

Environmental Toxicants and Autism: How to Safeguard Your Children.

Stephanie Seneff

AutismOne

May 20, 2015



“It's difficult to get a man to understand something if his salary depends on his not understanding it.”

Upton Sinclair

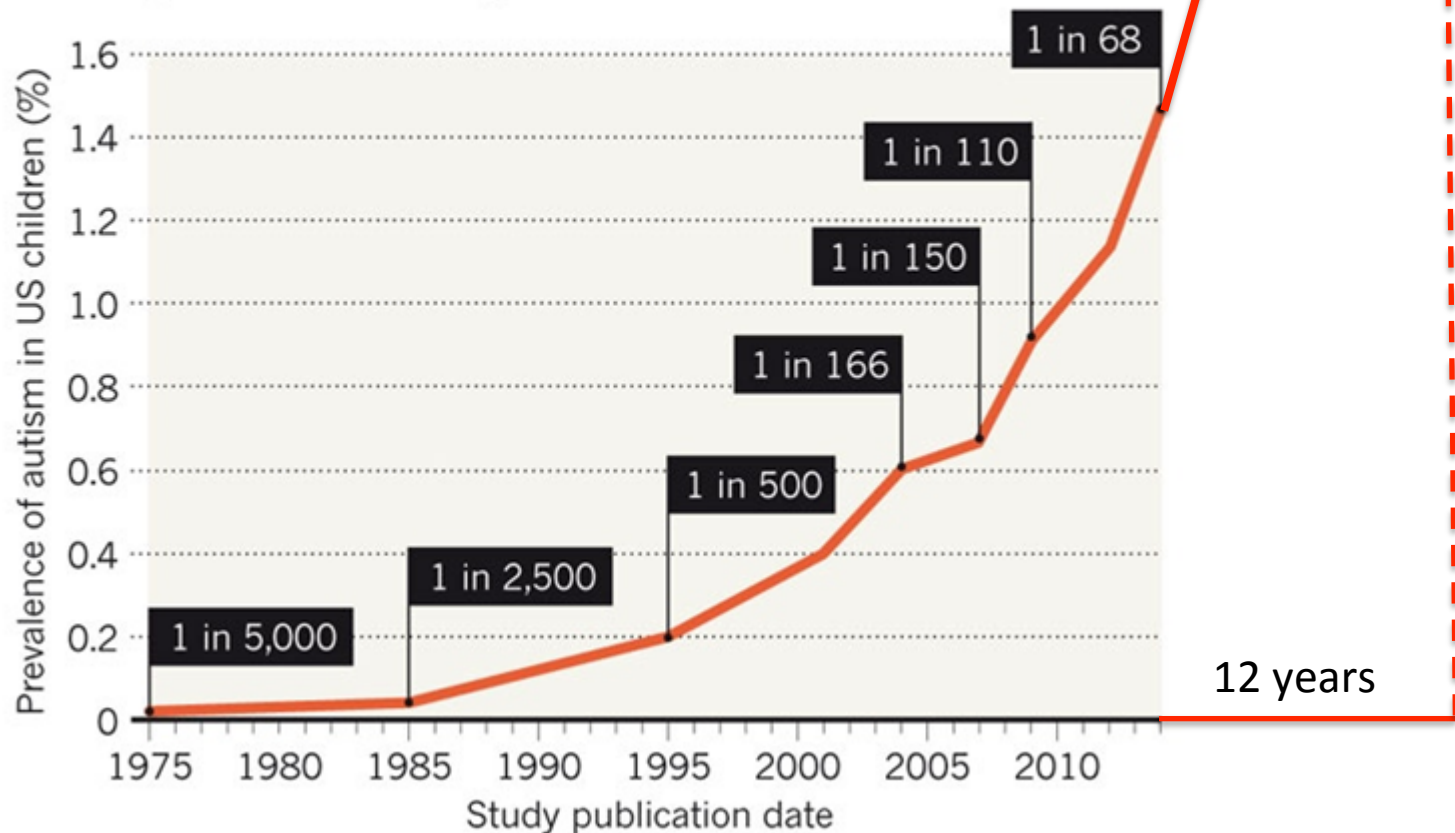
A Frightening Trend*



?

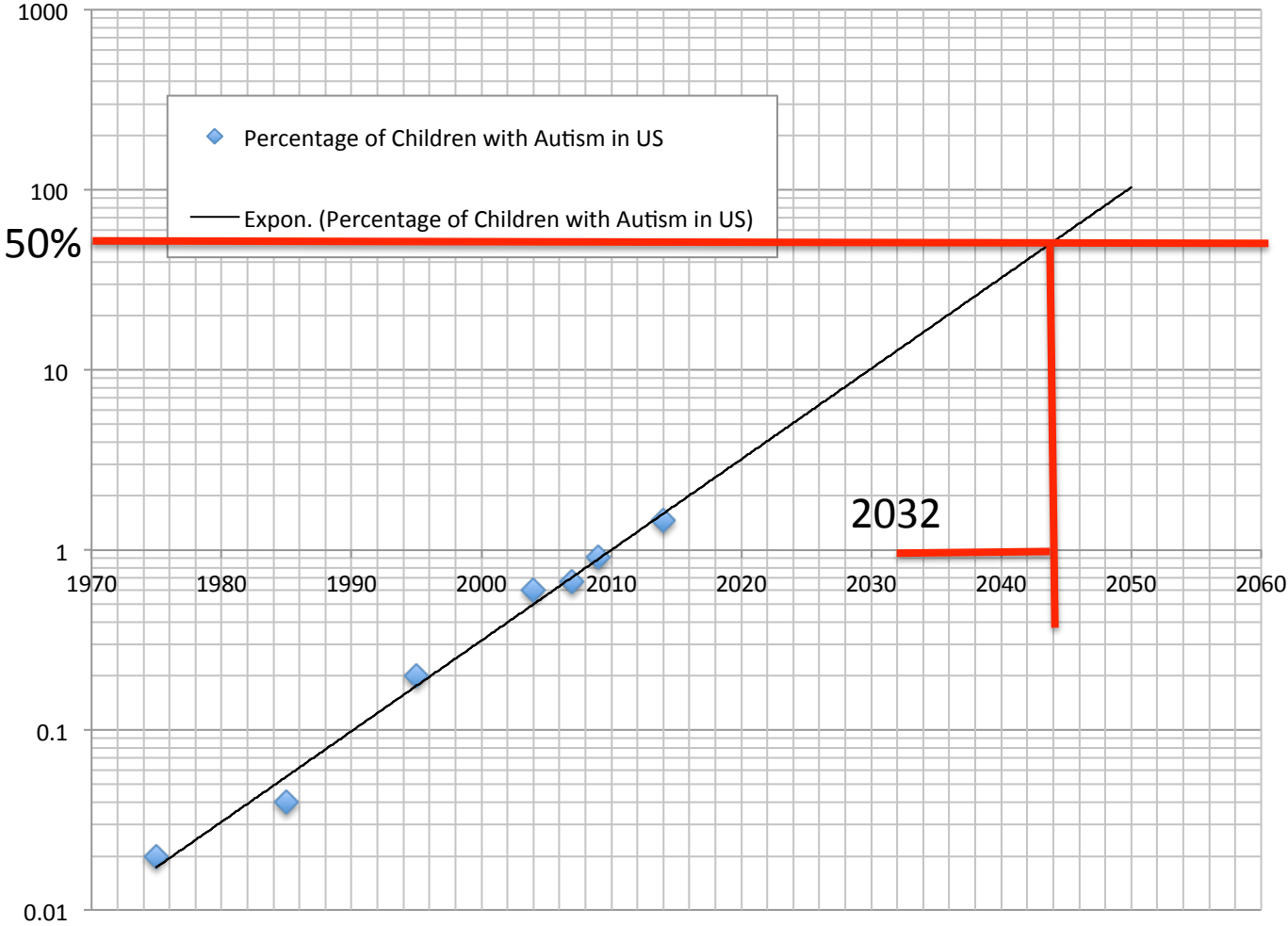
Exponential Growth!

Almost 1.5% of US children are now diagnosed with autism, according to data from 11 regions in the United States.

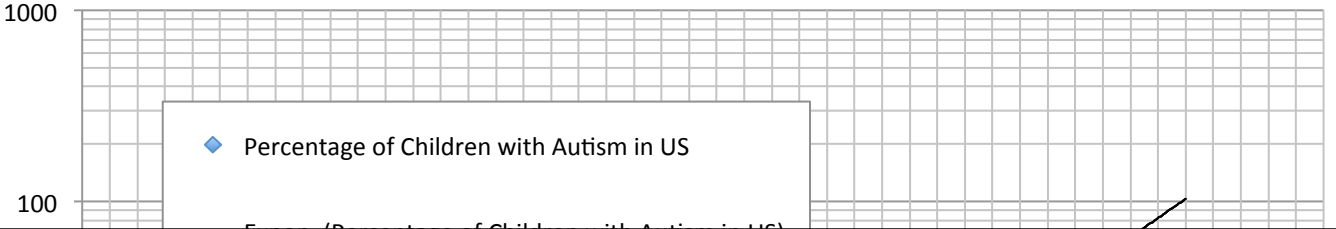


*K. Weintraub, Nature 479, Nov. 3 2011, 22-24.

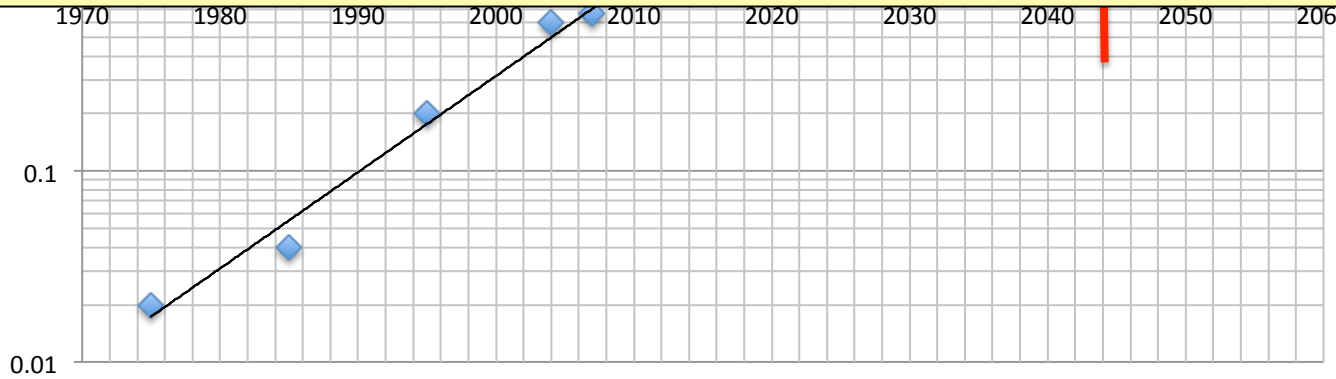
Percentage of children with Autism in the US



Percentage of children with Autism in the US



A linear extension of the trend line says that 1 in 2 children born in 2032 will end up on the autism spectrum.



Last Year's Talk

Video (no slides):

<http://www.autismone.org/content/autism-explained-synergistic-poisoning-aluminum-and-glyphosate-stephanie-seneff>

Slides:

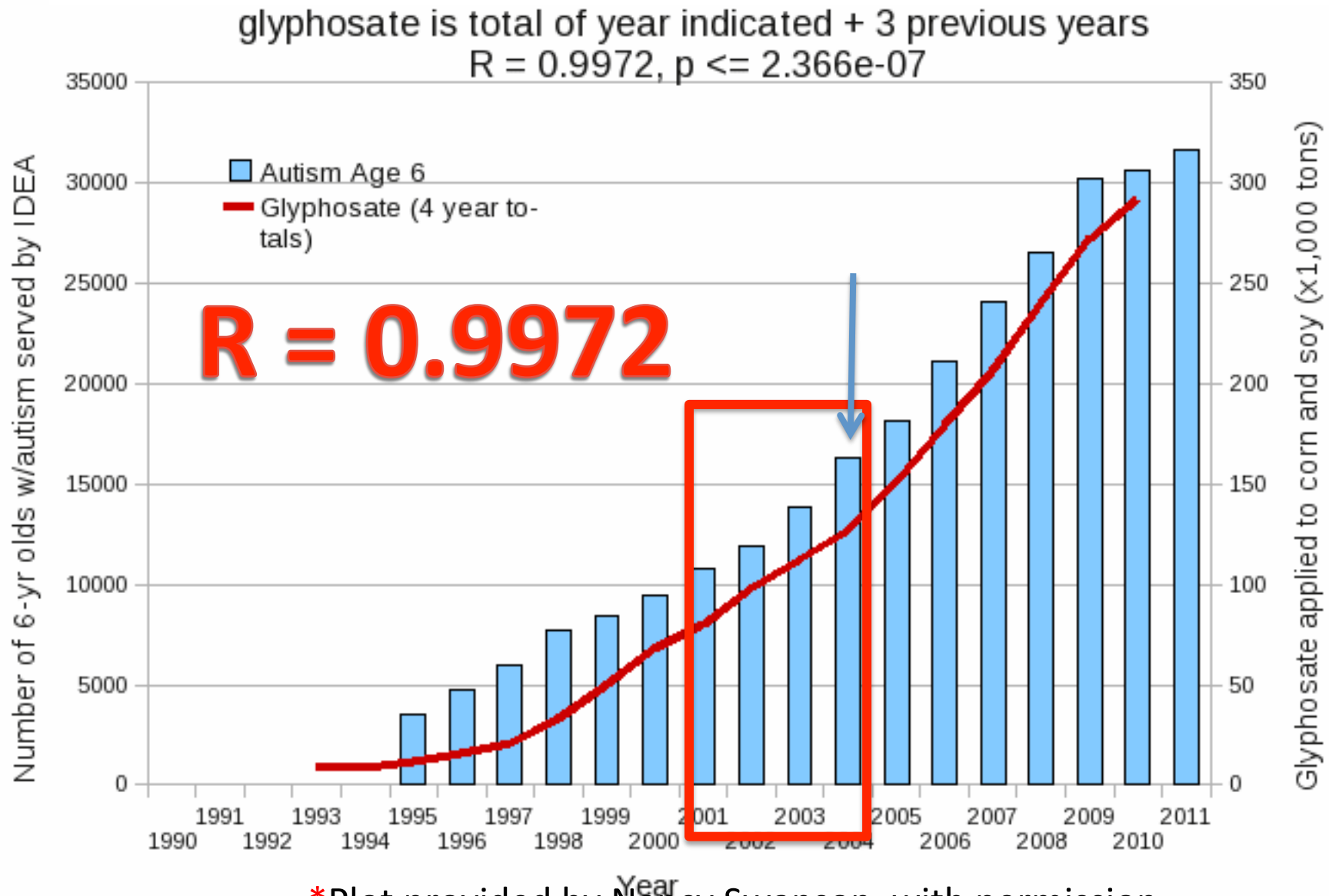
http://people.csail.mit.edu/seneff/glyphosate/Seneff_AutismOne_2014.pptx

Outline

- Glyphosate
- Toxic Food
- Glyphosate and Folic Acid
- Glyphosate, Oxalate and Anemia
- How to Protect Yourself and Your Family
- Summary

Glyphosate

Autism Prevalence: 6 year olds



* Plot provided by Nancy Swanson, with permission

Data sources: autism: US Department of Education; Glyphosate: US Department of Agriculture

Adoption of “Roundup Ready” Crops*

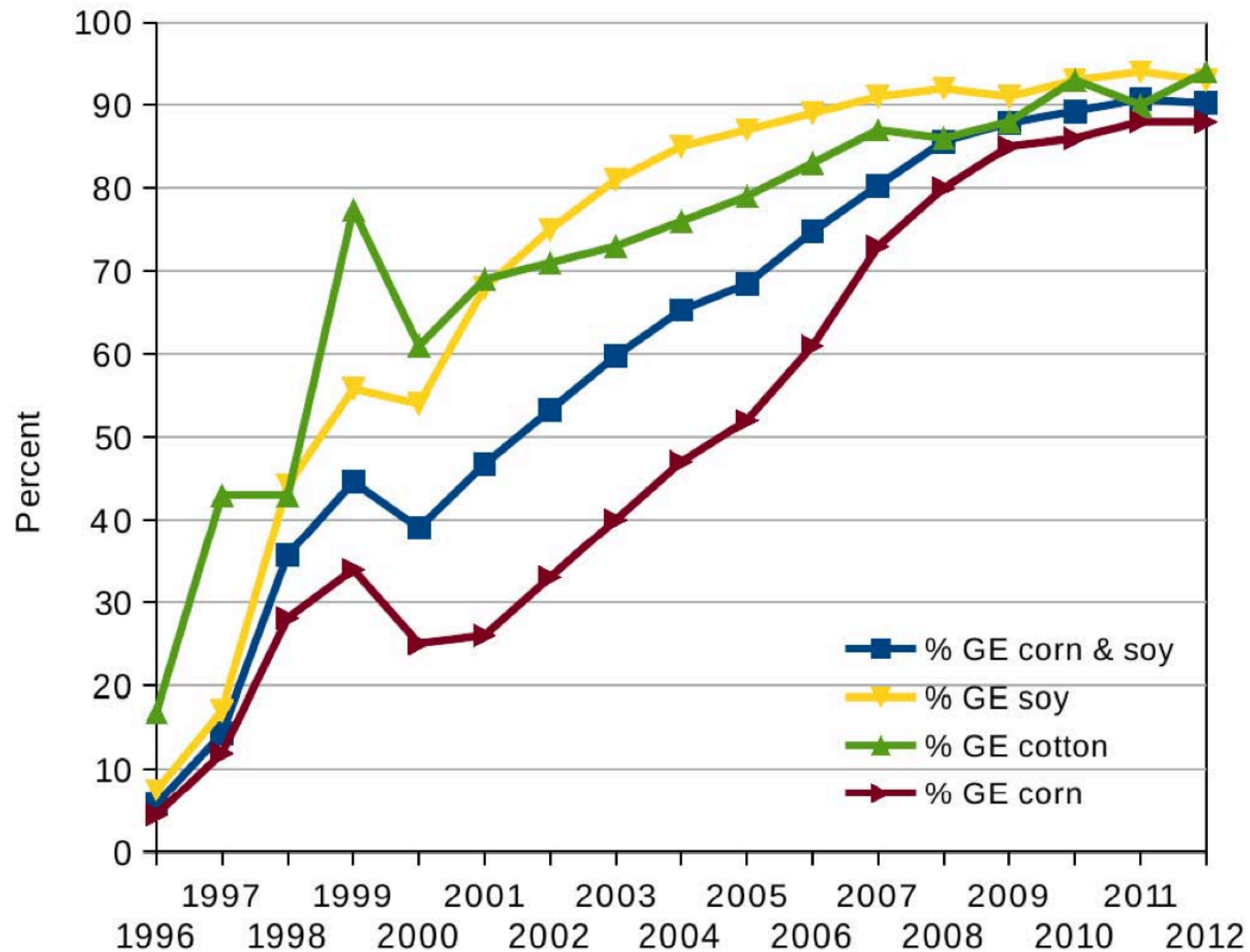
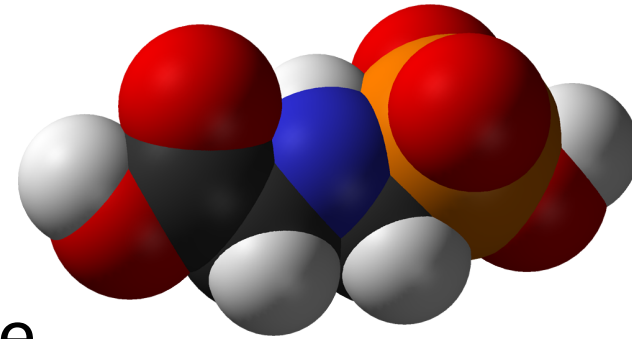


Figure 1. Adoption of GE crops in US.

* N. Swanson et al., Journal of Organic Systems 20145;9(2): 6-37.

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

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.”

*R. Mesnage et al. BioMed Research International 2014; Article ID:179691.

Some Biomarkers for Autism

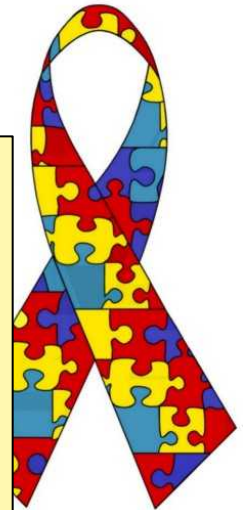
- Disrupted gut bacteria; inflammatory bowel
- Low serum sulfate
- Methionine deficiency
- Serotonin and melatonin deficiency
- Defective aromatase
- Excess serum oxalate
- Urinary p-cresol
- Mitochondrial disorder
- Glutamate toxicity in the brain



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



- Zinc and iron deficiency
- Urinary p-cresol
- Mitochondrial disorder
- Glutamate toxicity in the brain

Paper on Glyphosate and Manganese

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Original Article

Glyphosate, pathways to modern diseases III: Manganese, neurological diseases, and associated pathologies

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*Corresponding author

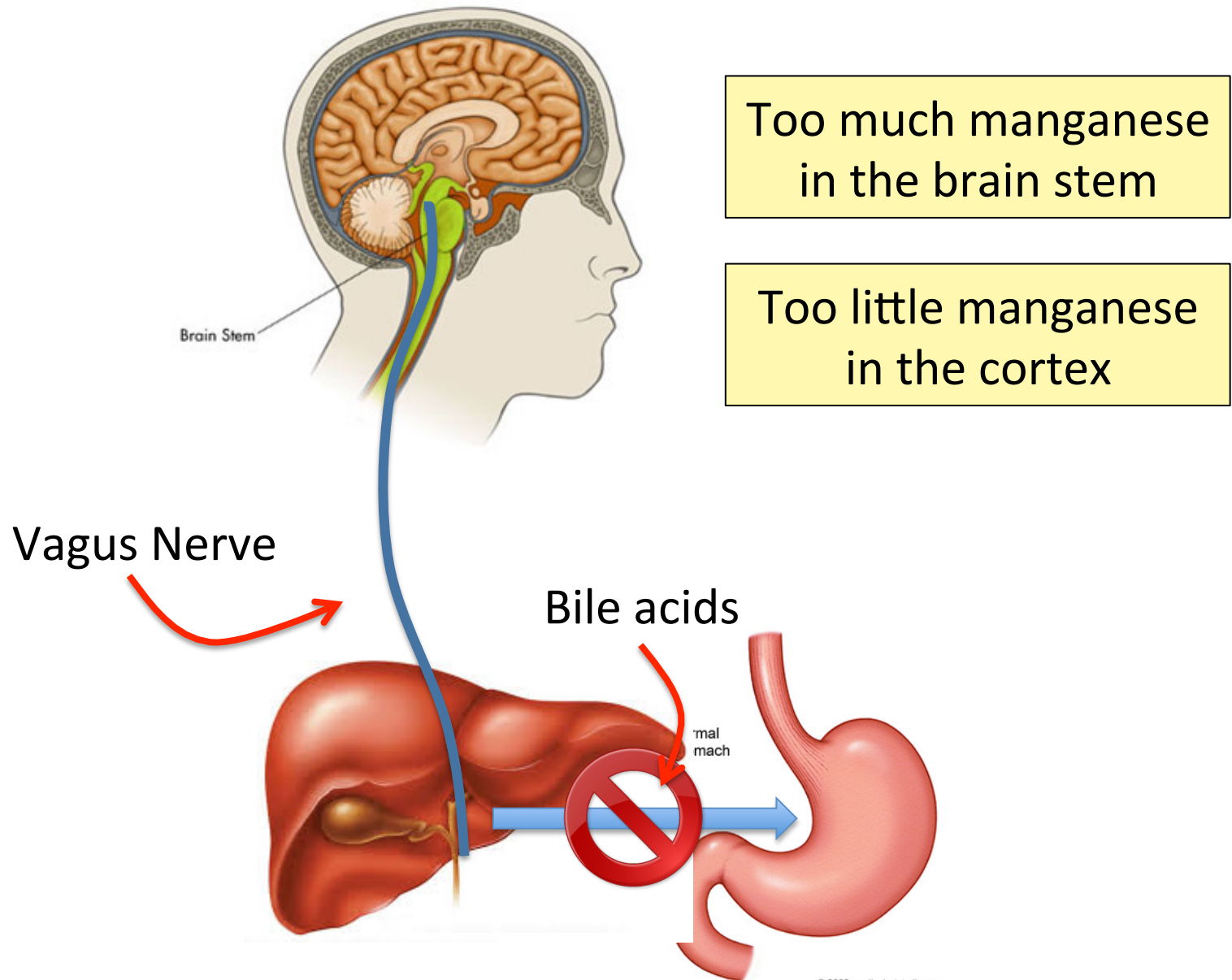
Received: 22 September 14 Accepted: 21 January 15 Published: 24 March 15

Manganese and Autism*

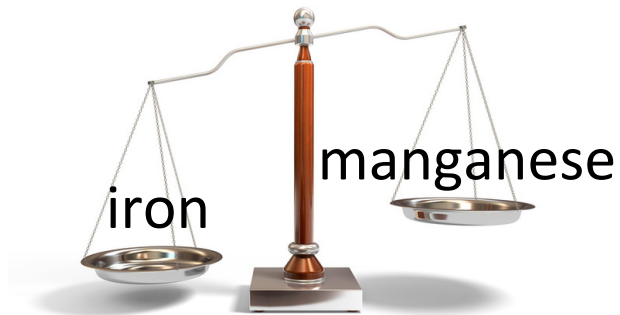
- Glyphosate chelates manganese
- Manganese disruption leads to:
 - Disrupted gut bacteria → anxiety
 - Impaired dopamine synthesis → thyroid disease
 - Glutamate and ammonium toxicity in the brain
 - Mitochondrial damage
 - Impaired bone development and osteoporosis
 - Impaired development of perineuronal nets
- Many of these pathologies are associated with autism

*A Samsel and S Seneff, Surg. Neurol. Int. 2015;6:45.

It's not just deficiency!



Balancing the Scales



Autism

Alzheimer's



ADHD

Parkinson's

Glyphosate disrupts the body's ability to distribute the minerals safely: Everybody walks a tight rope between deficiency and toxicity

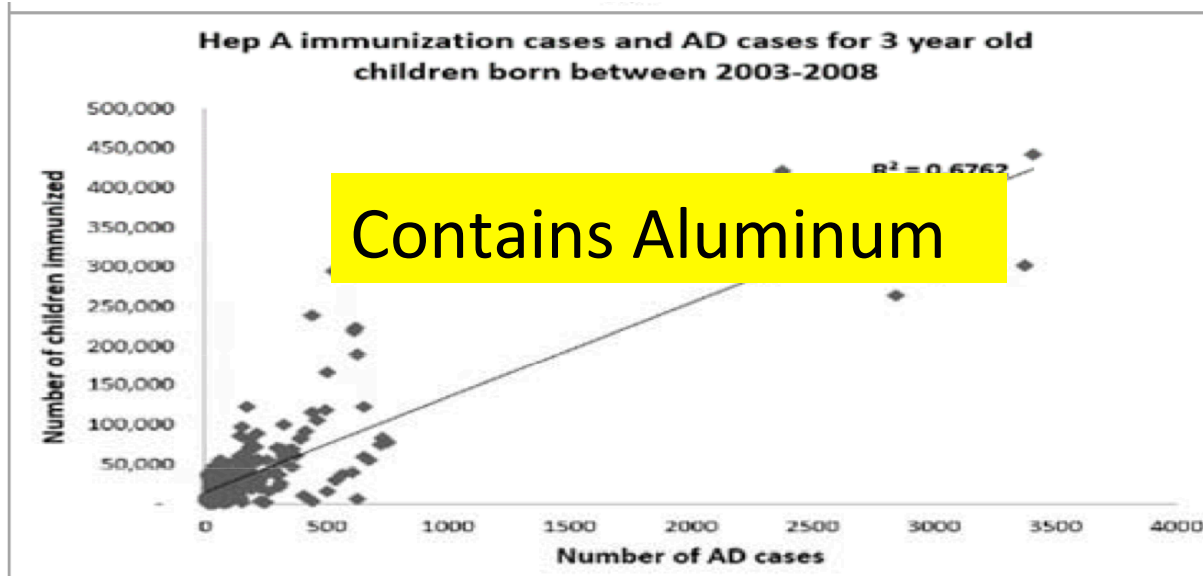
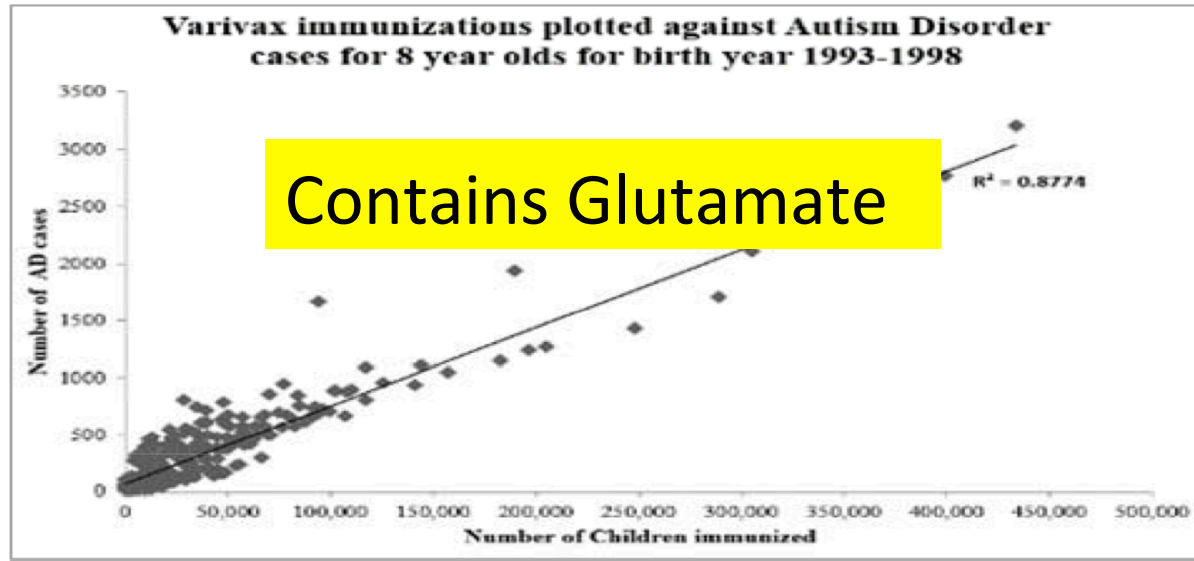
Glyphosate and Vaccines*,**

- Vaccines containing glutamate (MMR) and aluminum (Hep-B, DTaP) have been linked to autism
- Glyphosate enhances transfer of aluminum across the blood brain barrier and enhances uptake of aluminum into cells
- Glyphosate prevents detoxification of glutamate due to manganese deficiency

*A Samsel and S Seneff, Surgical Neurology International 2015, 6:45.

**S Seneff et al., Agricultural Sciences Jan. 12, 2015, 6, 42-70.

Varivax and Hepatitis A Vaccines: Linked to Autism*



*TA Deisher et al.,
Journal of Public Health
and Epidemiology 6(9),
271-284, 2014.

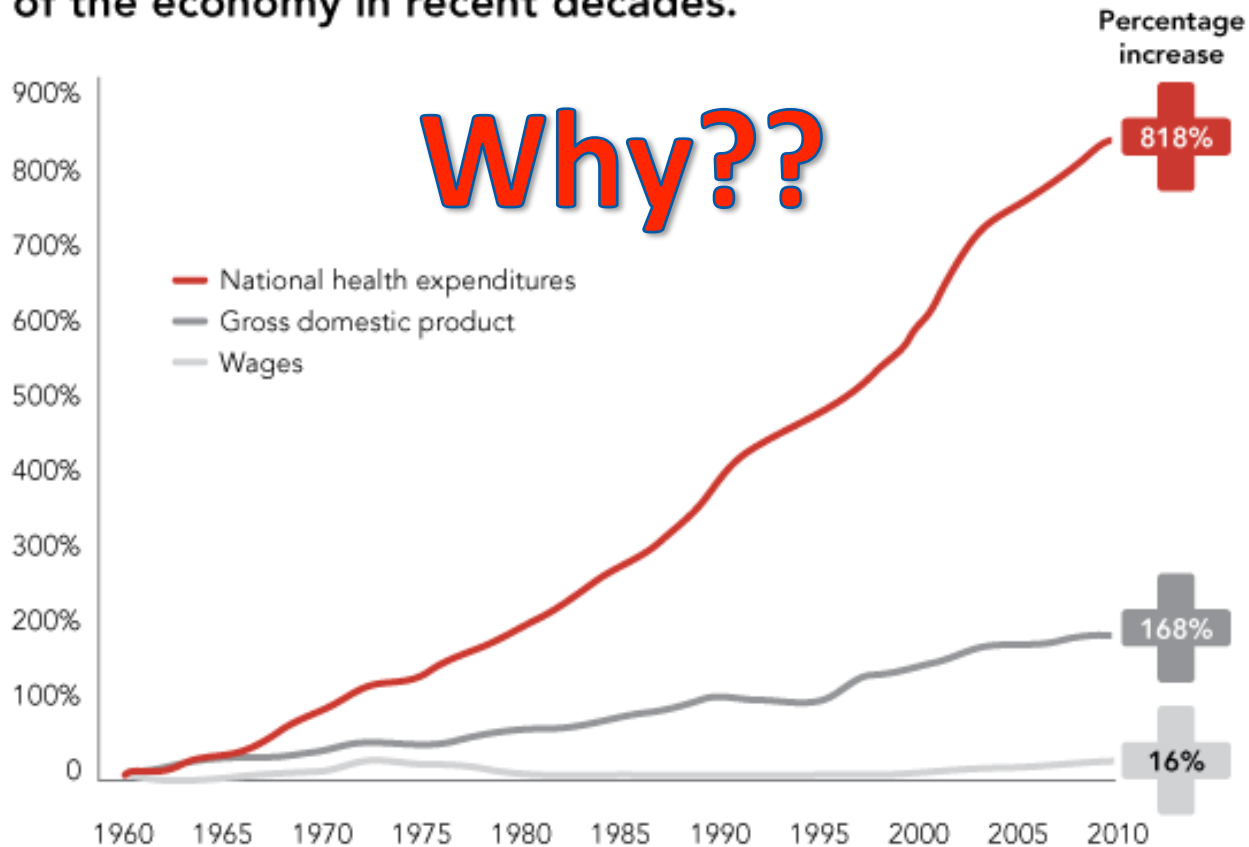
Recapitulation

- Monsanto claims glyphosate is nontoxic to humans, but this is not true
 - Gut microbes are damaged by shikimate pathway disruption
 - Adjuvants increase toxicity to plants but glyphosate is usually studied in isolation
- Many features of autism can be explained by glyphosate's known effects
- Impaired mineral management is key
 - Disrupted manganese and iron homeostasis
 - Aluminum and glutamate toxicity
 - These effects can explain increased frequency of severe adverse reactions to vaccines

Toxic Food

Health Care Costs: US

Health care spending has grown much faster than the rest of the economy in recent decades.



Sources: McKinsey, "Accounting for the Cost of U.S. Health Care" (2011), Center for American Progress

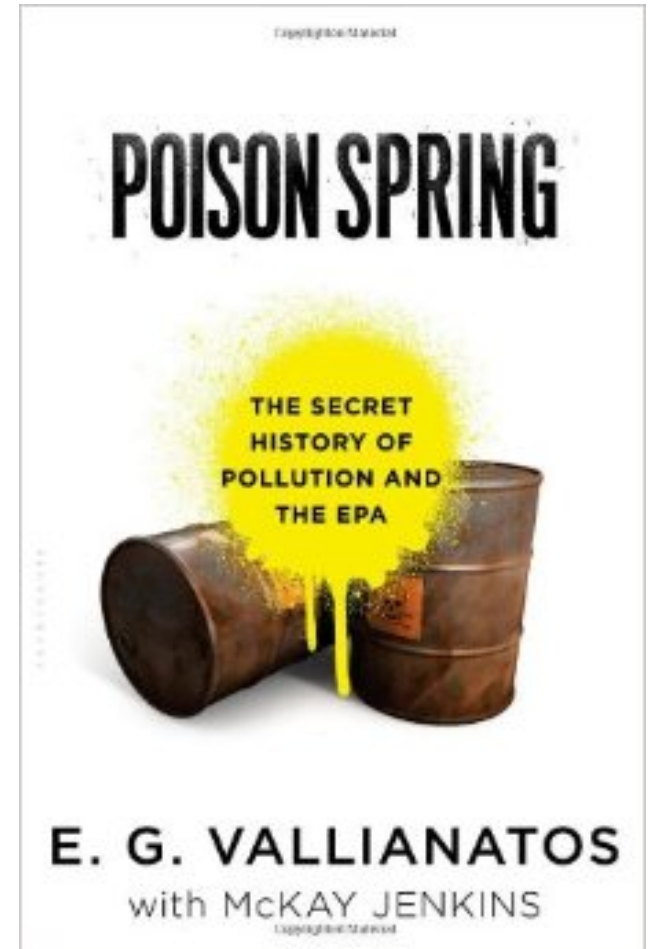
THE HUFFINGTON POST

Toxic Food!!



Poison Spring

- Author E.G. Vallianatos worked for the US EPA for 25 years.
- Corruption and misuse of science and public trust has turned EPA into a "polluters' protection agency."
- Repeatedly endorsed deadly chemicals, often against the advice of their own scientists.
- Botched field investigations.
- Turned a blind eye to toxic disasters.



Soy Protein Products*

- Heavily used in processed foods for emulsification, water and fat absorption, aeration and increasing protein content
 - Derived from "white flakes" made by defatting soybeans by extraction
 - Milled into defatted flours that are turned into soy protein isolates by further chemical processing
- These are added to infant soy formula!



* EW Lusas and MN Riaz, J Nutr 1995, 125(3 Suppl): 573S-580S.

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](https://doi.org/10.1371/journal.pone.0080488).

Protein Bars!

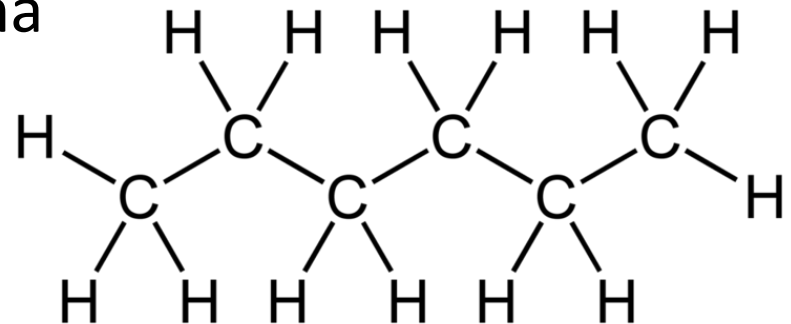
“Most soy protein ingredients in meat analogs and nutrition bars, which are listed on labels as soy protein isolate, soy protein concentrate or textured vegetable protein, have undergone *hexane* processing.”*



*<http://www.berkeleywellness.com/healthy-eating/food-safety/article/hexane-soy-food>

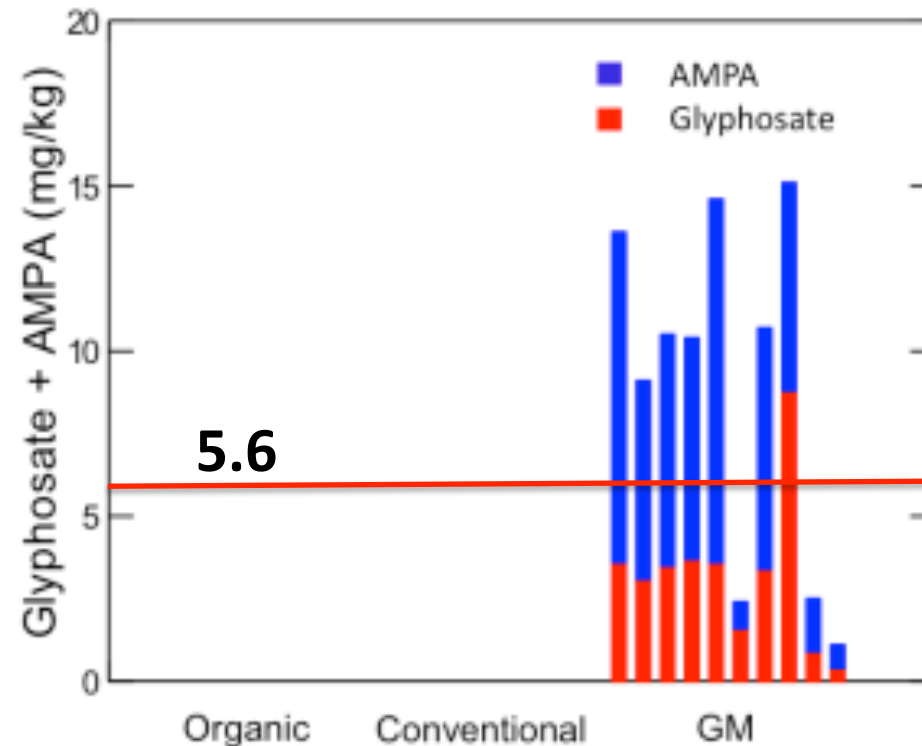
Toxic Effects of Inhaled Hexane*

- Low: Dizziness, headache, nausea, vomiting
- High: Death from asphyxiation
- Chronic: Peripheral neuropathy, pain, weakness, loss of sensation, impaired gait, muscle atrophy, visual disturbances
- Allowable amounts in food:
 - 10 parts per million in Europe
 - 500 parts per million in China
 - No restrictions in US



*N-HEXANE. *Toxicology data network Hazardous Substances Data Bank. US National Library of Medicine*

Glyphosate in GM Roundup Ready Soy*



“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).

Polysorbate 80*

- Food additives (emulsifiers) like polysorbate 80 induce inflammatory gut in mice
 - This is due to disruption of the gut microbes' cell wall
 - It leads to increased risk to obesity and diabetes
 - Exposed gut microbes can be transferred to germ-free mice and they too get fat and diabetic



*<http://www.nih.gov/researchmatters/march2015/03162015additives.htm>

Organochlorine Pesticides & Obesity in Women*

- Polychlorinated biphenyls (PCBs) and organochlorine insecticides (e.g., DDT) are xenoestrogenic
 - Linger a long time in the environment
 - Accumulate in fat tissue and lead to obesity (especially in premenopausal women)
- *They depend on CYP enzymes for breakdown*

*D Teixeira et al., Journal of Clinical and Endocrinology & Metabolism
[Epub ahead of print, Apr. 8, 2015]

Mercury Levels can be High in Rice, Fish, and High Fructose Corn Syrup

Mercury is probably the most toxic metal on earth



Mercury and Desulfovibrio

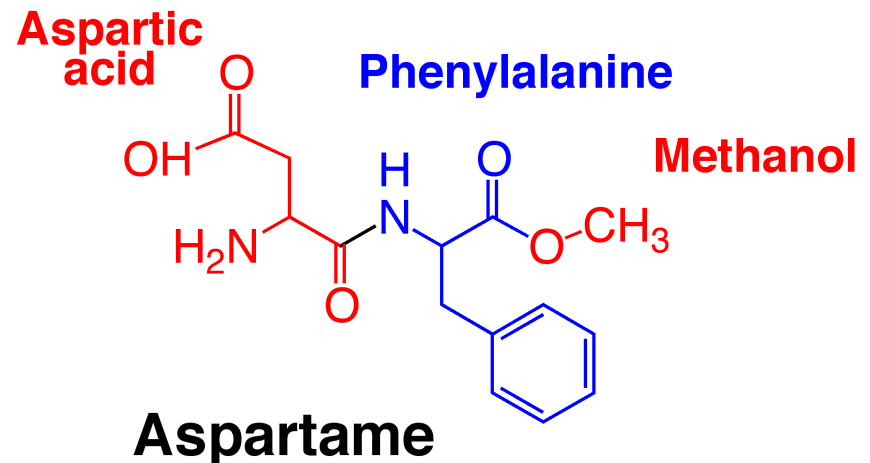
- Desulfovibrio is a gut microbe that reduces sulfate to hydrogen sulfide gas
 - It is over-represented in association with autism*
- Desulfovibrio also reduces nitrate to ammonia
- Desulfovibrio converts mercury to methyl mercury, a much more toxic form**

*SM Finegold et al., Anaerobe 2012;18(2):260–262.

**SC Choi et al., Appl Environ Microbiol. 1993 Jan;59(1):290-5.

Aspartame*

- Aspartame is the sweetener in NutraSweet, Equal, Spoonful, and Equal-Measure
 - Accounts for over 75% of the adverse reactions to food additives reported to the FDA
 - Aspartame breaks down to methanol (wood alcohol) and then to formaldehyde (neurotoxic)



*<http://articles.mercola.com/sites/articles/archive/2012/11/11/aspartame-dangers.aspx>

Recapitulation

- The EPA is not safeguarding our health
- Soy protein products are unsafe to eat due to both hexane and glyphosate
- Polysorbate 80 can cause disruption of gut microbes' cell walls leading to obesity and diabetes
- PCBs and insecticides are estrogen disruptors and their breakdown is inhibited by glyphosate
- Mercury levels can be high in fish and rice
- Aspartame is a dangerous sugar substitute, breaking down to formaldehyde

Glyphosate and Folic Acid

A Bit of History

The US first considered adding folic acid supplements to grains in 1996, and introduced the mandate in 1998

GMO “Roundup Ready” crops were just beginning to be introduced in 1996 and had obtained widespread adoption by 1998

Spina bifida is a very rare genetic disorder that is linked to folate deficiency

Adoption of “Roundup Ready” Crops*

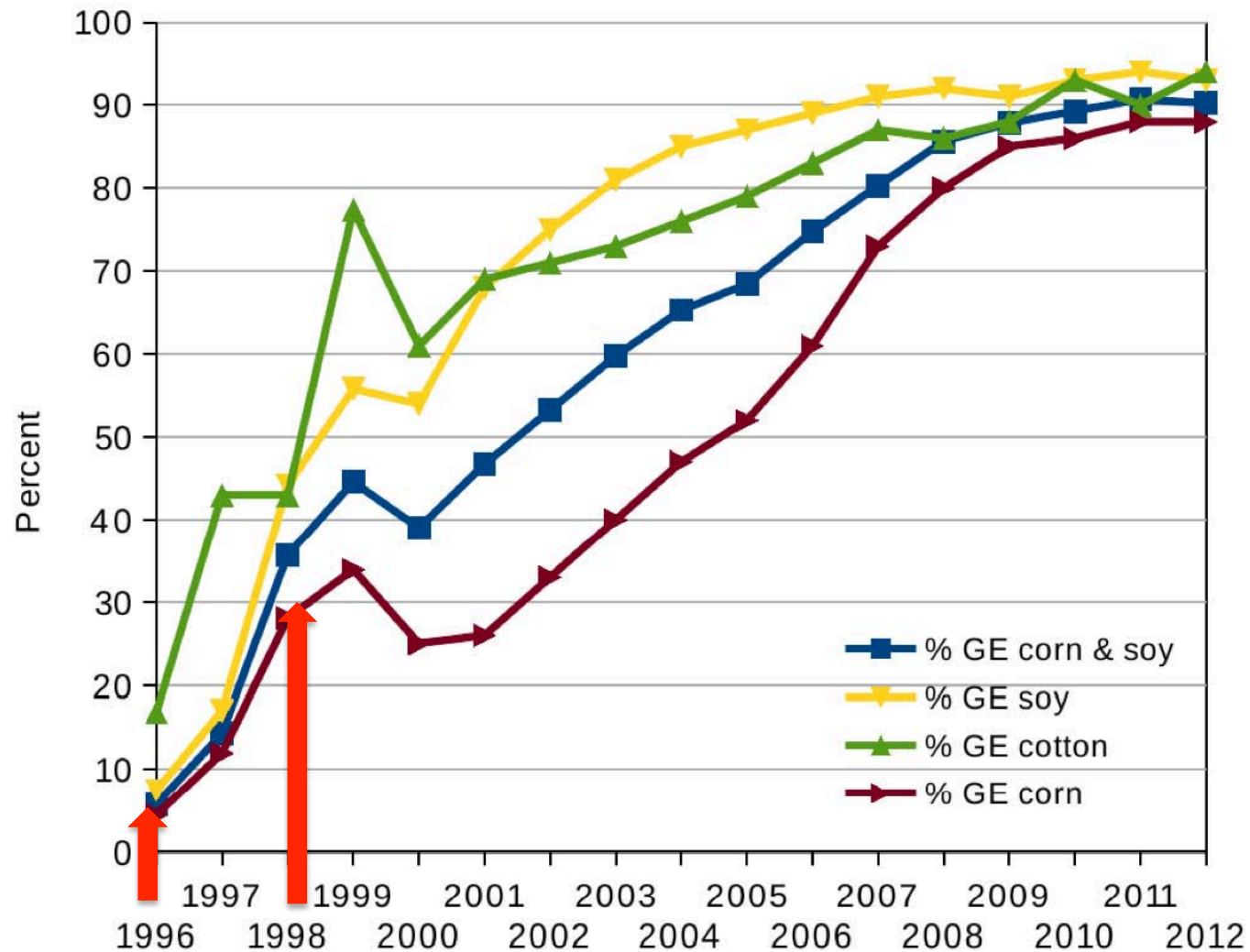
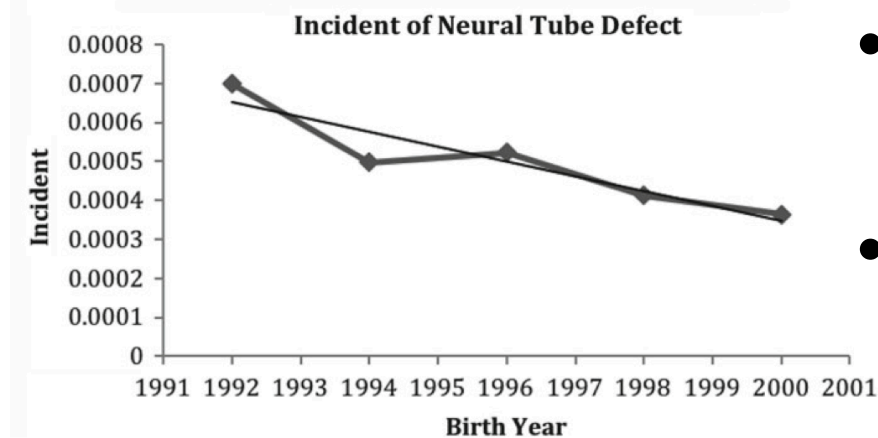
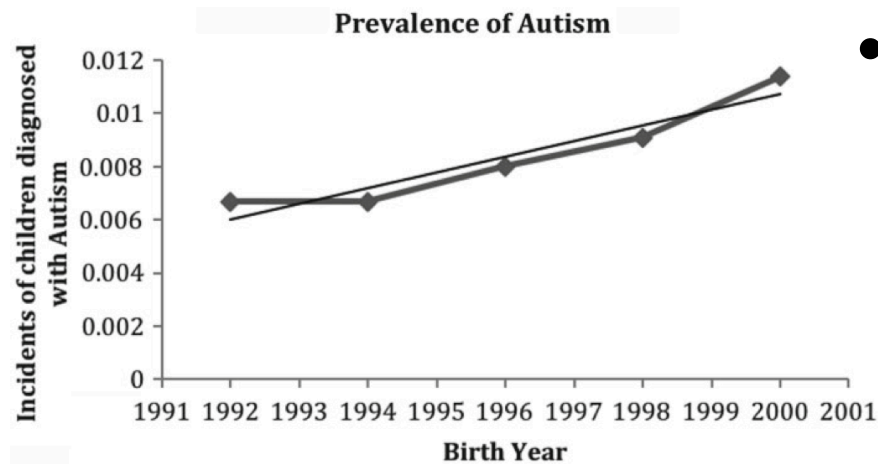


Figure 1. Adoption of GE crops in US.

* N. Swanson et al., Journal of Organic Systems 20145;9(2): 6-37.

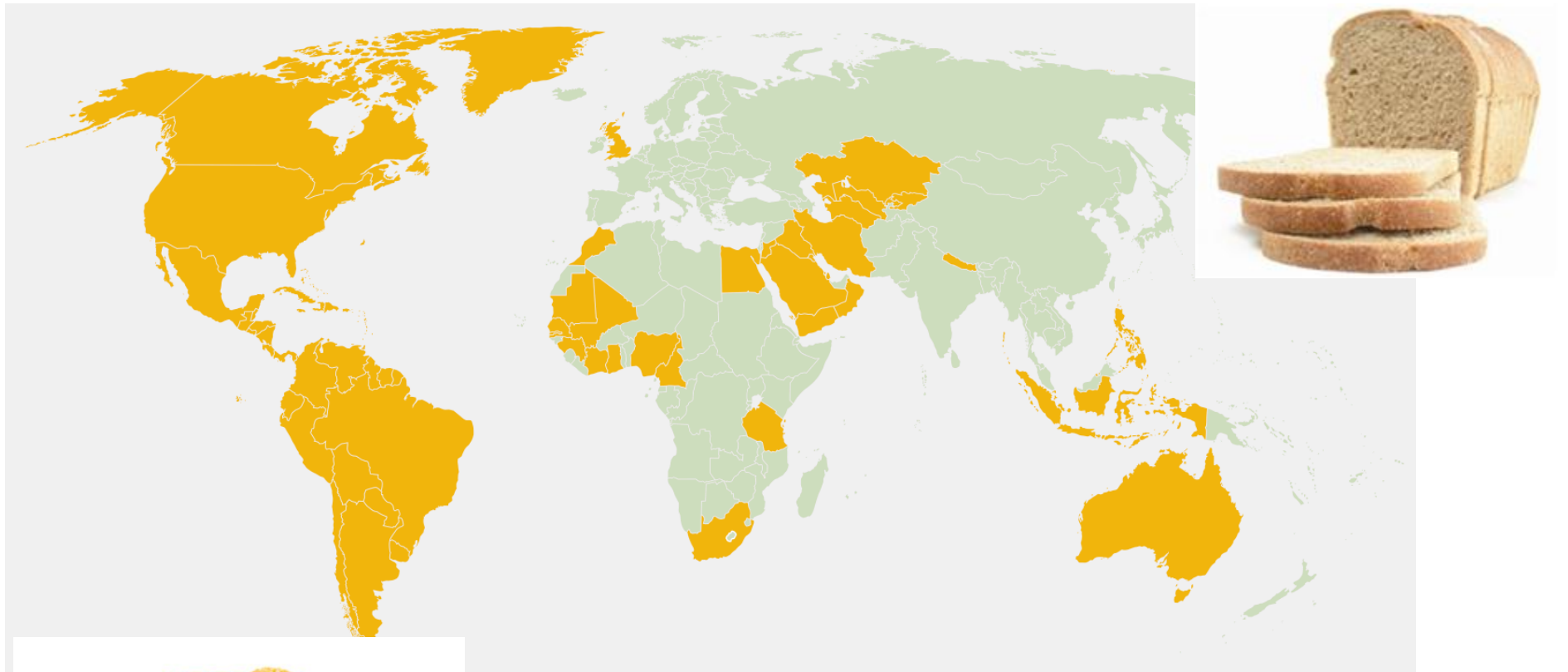
Inverse Correlation Between Neural Tube Defects and Autism Trends*



- Proposed mechanism involves increased GABA receptor activity (neuronal inhibition)
- GABA increase has been linked to autism
- Asthma is implicated as well

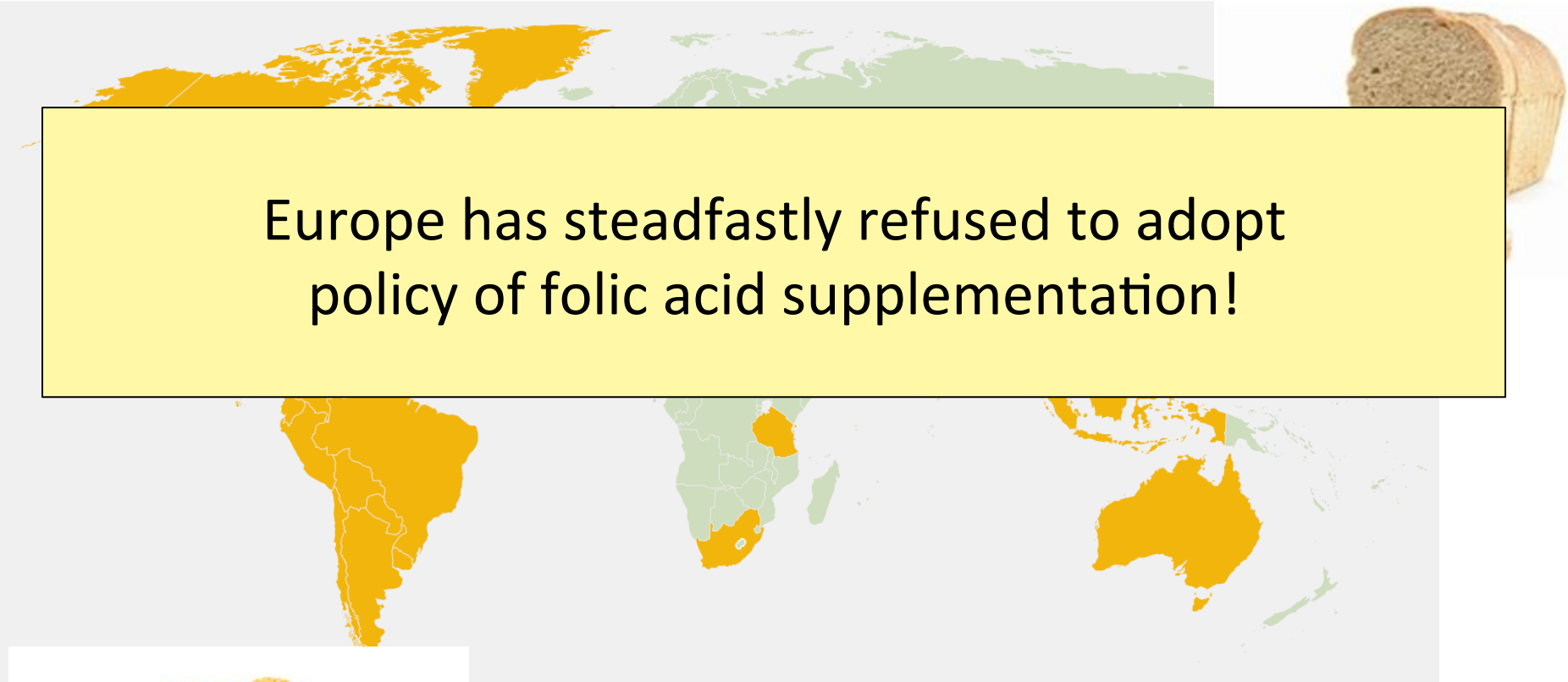
*Figure 4, K. Vasquez et al., Adv Exp Med Biol. 2013;775:101-9.

Folic Acid and/or Iron Fortification!!*



*B Handforth and S. Zimmerman,
Sight and Life 27 (1); 70-75, 2013

Folic Acid and/or Iron Fortification!!*



Europe has steadfastly refused to adopt policy of folic acid supplementation!



*B Handforth and S. Zimmerman,
Sight and Life 27 (1); 70-75, 2013

Folic Acid is Complex

- Folic acid is a synthetic, oxidized form of folate
- It induces oxidative stress in the liver
- This can lead to folic acid build-up (unnatural) in the blood
- This interferes with nitric oxide release which is important for promoting blood flow
- Folic acid in the blood may also cause the antibodies to folate receptors in the brain associated with cerebral folate deficiency

Generating Methionine from Homocysteine

Folate trap: One or more of these requirements are missing; Methyl group stays stuck on folate (inactive)

There is a belief that elevated serum homocysteine is bad, but the homocysteine is desperately needed to produce sulfate

Methionine

Homocysteine

Requirements:

Working MTHFR enzyme

Cobalamin

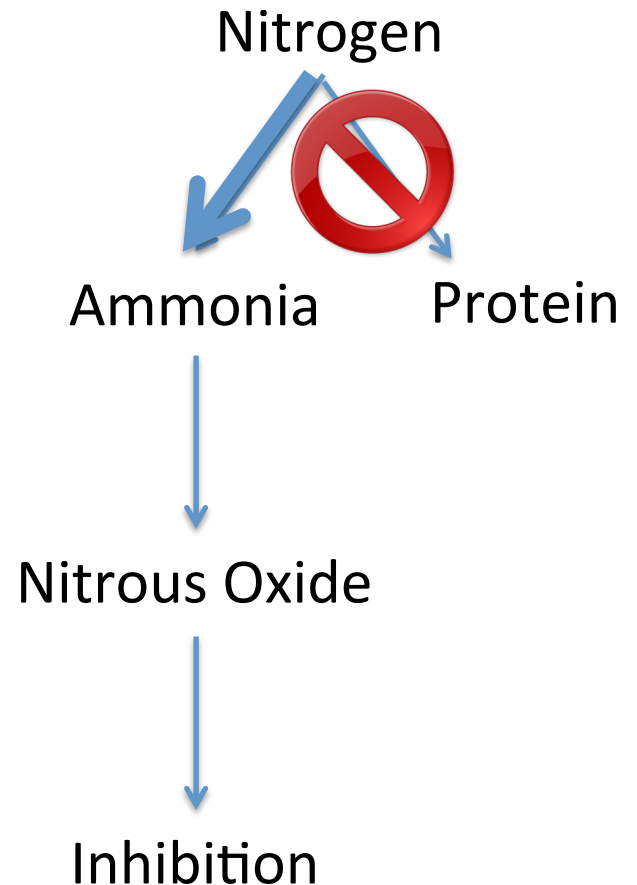
Zinc

Vitamin B6

Methyl tetrahydrofolate

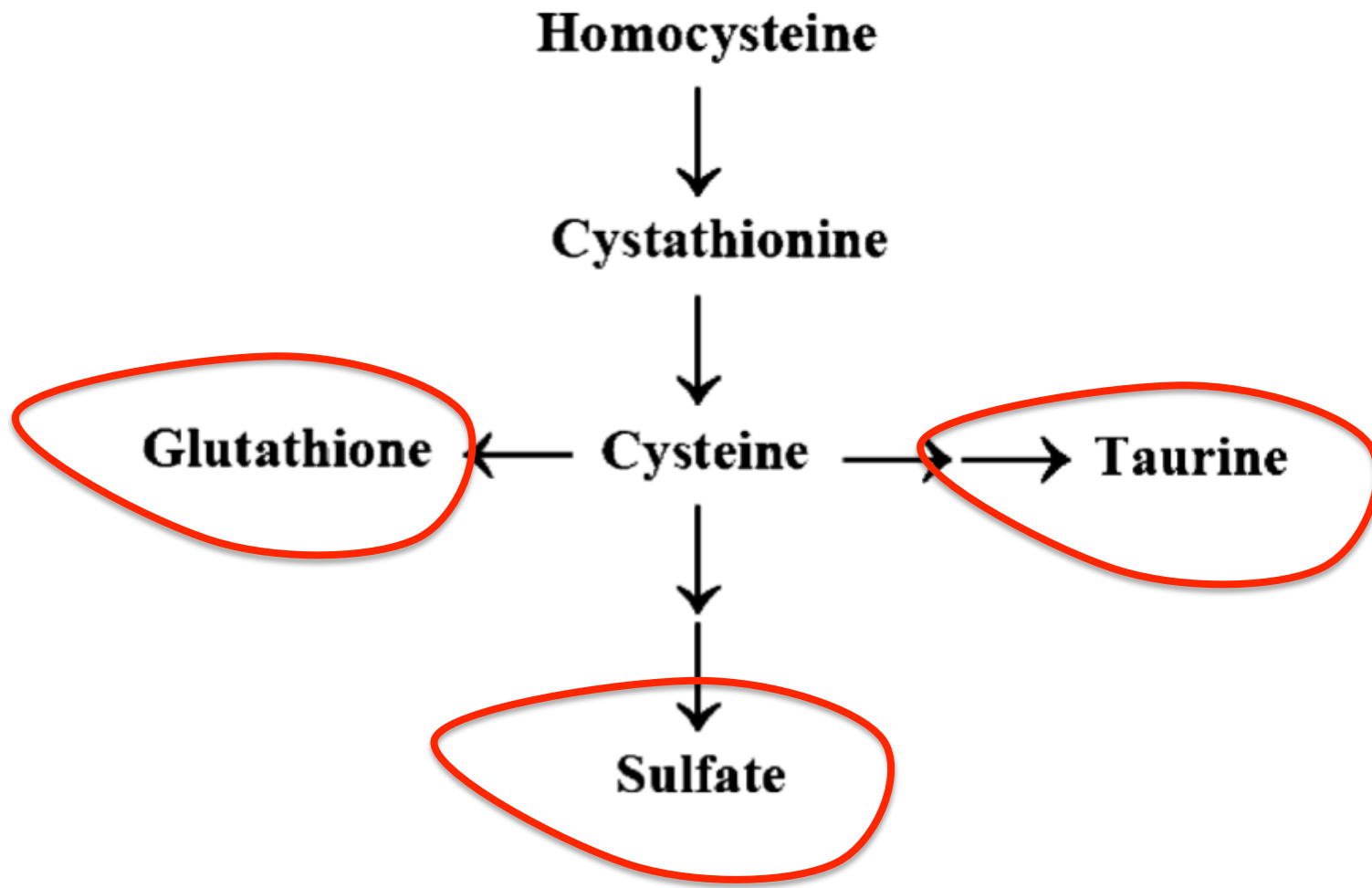
Nitrous Oxide Inhibits Methionine Synthesis

- Methionine synthase is inhibited by nitrous oxide
- Excess serum ammonia is a source of nitrous oxide
- Glyphosate likely induces ammonia synthesis by gut microbes (disrupts uptake of nitrogen into proteins)*



*SO Duke et al., Plant Physiol 1980; 65: 17-21.

Transsulfuration Pathway*

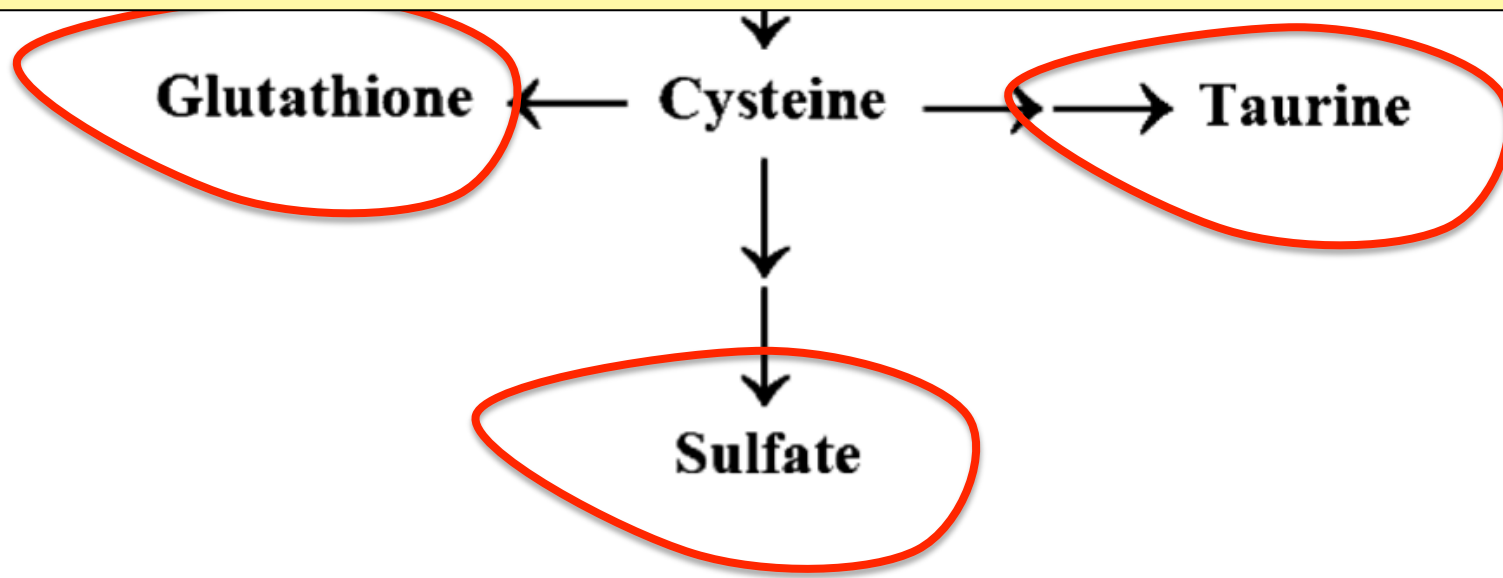


*Figure 1, DA Geier et al., Neurochem Res (2009) 34:386–393.

Transsulfuration Pathway*

Homocysteine

Three very important molecules!!!



*Figure 1, DA Geier et al., Neurochem Res (2009) 34:386–393.

What's the difference between folic acid and folate???

- Folic acid is a *synthetic* molecule, and it's stable
- Folate is typically methylated
- Folic acid is missing four hydrogen ions – *THIS IS VERY IMPORTANT!!!*

Folic acid is *oxidized*, and to convert it to folate is costly for the body

“High folic acid consumption leads to pseudo-MTHFR deficiency, altered lipid metabolism, and liver injury in mice”*

- Fed mice excessive amounts of folic acid
- *Reduced* methylation capacity in liver
- CYP7A1 level was dramatically reduced. (rate limiting enzyme in bile acid synthesis)
- Caused liver damage and fatty liver disease

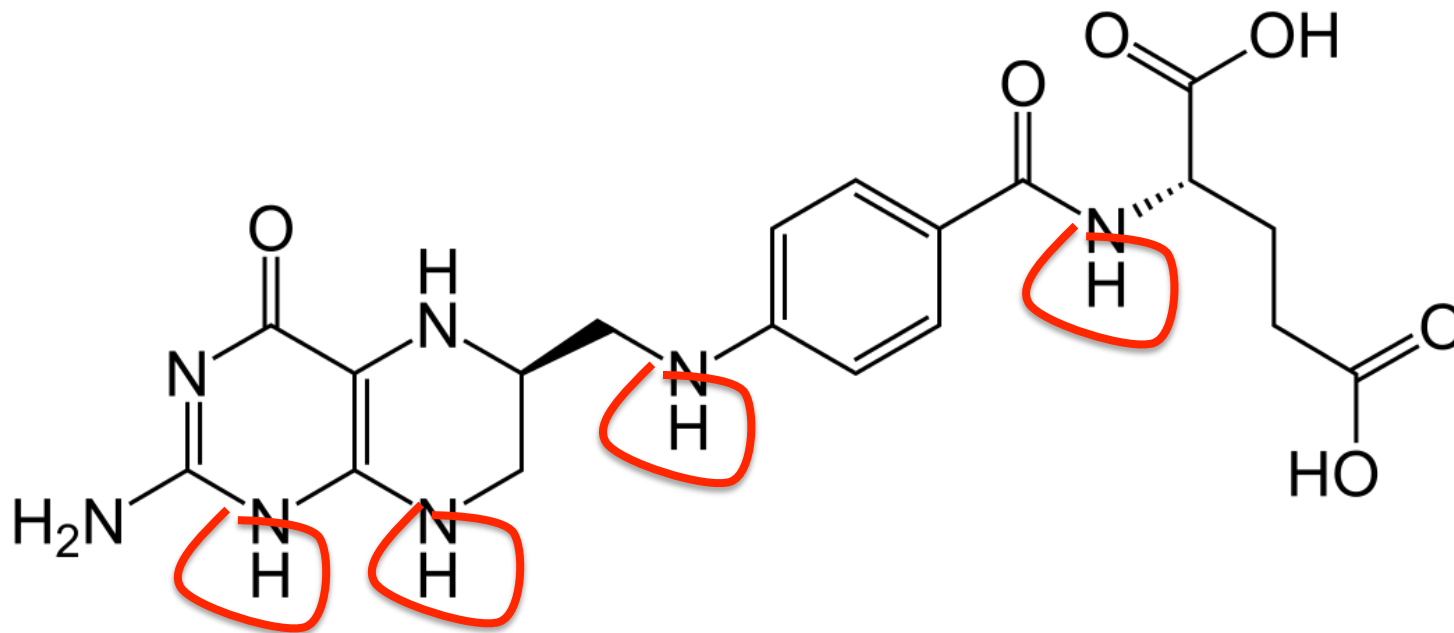


Works synergistically with glyphosate to disrupt bile flow

*KE Christensen et al., Am J Clin Nutr 2015;101:646–58.

“Cerebral folate deficiency with developmental delay, autism, and response to folinic acid”*

Folⁱⁿic acid is a form of TETRAHYDRO-folate



* P Moretti et al., *Neurology* March 22, 2005 vol. 64 no. 6 1088-1090

Recapitulation

- The timing of mandatory folic acid enrichment is uncanny: hide pending epidemic in spina bifida?
- Folic acid is synthetic, and it leads to excessive oxidation in the liver and/or depleted BH_4
- Glyphosate depletes methionine
 - Folate converts homocysteine to methionine, depleting sulfate supplies
 - This causes severe systemic sulfate deficiency
- Folate receptor antibodies in the brain may be an attempt to protect the brain from sulfate deficiency

Glyphosate, Oxalate and Anemia

Autism Linked to Oxalate Crystals*

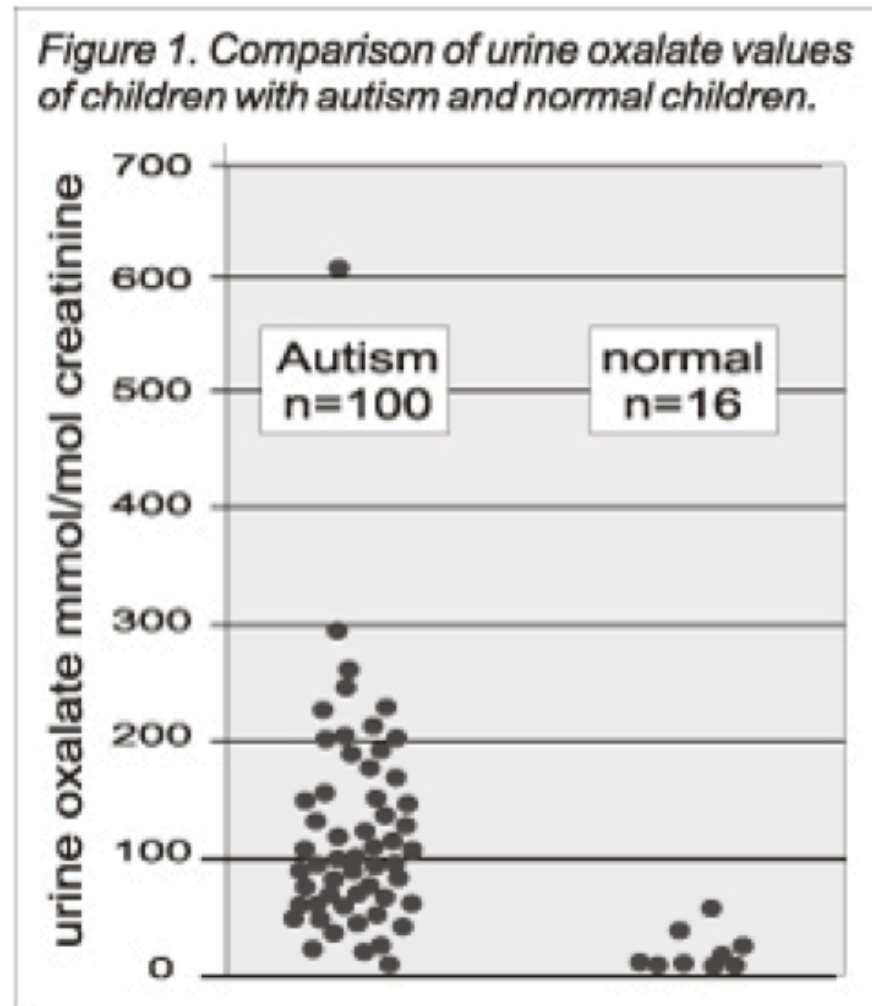
- Crystals of oxalate form kidney stones and cause great discomfort
- Study has shown at least 3-fold higher serum and urinary levels of oxalate in autistic kids**



*William Shaw, The Role of Oxalates in Autism and Chronic Disorders WAPF, March 26, 2010

**J Konstantynowicz et al., European Journal of Paediatric Neurology 16(5), 2012, 485-491.

“Oxalate crystals in the bone may crowd out the bone marrow cells, leading to **anemia** and immunosuppression”*

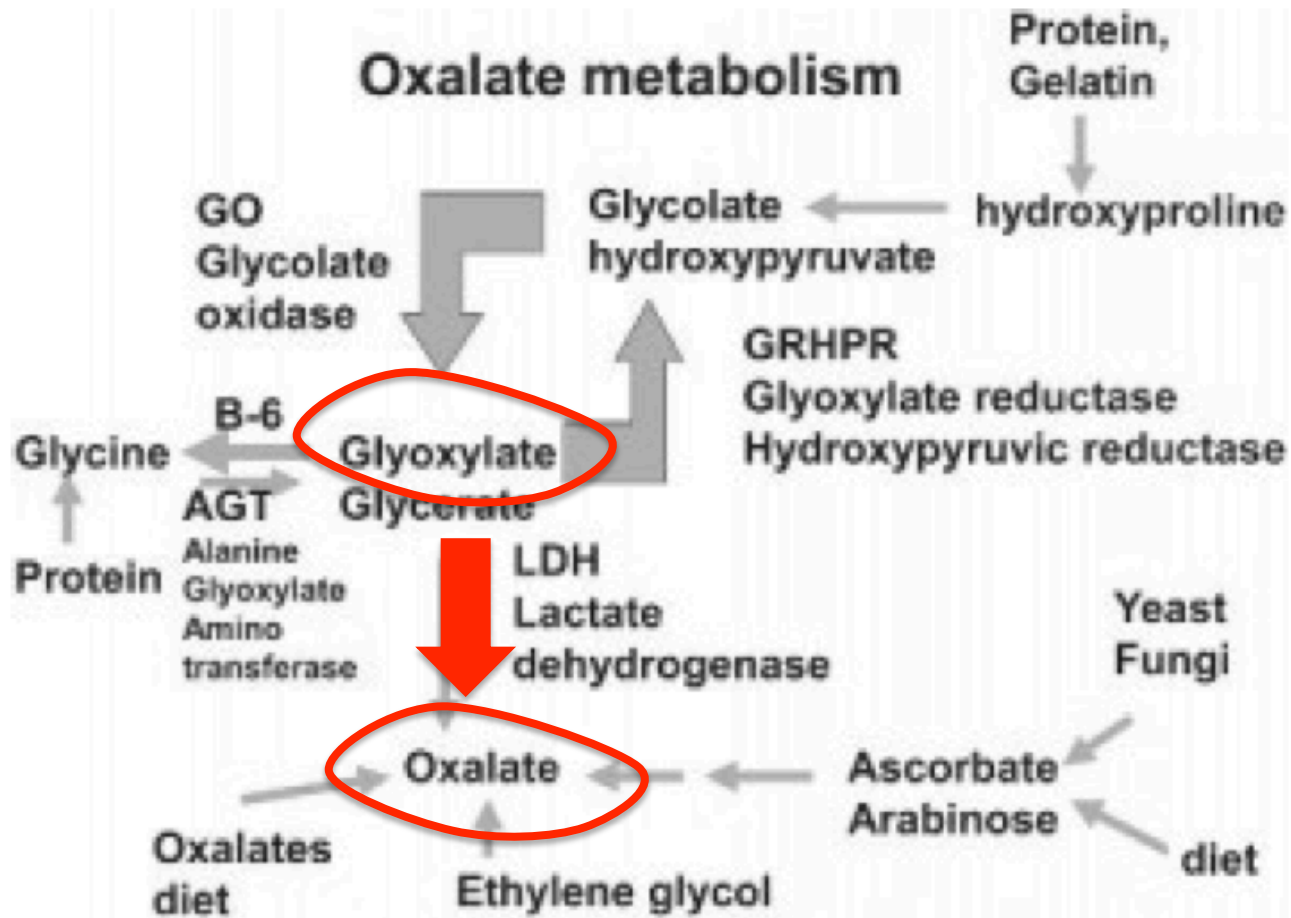


*<http://www.greatplainslaboratory.com/home/span/oxalates.asp>

“Cerebral edema, and perhaps injury to other organs, could result from oxalate crystal deposition in small blood vessels in the brain and other organs.”*

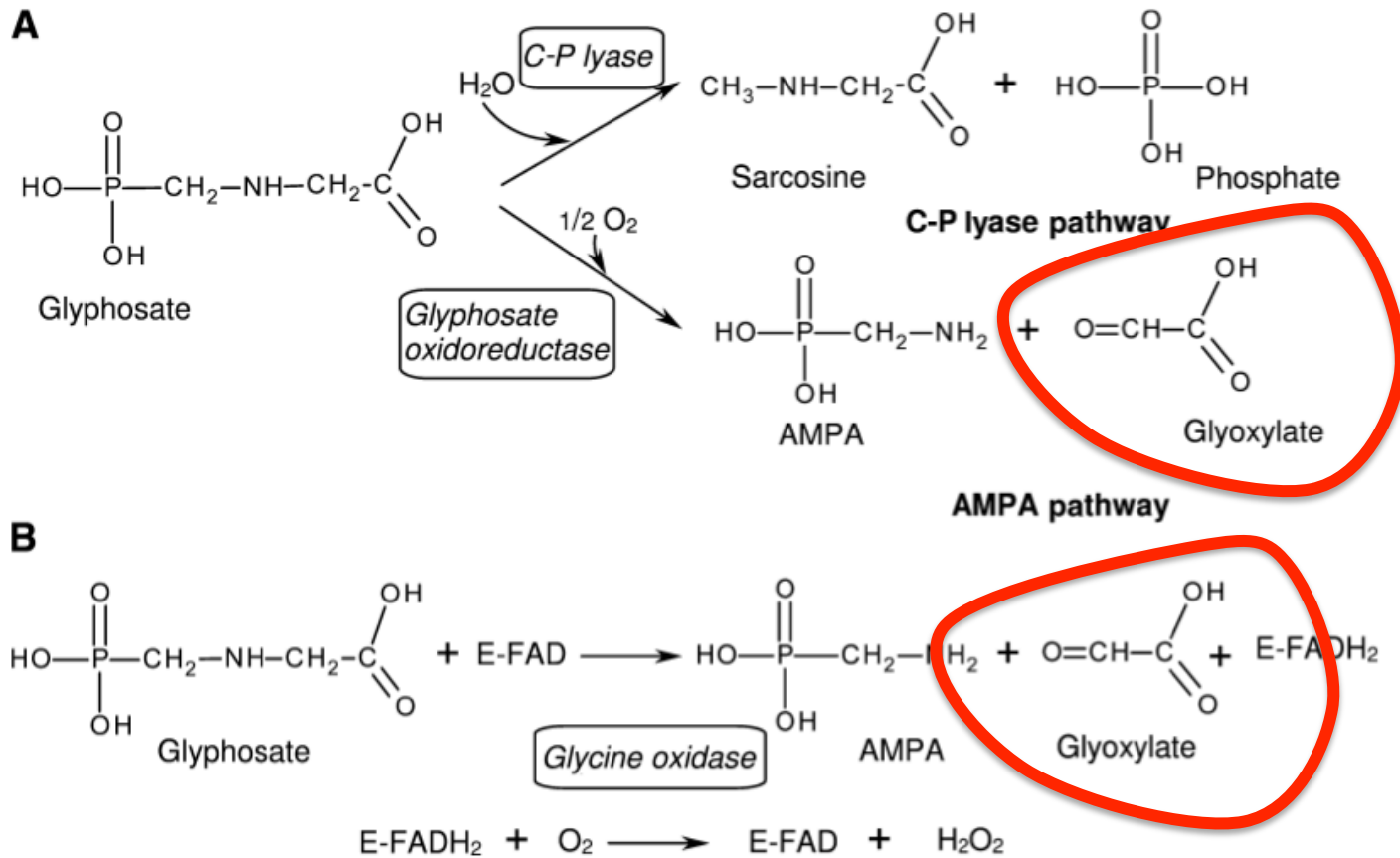
*K Froberg et al., Clin Toxicol (Phila). 2006;44(3):315-8.

Oxalate Metabolism*



*<http://www.greatplainslaboratory.com/home/eng/oxalates.asp>

Glyphosate Metabolism*



*Figure 3 in L. Polligioni et al., FEBS Journal 278 (2011) 2753–2766

Monsanto Patents: 2002-2010: Pesticide Compositions Containing Oxalic Acid

“[origin: WO02069718A2] Pesticidal concentrate and spray compositions are described which exhibit *enhanced efficacy* ... More particularly, the present invention relates to a method of enhancing the herbicidal effectiveness of *glyphosate* concentrate and tank mix formulations containing one or more surfactants through the addition of *oxalic acid*.”



US007723265B2

(12) **United States Patent**
Xu et al.

(10) **Patent No.:** US 7,723,265 B2
(45) **Date of Patent:** *May 25, 2010

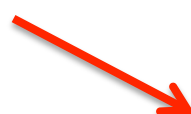
(54) **PESTICIDE COMPOSITIONS CONTAINING OXALIC ACID**

(75) **Inventors:** Xiaodong C. Xu, Valley Park, MO (US);
Ronald J. Brinker, Ellisville, MO (US);
Tracey L. Reynolds, Ballwin, MO (US);
William Abraham, Wildwood, MO (US);
Jeffrey A. Graham, Wildwood, MO (US)

(73) **Assignee:** Monsanto Technology, St. Louis, MO (US)

4,140,513 A	2/1979	Prill
4,159,901 A	7/1979	Beestman et al.
4,161,590 A	7/1979	Mueller
4,161,602 A	7/1979	Mueller
4,315,765 A	2/1982	Large
4,405,531 A	9/1983	Franz
4,431,765 A	2/1984	Doshak et al.
4,481,026 A	11/1984	Prisbylla
4,507,250 A	3/1985	Bakel
4,936,901 A	6/1990	Surgant, Sr. et al.
5,118,444 A	6/1992	Nguyen
5,317,003 A	5/1994	Kassebaum et al.
5,399,598 A	2/1995	Prill et al.

**Monsanto Technology,
St. Louis, MO**



Monsanto Patents: 2002-2010: Pesticide Compositions Containing Oxalic Acid

“[origin: WO02069718A2] Pesticidal concentrate and spray

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Oxalic acid and oxalate are essentially
the same thing!

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US007723265B2

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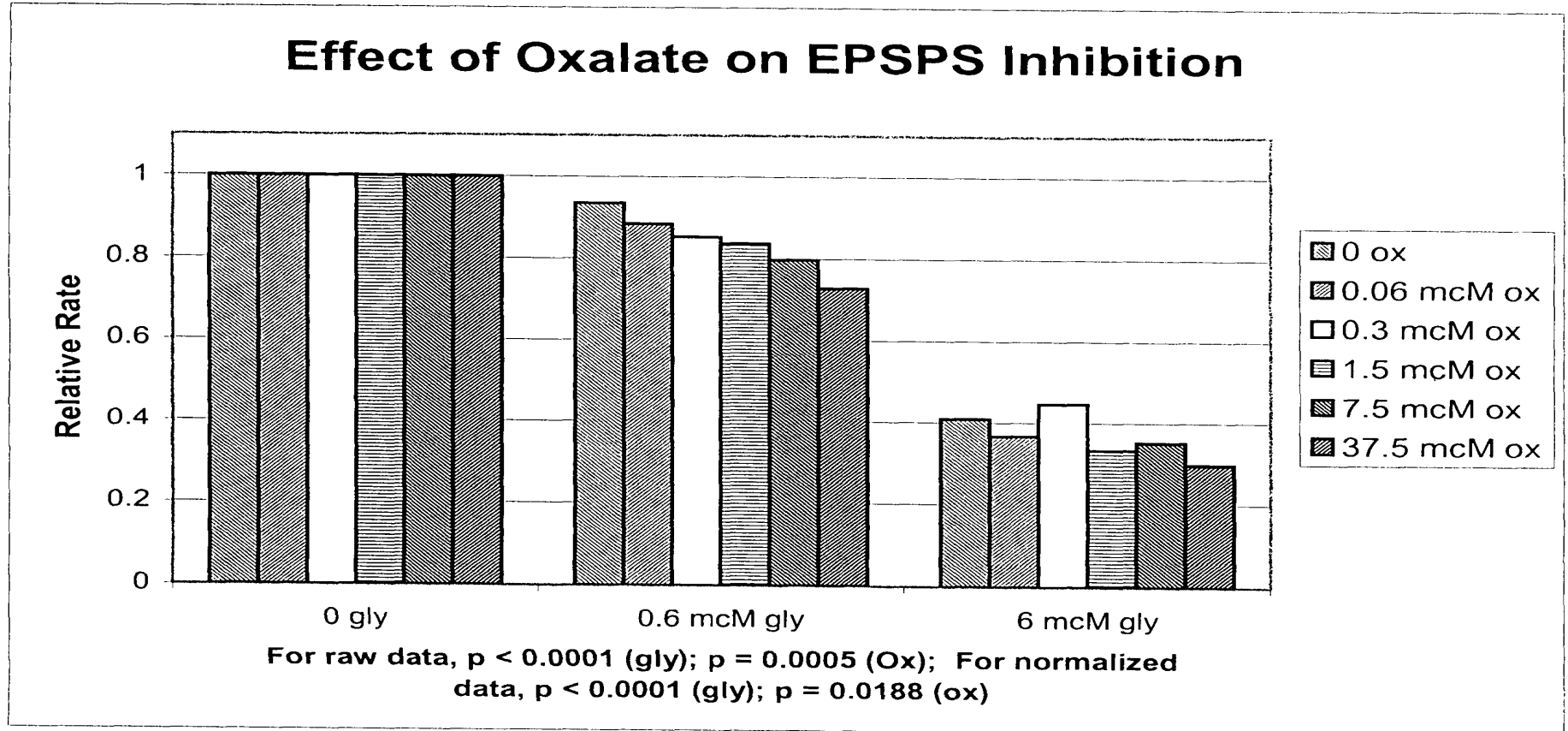
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5,118,444 A	6/1992	Nguyen
5,317,003 A	5/1994	Kassebaum et al.
5,388,588 A	2/1995	Patel et al.

Oxalate Enhances Glyphosate's Toxicity to Plants at Small Concentrations*



*Figure 1, Monsanto Patent #US 7,771,736 B2, Aug. 10, 2010

Hypothesis: flooding with oxalate prevents metabolism of glyoxylate to oxalate. Glyoxylate is a very potent glycating agent, leading to widespread damage. This also inhibits glyphosate breakdown to glyoxylate.

Roundup Brand Leadership Driven by Continuous Innovation

1975



Classic

- Standard for post emergent perennial weed control
- Improved environmental profile

1980



Rodeo

- Aquatic market
- Outstanding environmental profile (licensed to Dow)

1985



Accord

- Forestry Market
- Excellent environmental profile (licensed to Dow)

1990



D-Pak

- Super-high formulation for big volume users in southern U.S.

1995



Roundup DRYpak

- Solution to packaging issues
- First of high-load products



Ultra

- Introduction of 'Transorb technology'
- Safe on Roundup Ready crops

2000



Ultra Max

- High load version of Ultra
- Excellent Roundup Ready crop safety

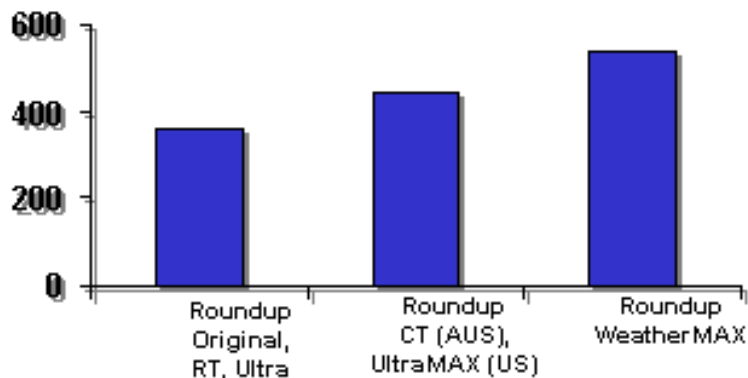
2005



Weather Max

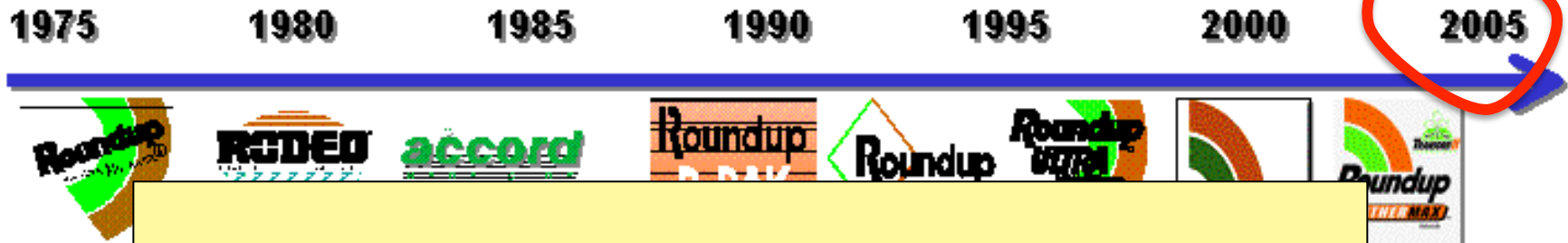
- Transorb II technology
- 50% more concentrated
- Rainfast warranty
- Best Roundup Ready crop safety to date

Active Ingredient Loading (g/L glyphosate)



- Monsanto continually innovates, creating breakthrough formulation technology
- Results:
 - More than 300 worldwide patents, 50 in U.S.
 - Faster launch of new formulations

Roundup Brand Leadership Driven by Continuous Innovation



WEATHERMAX!!

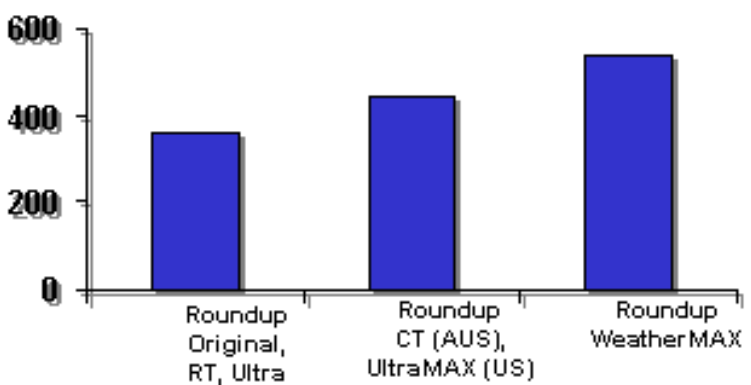
Classic

- Standard for emergent weed control
- Improved environmental profile

WeatherMAX

- Advanced adsorbent technology
- 50% more concentrated
- 5-year rainfast warranty
- Best Roundup Ready crop safety to date

Active Ingredient Loading (g/L glyphosate)



- Monsanto continually innovates, creating breakthrough formulation technology
- Results:
 - More than 300 worldwide patents, 50 in U.S.
 - Faster launch of new formulations

New Roundup Transorb'R' Herbicide Formulation to Hit Retail Shelves in Eastern Canada*

“In 2004, this powerful new formulation was chosen by more western Canadian growers than any other non-selective herbicide on the market. Grower satisfaction with the performance in the field has reached new heights - 99% of growers who used Roundup *WeatherMAX* were satisfied with their experience.”

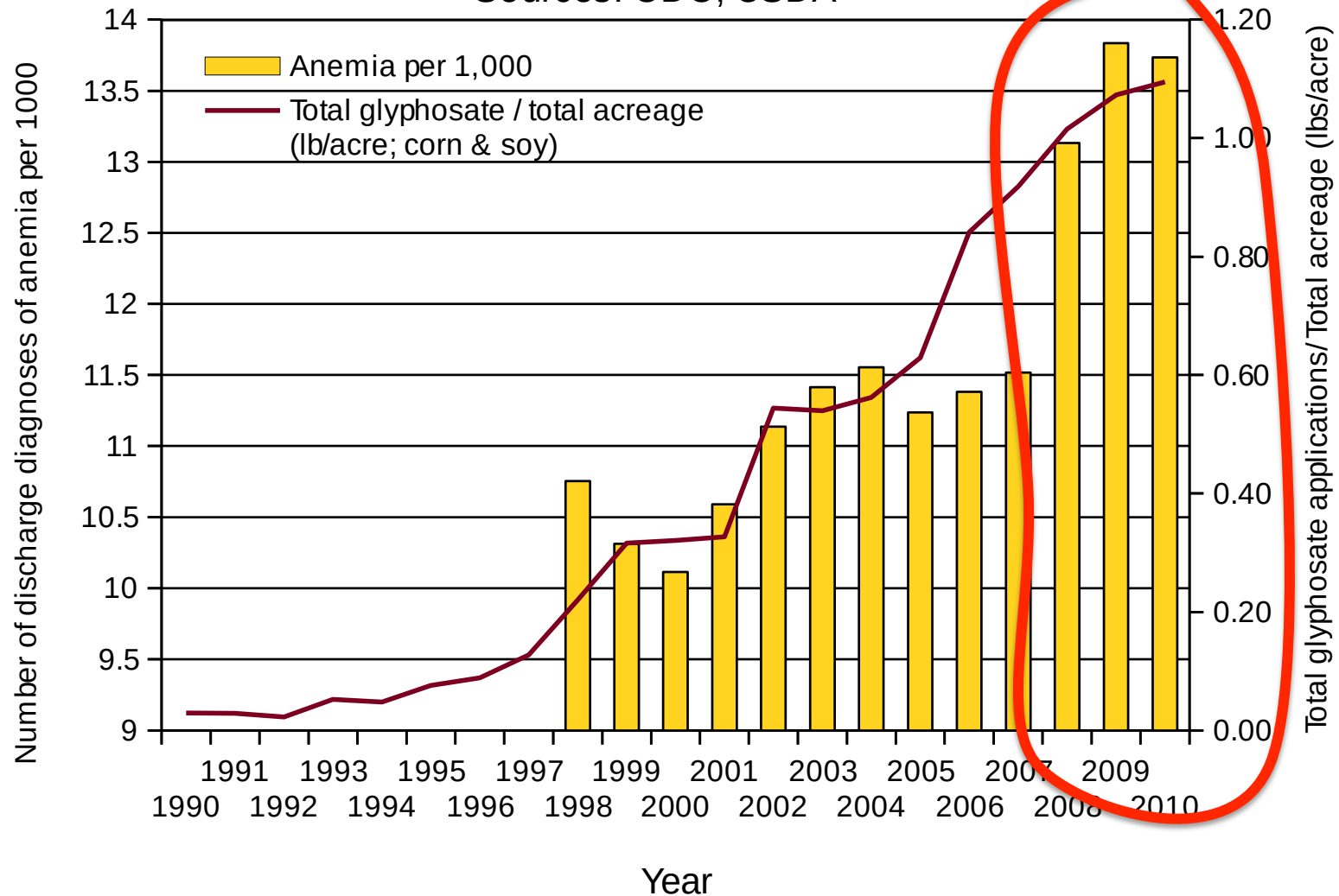
*www.highbeam.com/doc/1P2-13686824.html

JANUARY 3, 2005

Hospital Discharge Diagnoses of Anemia (ICD 280-85) & Glyphosate applied to corn & soy crops

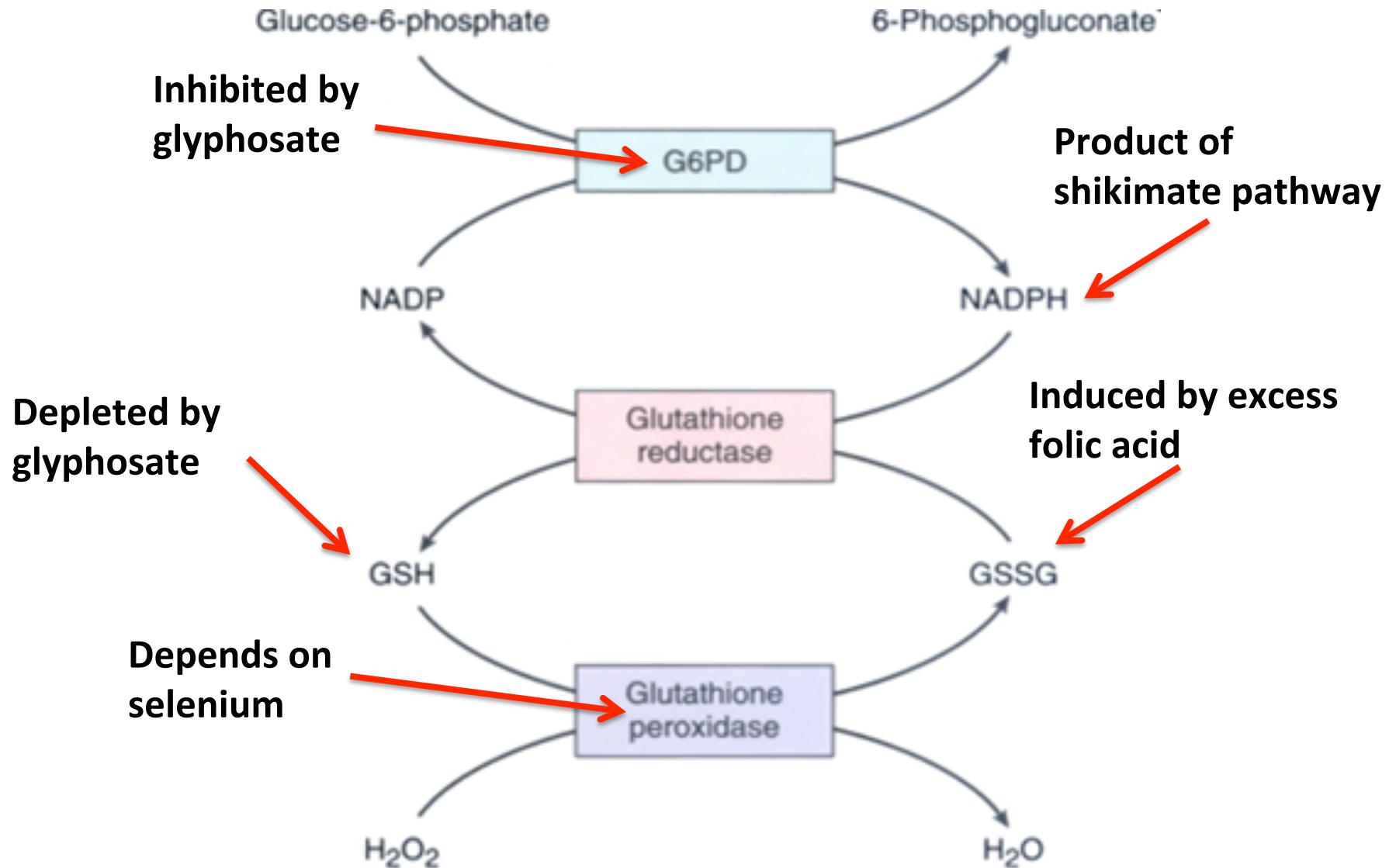
$R = 0.8952, p \leq 0.00018$

Sources: CDC; USDA

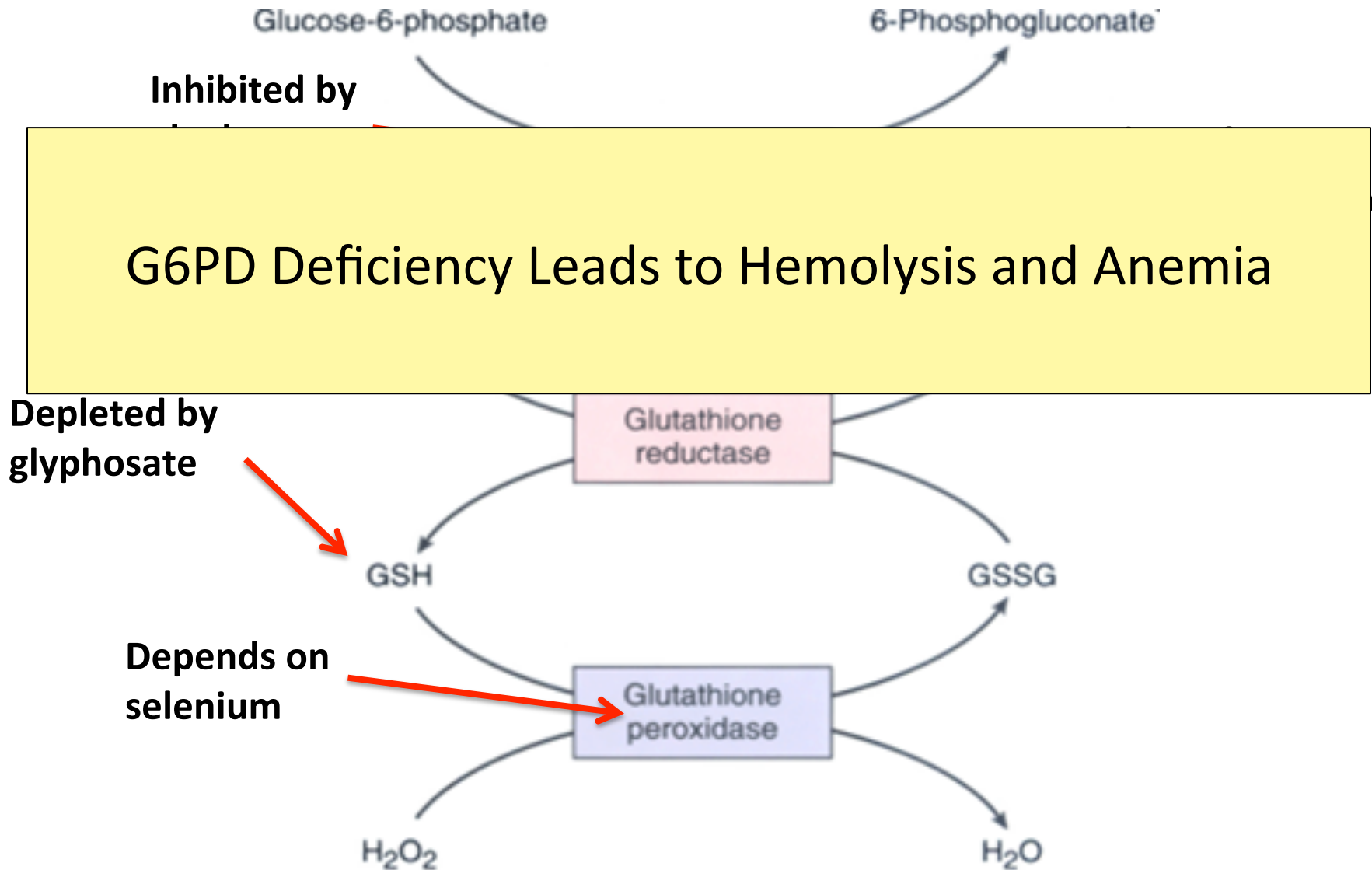


Plot produced in collaboration with Dr. Nancy Swanson from US Government data

This Detoxification Scheme is Essential in Red Blood Cells



Anemia is also Caused by Damage to Red Blood Cells



Anemia leads to low oxygen which induces chronic low grade encephalopathy linked to autism

Entropy **2013**, *15*, 372-406; doi:10.3390/e15010372

OPEN ACCESS

entropy

ISSN 1099-4300

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Review

Is Encephalopathy a Mechanism to Renew Sulfate in Autism?

Stephanie Seneff ^{1,*}, Ann Lauritzen ², Robert M. Davidson ³ and Laurie Lentz-Marino ⁴

Oxalate, Iron and Autism

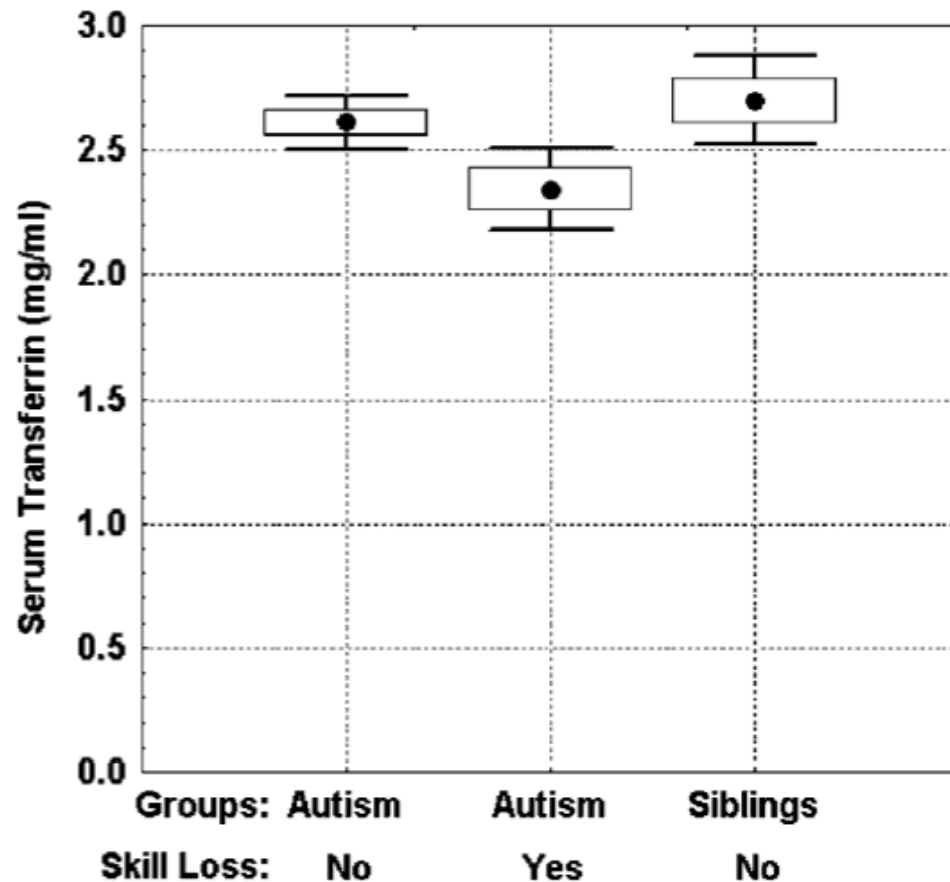
- Agricultural workers exposed to glyphosate suffer from high rate of kidney failure due to tubular interstitial diseases*
 - Tubules depend on transferrin to supply iron
 - Oxalate interferes with transferrin iron delivery**
- Autistic children also have intractable iron deficiency
- Child with defective gene for transferrin receptor had developmental delay and intractable seizures***

*C Jayasumana et al., Int. J. Environ. Res. Public Health 2014

**AN Luck et al., Biochemistry. 2013 November 19; 52(46)

***Stockler et al. Orphanet Journal of Rare Diseases 2014, 9:141.

Autistic Children are Sensitive to Iron Overload*



Children with autism have low levels of transferrin, which protects from oxidative damage due to free iron in the cells

□ ±1.00*Std. Err.
● Mean

*A Chauhan et al., Life Sciences 2004; 75: 2539–2549

Recapitulation

- Serum oxalate is elevated in association with autism
- Oxalate can cause crystals to form in tissues which is very damaging (especially in brain)
- Monsanto has patents on oxalate as an additive to enhance toxicity to plants
- Oxalate can work synergistically with glyphosate to cause essential iron deficiency
- Anemia can lead to low oxygen supply and encephalopathy (linked to autism)
- Oxalate interferes with delivery of iron to the tissues, and Impaired transferrin receptors are linked to autism

How to Protect Yourself and Your Family

Go Organic!



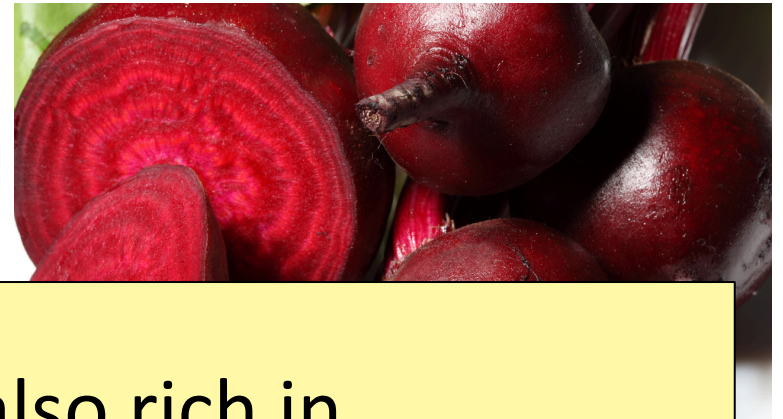
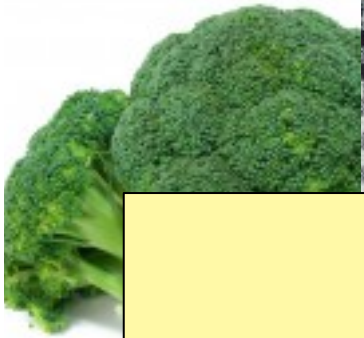
Avoid Foods that are Enriched in Folic Acid



Eat Foods that Contain Folate



Eat Foods that Contain Folate



These foods are also rich in manganese and sulfur



Extracts from Common Plants Can Treat Glyphosate Poisoning*

- Roundup is toxic to hepatic and embryonic cells at doses far below those used in agriculture and at residue levels present in some GM food.
- Extracts from common plants such as dandelions, barberry, and burdock can protect from damage, especially if administered prior to exposure.



*C Gasnier et al. Journal of Occupational Medicine and Toxicology 2011, 6:3

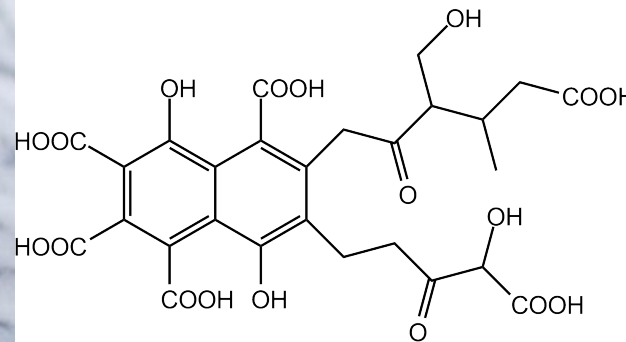
Treating Glyphosate Poisoning in Animals (e.g., cows) *



Activated charcoal, bentonite clay, humic and fulvic acids, and sauerkraut juice have been shown to be effective in reducing urinary levels of glyphosate and improving animal health



Bentonite Clay



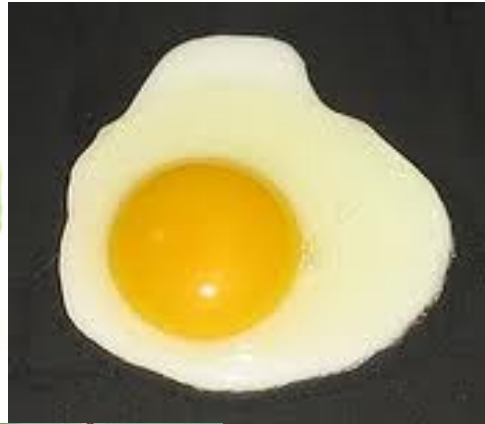
Fulvic Acid



Activated Charcoal

*H Gerlach et al., J Environ Anal Toxicol 2014, 5:2

Eat Foods High in Sulfur



Eat Foods Containing Manganese



Summary

- Autism rates are growing exponentially, and this trend will destroy the nation if we stay the course
- Our cheap food supply is making us sick
 - Mercury, aspartame, polysorbate 80, PCBs, organochlorine pesticides, hexane, folic acid, oxalate *and glyphosate!!* are all contributing
- Autism and ADHD are intimately related and may differ just by the balance of manganese and iron in a toxic environment
- We need to return to sustainable organic agricultural methods and we need to spend more time in the kitchen cooking whole foods!