Excitotoxins
The Taste that Kills

Russell L. Blaylock, MD
Russell L. Blaylock, MD, has written *Excitotoxins: The Taste that Kills* in which he explains that certain amino acids when overly abundant in the brain can cause neurons to die.

- Many biochemicals can act as neurotransmitters in the brain—some excite our neurons; others calm them.

**Three acidic amino acids**
- That excite our neurons so called "excitotoxins."
- Glutamate, Aspartate, and Cysteine
Why Toxic to our body?

Glutamate, as a neurotransmitter, exists in the extracellular fluid very small concentrations --- no more than 8 to 12uM.

- When the concentration of this transmitter rises above this level, the neurons begin to fire abnormally
- The cells undergo this specialized process of delayed cell death, excitotoxicity. That is, they are excited to death.
- For example, the food labelled as 'hydrolyzed vegetable protein,' 'vegetable protein,' 'natural flavorings,' and 'spices.' Each of these may contain from 12 per cent to 40 per cent MSG.
Brain

Brain is a living computer, made of billions of cells and pathways and trillions of neural connections.

- Frontal lobes—decision making, planning, thinking, and premotor areas
- Parietal Lobes—Association Cortex
- Occipital Lobes—Visual cortex
- Temporal Lobes—Memory lobes or interpretive cortex
The hippocampus

- short-term memory to long-term memory and
- spatial-memory
- In diseases such as Alzheimer's disease, the hippocampus is one of the first regions affected.

Wide Distribution of the glutamate neuron fibers throughout the brain
How Excitotoxins Were Discovered?
(Experiments with newborn of MSG exposed mice)

- In 1957, two ophthalmology residents, Lucas and Newhouse demonstrated widespread destruction of the inner nerve layer of the retina, (published in the *Archives of Ophthalmology*)

- 1969, Dr. John Olney, a neuroscientist and neuropathologist repeated Lucas and Newhouse's experiment.- newborn of MSG exposed mice were grossly obese and short in stature, hypo plastic organs and damage to widespread areas in the brain.
Mechanism of this destruction

- With calcium triggered stimulation, the neuron becomes very excited, firing its impulses repetitively until the point of cell death, hence the name excitotoxin.

- The Lock and Key theory as applied to the glutamate receptor, this cause the calcium channel to open allowing Ca to enter into the cell.

The synapse, demonstrating the secretory mechanism within the terminal end of the axon which holds the neurotransmitter packages and excretes into the synaptic clefts. Here it attaches to the receptor surface on the next neuron causing the cell to fire.
Failure of Protective Mechanisms

Energy, Magnesium, and Antioxidants

• Brain has many protective mechanisms against these toxins.
• Reducing excess glutamate (or glutamic acid) at the special glutamate receptors
• Storing the extra glutamate in nearby glia cells
• Magnesium to block the uptake of glutamate

Other protective processes

• The powerful antioxidant glutathione (formed from these amino acids when magnesium, potassium, and sufficient energy are all present)
• Vitamin C or ascorbic acid: Adequate ascorbate levels for CNS function and neural protection against excitotoxicity.
Free Radicals and Calcium

- First, the excitatory amino acids attached to specialized family of receptors (NMDA, kainate, AMPA and metabotrophic) cause calcium entry into the cells controlled by the "calcium pump," which requires much energy.
- Lack of protective mechanisms with excitotoxins, too much calcium enters the neuron through special channels in the cell membrane.
- This calcium will trigger a cascade of reactions, including free radical generation, eicosanoid production, and lipid peroxidation, which will destroy the cell.
Blood vessel walls in the brain that allow certain chemicals to enter the brain while excluding others—the so-called blood-brain barrier.

**Blood-Brain Barrier**

**Defects in Blood brain barrier**

Temporarily broken down by

- Heat stroke,
- Brain trauma
- Encephalitis
- Strokes,
- Hypertension,
- Severe hypoglycemia and also in Aging
A small silent stroke can act as a point of seepage for excitotoxins to bypass the barrier.

- In Alzheimer's disease the vessels have the appearance of "Swiss cheese.
- In children is exposure to excess lead from the environment, such as old lead paint can easily disrupt the blood-brain barrier.
Fetal effect

Dr. Blaylock points out that this barrier is not well developed in the very young and it may even be still developing in the adolescent.

Migration of neurons from the germinal layer to the cortex during embryonic development. Glutamate excess may interfere with this delicate process.
Neurodegenerative Diseases

Dr. Blaylock explains in detail and with excellent illustrations exactly which areas of the brain are involved in the neurodegenerative diseases: amyotrophic lateral sclerosis (ALS, Lou Gehrig's disease), Parkinson's, and Alzheimer's.

A cross section of the mid brain of the brain stem showing the pigmented cells of the Substantia nigra one of the principle sites of injury seen in Parkinson’s disease. By using selective glutamate blocking drugs or nutrients, one may be able to alter some of the more devastating effects of Parkinson's disease.
Huntington Chorea

Drawing A – Normal brain
Drawing B – Shrunken caudate nuclei and adjacent enlarged ventricles

Other factors

The brain requires enormous amounts of energy to survive.

- When the neurons have abundant energy supplies they are resistant to glutamate toxicity; when the energy deficiencies exits the neurons become vulnerable even as low doses of glucose.
We need to concentrate on whole, and unprocessed food.

Avoiding Excitotoxins

• In summary, Dr. Blaylock recommends that we avoid the dietary excitotoxins so prevalent in prepared foods—the MSG and the aspartame—NutraSweet.
• Over 100 million Americans now consume aspartame products and a greater number consume products containing one or more excitotoxins.
• Remember also that the powerful excitotoxins, aspartate and L-cysteine, are frequently added to foods and according to FDA rules require no labeling at all.

Additives that always contain MSG:
• Monosodium Glutamate
• Hydrolyzed Vegetable Protein
• Hydrolyzed Protein
• Hydrolyzed Plant Protein
• Plant Protein Extract