

# Aluminum Induced Immunoexcitotoxicity in Neurodevelopmental and Neurodegenerative Disorders

## Current Inorganic Chemistry 2012, Vol. 2, No. 1

Russell L. Blaylock, MD

This article has 85 references

- 1) Aluminum is a neurotoxin that disrupts cellular function.
- 2) Aluminum and aluminofluoride compounds activate the brain's innate immune system (microglia) releasing neurotoxic concentrations of excitotoxins [glutamate / aspartate] and pro-inflammatory cytokines, chemokines and immune mediators. This damages the brain.
- 3) Excitotoxicity [release of glutamate / aspartate, amino acids that function as excitatory neurotransmitters and in excess kill brain neurons] plays a significant role in the neurotoxic action of a number of metals including aluminum.
- 4) Metal ions, including aluminum drive crosstalk between cytokine (immune) receptors and glutamate (excitatory) receptors, called immunoexcitotoxicity.
- 5) Aluminum is the third most abundant metal on earth.
- 6) Aluminum "is a major neurotoxin and disrupter of neurological function."
- 7) Aluminum "is not essential to human metabolism at any concentration."
- 8) When humans are exposed to aluminum through the gut (from foods, industrial exposures, drinking water, and drugs), they are very poorly absorbed.
- 9) When humans are exposed to aluminum via parenteral fluids and/or vaccines, it is "completely absorbed and distributed throughout the body."**[Very Important]**
- 10) Microglia make up 5-15% of the cells in the central nervous system (CNS). When activated, microglia can secrete pro-inflammatory cytokines and excitotoxins. Microglia are activated by trauma, metal toxins, and immune system activation.
- 11) In neurodegenerative diseases such as Alzheimer's, Parkinson's, Huntington's, Pick's, HIV dementia, multiple sclerosis and amyotrophic lateral sclerosis, activated microglia are present in large numbers.
- 12) Because of its receptors, microglia function as the nervous system's resident immune cells.

- 13) Activated microglia release excitatory amino acids, particularly glutamate. Excess glutamate drives excitotoxicity. It is the excitotoxicity that "is the main pathological mechanism for actual damage to neurons and their processes."
- 14) The excitotoxic cascade can be triggered by an excessive release of glutamate from microglia and/or astrocytes.
- 15) "Under conditions of reduced energy [ATP] production, even low levels of glutamate can become excitotoxic." **[Very important: insulin resistance is epidemic in the US, and insulin resistance reduces ATP production]**
- 16) Neurodegeneration is a self-perpetuating chronic cycle:  
Glutamate activates microglia.  
Activated microglia produce and release inflammatory cytokines.  
Inflammatory cytokines stimulate the release of glutamate.  
This glutamate activates the microglia.
- 17) "Microglia and astrocytes are sites of preferential aluminum accumulation and toxic action." [Aluminum kills microglia and astrocytes, dumping their glutamate]
- 18) The release of glutamate from dying astrocytes is the main neurotoxic mechanism. **[Key Point]**
- 19) There is "indisputable evidence that aluminum can increase the levels of both pro-inflammatory cytokines and glutamate in the brain."
- 20) TNF-alpha [a cytokine] is elevated with aluminum exposure and triggers release of glutamate from microglia.
- 21) The "long-term persistence of aluminum [vaccine] adjuvants in humans results in cognitive dysfunction, affecting visual and verbal memory, as well as executive functions such as attention, working memory and planning."
- 22) "The greatest aluminum exposure from vaccines occurs during initial vaccinations soon after birth and during early childhood. Should a child follow the recommended vaccine schedule for the United States, they will receive a total of 5 mg of aluminum by 2 years of age from a total of 17 aluminum-adjuvanted pediatric vaccines. Such repetitive and continuous exposure to aluminum from vaccines could induce prolonged activation of microglia and subsequent release of glutamate and pro-inflammatory cytokines."
- 23) Adjuvant-aluminum in vaccines can accumulate in the brain, which "can be extremely detrimental to normal brain development." **[Important]**
- 24) Aluminum exposure from vaccines can directly activate both microglia and astrocytes causing immunoexcitotoxicity.

- 25) Aluminum in water causes systemic exposure to aluminum causing brain inflammation. "Even very small amounts of aluminum can activate microglia in a pro-inflammatory mode."
- 26) Aluminum in combination with copper additively increases brain inflammation. **[Excessive copper is found in 80% of US household water]**
- 27) Aluminum, mercury, lead and manganese all promote inflammation and oxidative stress in the brain.
- 28) "Aluminum preferentially accumulates in the mitochondria and cell nucleus, which makes this metal very resistant to removal by chelation." "The difficulty of removing brain intracellular aluminum will lead to its progressive accumulation over a lifetime, eventually reaching a neurotoxic threshold sufficient to trigger neurodegenerative disease processes."
- 29) Aluminum accumulates in the mitochondria and disrupts mitochondrial functions leading to energy deficits, increasing the sensitivity of neurons to excitotoxicity, accelerating neuronal damage.
- 30) Fluoride has a high affinity for aluminum, creating aluminofluoride. Exposure to aluminofluoride complexes has profound detrimental consequences on brain functions, especially as related to glutamate neurotransmission. [Fluoride is found in a lot of US water supplies and tooth paste]
- 31) Aluminum enhances excitotoxicity by inducing apoptosis of astrocytes.
- 32) Aluminum dramatically lowers neuronal glutathione levels.
- 33) "Two forms of aluminum are of special concern: aluminum-L-glutamate and nanoscaled aluminum, both of which have high absorption from the gut and passage into the brain, as well as higher toxicity profiles than aluminum alone."
- 34) Aluminum-L-glutamate is capable of crossing the blood brain barrier.
- 35) Nanoscaled aluminum, used in a growing number of products and vaccines, has higher absorption rates than naturally found aluminum.
- 36) Immune stimulation by vaccine aluminum adjuvants result in adverse neurological outcomes *via* activation of microglia, which are the brain's resident immune cells. "Once activated, microglia become the main source of both pro-inflammatory immune cytokines and excitotoxins such as glutamate. It is the interaction of cytokines and glutamate receptors that leads to immunoexcitotoxicity."

37) “In the immature and developing brain, immunoexcitotoxicity might lead to a number of neurodevelopmental conditions, such as autism spectrum disorders and seizures. In the mature, and especially the aging brain, these mechanisms can lead to progressive neurodegeneration, as seen with Alzheimer’s disease, Parkinson’s disease and Amyotrophic lateral sclerosis.”

38) “The presence of aluminum deposits within the neurons and glial cells could act as a continuous stimulus for immunoexcitotoxicity.”

39) “There is now sufficient evidence from a great number of studies to call for a re-evaluation of the use of aluminum additives for human consumption or as immune adjuvants.”

#### COMMENTS FROM DAN MURPHY

Aluminum is never beneficial for biological systems; it is always toxic. It is especially toxic to the brain, and especially for the developing brain. Incredibly, aluminum is commonly used as an adjuvant in vaccines (see **Article Review #38-13: Empirical Data Confirm Autism Symptoms Related to Aluminum and Acetaminophen Exposure**), and this aluminum is “completely absorbed and distributed throughout the body.” Because the blood brain barrier is incomplete until after the second year of life, this aluminum gets into the brain. As noted, US children receive 17 aluminum-adjuvanted pediatric vaccines containing a total of 5 mg of aluminum by 2 years of age. This is unconscionable and crazy, and the official incidence of autism in US children now stands at 1 in 50.

Brain aluminum kills microglia and astrocytes, dumping their glutamate. The glutamate causes excitotoxic damage and death of neurons.

Brain aluminum also damages the neuron’s mitochondria, reducing its ability to produce ATP for energy use. Yet, ATP is required to pump excessive glutamate into the astrocytes where it is held inactive. Consequently, more excitotoxic neuronal damage occurs.

I believe that one should not vaccinate with aluminum adjuvants and that aluminum should be removed from all vaccinations.

Other noted sources for human exposure to aluminum include drinking water (which uses aluminum sulfate [alum]), antiperspirants, aluminum cans, and aluminum cookware.

The bottom line is to understand these concepts, do what we can to avoid aluminum exposure, and increase glutathione production for detoxification purposes.