Glyphosate: The Elephant in the Room

Stephanie Seneff
MIT
May 19, 2014
Outline

• Autism and Dementia
• Obesity and Digestive Disorders
• Cancer and Endocrine Disruption
• Species in Stress
• Summary
Autism and Dementia
“Children today are sicker than they were a generation ago. From childhood cancers to autism, birth defects and asthma, a wide range of childhood diseases and disorders are on the rise. Our assessment of the latest science leaves little room for doubt: **pesticides are one key driver of this sobering trend.**”*

*http://www.emagazine.com/earth-talk/pesticides-and-childrens-health*
A Frightening Trend*

“If it is an environmental cause contributing to an increase, we certainly want to find it.”*

Number of children (6-21yrs) with autism served by IDEA plotted against glyphosate use on corn & soy ($R = 0.9869$, $p \leq 1.103e-06$)
sources: USDA:NASS; USDE

Review

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

Anthony Samsel \(^1\) and Stephanie Seneff \(^2\),*  

\(1\) Independent Scientist and Consultant, Deerfield, NH 03037, USA;  
E-Mail: anthony.samsel@acoustetracks.net  

\(2\) Computer Science and Artificial Intelligence Laboratory, MIT, Cambridge, MA 02139, USA

* Author to whom correspondence should be addressed; E-Mail: Seneff@csail.mit.edu;  
Tel.: +1-617-253-0451; Fax: +1-617-258-8642.

Received: 15 January 2013; in revised form: 10 April 2013 / Accepted: 10 April 2013 / Published:

Abstract: Glyphosate, the active ingredient in Roundup\textsuperscript{®}, 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
Is Glyphosate Toxic?

• Monsanto has argued that glyphosate is harmless to humans because our cells don’t have the shikimate pathway, which it inhibits

• However, our gut bacteria DO have this pathway
  – We depend upon them to supply us with essential amino acids (among many other things)

• Other ingredients in Roundup greatly increase glyphosate’s toxic effects

• Insidious effects of glyphosate accumulate over time
  – Most studies are too short to detect damage
Roundup Safety Claims Disputed*

“It is commonly believed that Roundup is among the safest pesticides. ... Despite its reputation, Roundup was by far the most toxic among the herbicides and insecticides tested. This inconsistency between scientific fact and industrial claim may be attributed to huge economic interests, which have been found to falsify health risk assessments and delay health policy decisions.”

"Another claim of Monsanto's has been that residue levels of up to 5.6 mg/kg in GM-soy represent "...extreme levels, and far higher than those typically found" (Monsanto 1999).

*Figure 1, T. Bohn et al. Food Chemistry 153, 15 June 2014, 207-215. www.greenmedinfo.com/blog/how-extreme-levels-roundup-food-became-industry-normal
Soy Formula Linked to Seizures in Autism*

"There was a 2.6-fold higher rate of febrile seizures, a 2.1-fold higher rate of epilepsy comorbidity and a 4-fold higher rate of simple partial seizures in the autistic children fed soy-based formula"

*CJ Westmark, PLOSOne March 12, 2014, DOI: 10.1371/journal.pone.0080488.
“The Zhengzhou Daily News reported on April 2, 2013: The number of children confirmed with autism has increased 100 times during the past 20 years”

- Infertility rates: 15.6% 2012; 8% 2002; 3% 1972.
- Parkinson's disease in China has increased over 20 fold during the last 20 years

*http://blog.sina.com.cn/s/blog_502041670102em9z.html
former Vice President of the Academy of Military Science of China
Main Toxic Effects of Glyphosate*

- Kills beneficial gut bacteria and allows pathogens to overgrow
- Interferes with function of cytochrome P450 (CYP) enzymes
- Chelates important minerals (iron, cobalt, manganese, etc.)
- Interferes with synthesis of aromatic amino acids and methionine
  – Leads to shortages in critical neurotransmitters
- Disrupts sulfate synthesis and sulfate transport

*Samsel and Seneff, Entropy 2013, 15, 1416-1463
The Enhancing Effect of Adjuvants*

“Adjuvants in pesticides are generally declared as inerts, and for this reason they are not tested in long-term regulatory experiments. It is thus very surprising that they amplify *up to 1000 times* the toxicity of their APs [Active Principles] in 100% of the cases where they are indicated to be present by the manufacturer.”

Some Biomarkers for Autism

• Disrupted gut bacteria; inflammatory bowel
• Low serum sulfate
• Methionine deficiency
• Serotonin and melatonin deficiency
• Defective aromatase
• Zinc and iron deficiency
• Urinary p-cresol
• Mitochondrial disorder
• Glutamate toxicity in the brain
Some Biomarkers for Autism

- Disrupted gut bacteria; inflammatory bowel
- Low serum sulfate
- Methionine deficiency
- Serotonin and melatonin deficiency
- Defective aromatase
- Zinc and iron deficiency
- Urinary p-cresol
- Mitochondrial disorder
- Glutamate toxicity in the brain

These can all be explained as potential effects of glyphosate on biological systems.
Glyphosate, Autism and Vaccine Reactions*

*Collaboration with Nancy Swanson

MIT Computer Science and Artificial Intelligence Laboratory
Sulfate, Sleep and Sunlight: The Disruptive and Destructive Effects of Heavy Metals and Glyphosate

By Claire I. Viadro, MPH, PhD

Neurological disorders, autoimmune diseases—they seem to be everywhere these days. Scientists writing in *Neurology* in 2007 estimated that the burden of neurologic illness affects "many millions of people in the United States."¹

Autoimmune illness, too, is at epidemic proportions—nearly 24 million Americans as of 2012.² These trends are disturbing enough in their own right, but even more disturbing is the general scientific apathy about why the surge in these diseases is occurring.

*articles.mercola.com/sites/articles/archive/2014/05/08/heavy-metals-glyphosate-health-effects.aspx*
Aluminum & Mercury
Autism & PDD & Anxiety

Formula: \[ \text{Al} + 1.5 \times (\text{Al w/ Hg}) + 2.0 \times \text{Hg} \]

VAERS database
Dementia and Autism Have Much in Common

Deaths from Senile Dementia (ICD F01, F03 & 290) plotted against glyphosate applications on corn & soy (R = 0.9933, p <= 1.947e-09) sources: USDA:NASS; CDC

Plot kindly provided by Nancy Swanson
Obesity and Digestive Disorders
Is Glyphosate Making Us Obese?
Gut Microbes and Obesity

- Our microbes outnumber our own cells 10 to 1
- There are between 200 and 300 different species in a typical person.
- Environmental toxins like glyphosate can cause an overgrowth of pathogens in the gut
  - They release toxic phenols
  - This can lead to inflammatory bowel disease
    • And a direct path to obesity!
- Gut microbes from an obese person induced obesity in mice*

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.
Human Digestive System Disorders

• We are seeing an alarming increase in the US in many diseases related to the gut
  – Crohn’s disease, inflammatory bowel disease, colitis, acid reflux disease, gluten and casein intolerance, celiac disease, leaky gut

• The gut-brain axis links neurological disorders with gut disorders

• I believe that glyphosate is a major cause
CHECK OUT OUR NEW GLUTEN FREE AISLE!
REVISED AND UPDATED

CELIAC DISEASE
A HIDDEN EPIDEMIC

End your medical odyssey and get the right diagnosis
Treat symptoms and complications
Learn how to live a gluten-free life
IS GLUTEN MAKING YOU SICK?

Peter H. R. Green, M.D.
Director of the Celiac Disease Center at Columbia University
and Rory Jones
Glyphosate, pathways to modern diseases II: Celiac sprue and gluten intolerance

Anthony SAMSEL \(^1\) and Stephanie SENEFF \(^2\)
Hospital Discharge Diagnosis (any) of Celiac Disease ICD-9 579
and glyphosate applications to wheat (R = 0.9759, p <= 1.862e-06)
sources: USDA: NASS; CDC

Graph provided by Nancy Swanson, with permission
Desiccation with Glyphosate*

• Advantages:
  – Hastens maturity to harvest
  – Weed control for next year's crop
  – Reduces green material and therefore strain on harvesting

• Disadvantages
  – Herbicide cannot be washed out prior to human use.
  – Animals fed herbicide-treated crops → contamination in animal products

• Crops include wheat, barley, legumes, corn, sunflower, kiwi, grapes (wine), raspberries, apples, soybeans, alfalfa, sugar cane

“We may be able to knock out 80% to 90% of the resistant ryegrass with glyphosate.”

*Ron Smith, Western Farm Press, Mar. 23, 2013
Celiac Disease, Glyphosate and Non Hodgkin’s Lymphoma (cancer)

• Glyphosate preferentially kills bifidobacteria*
• Bifidobacteria are depleted in celiac disease**
• Celiac disease is associated with increased risk to non Hodgkin’s lymphoma***
• Glyphosate itself is also linked directly to non Hodgkin’s lymphoma****

Acute Kidney Disease Death Rate Plotted Against Glyphosate and GMOs*

*Plot prepared by Nancy Swanson from available data online
Acute Kidney Disease Death Rate Plotted Against Glyphosate and GMOs*

*Plot prepared by Nancy Swanson from available data online*
Workers in Sugar Cane Fields are Most at Risk

Sri Lanka is the first country to ban glyphosate

Hypothesis

Glyphosate, Hard Water and Nephrotoxic Metals: Are They the Culprits Behind the Epidemic of Chronic Kidney Disease of Unknown Etiology in Sri Lanka?

This problem did not exist in Sri Lanka prior to the 1990s.
Cancer and Endocrine Disruption
Glyphosate is an endocrine disruptor that promotes breast cancer*

• Low and environmentally relevant concentrations of glyphosate possess estrogenic activity

• Glyphosate caused human hormone-dependent breast cancer cells to proliferate at concentrations of parts per trillion

Glyphosate and Minerals*

“Further, the occurrence of glyphosate in the tissue of deformed, new-born pigs and in the urine of sows shows that glyphosate is absorbed, circulates in the body and is deposited. Therefore, it does not preclude the possibility that undersupply of micro minerals happens because glyphosate binds these minerals, and that the bound minerals are not available for important biological processes in the animals.”

*MT Sørensen et al., Memorandum on "The feeding of genetically modified glyphosate resistant soy products to livestock” DCA, Aarhus University, Denmark. 4 February 2014
Glyphosate and Anencephaly*

- Yakima, Benton and Franklin counties in Washington State have an unusually high number of pregnancies affected by the birth defect, anencephaly.
- 75 pesticides were analyzed in studying contamination due to surrounding agriculture.
  - 47 (63%) of these were detected.
  - Glyphosate was applied in large amounts, but was not studied.
- 5% solution of glyphosate was also used heavily around irrigation ditches to control weeds.
  - Main herbicide recommended due to its “low toxicity.”

*Glyphosate has been linked to anencephaly due to its effect on retinoic acid*

*Barbara H. Peterson. Farm Wars, http://farmwars.info/?p=11137*
Glyphosate Upregulates Retinoic Acid*

“A substantial body of evidence demonstrates that glyphosate and Roundup cause *teratogenic* effects and other toxic effects on reproduction, as well as *genotoxic* effects. From an objective scientific standpoint, attempts by industry and government regulatory bodies to dismiss this research are unconvincing and work against the principle that it is the *responsibility of industry to prove that its products are safe* and not the responsibility of the public to prove that they are unsafe.”
"Male fertility under threat as average sperm counts drop”*

• Study of 26,600 men in France found sperm concentration had decreased by 32% since the 1990s.
• Numbers steadily dropped by 2% per year from 1989 to 2005.
• Proportion of normally formed sperm also declined by about 1/3.

Glyphosate’s Effects on Sertoli Cells in Rat Testis*

- Concentrations 10-fold diluted than that recommended for herbicide action
- Several pathologies noted:
  - Depletes glutathione (essential antioxidant)
  - Enhanced lipid and protein oxidation
  - Activates calcium channels; promotes calcium release from ER (stress response); induces cell death
  - Increases mitochondrial membrane permeability to calcium and protons

Species in Stress
Species in Stress

Fungus Infection

*R. Mason et al., Journal of Environmental Immunology and Toxicology 1:1, 3-12; 2013
Roundup herbicide enhances the growth of aflatoxin-producing fungi*

“Aflatoxins are mutagenic, carcinogenic, teratogenic, hepatotoxic, immunosuppressive, and they also inhibit several metabolic systems”*

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, dementia, celiac disease, kidney failure, etc.
• Glyphosate can also explain many species in distress