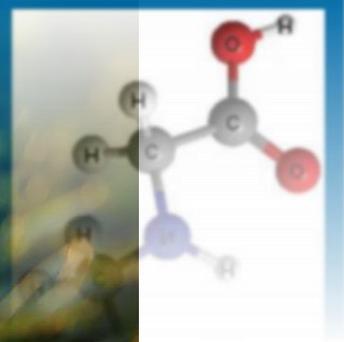
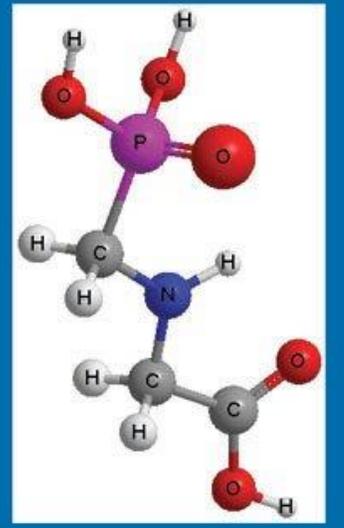




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and Mainstream Medicine.



GLYPHOSATE



KIRAN KRISHNAN
CSO, MICROBIOME LABS, LLC.

Glyphosate cannot be washed away

Glyphosate is transported from the leaves into the grains and fruit. During milling it is concentrated in wheat bran by a factor of four. It cannot be removed by washing or cooking, and is passed into milk and eggs.



GLYPHOSATE AND THE MICROBIOME

Glyphosate was designated as safe for use on food products because glyphosate did not show classical, systemic toxicology in mammalian, short-term, feeding studies. However, the toxicological study of glyphosate and its formulations (in particular dicarboxylic acid), were conducted prior to the discovery of the significance of the microbiome in health and the disease process.

Glyphosate was demonstrated to effect the Shikimate Pathway, an important biological pathway in lower order plants.

“Glyphosate suppresses 5-enolpyruvylshikimic acid-3-phosphate synthase (EPSP synthase), the rate-limiting step in the synthesis of the aromatic amino acids, tryptophan, tyrosine, and phenylalanine, in the shikimate pathway of bacteria, archaea and plants (de Maria *et al.*, 1996).”

Although humans do not utilize the shikimate pathway in our cells, many of the important and friendly members of our microbiome require this critical metabolic pathway for growth.

Thus, glyphosate acts as a chronic, pervasive low dose antibiotic in western society. The antimicrobial effect of glyphosate was demonstrated by Monsanto themselves in a patent filing on the compound.

“Glyphosate, patented as an antimicrobial (Monsanto Technology LLC, 2010), has been shown to disrupt gut bacteria in animals, preferentially killing beneficial forms and causing an overgrowth of pathogens.” (Samsel, *et al* 2013) *Interdiscip Toxicol.* 2013; **Vol. 6**(4): 159–184.**doi:** 10.2478/intox-2013-0026

THE GLYPHOSATE MICROBIOME

Glyphosate seems to have a characteristic perturbation pattern on the microbiome. One that is arguably worse than most antibiotics.

A culmination of Evidence on the disruption of gut bacteria by glyphosate from

- Poultry (Shehata *et al.*, 2013)
- Cattle (Kruger *et al.*, 2013)
- Swine (Carman *et al.*, 2013)

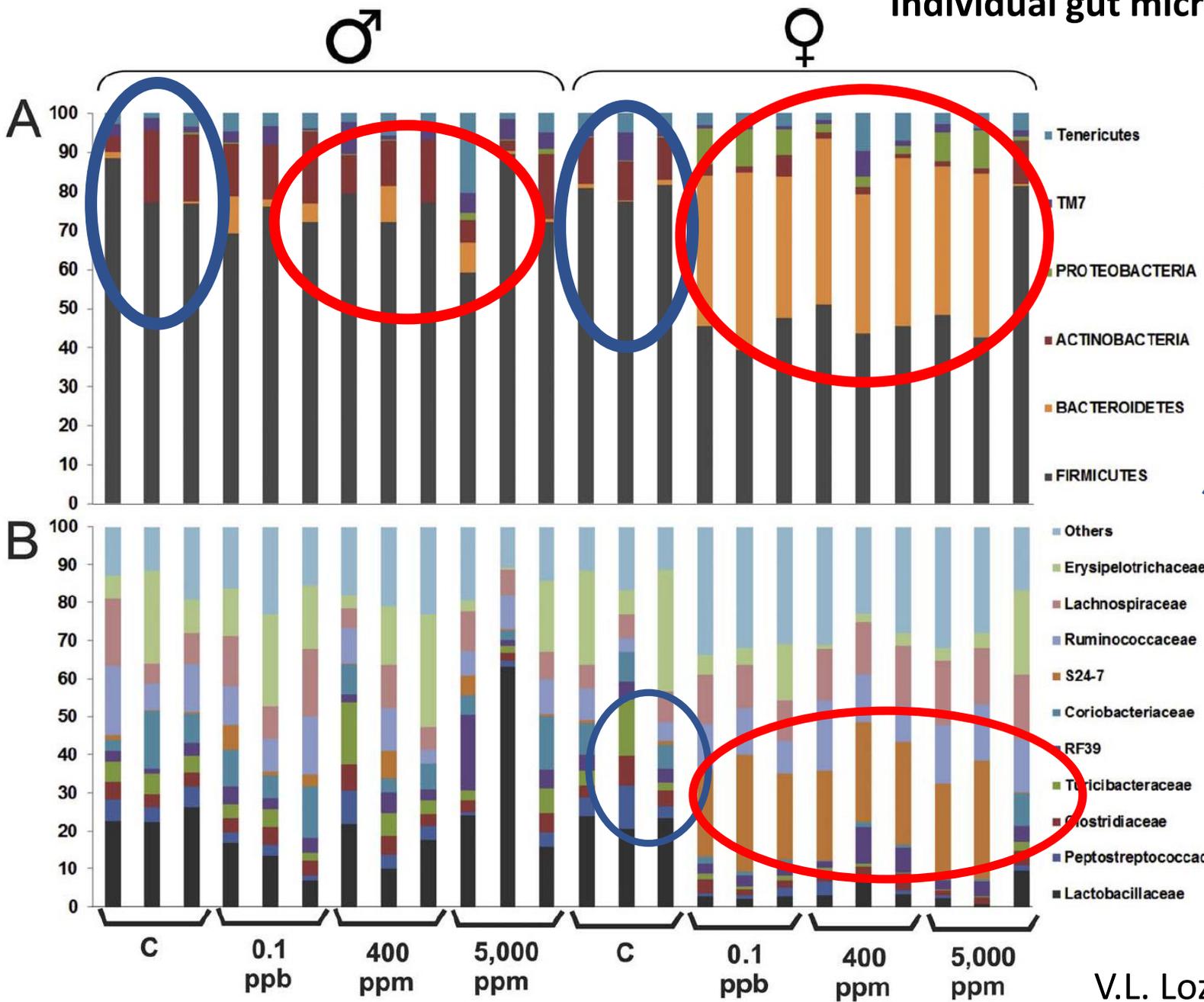
Studies show that glyphosate increases the ratio of **pathogenic bacteria** to other commensal microbes. **Salmonella** and **Clostridium** are highly resistant to glyphosate, whereas Enterococcus, Bifidobacteria, and Lactobacillus are especially susceptible.

Other Pathogens also do well under glyphosate exposure as they carry the enzymatic capability to metabolize glyphosate, for example;

“Pseudomonas spp. is an opportunistic pathogen and an antibiotic-resistant Gram-negative bacterium that has been shown to be able to break down glyphosate to produce usable phosphate and carbon for amino acid synthesis, but a toxic by-product of the reaction is formaldehyde.”

Entropy **2013**, 15, 1416-1463; doi:10.3390/e15041416

Individual gut microbiome profile of Roundup-treated rats.



Phylum Level Changes after RoundUp feeding

Family Level Changes after RoundUp feeding

RoundUp (glyphosate) feeding at 0.1ppb, 400ppm and 5000ppm all caused a significant change in the mammalian microbiome, where a tremendous increase in the growth of **gram-negative flora** was seen as well as **clostridia sp.**

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 and folate
- 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.

THE GLYPHOSATE MICROBIOME

In addition to the microbial changes to the microbiota, there are significant physical changes to the structure of the intestinal barrier. For example;

“A recent study on glyphosate exposure in carnivorous fish revealed remarkable adverse effects throughout the digestive system (Senapati *et al.*, 2009). The activity of protease, lipase, and amylase were all decreased in the esophagus, stomach, and intestine of these fish following exposure to glyphosate. The authors also observed disruption of **mucosal folds** and **disarray of microvilli structure** in the intestinal wall..”

Interdiscip Toxicol. 2013; Vol. 6(4): 159–184.[doi: 10.2478/intox-2013-0026](https://doi.org/10.2478/intox-2013-0026)

The Dynamic Duo of Deeper Destruction

GLYPHOSATE



WHEAT

Glyphosate is consumed heavily with wheat product

Glyphosate creates a pro-inflammatory and dysbiotic environment in the gut

Wheat contains Gluten, an antigenic peptide, which can be neutralized by proteolytic cleavage.

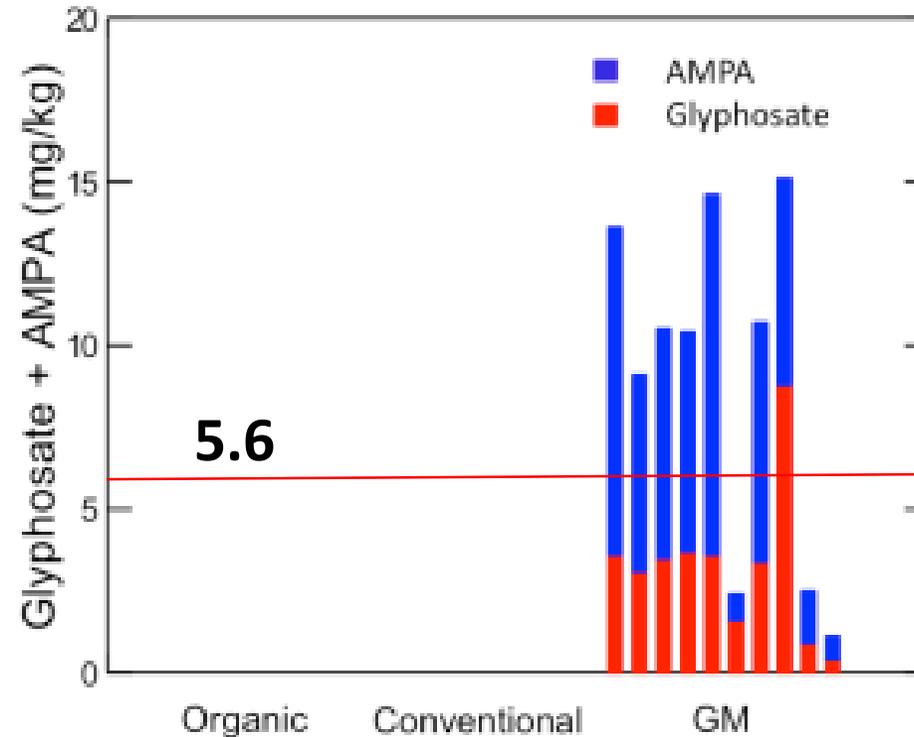
However, gluten is hydrophobic and thus escapes degradation by digestive enzymes

Thus, antigenic gluten enter the GIT at high level and with the dysbiosis and weakening of the microbiome from glyphosate, the gut ends up reacting heavily to wheat gluten, furthering leaky gut.

Glyphosate Test Report: Findings in American Mother's Breast milk, urine and water*

- Moms Across America initiative!
- Breast milk levels ranging from 76 ug/l to 166 ug/l are 760 to 1600 times higher than the European Drinking Water Directive allows
- Urine testing shows glyphosate levels over 10 times higher than in Europe
- Monsanto is wrong regarding bioaccumulation

Study of glyphosate and AMPA (breakdown product) residues in soy crops*



“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).

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"



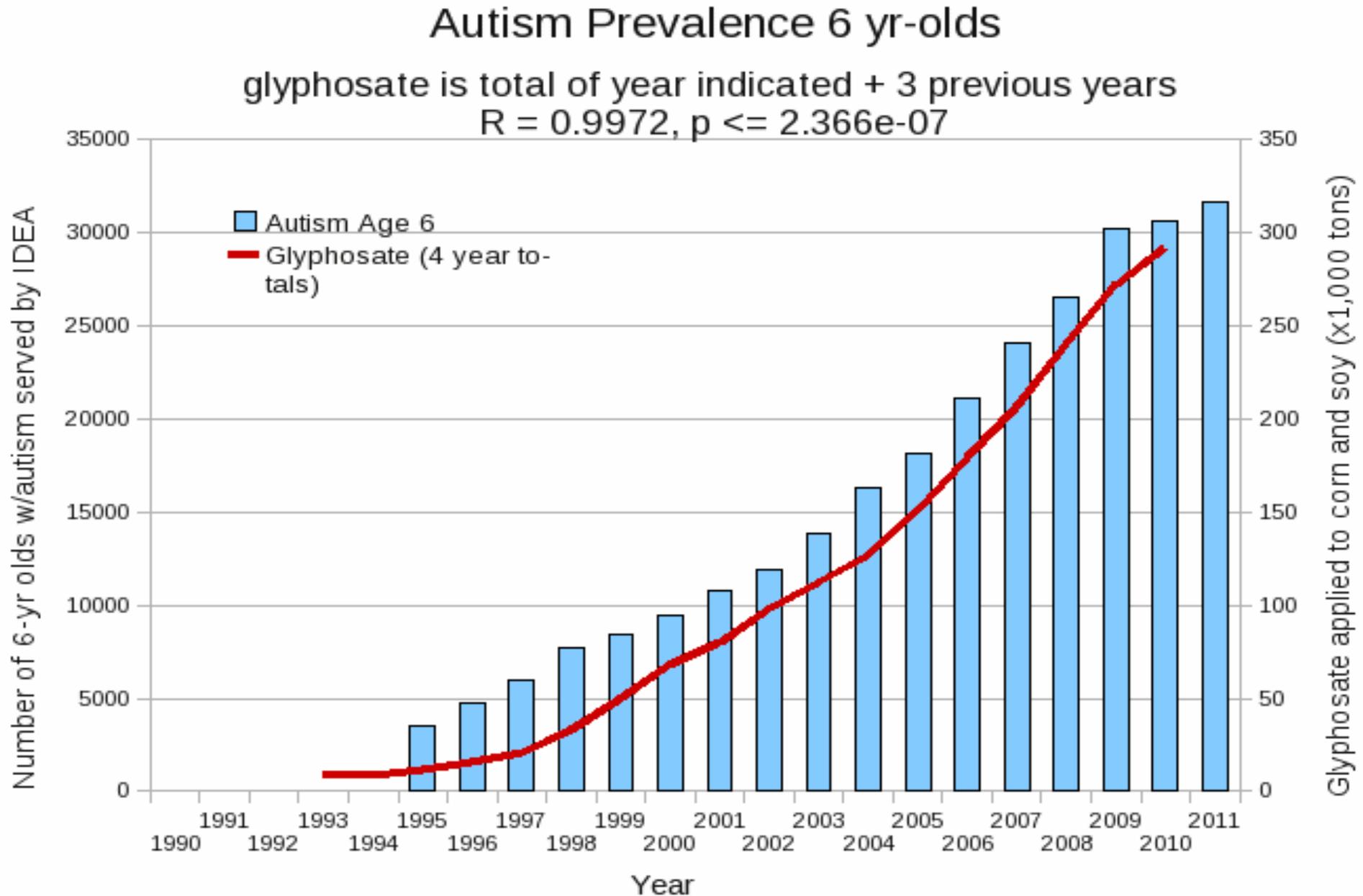
*CJ Westmark, PLOSOne March 12, 2014, DOI: [10.1371/journal.pone.0080488](https://doi.org/10.1371/journal.pone.0080488).

Diseases strongly linked to Glyphosate

According to Dr. S. Seneff, research scientist at MIT, glyphosate is possibly "the most important factor in the development of multiple chronic diseases and conditions that have become prevalent in Westernized societies," including but not limited to:

| | | |
|---------------------|---|---------------------|
| Autism | Gastrointestinal diseases such as inflammatory bowel disease, chronic diarrhea, colitis and Crohn's disease | Obesity |
| Allergies | Cardiovascular disease | Depression |
| Cancer | Infertility | Alzheimer's disease |
| Parkinson's disease | Multiple sclerosis | ALS |

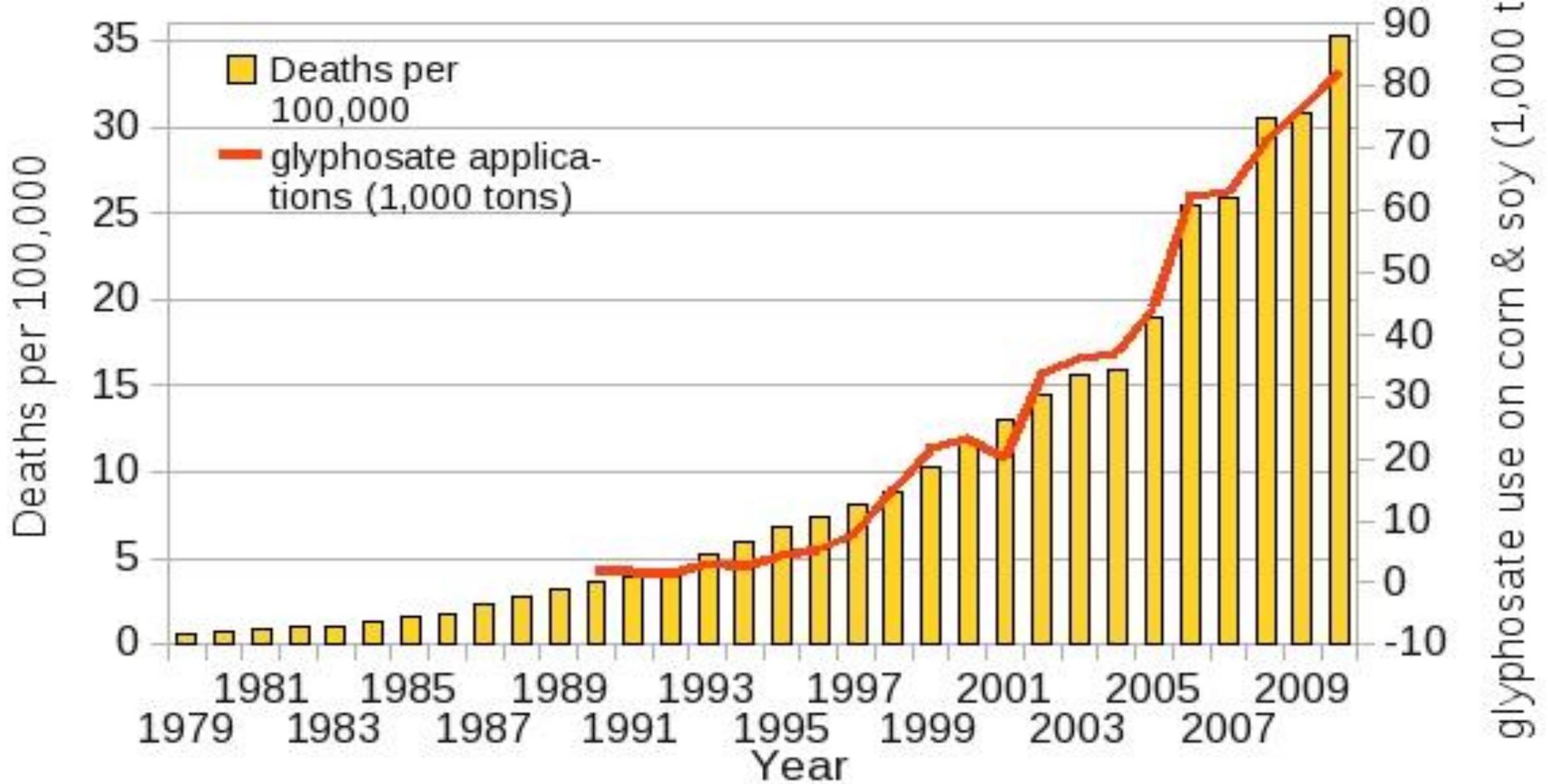
*Plot provided by Nancy Swanson, with permission



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

Dementia and Autism Have Much in Common

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



Plot kindly provided by Nancy Swanson

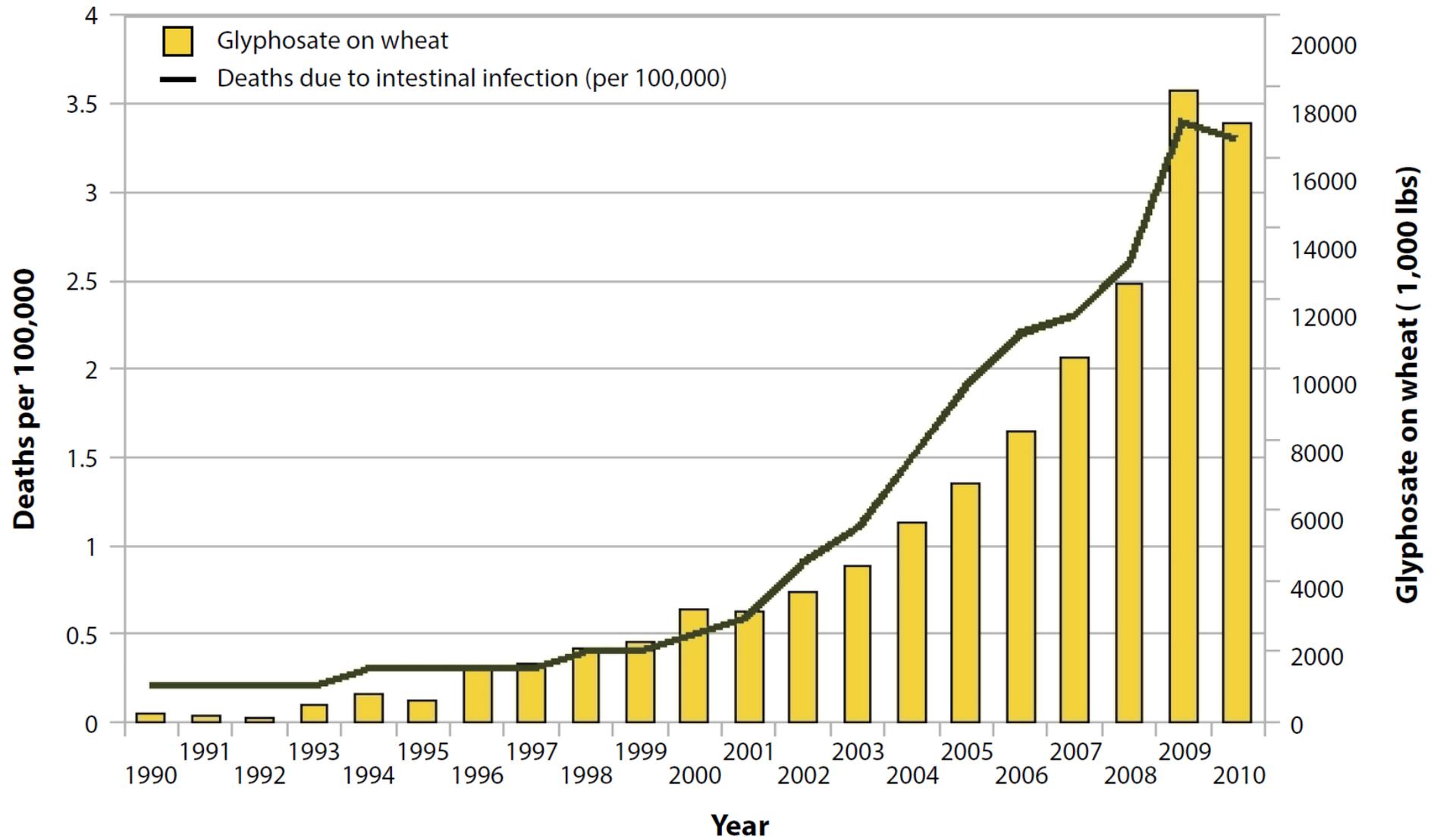


Figure 2. Deaths due to intestinal infections ICD A04, A09; 008, 009 with glyphosate applications to wheat ($R=0.9834$, $p\leq 3.975e-09$). Sources: USDA:NASS; CDC. (Figure courtesy of Nancy Swanson).

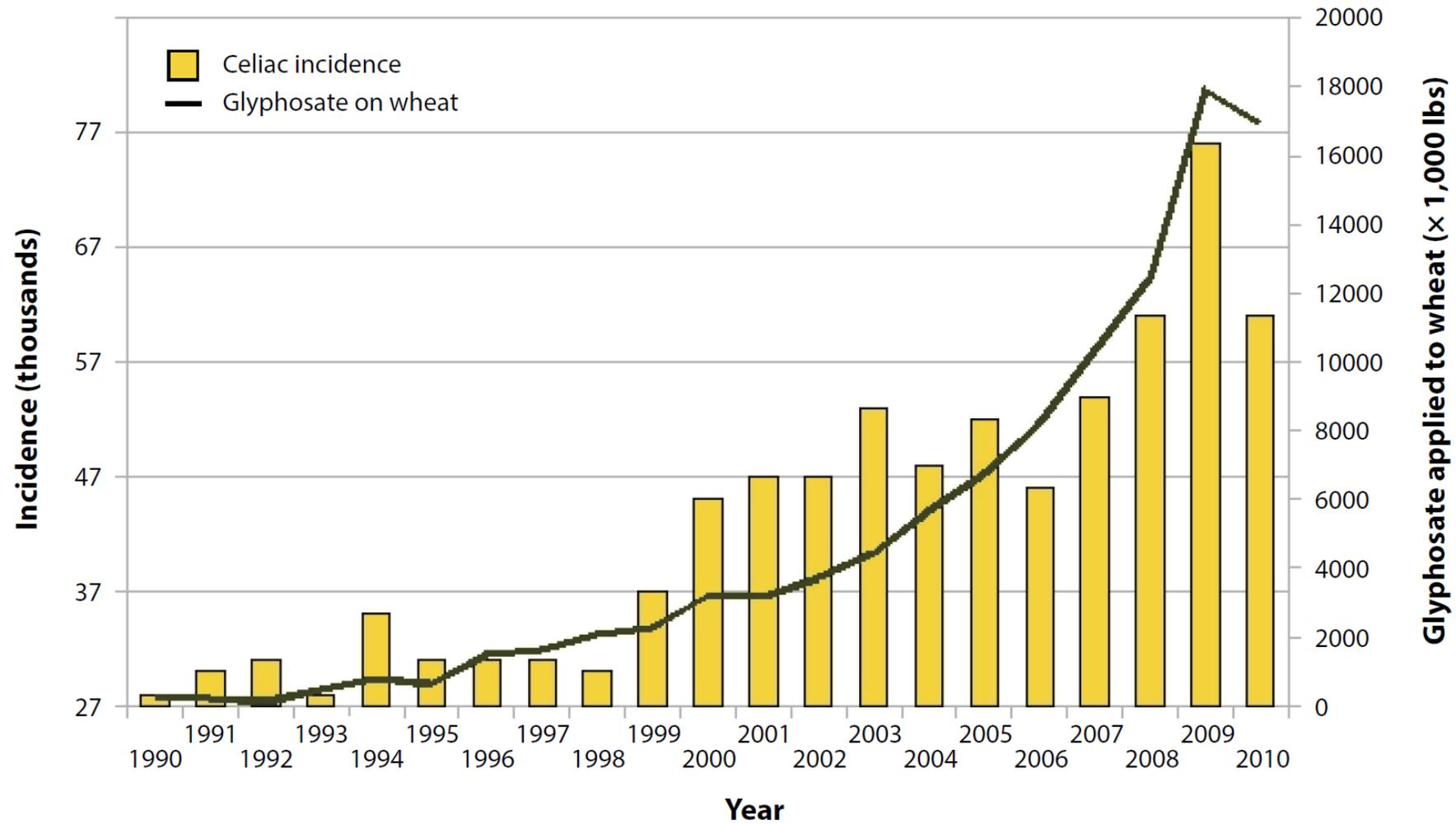


Figure 1. Hospital discharge diagnosis (any) of celiac disease ICD-9 579 and glyphosate applications to wheat ($R=0.9759$, $p \leq 1.862e-06$). Sources: USDA:NASS; CDC. (Figure courtesy of Nancy Swanson).

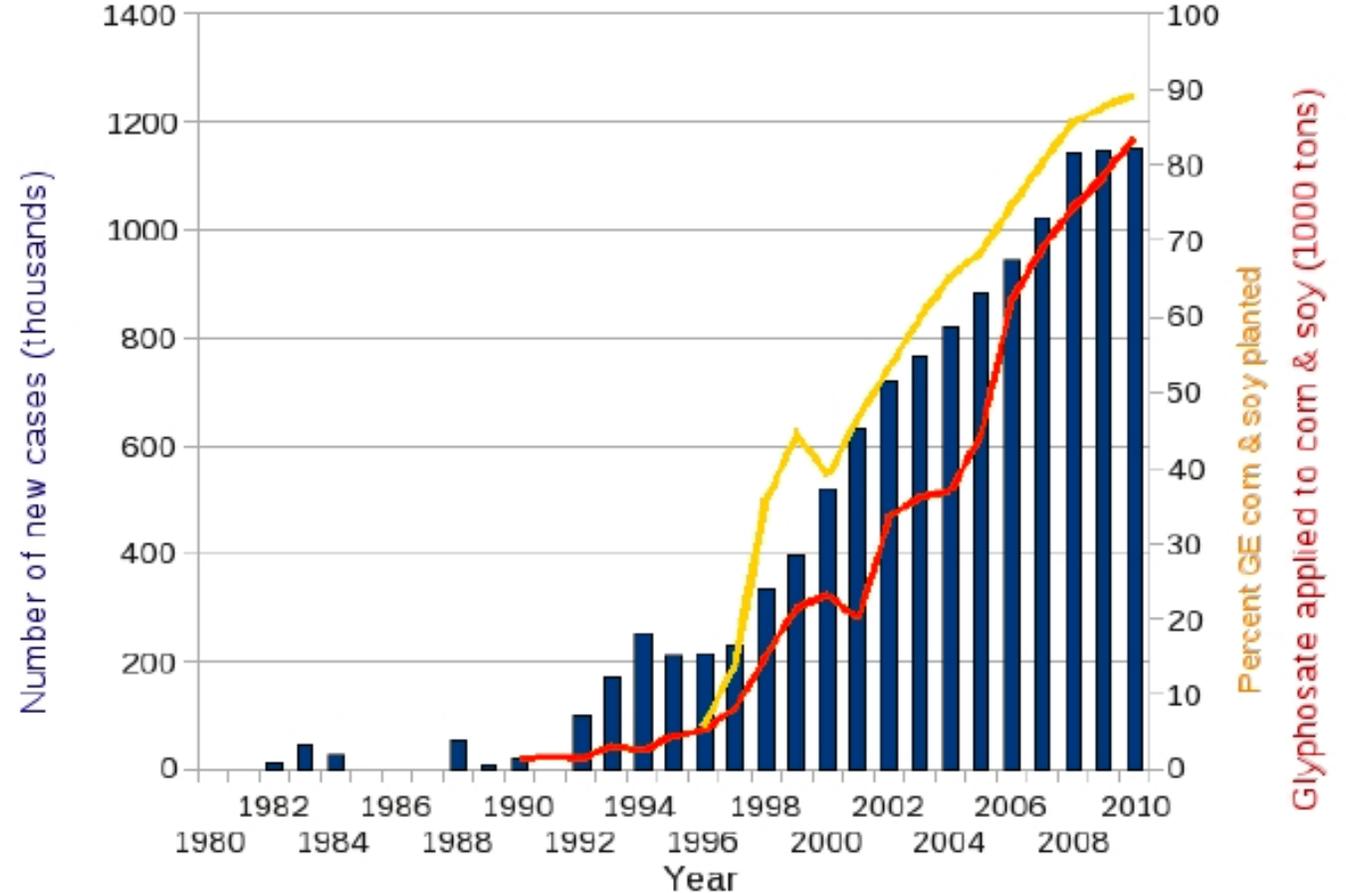
US data for % GE corn and soy crops planted and glyphosate applied plotted against the number of new cases of diabetes (adjusted) diagnosed annually.

Crop and glyphosate data from the United States Department of Agriculture; diabetes data from U.S. Centers for Disease Control (CDC).

Number of New Cases of Diabetes Diagnosed Annually (incidence)

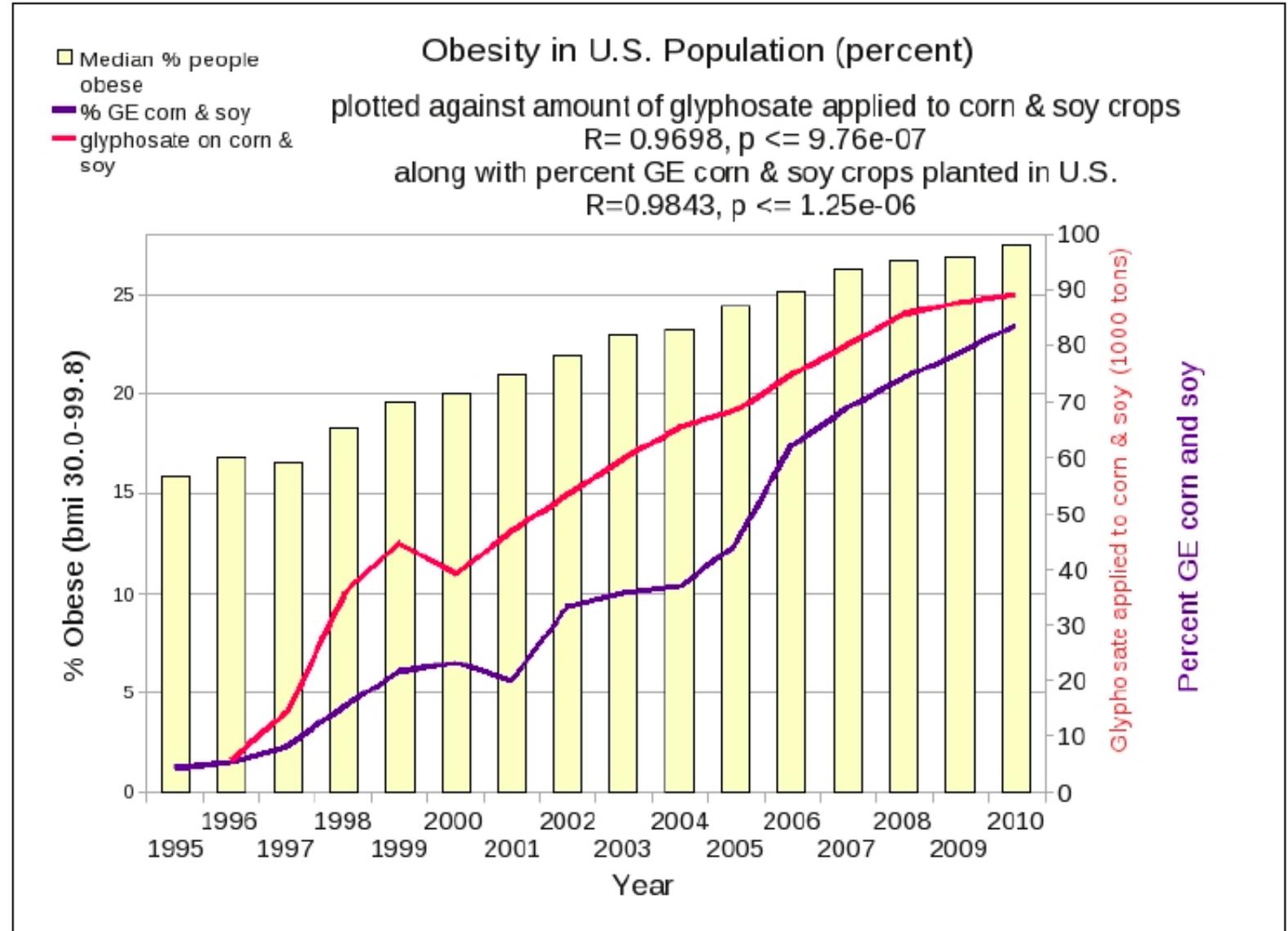
- Number of new cases (adjusted)
- Glyphosate applied to Corn & Soy
- % GE soy & corn crops

plotted against percent of GE corn & soy crops planted along with glyphosate applied on corn & soy in U.S.
 Pearson's coefficients for glyphosate & incidence $R=0.9643$, for %GE crops and incidence $R=0.9759$



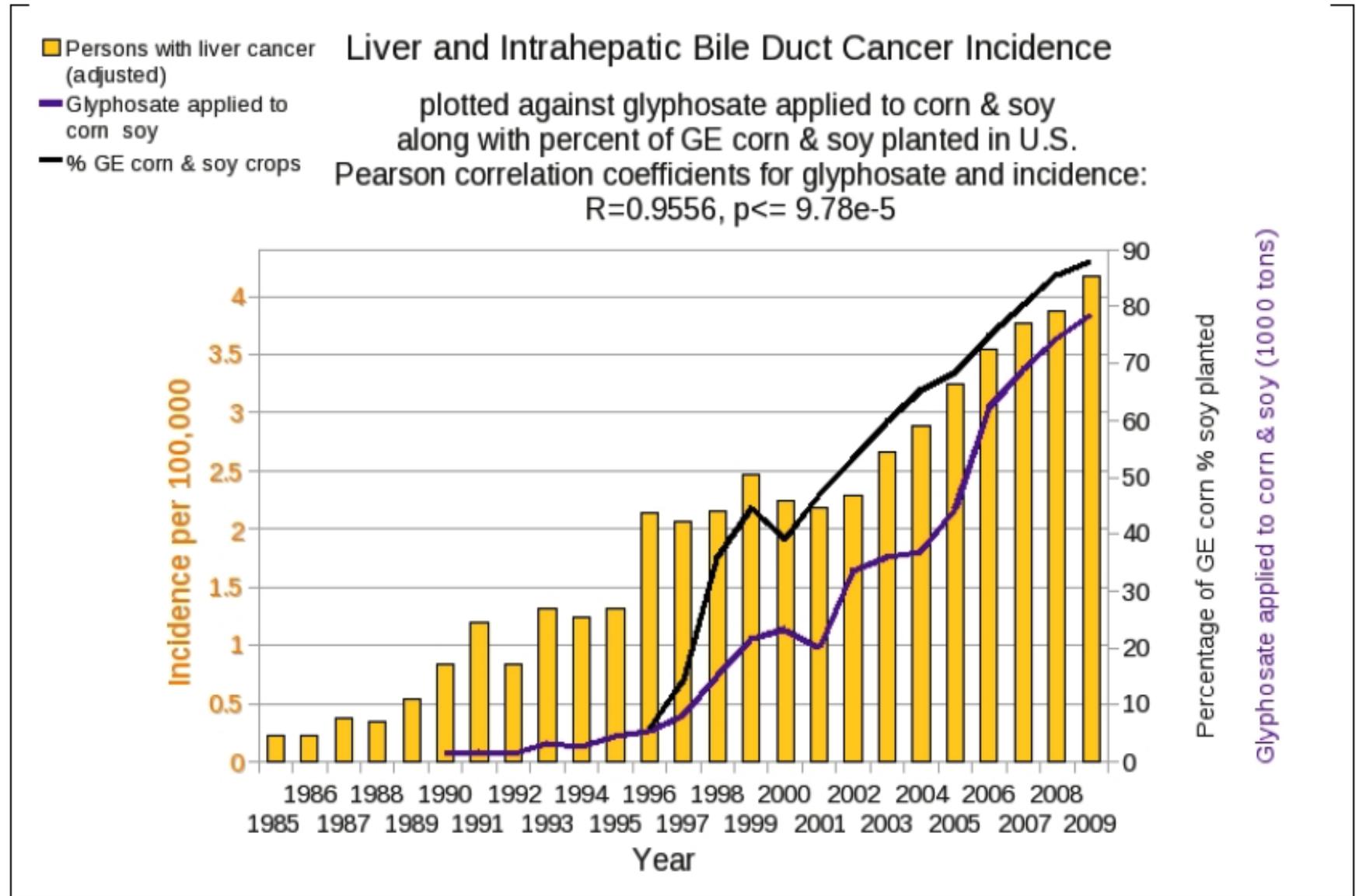
US data for % GE corn and soy crops planted and glyphosate applied to corn & soy plotted against % of U.S. population who are obese (BMI 30.0-99.8).

Crop and glyphosate data from the USDA; obesity data from U.S. CDC. By kind permission of Dr Nancy Swanson.



Persons with liver and bile duct cancer plotted against glyphosate applied to corn and soy and % GE corn & soy planted in the US.

By kind permission of Dr Nancy Swanson. Data from USDA and US CDC



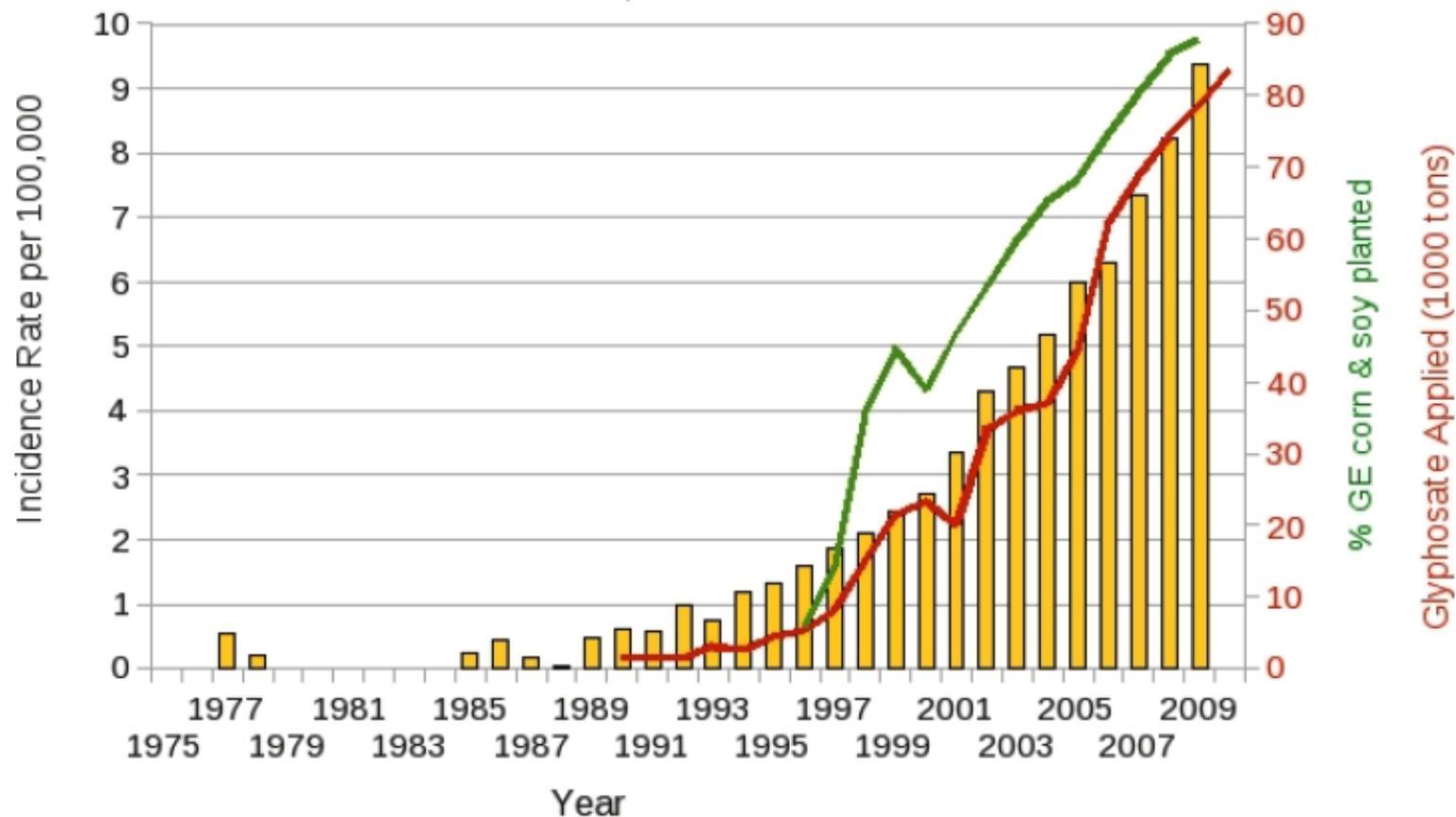
Incidence of thyroid cancer (adjusted) related to glyphosate applied to corn & soy crops and % GE soy & corn crops in the US.

Data from USDA and CDC. Graph reproduced by kind permission of Dr Nancy Swanson.

- M&F Incidence (adjusted)
- Glyphosate applied to Corn & Soy
- % GE soy & corn crops

Thyroid Cancer Incidence Rate

plotted against amount of glyphosate applied to U.S. corn & soy crops along with the percentage of genetically engineered corn & soy crops
 Pearson correlation coefficients for glyphosate & both male and female incidence
 $R = 0.9876, p \leq 7.851e-09$



OVERVIEW

- Glyphosate effects the shikimate pathway, which doesn't exist in human cells, but DOES exist in our mutualistic and commensal bacteria.
- Glyphosate seems to preferentially kill off “good” bacteria and help select for pathogens such as *clostridia* and *pseudomonas*. Thus glyphosate causes a significant, long term dysbiosis that is correlated to increased gut infections, Alzheimer's, cancers, diabetes, etc.
- The microbiome takes the brunt of glyphosate exposure and the dysbiosis drives metabolic disturbances and ultimately, leads to intestinal permeability. Many of the glyphosate associated conditions have an etiology in intestinal hyperpermeability.
- There is no known glyphosate detox pathway in the human body, the largest disturbance is to the microbiome.
- The strategy for helping patients deal with glyphosate exposure should be to minimize exposure by switching to organic foods and not using weed killers in our yards.
- In addition, **CAN WE** treat the dysbiotic microbiome and leaky gut by using specialized probiotics that can rebalance dysbiosis via competitive exclusion and resolve the resulting leaky gut. Bacillus endospores have been shown to perform these functions.
- We cannot remove glyphosate from the body or from our microbiome, but **CAN WE** use spore based probiotic formulations to rebalance the dysbiosis and reduce or heal the permeability.



**COULD
PROBIOTICS
HELP?**

BACILLUS ENDOSPORES CAN REVERSE AND LIKELY PREVENT GLYPHOSATE DAMAGE TO THE MICROBIOME

STEP 1: COMPETITIVE EXCLUSION OF PATHOGENS – Glyphosate acts as a chronic selection advantage for pathogenic bacteria in the microbiome. Spore probiotics have been shown to eliminate these pathogens in the microbiome.

Use of *Bacillus subtilis* PXN21 spores for suppression of *Clostridium difficile* infection symptoms in a murine model.

[Colenutt C¹, Cutting SM.](#)
[FEMS Microbiol Lett.](#) 2014 Sep;358(2):154-61. doi: 10.1111/1574-6968.12468. Epub 2014 May 29.

B. Subtilis
inhibits *C.diff*
growth

B. Subtilis inhibits
infectious *E.coli*

Bacillus subtilis spores competitively exclude *Escherichia coli* O78:K80 in poultry

[Roberto M. La Ragione^a, Gabriella Casula^b, Simon M. Cutting^b, Martin J. Woodward^a](#)
[Veterinary Microbiology.](#) [Volume 79, Issue 2](#), 20 March 2001, Pages 133–142

[Hepatogastroenterology.](#) 2007 Oct-Nov;54(79):2032-6.

The effect of probiotics on *Helicobacter pylori* eradication.

[Park SK¹, Park DI, Choi JS, Kang MS, Park JH, Kim HJ, Cho YK, Sohn CI, Jeon WK, Kim BI.](#)

B. subtilis and *Strep faecium* inhibit *H.Pylori*

B. Subtilis inhibits
Clostridium and
Salmonella

Competitive exclusion by *Bacillus subtilis* spores of *Salmonella enterica* serotype Enteritidis and *Clostridium perfringens* in young chickens

[Roberto M. La Ragione, Martin J. Woodward](#)
[Veterinary Microbiology Volume 94, Issue 3](#), 17 July 2003, Pages 245–256



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A synbiotic concept containing spore-forming *Bacillus* strains and a prebiotic fiber blend consistently enhanced metabolic activity by modulation of the gut microbiome *in vitro*



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Massimo Marzorati^{a,c,*}

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ARTICLE INFO

Keywords:

Faecalibacterium prausnitzii

Endotoxemia

Fructooligosaccharides

Galactooligosaccharides

Xylooligosaccharides

Obesity

ABSTRACT

A standardized *in vitro* simulation of the human gastrointestinal tract (M-SHIME[®]) was used to assess the effect of repeated daily administration of a synbiotic formulation, containing five spore-forming *Bacillus* strains and a prebiotic fiber blend, on the microbial activity and composition of three simulated human subjects. Firstly, while confirming recent findings, deeper phylogenetic insight was obtained in the resident M-SHIME[®] microbiota, demonstrating that the model maintains a diverse and representative, colon region-specific luminal and mucosal microbial community. Supplementation of the synbiotic concept increased microbial diversity in the distal colon areas, whereas specific enhancement of *Bacillaceae* levels was observed in the ascending colon, suggesting a

Evaluation of the effects of MegaSporeBiotic upon disturbing the microbiota of a healthy 3-year-old via glyphosate and Roundup on using the SHIME® technology

REPORT – December 2018

KINGS COLLEGE LONDON



Massimo Marzorati, PhD
Pieter Van den Abbeele, PhD
Cindy Duysburgh
Pauline Caboor
Eline Declerck
Sara Van Boxelaer



EXPERIMENTAL SET UP

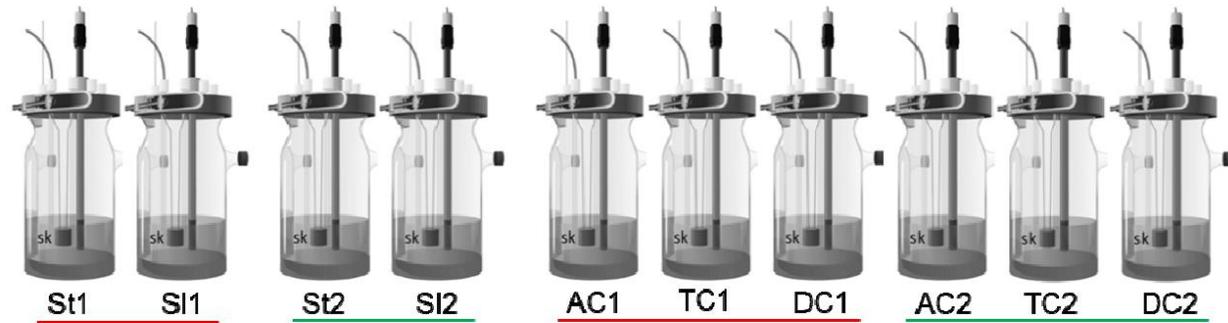


Figure 4: Configuration of the TWINSHIME. ST= stomach, SI= small intestine, AC= ascending colon, TC= transverse colon, DC= descending colon.

- Healthy 3-year old's microbiome
- No antibiotics
- Vaginal Birth
- Breast Fed for a min of 8 months
- No medication of any sort
- Healthy organic diet

Table 1: Overview of the different stages applied in this study. STAB = stabilization; CTRL = control; TR = treatment; COTR = co-treatment

| Week 1 | Week 2 | Week 3 | Week 4 | Week 5 | Week 6 | Week 7 | Week 8 | Week 9 | Week 10 |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|
| STAB | STAB | CTRL | CTRL | TR | TR | TR | COTR | COTR | COTR |

Exposure level of **1.6 mg/kg/day glyphosate**, which is in the range of the US ADI (i.e. 1.75 mg/kg body weight/day).

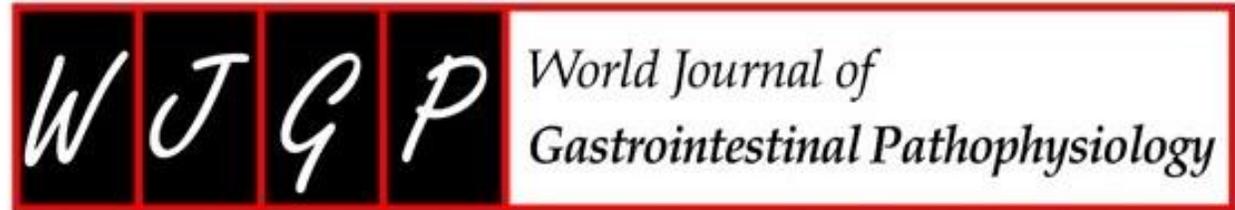
Glyphosate SHIME Study Results

- RoundUp:
 - had a more profound effect on the gut microbiome than pure glyphosate
 - Significantly decreased SCFA production (propionate, butyrate, valerate, caproate)
 - increased ammonia production
 - Increased the pH of the digestive tract
 - reduced microbial diversity and showed significant drop in keystone strains (*F. prausnitzii*, *Bifidobacterium*, *Akkermansia*)
- Spore probiotic treatment:
 - Addition of spores restored SCFA production by the end of week 2
 - By the end of week 2, the addition of spores reduces ammonia levels
 - We started to see the recovery of keystone strains



BACILLUS ENDOSPORES CAN REVERSE AND LIKELY PREVENT GLYPHOSATE DAMAGE TO THE MICROBIOME

STEP 2: HEALING THE LEAKY GUT – The dysbiosis caused by glyphosate leads to intestinal hyperpermeability, which in turn leads to chronic inflammation, immune dysfunction and cellular degeneration. A proprietary bacillus, multi-spore formulation has been clinically shown to significantly reduce leaky gut and the associated systemic inflammation, in as little as 30 days.



Submit a Manuscript: <http://www.f6publishing.com>

World J Gastrointest Pathophysiol 2017 August 15; 8(3): 117-126

DOI: 10.4291/wjgp.v8.i3.117

ISSN 2150-5330 (online)

ORIGINAL ARTICLE

Prospective Study

Oral spore-based probiotic supplementation was associated with reduced incidence of post-prandial dietary endotoxin, triglycerides, and disease risk biomarkers

Brian K McFarlin, Andrea L Henning, Erin M Bowman, Melody M Gary, Kimberly M Carbajal

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Brian K McFarlin, Andrea L Henning, Kimberly M Carbajal, Department of Biological Sciences, University of North Texas, Denton, TX 76203, United States

Author contributions: McFarlin BK designed the study, collected data, interpreted findings, and prepared manuscript; Henning AL, Bowman EM, Gary MM and Carbajal KM collected data, interpreted findings, and prepared manuscript.

Institutional review board statement: The study was reviewed

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Manuscript source: Invited manuscript

Correspondence to: Brian K McFarlin, PhD, FACS, FTOS, Associate Professor, Applied Physiology Laboratory, University of North Texas, 1921 West Chestnut Street, PEB Room 209, Denton, TX 76203, United States. brian.mcfarlin@unt.edu

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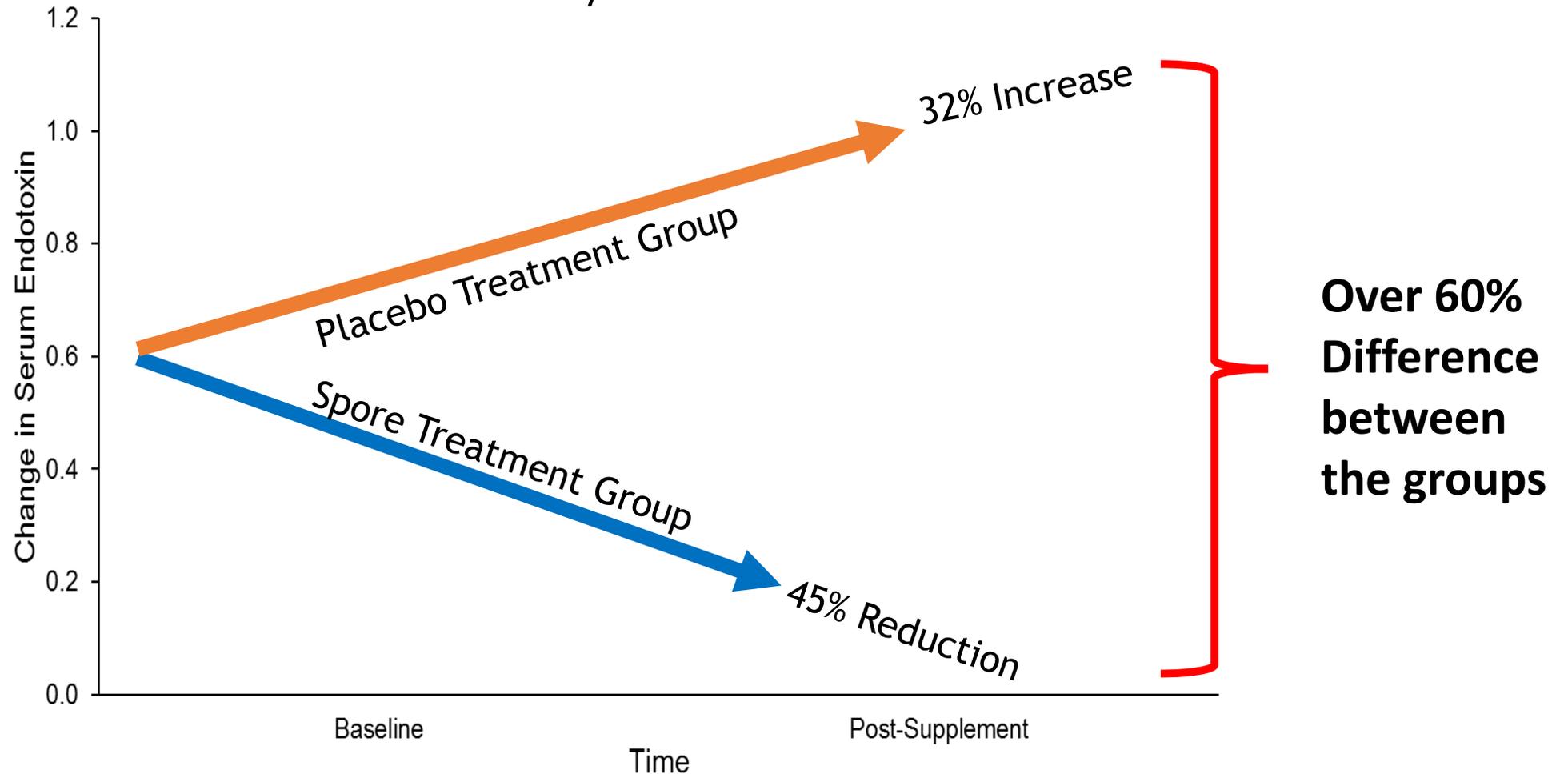
Received: January 26, 2017

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First decision: April 17, 2017

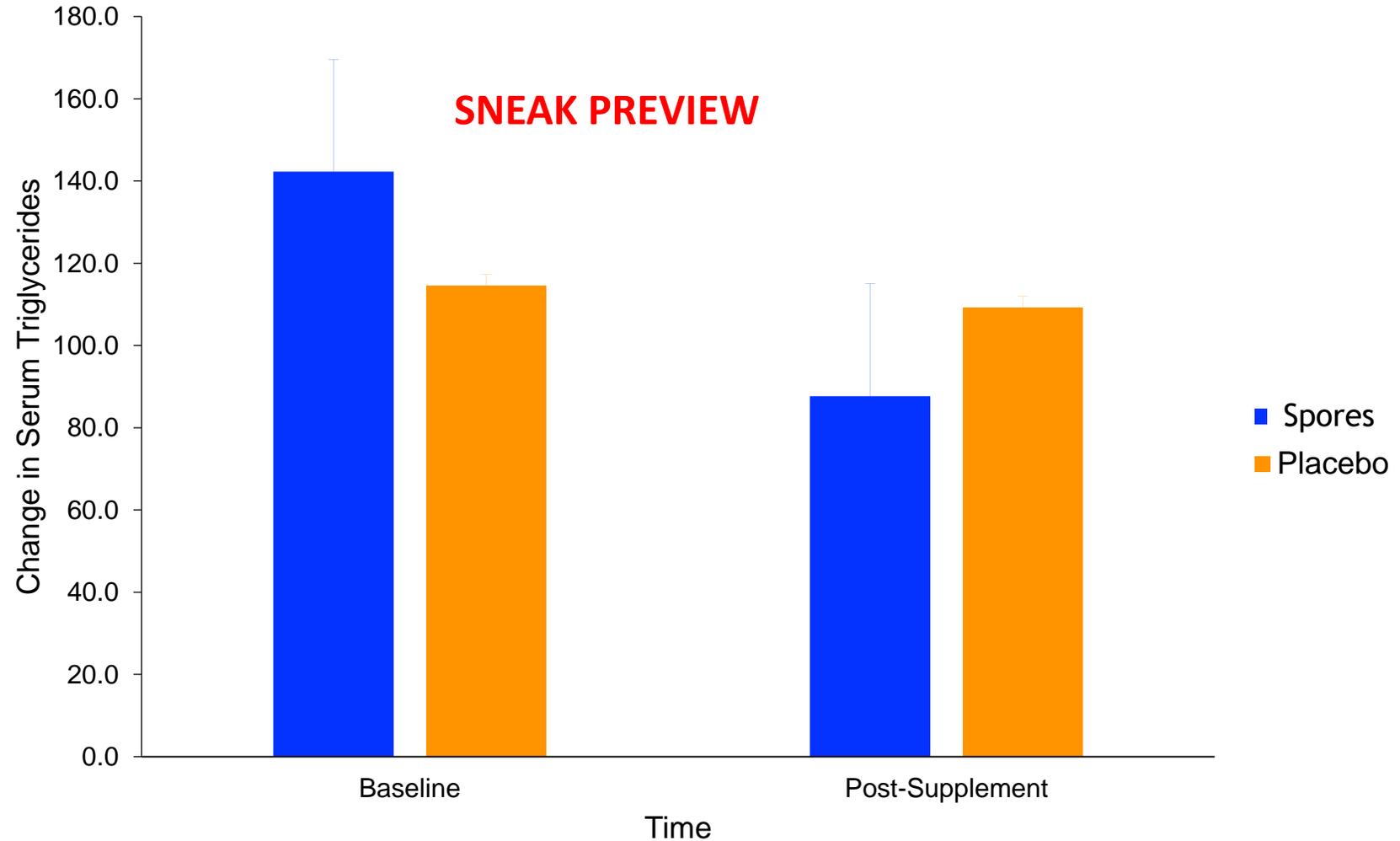
The effect of 30-days of probiotic supplementation on post-prandial responses to a high-fat meal: An Expanded Pilot Study

Principal Investigator: Brian K. McFarlin, PhD, FACSM, FTOS
University of North Texas



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Variables Significantly Effected by Probiotic

Variables Not Significantly Effected by Probiotic

| Variable | 30-d Supplementation | | | | | |
|---------------|-----------------------|--------------|--------------|--------------|--------|--------------|
| | Spore-based Probiotic | | | Placebo | | |
| | Pre | 3-h | 5-h | Pre | 3-h | 5-h |
| Endotoxin | Green | Black | Yellow | Light Green | Black | Red |
| Triglycerides | Green | Yellow | Light Yellow | Green | Orange | Light Yellow |
| Ghrelin | Light Green | Light Green | Orange | Light Green | Orange | Red |
| MCP-1 | Light Green | Light Green | Green | Yellow | Red | Orange |
| IL-12p70 | Green | Green | Green | Orange | Red | Yellow |
| IL-1beta | Light Green | Light Green | Green | Yellow | Orange | Red |
| IL-6 | Light Green | Green | Light Green | Orange | Yellow | Red |
| IL-8 | Light Green | Green | Light Yellow | Orange | Orange | Red |
| Glucose | Light Green | Yellow | Yellow | Light Green | Orange | Yellow |
| Insulin | Light Green | Red | Orange | Green | Orange | Light Green |
| Leptin | Yellow | Yellow | Red | Yellow | Yellow | Orange |
| GM-CSF | Yellow | Yellow | Orange | Light Green | Red | Light Green |
| IL-4 | Light Yellow | Light Green | Green | Orange | Orange | Light Green |
| IL-5 | Green | Light Green | Light Green | Orange | Orange | Yellow |
| IL-7 | Light Green | Yellow | Yellow | Orange | Yellow | Red |
| IL-10 | Green | Light Green | Light Green | Light Green | Yellow | Orange |
| IL-13 | Light Green | Light Yellow | Green | Light Yellow | Orange | Red |
| TNF-alpha | Orange | Green | Light Green | Light Green | Yellow | Yellow |

CONCLUSION

- RoundUp has a clear and significant effect on the microbiome and the effects have health implications for kids and adults
- ADI exposure levels can create significant metabolic and microbial changes in a pediatric microbiome in just 3 weeks
- Strategy for helping patients deal with glyphosate exposure should be to minimize exposure by switching to organic foods and not using weed killers in our yards.
- In addition, **WE CAN** treat the dysbiotic microbiome and resulting leaky gut by using specialized spore-based probiotics that can rebalance dysbiosis via competitive exclusion and resolve the resulting leaky gut. Bacillus endospores have been shown to perform these functions.
- We cannot remove glyphosate from the body or from our microbiome, but **WE CAN** protect against the damaging effects by using spore-based probiotics even with continued exposure to RoundUP.