Glyphosate: The Elephant in the Room

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The Autism Epidemic in the U.S.

One in 150 kids diagnosed on Autism Spectrum in 2007
The Autism Epidemic in the U.S.

One in 100 kids diagnosed on Autism Spectrum in 2009

One in 50 kids diagnosed on Autism Spectrum in Mar. 2013
One in Two in 2025?

The rate was 1 in 10,000 in 1970

Some Comorbidities with Autism

- Disrupted gut bacteria
- Impaired homeostasis of sulfur metabolites (especially sulfate)

Is there a toxic substance that is currently on the rise in our environment that could account for these comorbidities?
**Glyphosate**

- Glyphosate is now the #1 herbicide in the U.S. and is increasingly used around the world
  - Developed and patented by Monsanto in the 1970’s
  - Came out from under patent in 2000
  - Inhibits an enzyme in the shikimate pathway involved in synthesis of tyrosine, tryptophan and phenylalanine (the three aromatic amino acids)
- Huge expansion of GMO corn, soy, cotton and canola crops has led to sharp increases in the last decade

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**Is Glyphosate Nontoxic?**

- Monsanto has argued that glyphosate is harmless to humans because we don’t have the shikimate pathway
- However, our gut bacteria DO have this pathway
  - We depend upon them to supply us with essential amino acids (among many other things)
  - Tryptophan → serotonin → melatonin
  - Tyrosine → dopamine, adrenaline, and melanin
- Roundup contains surfactants that greatly increase glyphosate’s toxic effects
- Insidious effects of glyphosate accumulate over time
Recent Publication

Glyphosate’s Suppression of Cytochrome P450 Enzymes and Amino Acid Biosynthesis by the Gut Microbiome: Pathways to Modern Diseases

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Abstract: Glyphosate, the active ingredient in Roundup®, is the most popular herbicide used worldwide. The industry asserts it is minimally toxic to humans, but here we argue otherwise. Residues are found in the main foods of the Western diet, comprised primarily
Glyphosate: Some Biological Effects

• Depletes aromatic amino acids and methionine
  – Serotonin deficiency is linked to obesity, autism, Alzheimer’s disease, depression, and violent behavior
  – Dopamine deficiency leads to Parkinson’s disease
  – Methionine is an essential sulfur-containing amino acid
• Disrupts gut bacteria
  – Studies with chickens and cows show overgrowth of pathogens in gut
• Disrupts cytochrome P450 (CYP) enzymes which are involved in:
  – Homeostasis of sterols like vitamin D, cholesterol, and sex hormones
  – Bile acid production
  – Detoxifying environmental toxins
  – Stabilizing blood (hemorrhaging vs blood clots)
• Depletes important minerals
  – Calcium, manganese, zinc, cobalt, iron, ...
• Likely impairs sulfate synthesis and sulfate transport

Some Biomarkers for Autism

• Disrupted gut bacteria; inflammatory bowel
• Low serum sulfate
• Methionine deficiency
• Serotonin and melatonin deficiency
• Defective aromatase (CYP enzyme)
• Zinc and iron deficiency
• High serum nitrate and ammonia
• Impaired immune function
• Chronic low-grade inflammation in the brain
Some Biomarkers for Autism

- Disrupted gut bacteria; inflammatory bowel
- Low serum sulfate

These can all be explained as potential effects of glyphosate on biological systems

- High serum nitrate and ammonia
- Impaired immune function
- Chronic low-grade inflammation in the brain

Glyphosate and Autism*

Number of children (6-21 yrs) with autism served by IDEA plotted against glyphosate use on corn & soy

Pearson Correlation Coefficient = 0.985

Glyphosate and Autism

Pearson Correlation Coefficient = 0.985

*Nancy Swanson, http://www.examiner.com/article/
data-show-correlations-between-increase-neurological-diseases-and-gmos

Sulfate
Rosemary Waring on Autism (1990)*

“These results indicate that there may be a fault either in manufacture of sulphate or that sulphate is being used up dramatically on an unknown toxic substance these children may be producing” (p. 198).


Sulfated Glycosaminoglycans (GAGs)

- Prominent in extracellular matrix of nearly all cells
- Amount of sulfate depends on availability
- Involved with ion and nutrient transport across plasma membrane
- Crucial for maintaining healthy blood vessels

http://www.science-autism.org/sulphate.htm
Impaired heparan sulfation in mouse brains led to all the symptoms of autism* 


Kosmotropes Gel the Blood

- Carbonate: $\text{CO}_3^{2-}$
- Phosphate: $\text{PO}_4^{3-}$
- Sulfate: $\text{SO}_4^{2-}$
- Carbonyl: $\text{C}(\equiv\text{O})$
- Glyphosate: $\text{HO}_3\text{PO}_2\text{NH}_2$
Kosmotropes Gel the Blood

Intentional poisoning by drinking glyphosate leads to death due to disseminated intravascular coagulation

Safe Sulfate Transport: Carbon Rings

- vitamin D sulfate
- serotonin sulfate
- dopamine sulfate
- cholesterol sulfate
- estrone sulfate
- DHEA sulfate
Safe Sulfate Transport: Carbon Rings

Glyphosate depletes serotonin and dopamine and disrupts enzymes involved with sterol sulfation: Imperiled sulfate transport

Alzheimer’s Disease, Infant Mortality, and Obesity
Changes in Causes of Death in U.S.

Alzheimer’s disease mortality increased compared with selected major causes of death.

Figure 1. Percent change in age-adjusted death rates for selected causes of death: United States, 2000 and 2010


Alzheimer’s disease and autism have a great deal in common.
Infant Mortality Rates: U.S. and Elsewhere

We are now #46 on infant mortality -- behind Cuba and Guam

Obesity in US over Time*

Glyphosate was introduced into the food chain in 1975

*Figure 1 in R.J. Johnson et al., Am J Clin Nutr 2007;86:899–906.
To my knowledge, no studies have been done assessing the effects of glyphosate on humans.

The U.S. government does minimal monitoring of glyphosate residues in foods.
Summary

- I believe we need to be very worried about glyphosate in the food and water supplies
- Glyphosate’s disruption of gut bacteria, depletion of essential amino acids and minerals, and interference with cytochrome P450 enzymes have widespread consequences
- Glyphosate may be the most important factor in the U.S. health crisis related to obesity, autism, Alzheimer’s disease and infant mortality

Thank you!