or the opposite of homeostasis. We were meant by Nature to consume foods in their whole, natural state. Even with organic foods, it is dangerous (especially if you are fighting a deadly disease) to consume foods that have been altered and refined. You could eat organic all day long, and be doing the wrong thing: Consuming juices, fruit leathers, jams, tofu and other altered foods. Fiberless sweet foods are way too high in sugars (a glass of orange juice, for example, would have the sugar of 4-8 oranges...you could never eat that many oranges!) and are *without* the protective fiber nature put there to properly handle the inevitable elevated glucose. Elevated glucose and its "up and down rollercoaster" have been the issue of much study with regard to weight gain, diabetes, heart disease and more. It appears, as well, that glucose is a direct precursor to glutamate!

An animal study in 1974 determined that ***glucose is a major precursor of glutamate*** and related amino acids. The researchers "tagged" glucose (<sup>14</sup>C) and observed it gaining access to a large glutamate pool, and that it did so at a higher level of activity than glutamine or other amino acids like aspartate, GABA, serine or leucine, for example (Starr MS). This is a major point for consuming a whole foods diet, and not allowing yourself to stray into thinking that as long as it's "organic" it's acceptable. And this brings us to the ***Ketogenic Diet*** which observed (in the 2-3% of ALS patients with SOD enzyme mutation, or *familial ALS*) that a diet without glucose stopped the progression of ALS. The first study that showed that the ketogenic diet alters the progression of ALS (in mice) was completed in 2006. We don't have long-term results of whether humans could even follow such a diet without horrific other side effects for any length of time (it's quite reminiscent of the Atkins diet). Children with epileptic seizures who have tried the diet were treated with it first in the hospital. Some of the side effects were dehydration, constipation, and even complications from kidney stones, and gall stones. Admittedly, doctors say they don't know precisely why a diet that mimics starvation (as does the Ketogenic diet, by removing all carbohydrates and only allowing proteins and fats – which on other levels, like cardiovascular, would be quite dangerous) but with both ALS patients (familial) and children with epileptic seizures, it "works". I propose it is because of the absence of glucose, and the lessening of the glutamate in the brain which is the first, foremost and powerful factor in neuron excitation leading to neuron death. *But there are other, long-term ways to accomplish the same thing*, and that is by only consuming whole, natural carbohydrates with all the fiber nature gave them. Where most people get into trouble is thinking that if apples are good, then so is apple juice, or apple leather.

A whole foods, organic diet will also, *especially because of a lack of pesticides*, contribute to healing the gut of bacteria and yeast overgrowth (producing *endotoxins* or toxins your own body makes) leading to inflammation, permeability and resultant liver poisoning, resultant allergies, inability to process foods properly as well as to the inability to manufacture needed toxin-clearing enzymes. And of course, while on a diet free of pesticides, and cleaning up your environment of solvents and other toxic chemicals, you can take “probiotic” supplements to assist in the more rapid return of the gut to a healthy flora.

Many people who try to kill off intestinal fungus with a diet free of all carbohydrates, including fruits. What is ignored here, is that in order to reach *homeostasis*, we also must *feed the good bacteria* and allow them to proliferate so the gut can return to a healthy flora (good bacteria) that *naturally* keeps the fungus population down and will ensure long-term success. The natural carbohydrates in whole, fibrous foods, including fruits not only feeds the good flora, but if adhered to strictly, is the ticket for helping you succeed on the right diet. No, you can’t have that piece of cheesecake, but enjoy a big, juicy, Fuji apple and it can amazingly eliminate the craving that threatens to completely destroy your efforts at eating properly. Again, you’ll be feeding the *beneficial* flora in your gut as well. There are better ways to get fungus and pathological bacterial under control.

Indeed, a 2006 study once again proved that fresh, raw garlic destroyed with 100% efficacy every form of fungus (they listed 87 strains) including *Candida*, that was exposed to the garlic. In fact, the garlic worked as well as the drug ketoconazole. Garlic has other beneficial properties that have been the subject of many studies, including garlic’s beneficial effect on blood pressure. Ketoconazole, on the other hand, like all drugs, has a rap sheet of side effects and potential dangers. All to say, eat lots of fresh, raw garlic on your salads (you should be having a big salad every day) and kill off the gut fungus that way. If you have any outward signs of fungus (like fingernail or toenail fungus) you’ll be pleased to watch them disappear! Don’t worry about the smell, you can wear a sign: “Pardon the smell, fungus-fighting in progress.”

Unfortunately, because of not having a more complete picture of the cause of disease (glutamates, pesticides, heavy metals), health food stores as well healthcare practitioners have made a good living selling you “bandaids” in the form of supplements and special diets. If they had warned you of the deadly danger of the aforementioned poisons you were unknowingly being injected with, slathered on or fed, I bravely state, *you would likely not be suffering with a neurodegenerative disease today*. Neurodegenerative diseases have risen side-by-side with the world’s use of glutamates, pesticides and heavy metals. But again, there is hope.

## ***FOR NOW AVOID EXCESSIVE PRECURSORS TO NITRIC OXIDE***

### **Studies**

“In particular, nitric oxide [NO] heavily influences the excitatory neurotransmitter glutamate, mainly through NMDA receptors, and the inhibitory neurotransmitter GABA, mainly through GABA A receptors. Due to the involvement of glutamate and GABA in a delicate balance conditioning the functional status of the neural cells, this interaction suggests a role for NO in regulating neuronal excitability and its transition towards hyperexcitability phenomena.” Ferraro G, Sardo P. **Nitric oxide and brain hyperexcitability.** *In Vivo*. 2004 May-Jun;18(3):357-66

“During the past ten years, there has been a growing interest in L-arginine (LA), a semi-essential amino acid, which has recently been shown as a physiological precursor of nitric oxide (NO).” **The nitric oxide pathway: is L-arginine a gate to the new millennium medicine? A meta-analysis of L-arginine effects.** *J Med.* 1999;30(3-4):131-48.

“Nitric oxide (NO) mediates pathogenic changes in the brain...” **Elevated endogenous nitric oxide increases Ca<sup>2+</sup> flux via L-type Ca<sup>2+</sup> channels by S-nitrosylation in rat hippocampal neurons during severe hypoxia and in vitro ischemia.** Tjong YW et al. *Free Radic Biol Med.* 2007 Jan 1;42(1):52-63. Epub 2006 Sep 27.

“Recent findings indicate that nitric oxide (NO) over-production might be an important factor in the pathogenesis of sporadic amyotrophic lateral sclerosis (SALS). Moreover, we also found increased copper and zinc superoxide dismutase activity the cerebrospinal fluid from SALS patients.... As copper and zinc superoxide dismutase can react with nitroxyl forming nitric oxide, the conditions for a closed, but continuous loop of nitric oxide biotransformation are present in the cerebrospinal fluid of ALS patients.

**Biotransformation of nitric oxide in the cerebrospinal fluid of amyotrophic lateral sclerosis patients.** Kocic AN et al. *Redox Rep.* 2005;10(5):265-70.

“Markers of oxidative and nitrosative stress have been found in spinal cord, cortex, cerebrospinal fluid and plasma of patients affected by amyotrophic lateral sclerosis..” **Effect of nitric oxide on lymphocytes from sporadic amyotrophic lateral sclerosis patients: toxic or protective role?** Cereda C. et al *Neurol Sci.* 2006 Nov; 27(5):312-16.

“The data support roles for oxidative stress, protein nitration and aggregation, and excitotoxicity as participants in the process of motor neuron degeneration caused by mutant superoxide dismutase-1.” **Motor neuron degeneration in amyotrophic lateral sclerosis mutant superoxide dismutase-1 transgenic mice: mechanisms of mitochondriopathy and cell death.** *J Comp Neurol.* 2007 Jan1;500(1):20-46.

“The cascade of events that leads to neurons death is complex” but includes nitric oxide and excitotoxicity. **Neurodegenerative diseases and oxidative stress.** Emerit J et al. *Biomed Pharmacother.* 2004 Jan;58(1):39-46.

“To determine whether or not the occurrence of sporadic amyotrophic lateral sclerosis (sALS) is associated with both excess nitric oxide (NO) metabolites and decreased protective superoxide dismutase (SOD) activity in the cerebrospinal fluid (CSF), we measured nitrate concentration and SOD activity in the CSF of sALS patients ...we found stable NO metabolite levels to be significantly higher and SOD activity lower... **Raised nitrate concentration and low SOD activity in the CSF of sporadic ALS patients.** Boll MC et al. *Neurochem Res.* 2003 May;28(5):699-703.

“Recent findings indicate that nitric oxide (NO\*) over-production might be an important factor in the pathogenesis of sporadic amyotrophic lateral sclerosis (SALS). As Cu,Zn-SOD can react with nitroxyl forming NO\*, the conditions for a closed, but continuous, loop of NO\* biotransformation are present in the CSF of ALS

patients.” Kokic AN et al. **Biotransformation of nitric oxide in the cerebrospinal fluid of amyotrophic lateral sclerosis patients.** *Redox Rep.* 2005;10(5):265-70.

“Ingestion of a high-protein meat meal results in significant increases in renal plasma flow and glomerular filtration rate...the study...was designed to test the hypothesis that nitric oxide is involved in the renal hyperemic responses to a meat meal...the meat meal resulted in significant renal hyperemia” Salazar FJ et al. **Role of nitric oxide in the renal hemodynamic response to a meat meal.** *Am J Physiol.* 1994 Oct; 267(4Pt2): R1050-5.

**I**t has been known for some time that oxidative stress, superoxide dismutase and zinc are involved in amyotrophic lateral sclerosis (ALS). It has also been determined that the disease is caused by the unexplained death of motor neurons in the spinal cord - neurons that control the movement of all voluntary muscles. Heretofore, mutations to the antioxidant enzyme superoxide dismutase (SOD) have been the only published *cause* of ALS. Additionally, recent research indicates that the loss of zinc from superoxide dismutase is what causes motor neurons to die in one type of ALS (familial). Work is currently underway to characterize how zinc is handled in motor neurons and why superoxide dismutase can become zinc deficient in ALS with the goal being to understand how mutations to superoxide dismutase causes ALS. The major function of superoxide dismutase is to scavenge the oxygen radical superoxide. So it is *very* interesting to note that a recent discovery by the Linus Pauling Institute is that a major target for superoxide is *nitric oxide*.

Nitric oxide was discovered to be a vasodilator by Koch-Weser in 1974. In the 1980's L-arginine was discovered to be the building block of nitric oxide. Later, scientists discovered that nitric oxide plays the role of a “second messenger”, followed by glutamate stimulation of neurons in the central nervous system. Structurally, there is a very close relationship between nitric oxide and glutamate. Nitric oxide easily passes into the energy portion of the neuron, the mitochondria, and by a series of events causes an efflux of calcium out of the cell. This efflux of calcium out of the mitochondria permits the free movement of a large number of molecules in and out of the mitochondria leading to mitochondrial collapse, and cell death. In addition, nitric oxide causes the inhibition of glutamate transporters to do the job of eliminating excess glutamate which leads to a buildup of glutamate, excessive stimulation of neuron activity (excitotoxicity) and neuronal death. A Press Release in 1998 informed the world of the discovery of even more varied roles of nitric oxide. Reports of this “free radical”, endogenous nitrovasodilator, sometimes good, sometimes evil molecule have been the focus of much study ever since. Indeed, until fifteen years ago, nitric oxide was only considered as a toxic air pollutant, damaging the lung and promoting cancer by damaging DNA. However, nitric oxide is also produced by cells lining the arterial walls to relax the underlying smooth muscle and increase blood flow. For example, nitric oxide is the active metabolite produced from nitroglycerin that stops angina in heart disease patients. Viagra works by prolonging the effects of nitric oxide in blood vessels in the penis to maintain erections. But research with ALS and other neurodegenerative diseases now focuses in on the damaging roles of nitric oxide, peroxynitrite and nitrotyrosine (all related molecules). In fact, nitric oxide, in reaction with superoxide produces the powerful oxidant *peroxynitrite*, which promotes oxidative damage to blood vessels, skin, heart, lung, kidney and brain

The folks at the Linus Pauling institute are characterizing the role of peroxynitrite in injuring cells and how cells respond to that damage. One sign of damage left by peroxynitrite is nitration of amino acids in proteins. They hypothesize that nitration is particularly important as a defense against viral infections, damaging proteins and

RNA necessary for viral replication, but at the same time can be damaging to host tissues and cells, thereby contributing to acute injury and chronic disease.

In a 2005 study on how nitric oxide and its metabolites mediate microglial toxicity (phagocytic immune cells of the central nervous system) to oligodendrocytes (oligodendrocytes form myelin sheaths around axons to support rapid nerve conduction in the central nervous system (CNS). Damage to myelin can cause severe CNS disorders). They state that *localized activation of microglia has been implicated in the pathogenesis of a number of neurological diseases, including ALS*. They say that microglia are extremely responsive to environmental or immunological challenges and are the predominant cell type producing neurodegeneration. One of the functions of microglial cells is to engulf and remove toxic and foreign substances away from neural cells. However, the researchers in the 2005 study seem puzzled as to what could possibly be activating the microglia. A recent study by John Hopkins University found that similar excessive activation of the microglia were found in the autopsied brains of autistic people. Interestingly, a March 2006 “blog” on the internet launches into the story of how Albert Einstein’s brain was taken at autopsy and kept for over 40 years to be studied by scientists (<http://notmercury.blogspot.com/2006/03/way-to-go-einstein.html>). Among those studies was one where they found that Einstein’s brain had excessive activation of the microglia. Some went so far to say Einstein might have been autistic.

Shortly after the Hopkins study was published, Thimerosal® opponents were quick to point out that *mercury is able to trigger microglial activation*. In fact, in high concentrations mercury in the brain is primarily located within microglial cells. Exposure to certain toxins, including mercury, triggers expansion and proliferation of the brain's microglial immune cells because they are in charge of responding to and removing agents that can harm neural cells. They are merely trying to do their job. Mercury triggers microglial activity, and microglial activity is enhanced by nitric oxide. Nitric oxide in the small amounts made by the body and used to activate the immune system for example, is a normal process. But in excess, nitric oxide becomes a villain, participating in a cascade of events leading to neuronal death.

Nitric oxide, the aforementioned potent activator of microglial activity, is made from the amino acid arginine. All foods containing protein will have some degree of arginine, but those same foods will also have the amino acid lysine. Lysine can be viewed as arginine’s “opposite”. Viral replication is stimulated by arginine, and deterred by lysine. Doctors can now tell patients with confidence of the positive role of nitric oxide (and thus arginine) in cardiovascular health, the immune system and more. Nature has a way of “balance” and it follows with nitric oxide, which is good in the right amounts, and bad when there is too much or too little. As discussed earlier with glutamate, and the body making the tiny amounts it needs, in like manner, by consuming a diet favoring lysine over arginine, we can favorably influence a lessened production of nitric oxide. If we go back once again to the wisdom of nature, we could note that human milk (and what wise person among us would deny that breastfeeding an infant is anything but best) is approximately 1½ times higher in lysine than arginine. Using that fact as our starting point, a diet that prevents an excess of nitric oxide formation (and we’ll discuss other measures to do the same in other sections) would be anywhere from equal amounts of arginine to lysine to anything greater than a 1:1 ratio.

## *What About Dairy?*

Many people in their quest for their best diet have undergone “allergy” tests, and have been told they are allergic, for example, to dairy. This really means proteins from the milk aren’t being fully digested in their digestive tract, likely due to dysbiosis (excessive bacterial and fungal overgrowth) and are leaking through a highly permeable gut (caused by the dysbiosis) and once in their bloodstream these “macroparticles” of protein seen as foreign invaders (in the same way as a virus would be seen) causing a series of events leading to allergic symptoms. However, most people I’ve talked to don’t have any outward “allergy” symptoms to the foods to which they are told they are allergic. Some factors to consider are:

1. In fighting ALS, you do need to obtain enough calories to sustain health and weight. Giving up dairy to consume, say, soy milk (which is a processed product containing a higher percentage of free glutamates) may not be in your best interest. Using rice milk is higher in arginine than you want, and high in fiberless added sugars.
2. Are you truly allergic to dairy, or to the hormones, pesticides and antibiotics in commercial dairy?
3. Once you are on the path of whole, organic foods, and your gut flora normalizes, you may find you don’t have an allergy to dairy after all, and you can fully digest the foods you need.
4. High quality, organic yoghurt contains the probiotics that can help you on your way to a healthy gut intestinal environment.

On the other side of the coin, neither a sedentary, elderly or very ill person *should* consume dairy. Nature intended that milk be for the infant of the animal that produced it. Cow milk proteins are many times larger than human milk proteins and that only begins the litany of problems with adults consuming cow or any other animal’s milk. For one thing, dairy can quickly create an excess of mucous in anyone, but especially someone who doesn’t frequently do the kind of exercise that assists in the elimination of mucous (like jogging). Dairy should certainly not become a main staple in the diet of someone not in the best of health, but if used, should be treated more like a “condiment”. Adults *can* live nicely without dairy – very well, in fact. A whole, organic “plant-source” diet rich in vegetables, beans and fruits with a much lesser addition of *organic* meats and poultry, healthfully sustains entire cultures around the globe. A reasonably healthy person, in fact, might presume they could live out a long, healthy life if *all* they ate was whole, organic plant foods, including those (like nuts, seeds and grains) only avoided in illnesses where nitric oxide and cell proliferation is involved.

That said, you sometimes have to prioritize. If you must choose between a doughnut and an apple, eat the apple as long as it’s organic. If your choice is between a piece of pie and a fruit salad, eat the fruit salad, as long as it’s organic. If you find it is difficult to obtain enough calories to maintain enough weight, eat some grains, as long as they’re organic. When that point comes that you feel like you don’t ever want to see another vegetable, that’s that day you have some organic chicken and organic brown rice. You normally avoid dairy, but see everybody else at the gathering eating icecream, so have a cup of organic yoghurt with organic strawberries. You get the picture.

## ***What About Meat?***

As earlier mentioned, the human physiological makeup is ideally suited to mostly, or all vegetable-source foods. The reasons for this are:

1. The human dentition (flat, grinding surfaces and the absence of pointed “canine” teeth designed to cut into flesh)
2. The human GI tract (longer, for the complete breakdown and digestion of fibers in vegetable-source foods)
3. The makeup of human digestive enzymes, more suited to vegetable-source foods.

Truly anyone that argues against such obviousness is merely defending their love of food, and not their desire for absolute truth. Eating meat is like eating “second-hand” vegetables. The animal whose flesh you consume ate the vegetables firsthand. We obtain every nutrient and amino acid needed from vegetable-source foods. Where so-called vegetarians or vegans have historically contributed to a bad name for what is truly the ideal way to go, is in thinking that as long as it doesn’t have meat, it’s “okay”...like MacDonald’s “MacFish Burger”. This line of thinking has given rise to hydrolyzation, modification, isolation, etc. of beans and grains to create all sorts of “delicacies” like tofu, “protein bars” and soymilk. When analyzed these are nothing more than simple carbohydrates mixed with oxidized fats, altered proteins, and high levels of free glutamates...*not* a recipe for optimum cellular health.

## ***Low Arginine Foods***

For the sole purpose of not contributing to an excess fueling of nitric oxide production, you would at a minimum want to choose mostly from foods with a ratio of more lysine than arginine. This is also a well-known necessity in cell proliferative conditions like cancer and viral conditions like herpes. There will be foods with a favorable ratio that should not be consumed for *other* reasons, like their MSG content (Parmesan cheese is a good example- while higher in lysine than arginine, it is made with “enzymes” that cause the formation of excess glutamate), or dairy (excess mucous production or allergies to the proteins in dairy), or meats (see above). We would also want to make sure each low arginine food is grown organically and prepared without adding any MSG or other chemicals. Below is a table with examples of the ratios. This table by no means lists every food, but gives you a clear picture as to which categories of foods are the best for someone wanting to not fuel excessive nitric oxide production. Choose organic whole foods from the greater than 1.0 ratio. As you get to the “borderline foods” (.9 ratio, for example) the table has them a lighter color – use them less often or in lesser amounts. The foods you should avoid are grayed.

<b>FOOD</b>	<b>Weight in grams</b>	<b>Lysine in milligrams</b>	<b>Arginine in milligrams</b>	<b>Ratio of Lys/Arg Listed highest to lowest ratio - with 1.0 and <i>higher</i> being the goal</b>
<b>DAIRY PRODUCTS</b>				
Dairy Products are all higher in Lysine than Arginine, and in fact, have the highest favorable ratio				
Plain Yogurt	14.1	9	3	3.000
Swiss Cheese	28	733	263	2.787

Provolone Cheese	28	750	290	2.586
Goat Milk	244	708	291	2.433
Cream Cheese	28	192	81	2.370
Mozzarella Cheese	28	559	236	2.369
Butter	14.1	9	4	2.250
Cheddar Cheese	28	588	267	2.202
Whole Milk	244	637	291	2.189
Cottage Cheese, creamed	210	2120	1190	1.782
Human Milk [as reference]	246	168	105	1.600

#### VEGETABLES

Most Vegetables and Beans are slightly higher in lysine than arginine, and are extremely valuable in your diet for the phytonutrients, bulk, chlorophyll, and the satiety they provide. And remember, we *need* arginine...just not excess. Those vegetables that are not 1.0 ratio or higher include lima beans, broccoli, collards and peas – but they are *too close* ( in the 0.9 ratio range) and do not need to be left out of your diet unless you find you feel better without them

Beets	136	72	30	2.400
Potato	150	190	140	1.357
Green Beans	110	97	80	1.213
Lettuce, Romaine	56	58	50	1.160
Lettuce, Iceberg	75	60	52	1.154
Lentil Sprouts	77	548	470	1.166
Cauliflower	100	108	96	1.125
Spinach	55	98	90	1.089
Chinese Cabbage	70	62	59	1.051
Corn (fresh)	154	210	200	1.050
Sweet Potato	130	105	100	1.050
Turnip Greens	55	54	52	1.038
Asparagus	134	194	192	1.010
Beet Greens	38	20	20	1.000
Leeks	124	97	97	1.000
Pumpkin	245	96	96	1.000
Endive	50	32	32	1.000
Lima Beans	170	765	775	0.987
Okra	100	82	84	0.976
Broccoli	88	124	128	0.969
Collards	186	140	72	0.931
Carrots	110	44	48	0.917
Peppers, sweet	100	38	42	0.905
Radish	45	16	18	0.889
Watercress	104	172	200	0.860
Swiss Chard	36	36	42	0.857
Eggplant	82	42	50	0.840
Cabbage	70	40	48	0.833
Peas, Green	146	463	625	0.741
Brussels Sprouts	88	130	178	0.730
Onions, Green	100	4	6	0.667
Mushrooms	70	48	72	0.667
Cucumber	104	22	36	0.611
Squash, winter	205	902	1590	0.567
Yams	200	89	191	0.466
Pumpkin seeds & squash	140	2530	5570	0.454
Garlic	3	8	19	0.421
Onions, mature	160	90	262	0.344
Rutabaga	140	55	207	0.266

#### FRUITS

A clear picture emerges: The best fruits are tropical fruits (papayas, and mangoes for example), “rose family” fruits (apples, for example), and stone fruits (apricots and plums for example). And yes, avocados and tomatoes are fruits.				
Papaya	454	76	30	2.533
Mango	300	85	39	2.179
Apricot	114	103	48	2.146
Apple	150	17	8	2.125
Pear (dried)	175	116	56	2.071
Applesauce (unsweetened)	244	24	12	2.000
Apricot (dried)	35	89	49	1.816
Fig (dried)	189	228	131	1.740
Avocado	272	189	119	1.588
Pineapple	155	39	28	1.393
Persimmon	200	55	42	1.310
Peach	115	20	16	1.250
Plum	5.5	90	74	1.216
Watermelon	160	99	94	1.053
Tomato	123	41	27	1.519
Banana	175	55	54	1.019
Strawberries	149	37	39	0.949
Dates	83	50	55	0.909
Tangerine	116	27	37	0.730
Orange	180	62	85	0.729
Elderberries	145	38	68	0.559
Plantain	148	89	160	0.556
Blackberries	145	17	49	0.347
Blueberries	145	17	49	0.347
Grapes, slip skin	153	13	42	0.310
Grapes, adherent skin	160	24	78	0.308
Grape Juice	253	25	119	0.210
Orange Juice	248	22	117	0.188
BEANS, MEATS, POULTRY, EGGS				
Sadly, fish, though having a similar ratio of lysine to arginine as human milk, is unacceptable in the diet because of the high probability of mercury contamination. Whole soybeans or soybean sprouts are good, but any other soy product generates MSG in manufacture.				
Soybean sprouts	70	386	266	1.451
Chicken dark meat	109	1860	1320	1.409
Chicken light meat	88	1730	1230	1.407
Beef Round Steak	454	7320	5550	1.319
Porterhouse Steak	454	6560	4980	1.317
Turkey, dark meat	152	2620	2020	1.297
Ground Beef, Lean	113	1670	1350	1.237
Lentil Sprouts	77	548	470	1.166
Whole Egg, dried	5	155	147	1.054

Way too high in arginine are grains, nuts, seeds, gelatin and chocolate [though the latter two are not listed below].

Examples:

Food	Weight in grams	Lysine in milligrams	Arginine in milligrams	Ratio Lys/Arg
Wheat, shredded	23.6	79	133	0.594
Bran Flakes	47	177	314	0.564
Oatmeal	234	78	147	0.531
Rice, puffed	14	38	73	0.521
Macadamia nuts	134	434	1200	0.362
Peanuts	144	1450	5050	0.287
Coconut, shredded	80	118	437	0.270

Almonds	142	946	3540	0.267
Pecans	108	315	1190	0.265
Sesame Seeds	150	1240	4990	0.248
Walnuts	100	466	2520	0.185

Transcribed and calculated using data from *Agricultural Handbook, 1-23, U.S. Department of Agriculture.*

And so we have walnuts as having our most “dangerous” ratio of high arginine to low lysine...and how many times have you met someone who could eat most nuts...but not walnuts? They’ll tell you “I get little sores in my mouth”. Hmmm.

## ***SUPPLEMENTS Maximize Liver Function; Safely Chelate Out Heavy Metals; Naturally Squelch Excess Nitric Oxide [+Antioxidants in General]; Support Mitochondrial Energy + Re-establish Beneficial Flora in Gut***

### **Studies**

“**Vitamin B<sub>2</sub>** decreased the plasma elevated NO levels in accordance with a reduction in expression of inducible NO synthase...” Inhibitory mechanisms of **highly purified vitamin B2** on the productions of proinflammatory cytokine and NO in endotoxin-induced shock in mice. *Life Sci.* 2005 Nov 26;78(2):134-9.

“...neuroprotective property of **magnesium** might be mediated in part through the inhibition of nitric oxide production shortly after oxygen-glucose deprivation.” Neuroprotective effects of magnesium on metabolic disturbances in fetal hippocampal slices after oxygen-glucose deprivation: Mediation by nitric oxide system. *Journal of the Society for Gynecologic Investigation.* Vol. 9, Issue 2, March-April 2002, Pages 86-92.

“**Wogonin** (wogonin is a flavonoid derived from the root of the *scutellaria baicalensis* herb) inhibited inflammatory activation of cultured brain microglia in vitro and provided neuroprotection in microglia...” Flavonoid wogonin from medicinal herb is neuroprotective by inhibiting inflammatory activation of microglia. Heasuk Lee et al. *The FASEB Journal* Vol 17, October 2003 Pg. 1943-44.

“**Phosphatidylserine** and **Phosphatidylcholine** liposomes can inhibit the microglial production of both NO and O(2)(-), and thus presumably prevent a subsequent formation of ONOO(-). Therefore, PS/PC liposomes appear to have both neuroprotective and anti-oxidative properties through the inhibition of microglial activation.” Phospholipids modulate superoxide and nitric oxide production by lipopolysaccharide and phorbol 12-myristate-13-acetate-activated microglia. Hashioka S et al., *Neurochem Int.* 2007 Feb;50(3):499-506. Epub 2006 Nov 28

“**Phosphatidylcholine** and **Glycerol-phosphorylcholine** may help build nerve cell membranes, facilitate electrical transmission in the brain, hold membrane proteins in place, and produce the neurotransmitter acetylcholine” ~ Because **Phosphatidylserine** competes with glutamate, it may protect us from glutamate toxicity.” Soy Lecithin: From Sludge to Profit Kaayla T. Daniel, PhD, CCN

“KBV (**Bee Venom**) has anti-inflammatory properties that inhibit iNOS” Effect of honey bee venom on microglial cells nitric oxide and tumor necrosis factor-alpha production stimulated by LPS. Hans S et al. *J Ethnopharmacol.* 2006 Nov 15; [Epub ahead of print]

“...significant suppressive effects of **ginsenosides** on proinflammatory responses of microglia implicate their therapeutic potential in neurodegenerative diseases accompanied by microglial activation.” Differential effects of ginsenosides on NO and TNF-alpha production by LPS-activated N9 microglia. Wu CF et al. *Int Immunopharmacol*. 2007 Mar;7(3):313-20. Epub 2006 Dec 1.

“...pro-glutathione agents (like **alpha-lipoic acid** LA) can spare cellular glutathione and protect cells from glutamate insult .” Antioxidants and herbal extracts protect HT-4 neuronal cells against glutamate-induced cytotoxicity. Kobayashi MS et al. *Free Radic Res*. 2000 Feb;32(2):115-24

“**SAMe** is required in numerous transmethylation reactions involving...phospholipids, and amines with other neurotransmitters. The synthesis of SAMe is intimately linked with folate and vitamin B12....deficiencies of both these vitamins have been found to reduce CNS SAMe concentrations. Both folate and vitamin B12 deficiency may cause similar neurological and psychiatric disturbances, including depression, dementia, myelopathy and peripheral neuropathy.” Bottiglieri T, et al. **The clinical potential of ademetionine (S-adenosylmethionine) in neurological disorders.** *Metabolic Disease Center, Baylor Research Institute, Dallas, TX*.

Ultra-high doses of **methyl-B12** may be of clinical use for patients with peripheral neuropathies. **Ultra-high dose methylcobalamin promotes nerve regeneration in experimental acrylamide neuropathy.** Watanabe T. et al. *J Neurol Sci* 1994 Apr;122(2):140-3

In 1941 **Ca-AEP** [amino ethyl phosphoric acid ] was discovered by biochemist Erwin Chargaff as a vital component in the structure of cell membranes: A cell sealer and protector; electrolyte and nutrient carrier, to maintain a cell’s electrical charge. Studied for 30 years, mostly in Germany, Ca-AEP therapy has shown promising benefits to sufferers of neurological diseases like multiple sclerosis and amyotrophic lateral sclerosis. In high doses Ca-AEP temporarily “coats” nerves and aids in the transmission of messages.

Evidence to date shows that **creatine** supplementation has a good safety profile and is well tolerated by ALS patients. Creatine also offer hope for the treatment of diseases characterized by weakness and muscle atrophy. Creatine offers potential benefits for diseases involving mitochondrial dysfunction. Recent data also support the hypothesis that creatine may have a neuroprotective effect. Ellis AC, Rosenfeld J. **The role of creatine in the management of amyotrophic lateral sclerosis and other neurodegenerative disorders.** *CNS Drugs*. 2004;18(14):967-80.

Glutamate induces cell death by upsetting the cellular redox homeostasis, termed oxidative glutamate toxicity... Our results suggest that **curcumin** has a neuroprotective effect against oxidative glutamate toxicity by inhibiting MAP kinase signaling and influencing cell-cycle regulation. Suh HW et al. **Curcumin attenuates glutamate-induced HT22 cell death by suppressing MAP kinase signaling.** *Mol Cell Biochem* 2006 Nov 25

“The results of the study show that there is an interaction between **curcumin** and both cadmium and lead, with the possible formation of a complex between the metal and this ligand. These results imply that curcumin could be used therapeutically to chelate these toxic metals, thus potentially reducing their neurotoxicity and tissue damage.” Daniel S., et al. **Through metal binding, curcumin protects against lead- and cadmium-induced lipid peroxidation in rat brain homogenates and against lead-induced tissue damage in rat brain.** *J Inorg Biochem* 2004 Feb;98(2):266-75

## **Zinc**

Mutations to the copper, zinc superoxide dismutase (SOD) gene are responsible for 2-3% of amyotrophic lateral sclerosis (ALS) cases. These mutations result in the protein having a reduced affinity for zinc. Zinc amplifies mSOD1-mediated toxicity in a transgenic mouse model of amyotrophic lateral sclerosis, Supplementing zinc with even 18 mg/kg/day resulted in a more rapid death of some mice; adding copper helped reverse the “death by zinc”. Ermilova IP et al. **Protection by dietary zinc in ALS mutant G93A SOD transgenic mice.** *Neurosci Lett.* 2005 Apr 29;379(1):42-6. Epub 2005 Jan 13

Consult with your personalized regenerative medicine practitioner to discern the best possible supplemental program for you. It can prove to be an expensive proposition (\$500 or more per month) and so you want to get the most benefit from the right supplements. Your practitioner will likely know the best brands of supplements to take, as all are not created equal. In addition, your practitioner will likely have you on certain intravenous and other therapies that may require certain supplements to be added or unnecessary.

## **TERMINOLOGY**

**Amyotrophic lateral sclerosis (ALS)** A serious, progressive, neurologic disease in which loss of nerve cells produces muscle paralysis anterior horn cell A motor neuron in the anterior horn gray matter of the spinal cord; directly Antiglutamatergic Selective action (usually via a drug) against glutamate activity Astrocyte One of the large neuroglia cells of nervous tissue. Also called *astroglia*, *Deiters' cell*, *macroglia*.

**Astroglia** tissue consisting of large stellate (star-shaped) neuroglial cells

**DNA** The material inside the nucleus of cells that carries genetic information. The scientific name for DNA is deoxyribonucleic acid.

**EAAT** human excitatory amino acid transporter

**Excitotoxin** Class of substances that damage neurons through paroxysmal activity [Paroxysmal - recurring "sudden attacks" of symptoms]

**Excitotoxicity** receptor-mediated calcium influx (excitotoxicity)

**Ethylmercury** (sometimes ethyl mercury) is a cation that forms organomercury compounds such as ethylmercury chloride and ethylmercury urea. Ethylmercury is a highly toxic and bioaccumulative organic compound. It is composed of an ethyl group and a mercury atom; its chemical formula is C<sub>2</sub>H<sub>5</sub>Hg<sup>+</sup>.

**GGT** Blood levels of Gammaglutamyltransferase. The enzyme has been found to be a relatively sensitive index of liver damage in clinical studies of alcoholics and heavy drinkers

**Glutamate** An amino acid neurotransmitter normally involved in learning and memory. Under certain circumstances it can be an excitotoxin and appears to cause nerve cell death in a variety of neurodegenerative disorders

**Homeostasis** The ability or tendency of an organism or cell to maintain internal equilibrium by adjusting its physiological processes

**L-Arginine** This amino acid functions as a precursor to the formation of nitric oxide

**Macroglia** That portion of the neuroglia composed of astrocytes

**Methylmercury** A human-made molecule, synthesized for commercial purposes (to kill mold), and a naturally occurring compound made by certain bacteria. Methylmercury penetrates the brain and is a potent neurotoxin. Methylmercury also crosses the placenta, and, as a result, a large number of women who were exposed during pregnancy in past methylmercury epidemics gave birth to severely brain-damaged children

**Microglia** Any of the small neuroglial cells of the central nervous system having long processes and amoeboid and phagocytic activity at sites of neural damage or inflammation.

**Mitochondria** The mitochondria are the principal energy source of the cell. Mitochondria convert nutrients into energy as well as doing many other specialized tasks.

**Neurotransmitter** Specialized chemical messenger (eg, acetylcholine, dopamine, norepinephrine, serotonin) that sends a message from one nerve cell to another. Most neurotransmitters play different roles throughout the body, many of which are not yet known

**Nitric Oxide** Nitric oxide (NO) is a free radical playing a multifaceted role in the brain and its excessive production is known to induce neurotoxicity.

**Nitric Oxide Synthase** Nitric oxide synthase enzymes produce nitric oxide (NO) by catalysing a five electron oxidation of a guanidino nitrogen of L-arginine. Oxidation of L-Arginine to L-citrulline occurs *via* two successive monooxygenation reactions producing  $N^{\omega}$ hydroxyLarginine as an intermediate. 2 mol of  $O_2$  and 1.5 mol of NADPH are consumed per mole of NO formed.

**Parkinson's Disease (PD)** is a neurodegenerative disorder that causes slowed movements, tremor, rigidity, and a wide variety of other symptoms. Neurodegenerative refers to the degeneration, or death, of neurons, the type of cell in the brain that is the basis for all brain activity.

**Pesticides** any chemical or biological agent that kills plant or animal pests; herbicides, insecticides, fungicides, rodenticides, etc. are all pesticides

**Phagocytic Activity** Phagocytic cells are cells that ingests microorganisms and foreign particles

**SOD1 (Superoxide Dismutase 1)** An enzyme that destroys superoxide. One form of the enzyme contains manganese and another contains zinc. Superoxide is a highly reactive form of oxygen. For ALS, 20% of the total population of patients have mutations in the gene for copper/zinc superoxide dismutase type SOD1. SOD1 normally breaks down free radicals, but mutant SOD1 is unable to perform this function.

**Toxins** a chemical compound from one organism that is harmful to another organism