Excitoxins

Aside from eliminating foods that one is truly allergic to, the most vital dietary intervention you can make is in removing excitotoxins. Dr. Russell Blaylock MD, a neurosurgeon and chief authority on excitoxins, defines these chemicals as "A group of excitatory amino acids that can cause sensitive neurons to die 5-14. The most commonly used substances include glutamate, aspartate, and cysteine, all of which change your perception of the drink or food's flavor, creating a delicious and savory affect. Most people believe these are used as preservatives, however, aside from actually leading you to enjoy and subsequently crave the product, these toxins have no other purpose. Conversely, as natural products in the body, each of these amino acids plays a crucial role in neurological function yet must be present in highly regulated, miniscule quantities. In fact, the memory for cocaine addiction resides within the glutamate receptor, which is one reason you just have to have Top Ramen and a Diet Coke for dinner. Though many will instantly recognize the most notorious excitotoxin, MSG, also known as monosodium glutamate, most are unaware that MSG exists in virtually every single processed food that we eat today. Whether you are eating organic plain whole-wheat crackers or Taco Bell fajitas, you are most likely ingesting, at minimum, 3-4 glutamates in the crackers and up to 30 or more of these toxins in the fajitas.

Although Umami, also known as "pleasant" or "savory" has been used as a flavor enhancer in processed foods since 1948 5 & 64, this restaurant syndrome was only coined in 1969, when medical providers recognized a condition that often coincided with eating Chinese food 2,5,61,64,73, & 77. Despite this association, a more fitting moniker might include "Processed Food Syndrome" since many mistakenly assume they are protected, simply by not eating particular foods. Frankly, nothing could be more misleading since the most preferred and trusted brands in the food industry including Libby, Pillsbury, Nestlé's, and Campbell's often include multiple versions of Umami, a chemical commonly known as monosodium glutamate (MSG). Perhaps most alarming of all is that many of these companies claim "No MSG" while integrating as many as 20 MSG ingredients into their products. Even so, you won't generally recognize this as they conceal it behind terms such as autolyzed yeast, hydrolyzed soy protein and the standard favorite, natural flavors, **See table 1** 5,48,59-60, & 64. This ploy has been widely successful since few realize they habitually eat these impurities and feed them to their children. Regrettably, the secret recipe that many companies and restaurants use to attract consumers really comes down to one main chemical, Monosodium glutamate or its derivatives. Today we dispel the myth of wholesome goodness behind what makes Campbell's soup "Hmm Hmm Good!"

Despite MSG's widespread availability for centuries throughout Japan and parts of Asia, US food manufacturers only learned of this extract during WW II 5 & 64. American servicemen were not eating their poor quality military rations while Japanese soldiers were noted to have robust appetites, which was largely attributed to umami. Shortly after a conference between the nation's top corporate and government officials, MSG was added to everyday goods and it has doubled in every single decade since 5 & 64. Though it was originally derived from seaweed and later wheat gluten, MSG is currently produced as a free glutamate from the fermentation of corn, potatoes, and rice. Considering its natural origin, this chemical was felt to be safe, and possibly even beneficial. Nonetheless, the fact that it afforded a satisfying flavor to bland and even unpleasant meals meant that it would become indispensible. In retrospect, it seems

highly unlikely that anyone could have anticipated just how ubiquitous this additive would become in the average American's diet. With time, it became a matter of financial survival for most companies to include MSG, NutraSweet, and similar additives since this led consumers to choose one product over another. A smaller company could choose to make homemade chicken noodle soup using 140 chickens or they could use a barrel of MSG, which provided that savory flavor, while only using 10 chickens. Aside from repeat customers, this practice would also ensure larger orders due to MSG's addictive properties. Though in all fairness to these early companies, little to no harmful effect was known at the time and with MSG present, study participants continued eating, well after feeling full. In fact, it is now customary for researchers to nickname the lab rats, as "MSG fed rats" since all become morbidly obese 3,5,26,36, 42-45, & 64. With this in mind, The Nation's "war on obesity" might be better focused toward many of these toxic food ingredients as well as regular exercise.

Neurotransmitters (NT) have many functions throughout the body. Some NTs are excitatory and lead to increased electrical conduction between cells while others are inhibitory and reduce the activity. Ultimately, there must be a balance between both types of NTs for proper neurological function. The most common stimulating NTs are the amino acids glutamate (glutamic acid), aspartate (aspartic acid), and cysteine (cysteic acid) while the primary calming NT is GABA (gamma-aminobutyric acid) 5,37,52, &77. These particular amino acids are made in the body, playing a crucial role in neurological function and as such, they are tightly regulated in miniscule quantities **See Table 2** 5,8,25,33,35, & 49. Though glutamate has many functions within the body, it is essential for taste, sight, and hearing as well as problem solving, learning, and memory. Glutamate acts as the spark that allows one nerve cell to communicate with another. In doing so, this chemical messenger allows you to learn about topics you never thought possible while remaining interested and engaged. Still, we cannot remain at the edge of our seats indefinitely and this is where GABA comes to the rescue. In fact, with so many glutamate receptors throughout the body, mechanisms are in place to maintain stability by providing GABA. Aside from poor sleep, GABA is the main source of sleepy looks and yawning after a long day of scientific lectures. You simply need a glutamate break (or a nap) and GABA makes this possible even while your children and other responsibilities do not. Yet when too much glutamate is present, nerve cells fire erratically and become inflamed, often self-destructing 5-4,19,22,32,64,& 77.

Monosodium glutamate is a synthetic copycat of glutamic acid yet unlike its' prototype, this artificial version has been broken down, usually through fermentation. This is another reason fermented foods have become so popular recently. My husband once played a trick on my ultra finicky daughter, who also happens to be the Betty Ford of glutamates, and lured her to drink the most ghastly version of Kombucha available. Though we didn't realize it at the time, this fermented drink is rife with free glutamates so imagine our surprise when she wanted more and more! Despite the considerable benefits to the digestive tract, these products often provide ample amounts of free glutamate and may pose problems for those sensitive to them, particularly anyone with inflammatory bowel issues and autism spectrum disorders. This is due to the processed glutamate being detached from its fellow amino acids so that it is free to enter the bloodstream at 8-10 times the normal rate. Unfortunately, any free glutamate is now much more capable of crossing the protective blood-brain-barrier (BBB), particularly in the presence of inflammatory conditions 4-6,14,17-18,24,32-34,37,41,44-45,47-50,52,54-56,59-60,63-66,70-71,73-74,78-80,82. On the contrary, bound glutamate is found in many protein rich foods

and cannot readily enter the bloodstream or cross the BBB's rich capillary network. Additionally, there are naturally occurring foods that contain high levels of free glutamate, **See Table 1**. Whereas controversy exists over whether these naturally free glutamate rich foods pose a problem, I can attest to the fact, that at least in our household, tomato sauce, soy sauce, and Parmesan cheese are always related to behavioral changes and headaches. I have also found that once patients keep food diaries, the overwhelming majority recognizes this as well.

Many studies have demonstrated elevated glutamate levels in a variety of neurological conditions. However, several studies in the past decade have revealed abnormally high glutamate levels *and* chronic immune system activation in the brains of both autistic children and adults 5-14, 22, 53,58, 69, 75, 79, 86, & 89. Though chronic immune activation is incited through many routes, some of the most common risks include viral and bacterial infections, live virus vaccines, and heavy metals or toxins such as mercury, lead, cadmium, and aluminum 5-14,90-91,94, 96-97,145, 147-152, 154 & 155. Excitotoxins such as glutamate, aspartame, and cysteine are also powerful immune activators 10-13,72,87-88, 92-113. And, since glutamate receptors also exist throughout the serotonin and dopamine pathways, these chemical hit men have a pervasive influence over a vast array of neurological pathways **See table 3** 5-13, 56, 58, 66 & 87. As for heavy metals, mercury has been shown to drastically increase the body's natural glutamate levels while suppressing at least two crucial transporters that block further excitotoxicity, thus greatly exaggerating the reaction 5-14,76, 94, & 96. Apart from instigating a host of inflammatory responses, both aluminum and mercury drastically reduce glutathione, a potent antioxidant critical in removing toxins and free radicals along with supporting immune protection 5-14, 64, 76,79-81, 88,156-158,160-162. The glutamate reaction also depletes this free radical scavenger, though it carries more threat with the additional consumption of a diet laden with enhanced excitotoxins. Adding insult to injury, with data gleaned from The Human Genome Project we now understand that genetic typos exist, known as single nucleotide polymorphisms (SNP). Depending on the location of the SNPs, there may be mild to serious disruptions in the standard filtering and processing pathways leading many to reach toxic threshold that much sooner 22, &156-162. Inevitably, when one is constantly thrown into a tempest of environmental toxins and infectious diseases, that which was once a minor assortment of genetic shortcomings and only exposed through mild health issues much later, is now catastrophic.

The potential for harm was first noted in 1957 when two ophthalmologists, Lucas and Newhouse, speculated that MSG would prove beneficial for a hereditary eye disease in mice. Since MSG was believed to provide energy to brain cells, there could be great potential for this synthetic glutamate. You can imagine their dismay when they found that MSG had destroyed all of the nerve cells in the inner layer of the retina, known for visual reception 5,46, & 64. With this realization, it may seem less mysterious that so many young children and older adults, who are the most vulnerable groups in our population, suffer from a variety of visual disorders. Upon reviewing the unexpected findings, Dr. John Olney, a neuroscientist working for the Dept. of Psychiatry, at Washington University, decided to repeat this study almost a decade later. Much to his amazement, Dr. Olney found that a single dose of MSG not only destroyed the retina but also highly specialized cells in the brain that are part of the hypothalamus. This area is unprotected by the BBB yet is essential for regulating many endocrine functions 5, 46-47, & 64. In addition to many other endocrine disorders, mice treated with MSG eventually develop a shorter, overweight body habitus and acquire problems with infertility, thyroid

dysfunction, and diabetes [3, 5, 26, 36, 42-45, 62, 64, & 74]. In considering the health conditions that afflict today's youth, it is no surprise that ADD/ADHD, autism, anxiety, obesity, and diabetes rank the most common and are increasing with alarming frequency.

Dr. Olney performed many subsequent investigations using different species and each outcome was similar; though all suffered brain and retinal lesions, it was the younger animals that were most susceptible to MSG's toxic effects [45-52]. This was most concerning for two reasons; pregnant women were unaware of these risks and formula and baby foods contained the same amounts of MSG that were used in Olney's experiments [5, 46-47, & 64]. After alerting the Food and Drug Administration without success, this neuroscientist appeared before a congressional committee investigating food additives. Though he carefully presented the data and research findings, inexplicably, there were no mandates or requests for manufacturers to remove or even reduce the amount of MSG in baby products, let alone general foodstuff. Soon afterward, in 1971, other researchers such as W.A. Reynolds, et al., conducted experiments though curiously, those funded by the pharmaceutical or food industries verified high safety profiles. It was not until much later that Dr. Olney learned Reynolds and colleagues had also used phencyclidine, a drug known to block the glutamate receptors, thereby preventing MSG's attachment [5, p. 57]. Nevertheless, Dr. Olney's persistent advocacy for such policies discouraged food manufacturers so that they finally removed MSG from infant foods and formulas. Regrettably, they continue to use this harmful flavor enhancer in all of their other products while using the most toxic versions such as hydrolyzed protein in infant foods and formulas as well as general goods, in order to evade detection [5, 26, 36, 45-52, 62, 64, & 74].

In order to fully evaluate damage potential, it is important to consider any area of the brain that does not have BBB protection. As already noted in Dr. Olney's work with MSG, one of the areas sustaining the most damage is known as the hypothalamus. This tiny region has an extensive network of glutamate receptors and controls the autonomic nervous system as well as the master endocrine gland, the pituitary, consequently acting as the body's thermostat for heat and hormone regulation. Aside from supporting blood sugar levels, sex hormones, adrenal and thyroid function, puberty, fertility, and much of growth and development, this area also sustains the sleep-wake cycle, emotional and temperature regulation, food and water intake, motor function and control and immunity [5,20,37,45,47,53,56, 62-64,76, & 78-79]. Considering the deluge of excitotoxins one receives in industrialized nations, both inherently and through the diet, it's undoubtedly no coincidence that most of these biological processes are substantially altered, thus manifesting in a plethora of medical ailments.

Nevertheless, it is one thing to understand this on an academic level and another to appreciate this from firsthand experience. Like many other medical providers, I have found that in considerably limiting dietary triggers, most people will have at least a 25-50% improvement, which is almost always seen within 4 to 6 weeks of starting the intervention. In treating many adults who suffer from conditions such as MS, CFS, FM, anxiety and migraines and have experienced as much as a 50-60% reduction in their symptoms with these changes, I find that I am unable to ignore the magnitude of excitotoxicity. For instance, during an MS exacerbation, the blood-brain barrier near the lesions becomes inflamed and breaks down, leaving surrounding brain cells and tissue vulnerable to these toxins. If such individuals drink diet sodas or eat highly processed foods during these episodes, the damage will be much more extensive. For those with

autism, ADD/ADHD, OCD, PANDAS, mitochondrial dysfunction and behavioral problems, reducing the catalyst is often profound.

In reviewing many of the deleterious effects these chemicals exert on the neurological and endocrine systems, it is no wonder children are especially vulnerable. For all of these reasons, aside from eliminating foods that one is truly allergic to, the most vital dietary intervention anyone can make is in decreasing this toxic burden. Though there are many strategies for making such adjustments, the most imperative is reminding oneself that this will benefit the entire family yet shouldn't be an all or nothing type of intervention. There are also many effective supplements that help to counteract the harmful consequences of excitotoxins**,** yet nothing is as successful as reducing the onslaught. In fact, many experts believe that this is the prevailing reason the gluten free and casein free diet (GF/CF) is often not as promising as it once was for children with ADD/ADHD or autism spectrum disorders. Since wheat gluten is 25% glutamic acid, its removal is typically advantageous, despite taking more time to reap the benefits. Still, it is well known within the field that many convey significant progress when they initially start this diet yet as time goes on they experience a plateau or serious decline in those gains. Due to this, many begin to question whether they truly had any benefit at all or if they may have imagined such progress. The more likely explanation is that as they introduced more and more processed corn, roasted nuts, and soy products, they were once again eating foods chock-full of excitotoxins, particularly when they found brands they really enjoyed. Within my own family, we observed considerable benefit in removing casein yet had an unexpected regression upon adding several soy and corn products. Our hectic work, school, medical, and treatment schedules only added to the load so that as we layered in more new and tastier GF/CF snacks and meals, the worse it became. Fortunately, the solution was there all the time and balance was in order. **Please See Table 4** for tips on removing these chemical hitmen.

We are fortunate to live in a time when scientific inquiry and discovery allows for both enlightenment and progress. Countless studies have clearly revealed the destructive effect of excitotoxins, particularly in concert with so many other toxic environmental exposures and illnesses. An isolated exposure to mercury or aluminum might not lead to chronic health issues when the system is running optimally and there are limited pollutants otherwise. Similarly, a simple bout of strep or influenza may resolve without incident yet they become more and more significant as toxic threshold accrues. Unfortunately for children today, these toxic encounters are never-ending. Yet despite the mounting data, most remain unaware. Despite the fact that these chemicals impact the sleep cycle, mood, visual processing, hearing, appetite, and growth and development in addition to having an insidious effect on the neurological and endocrine systems, profit margins seem to reign supreme. In essence, such a multifaceted assault provides the domino effect necessary in bringing down such finely honed instruments as the human brain and body. Perhaps it is time to honor the scientific process, regardless of the inconvenience to revenue. After all, it has been most detrimental to the generation who will someday lead our nation.

Table 1. Ingredients that include Monosodium Glutamate

Ingredients with Hidden Free Glutamic Acid	Ingredients that often have free Glutamic Acid	Probable Sources of Free Glutamic Acid
Glutamic acid Glutamate Monosodium glutamate Monopotassium glutamate Calcium glutamate Monoammonium glutamate Magnesium glutamate Natrium glutamate Natural Flavors Yeast extract ***Anything "hydrolyzed*** Calcium caseinate Sodium caseinate Yeast food or yeast nutrient Autolyzed yeast Gelatin Textured protein Soy protein Soy protein concentrate Soy protein isolate Whey protein Whey protein concentrate Whey protein isolate Vetsin AuxiGro (plant enhancer) Ajinomoto Umami Worchester sauce Soy sauce ***Examples of hydrolyzed*** Pea, soy, wheat, whey, corn, & vegetable protein. This additive is the most harmful version as it contains all 3 excitotoxins: glutamate, aspartate, & cysteine as well as chemicals known to be carcinogenic. *Some vaccines also include MSG such as Merck's Varivax & the MMR.	Carrageenan Guar gum Locust bean gum Bouillon and broth Stock Any "flavors" or "flavoring" Maltodextrin Citric acid, Citrate Anything "ultra-pasteurized" Barley malt Pectin Protease Anything "enzyme modified" Anything containing "enzymes" Malt extract Soy sauce Soy sauce extract Anything "protein fortified" Anything "fermented" **Any ingredients listed as "seasoning," "spices," "natural flavoring," or "protein fortified*. **Below are MSG Flavor enhancers. If these are present, MSG is as well:* • Disodium 5'-guanylate • Disodium 5'-inosinate • Disodium 5'-ribonucleotides *Diet soda, chewing gum, low-calorie & low-fat foods almost always have multiple versions of MSG and/or aspartame included.	Corn starch Corn syrup Modified food starch Lipolyzed butter fat Dextrose Rice syrup Brown rice syrup Milk powder Reduced or Non-fat milk **Most no-fat or low-fat products & those with enriched vitamins, etc., are highly likely to contain MSG*. **Any addictive food or snack is most certain to have several excitotoxins present. Many times, once these foods are removed, taste buds and receptors adjust so that natural foods become more palatable*. *Cysteine is another amino acid that acts as an excitotoxin **Aspartame: Hidden Sources** AminoSweet Aspartic Acid Aspartate NutraSweet Neotame Aspartame is often found in medicines, particularly children's OTC and prescription medications. **Foods naturally high in free glutamate:** Tomatoes Peas Mushrooms Olives Parmesan cheese & dairy Soy sauce Black bean paste Breast milk

This table has been modified from Truth in Labeling, courtesy of Jack and Adrienne Samuels. According to Dr. Samuels, natural glutamic acid found in untreated protein is not problematic. In order to induce an MSG reaction, the glutamic acid must be either processed or extracted from a fermented protein. If an MSG containing ingredient such as yeast extract is used instead of MSG, the manufacturer may make the statement "no added MSG". Whereas if MSG is processed into a product instead of being poured into product, the company may declare "no MSG." 5,59-60,48,& 64.

Table 2. Essential, Non-essential & Potentially harmful Amino Acids

Essential Amino Acids	Non-essential Amino Acids	Conditionally Essential	Potentially Harmful
Isoleucine	Alanine	Arginine	Aspartate
Leucine	Arginine	Cysteine	Cysteine
Lysine	Aspartate	Glycine	Glutamate
Methionine	Cysteine	Glutamate	Glutamine
Phenylalanine	Glutamate	Histidine	
Threonine	Glutamine	Proline	
Tryptophan	Glycine	Serine	
Valine	Proline	Tyrosine	
Histidine	Serine		
Tyrosine	Asparagine		

- **Essential amino acids are required for life and not made in the body so must be obtained through the diet.**
- **Non-essential amino acids are often made in the body yet may also be required through diet in times of illness or high stress, such as oxidative stress.**
- **Conditonally essential amino acids are not normally required in the diet but may be required in vulnerable populations such as the elderly, infants and young children or during illness or other chronic health issues.**
- **Harmful amino acids are those that may be detrimental in higher than normal ranges. These are typically excitotoxic amino acids such as glutamate, aspartate, and cysteine.**

Table 3. Signs & Symptoms of Glutamate Toxicity

Monosodium Glutamate Toxicity		
Early Findings	**Later Findings**	**Currently Under Investigation**
✓ Flushing ✓ Sweating ✓ Headache/migraine ✓ Low blood pressure ✓ Flu-like achiness & malaise ✓ Facial pressure and/or pain ✓ Numbness to face or mouth ✓ Dizziness/ Lightheadedness ✓ Chest Pain ✓ Loss of balance (ataxia) ✓ Confusion/ Disorientation ✓ Heart Palpitations ✓ Shortness of breath ✓ Nausea/vomiting ✓ Abdominal pain ✓ Diarrhea ✓ Lethargy/sleepiness ✓ Insomnia ✓ Slurred speech	▪ Asthma ▪ Urticaria/Hives ▪ Runny nose ▪ Angioedema (swelling of face, throat, tongue) ▪ Frequent night waking ▪ Agitation/rage reactions ▪ Seizures ▪ Tremors ▪ Impaired memory & learning ▪ Anxiety/panic attacks ▪ Hyperactivity ▪ Depression ▪ Behavioral problems ▪ Hypertension ▪ Tinnitus ▪ Hearing loss ▪ Frequent urination ▪ Blurred vision or poor focus ▪ Muscle fatigue or twitching ▪ Extreme dryness/thirst ▪ Nerve pain/sciatica ▪ Hypoglycemia	• Neuropathy • Dementia • Obesity • Vision: retinopathy, cataracts, & visual processing problems • Polycystic ovaries • Diabetes • Sex hormone imbalance • Infertility • Cancers • White matter lesions (MS) • Irritable Bowel Syndrome • CFS/FM • Autism & PDD NOS • Interstitial Cystitis (chronic bladder pain) • ADD/ADHD • Atrial fibrillation & other heart rate disturbances • Restless leg syndrome • Syncope (loss of consciousness)

Table 4. Ten Tips for reducing Excitotoxicity

Practical Tips for Eliminating Glutamates
These days we don't live in cabins on the remote Alaskan tundra so you can only do the best you can with the time and resources you have available. Take it one step at a time, and remember that this isn't just about chronic neurological and autoimmune illness; it affects everyone. Work toward gradual changes and look for suitable alternatives, as even mild improvements can make a significant difference in health. See table 4 for beneficial supplements as well.
1. Remember that this is not an all or nothing lifestyle change. Gradually remove & replace what you reasonably can. If you can eliminate 40-50% of these toxins, you have made substantial progress toward lifelong neurological health.
2. There is no need to memorize all of the names for MSG. A good rule of thumb is if it takes you more than 2 minutes to read the ingredient list, it has too many excitotoxins.
3. Make an MSG limit & stick with it. Most GF/CF crackers or cookies have at least 3 to 5 hidden chemicals while the majority has 5 to 10, this is what makes them taste good. A box of Hamburger Helper, Rice-a-Roni or a can of Campbell's soup has at least 10 to 20 toxic ingredients! Try to limit each product to 5 or less and avoid having more than 2-4 of these foodstuffs mixed in with homemade meals per day.
4. Remember, there is almost always a reasonable substitute for favorites. It is also important to realize that your taste buds will adapt once accustomed to less MSG.
5. Compromise to reduce your overall level. For example, roasted peanut butter is more convenient & flavorful yet higher in glutamates than raw nut butter. Consider mixing ½ roasted nut butter with ½ raw nut butter to cut down on content and retain flavor.
6. Make up enormous batches of meatballs & patties, seasoned taco meat, stuffed meatloaf, chicken soup, chili, whole grain rice, Sandwiches, stir-fry, Sausages, GF/CF pancakes & waffles, etc., and freeze them in meal size batches for busy nights & mornings. It's much easier to reheat food in a toaster oven than to cook an entire meal three times a day.
7. If you occasionally eat fast food, limit the burger to "protein style" with some plain fries.
8. Don't forget that anything that is so delicious you just can't stop eating it or often crave it is undoubtedly chock-full of excitotoxins, which are triggering the addiction pathway.
9. Whenever possible, avoid any processed dipping sauces, soy sauce, soups, gravy, Worcester sauce, and many (not all) salad dressings as well as powder packs in foods such as Top Ramen, Mac & Cheese, Bouillon, Accent, Taco & other seasoning packs, etc.
10. Remember, life is short so it's a compromise; when you really enjoy something and can't make or find a good substitute, search for other ways to limit your daily intake. For instance, a really good GF/CF & excitotoxin free bread is often difficult to make and there are more appealing products on the market now so instead, trade your canned soup or flavored chips and crackers for plain GF potato chips or potato sticks.

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