Food Plague Primer: Glyphosate and Genetically Engineered Crops

This brief booklet is a preview to *Food Plague: Could our daily bread be our most deadly exposure.*

"Modern agriculture" produces more calories per capita today than ever in history and those calories have translated into the epidemic of cardiovascular disease, obesity and diabetes seen worldwide. Chronic disease (cardiovascular disease, obesity and diabetes) have now surpassed infective disease as the leading cause of death in developing countries. These calories are empty calories. Analysis of USDA nutrient testing of foods comparing 1941 data to 1991 show anywhere from a 15 to 76 percent decline in food nutrient value. British Ministry of Agriculture studies show the similar nutrient decline. http://www.worldwatch.org/node/5339 http://www.chooseorganics.com/organicarticles/fruit_nutrition.htm

Paralleling this food nutrient decline has been the increase in crop loss due to pests and disease mirrored by the increase use of chemical weapons on the farm and in the greenhouse. As soils became more and more depleted, weeds became more problematic for farmers. Herbicide applications have largely replaced cultivation leading to continuously increased rates of herbicide applications leading to herbicide resistant weeds. The same holds true for insecticides, fungicides, and all the other ‘cides.

This brings us to the advent of genetically engineered crops and the world wide drive to use glyphosate based herbicides. Most genetically engineered crops are engineered for surviving the application of glyphosate termed GR, glyphosate resistant or RR, RoundUp resistant. More on genetically engineered crops later.

Glyphosate was originally patented by Stauffer Chemical December 8, 1964,

number 3,160,632 as a descaling agent, a very strong metal chelator. Descaling agents are chemicals used to clean out the calcium and other mineral deposits that build up in pipes and boilers of home and commercial hot water systems. These descaling agents are chelators, meaning their molecular structure is such that they grab onto metal ions of calcium, iron, manganese, magnesium, etc. and dissolve them away. Chelating agents are used in many applications in addition to descaling agents as they are very effective metal binders and allow the metals to be water soluble and easily transportable in a liquid solution. Some chelating agents such as EDTA are used to remove toxic heavy metals such as lead, cadmium and arsenic while others such as organic acids and amino acids are used to improve trace nutrient transport into the plant.

It was serendipitously found that the descaling agent, N-(phosphonomethyl) glycine (glyphosate) also appeared to kill

weeds. Subsequently, Monsanto acquired glyphosate from Stauffer and then received a patent 3,455,675 July 15, 1969 for its use as a herbicide. It was found that glyphosate blocks the EPSPS (5-enolpyruvylshikimate-3-phosphate synthase) enzyme in plant metabolism and it was "accepted" that this was the mechanism of action for plant kill.

Conveniently not mentioned is the mechanism by which glyphosate disrupts the EPSPS enzyme found in plants and many microorganisms. Enzymes are functional proteins that act as catalysts in biological factories such as in the manufacture of fats, proteins and carbohydrates. Think of them as the "carpenters" that assemble the fat, protein or carbohydrate "house".

All enzymes have an "ignition key" that activates them. These keys are most commonly either vitamins or trace minerals. If the key is deactivated or removed, the enzyme cannot function any more than can your car start without the key in the ignition.

The mechanism by which glyphosate disrupts the EPSPS enzyme in plants and microorganism is by chelating the manganese metal co-factor of this enzyme. In other words it steals the "ignition key" of the enzyme. The significance of this is the fact that glyphosate, the chelator, targets nutritive cations (manganese, zinc, copper, iron, calcium, magnesium, cobalt…) in plants, microorganisms, animals and humans. Glyphosate is first and foremost a chelating agent, a broad spectrum chelating agent.

Details are very important. Glyphosate's herbicidal characteristics do NOT come from its direct "kill" of plants. Plants grown in sterile soil sprayed with glyphosate/RoundUp do not die. Fundamentally **the herbicidal effect of glyphosate is ultimately due to soil pathogens** gaining access to the "weed" thanks to glyphosate's weakening of the plant and killing of beneficial microbes by

the chelation of manganese and other trace elements.

Let me repeat, the actual "kill" mechanism of the "herbicide" glyphosate, the active ingredient in RoundUp, comes from soil borne pathogens promoted by glyphosate after killing the beneficial microbial competitors and weakening the plant's immune system. Glyphosate kills (via chelating vital trace elements) important beneficial soil microbes. This is a very "uncomfortable" fact for industry and academics beholding to the industry because the fact that glyphosate kills beneficial microorganisms and promotes pathogens leads to greater disease pressure and the consequent economic loss for farmers.

Industry spokesmen and beholding academics routinely deny that glyphosate works in this fashion; however, U.S. patent 7,771,736 issued August 10, 2010 was for glyphosate as an **antimicrobial**. One group of beneficial microbes named in the patent

directly killed by glyphosate is the pseudomonas microbes. Pseudomonas soil bacteria are important phosphate mobilizers and suppressors of fusarium pathogenic fungi. Pseudomonas and most beneficial soil microbes additionally have an important function in making soil minerals available for plant use. Minerals are found in different states of oxidation/reduction meaning varying states of electrical valence and electron exchange.

Plants and animals require most minerals in the reduced valence form to be nutritive. For example, in order for iron in our hemoglobin to carry oxygen, it must be in the Fe+2 form. That is the reduced form. If it gets oxidized to the Fe+3 form (meaning it is "rusted"), it does not carry oxygen and is called "met-hemoglobin." Beneficial microbes such as pseudomonas convert nutrient minerals, such as iron, to this lower or reduced oxidative state while pathogens such a fusarium convert these same nutritive minerals to the more oxidized state

rendering these minerals unusable by plants and animals. This oxidizing process is part of the pathogens mechanism of attack on the plant or animal to gain the upper hand and kill the prey. Research by Kremer at USDA-ARS verifies this process.

Summarizing, there is a two pronged mechanism occurring with glyphosate, trace mineral chelation and pathogen proliferation. These mechanisms have extended consequence. Not only are nutritive minerals directly chelated out of the system, but the proliferation of pathogens effectively converts additional nutritive mineral to unusable form leading to further nutrient deficiencies in growing crops. This process is occurring throughout the entire food chain as glyphosate residue in food is becoming common. Glyphosate is essentially "rusting away" the fabric of our soils leading to the proliferation of disease pathogens and nutrient deficiencies throughout the food chain.

The widespread weed resistance developing to glyphosate worldwide is actually resistance development to the pathogens proliferated due to the glyphosate. Higher and higher rates of glyphosate have to be used to produce the desired effect, blends with other herbicides are commonplace and in some areas, due to weed resistance, glyphosate has fallen out of favor as a herbicide. *No-Till Farmer*, May 2012 reported, "..at least 21 varieties of glyphosate-resistant weeds have been identified in the U.S." and "Between 2005 and 2010, the resistance problem mushroomed, with some Midwestern states reporting millions of acres of glyphosate-resistant weeds, mostly marestail and waterhemp." Worldwide the concern is greater with 357 biotypes and 197 species of weeds now reported resistant to glyphosate. (http://www.weedscience.org/In.asp) This in spite of glyphosate application rates increasing from 2 liters per hectare to as much as 20 liters per hectare (roughly 8 quarts per acre) in some areas of South

America.
(http://www.reduas.fcm.unc.edu.ar/statement-from-the-1st-national-meeting-of-physicians-in-the-crop-sprayed-towns/)

The French Supreme Court ruled that "biodegradable" had to be removed from the label because manufacturers had failed to show glyphosate to be biodegradable. "Monsanto falsely advertised its herbicide as 'biodegradable' and claimed it 'left the soil clean'" (Anon 2009). Danish soil leaching studies research showed that glyphosate remained in soil lechate for 18 months (Laeger, 2000) and Swiss forest soils research found glyphosate in the forest soils more than three years after the last application of glyphosate (Cox, 1995) It is true that glyphosate will rapidly bind to certain soils giving the appearance of degrading because it is not easily detected. As a chelating agent, it binds to soil particles, effectively giving the appearance of "disappearing." However, when conditions are correct, especially after the

application of phosphorous fertilizers, the glyphosate is again mobilized disrupting soil microbiology and immobilizing vital trace minerals.

Research had repeatedly shown that glyphosate reduces the levels of trace minerals in the crop and subsequently increases its susceptibility to disease. Head scab in wheat in all the Northern states and Canada is directly attributed to the use of glyphosate as the most influential agronomic factor causing this disease as shown by Fernandez et al. 2005, *Crop Sci. 45: 1908-1916*, Fernandez et al., 2007, Crop Sci. 47:1574-1584. Head scab in wheat results in mycotoxins, fungal toxin residues in the grains and subsequently in our foods.The reduction in lignin, amino acids and carbon dioxide utilization are all correlated with the use of glyphosate per Zobiole, 2009.

Glyphosate use is now correlated directly with the increase in crops disease on or around every crop it is used upon or has

been used upon due to it's chelation/immobilization of trace elements and suppression of beneficial soil microbes and resultant promotion of pathogens. This includes canker and greening in citrus, fusarium in all crops and Goss's Wilt in corn per Huber, "Glyphosate Effects on Crops, Soils, Animals, and Consumers**"**, December 2011. For consumers this means increases of toxic mycotoxins (fungal toxins) in their food wherever glyphosate is being used per Huber from the *Proc. Natl. FHB Forum 2009, Orlando, FL.*

The list just goes on and on of adverse effects on our food chain from glyphosate seen around the world. Mycotoxins in the grains are a serious threat to fetuses and children due to their endocrine disrupting characteristics. Milling companies are finding it more and more difficult to find American wheat low enough in mycotoxins to be suitable for commercial foods.

Though seemingly convenient, glyphosate has perpetuated serious environmental and human health consequences only recently made public thanks to the retirement of a few key university and USDA researchers now able to shed light on the truth about glyphosate. In part II, I will discuss the toxicity research on glyphosate and the human suffering it is leaving in its wake.

Cox 1995. http://intranet.catie.ac.cr/intranet/posgrado/Agricultura%20Ecol%C3%B3gica/AE-512/Lit%20reviews/Moraes%20Natashia%20Diseno/articulos/Glyphosate_Fact_Sheets.pdf).

Part II.

It was mentioned in part I of this article that glyphosate disrupts soil microbiology specifically targeting beneficial soil microbes essential for plant protection and nutrient metabolism. Glyphosate has been shown to be significantly toxic. Note the reason Poison Control contends glyphosate to be relatively harmless to humans is because it is still quoting 1983 data provided by Monsanto. Research since paints a much different picture. It is genotoxic, terratogenic and cytotoxic meaning it has been shown to cause cancer, birth defects and aberrant cell function and death. The following table from Huber 2011is a list of adverse effects and the cited authors and the concentrations of glyphosate to get these effects.

Direct Toxicity of Glyphosate

Rate (ppm)	System affected	Reference
0.5	Human cell endocrine disruption	Toxicology 262:184-196, 2009
0.5	Anti-androgenic	Gasner et al, 2009
1.0	Disrupts aramatase enzymes	Gasnier et al, 2009
1-10	Inhibits LDH, AST, ALF enzymes	Malatesta et al, 2005
1-10	Damages liver, mitochondria, nuclei	Malatesta et al, 2005
2.0	Anti-Oestrogenic	Gasnier et al, 2009
5.0	DNA damage	Toxicology 262:184-196, 2009
5.0	Human placental, umbilical, embryo	Chem.Res.Toxicol. J. 22:2009
10	Cytotoxic	Toxicology 262:184-196, 2009
10	Multiple cell damage	Seralini et al, 2009
10	Total cell death	Chem.Res.Toxicol. J. 22:2009
All	Systemic throughout body	Andon et al, 2009
1-10	Suppress mitochondrial respiration	Peixoto et al, 2005
	Parkinson's	El Demerdash et al, 2001
	POEA, AMPA even more toxic	Seralini et al, 2009

EPA Federal Resister Listing: 13ppm for animal feed as of May 2011; sweet corn 3.5ppm and poultry meat at 0.1ppm.

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Birth defects are a devastating occurrence being seen with increasing prevalence in all pesticide sprayed areas. It is getting so bad in some areas of South America where

glyphosate applications have increased 10 fold that in 2010 doctors got together for a conference in Argentina to discuss the epidemic of birth defects among people in crop sprayed areas and met again in 2011. The full paper is available at the following site: http://www.reduas.fcm.unc.edu.ar/wp-content/uploads/downloads/2011/10/INGLES-Report-from-the-1st-National-Meeting-Of-Physicians-In-The-Crop-Sprayed-Towns.pdf

The following citations further indict glyphosate as a very toxic product even at doses of 450-fold dilutions of those used in agricultural sprays. The toxic effects include everything from birth defects to neurological disruption in Parkinson's Disease to endocrine disruption in blocking testosterone levels.

"Glyphosate-based herbicides are toxic and endocrine disruptors in human cell lines." Gasnier C, Dumont C, Benachour N, Clair

E, Chagnon MC, Séralini GE. *Toxicology*, 2009 Jun 17. [Epub ahead of print].

"Glyphosate formulations induce apoptosis and necrosis in human umbilical, embryonic, and placental cells." Benachour N and Seralini, GE. *Chem Res Toxicol*, **22**: 97-105, 2009.

"Time- and dose-dependent effects of roundup on human embryonic and placental cells." Benachour N, Sipahutar H, Moslemi S, Gasnier C, Travert C, Séralini GE. *Arch Environ Contam Toxicol*, **53**: 126-133, 2007.

Paganelli A, Gnazzo V, Acosta H, López SL, Carrasco AE. "Glyphosate-based herbicides produce teratogenic effects on vertebrates by impairing retinoic acid signaling." *Chem Res Toxicol.* (2010) **23**: 1586-1595.

"…we found genotoxic effects after short exposure to concentrations that correspond to a 450-fold dilution of spraying used in

agriculture…" Koller VJ, Fürhacker M, Nersesyan A, Mišík M, Eisenbauer M, Knasmueller S "Cytotoxic and DNA-damaging properties of glyphosate and Roundup in human-derived buccal epithelial cells." *Arch Toxicol*. 2012 Feb 14.

At lower non toxic concentrations of Roundup and glyphosate (1 ppm), the main endocrine disruption is a testosterone decrease by 35%. Leydig cells are exposed to this kind of environmental doses (Acquavella et al., 2004) because 1 ppm was found in human urine and thus was present in blood. When 10 ppm of G are given to rats, half was still found in plasma 15 h later (Anadon et al., 2009).

Émilie Clair a,b, Robin Mesnage a,b, Carine Travert a, Gilles-Éric Séralini a,b, « A glyphosate-based herbicide induces necrosis and apoptosis in mature rat testicular cells in vitro, and testosterone decrease at lower levels." *Toxicology in Vitro* 26 (2012) 269–279.

Glyphosate, has also been reported involved in the pathogenesis of Parkinson's Disease.

Glyphosate's mode of action is to interfere with the synthesis of the amino acids phenylalanine, tyrosine and tryptophan. (Astiz et al., 2009; Peixoto, 2005).

Ya-xing Gui, Xiao-ning Fan, Hong-mei Wang, Gang Wang, Sheng-di Chen. "Glyphosate induced cell death through apoptotic and autophagic mechanisms" Neurotoxicol Teratol (2012), doi:10.1016/j.ntt.2012.03.005

Professor Robert Bell showed that RU impairs the cell's ability to repair aberrant DNA so this faulty DNA perpetuates in the organism affecting development and future cancer. (Le monde selon Monsanto, coédition La Découverte/Arte (2008) p103.)

Texas Tech University has established that the exposure of Roundup to Leydig cells located in the testes plays an important role

in the functioning of the male genital tract and reduces their production of sex hormones by 94%. (testosterone and oxytocin) Lance P. WALSH, "Roundup inhibits steroidogenesis by disrupting steroidogenic acute regulatory (StAR) protein expression." *Environmental Health Perspectives*, vol. 108, 2004, p. 769-776.

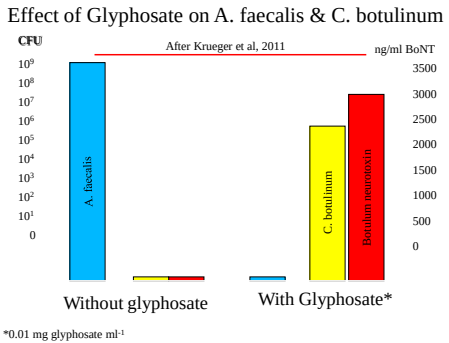
"Roundup is antiandrogenic from 0.5 ppm, below toxic levels and close to human serum levels" (0.1–0.2 ppm in Acquavella et al., 2004).

And if there weren't enough, glyphosate has been implemented in the disruption of dairy processing microbiology in making various fermented foods. How is it getting there, it is coming through the feed, into the animal and into the milk.

Emilie Clair, Laura Linn, Carine Travert , Caroline Amiel, Gilles-Eric Se´ralini Jean-Michel Panoff. "Effects of Roundup and Glyphosate on Three Food Microorganisms:

Geotrichum candidum, Lactococcus lactis subsp. cremoris and Lactobacillus delbrueckii subsp. Bulgaricus." *Curr Microbiol*. DOI 10.1007/s00284-012-0098-3. Springer. Published Online 24 February 2012.

Yet another problem with glyphosate coming through in the feed, especially from grains and DDG's (distillers dried grain), is the disruption of beneficial gut bacteria allowing the proliferation of C. botulinum and the subsequent death of cattle by systemic botulism poisoning. This has become a significant problem in dairy herds in Germany with animals dying of systemic botulism poisoning precipitated by glyphosate residue in the feed.



Chronischer Botulismus des Rindes eine Faktorenkrankheit (Cow illness from chronic botulism) **Welche Rolle spielt das Totalherbizid Glyphosat?** (What role does glyphosate play?) M. Krüger, A. Shehata, J. Neuhaus, T. Müller, M. Kotsch, W. Schrödl Institut für Bakteriologie und Mykologie, 2011

Is this a problem for families in the US? The following study on SIDS babies in the U.S. found that 20% had botulism toxin in

their bodies upon autopsy. Bartram U, Singer D. **Infant botulism and sudden infant death syndrome.** Klin Padiatr. 2004 Jan-Feb;216(1):26-30. Universitäts-Kinderklinik Wuerzburg. http://www.ncbi.nlm.nih.gov/pubmed/14747968

I recently took the opportunity to personally visit the team of veterinarians at Leipzig University doing this ground breaking research on the induction of systemic botulism by glyphosate. This herbicide induced disease has been found both in cattle and in humans at an increasing prevalence. It is an impending Public Health disaster in my opinion. More concerning is the political and academic harassment these vets are receiving for telling the truth, for reporting their findings because a glyphosate induced botulism poisoned dead cow threatens the "cash cow."

I find it interesting how those same people espousing conservative pro-life, anti-abortion political positions, never think twice about spraying chemical weapons all over our food which have been proven to cause miscarriages, spontaneous abortions, birth defects and child cancers.

It would take weeks of continuous reading to get through even the basic journal articles on the adverse effects of glyphosate on soil microbiology and nutrient flow plus the reduction in plant nutrient content caused directly and indirectly by glyphosate and then the consequential increased incidence of plant diseases resulting from glyphosate applications to the soil/crops. Papers by Zobiole et al, Kremer and Means, Rahe and Johal, Schafer et al, Fernandez et al, Dunfield and Germida, Bellaloui et al, Cakmak et al, Comeau, Nafziger, Roemheld et al, Weiss et al., Jolley et al, Phillips, etc., etc. all report the problems at hand from glyphosate in the soil and food chain.

Fortunately, there is Dr. Don Huber, the retired Purdue plant pathologist who has really opened Pandora's box regarding the disaster of glyphosate use in agriculture after forty plus years of research in the field. Purdue University has tried its best to distance itself from Dr. Huber since his retirement because he is telling the truth; truth that he was not allowed to tell until after he retired.

What most people don't know is that Dr. Huber is also a retired Army Colonel who spent half his career at Ft. Detrick, Maryland working in the bio-threats arena for the Department of Defense while maintaining his "civilian" research and teaching duties at Purdue. This is a professional scientist with the highest standards, an impeccable reputation and a man who takes his oath to defend our country serious, serious enough to tell the truth about glyphosate, academic research suppression and the threat it and genetically modified crops pose to the health and safety of all mankind. Part of his job

description at Ft. Detrick was and is to sound the warning whenever a biological threat against the U.S. or its allies was/is discovered. That he has done and is doing yet today.

Any farmer or researcher that calls himself/herself a scientist and abides by the scientific approach must come to the conclusion that despite its seemingly "miracle" personality, glyphosate is toxic, is degrading our soils and food crops leading to novel diseases, resistant weeds, and insect pests and contributing to the decline in human health via birth defects, cancers, neurological diseases, nutrient decline and microbial disruption, all well documented in the scientific literature. In part III I will discuss genetically engineered crops, what the scientific literature presents and what the future holds.

Part III

Some of you are old enough to remember having portable X-ray machines in shoe stores. Every customer could put their feet in the x-ray beam and determine if the shoes fit properly or so was the claim. Some of you of that same age group remember when x-ray radiation was the treatment of choice for chronic tonsillitis. X-ray was such a marvelous technology, perfectly safe and so in vogue. And so it was, right up to the point where scientists discovered such indiscriminate use to be cancer causing, such use was abandoned yet many of you have suffered the consequences of that early life exposure by way of thyroid cancer or other cancers.

Ooops, we made a mistake on that one. The same "mistakes" were made with asbestos, coal dust, nuclear radiation, benzene, lead, mercury, thalidomide, DES, Rezulin, Phen-Phen and most recently several oral contraceptives, osteoporosis drugs and

diabetic drugs. All of these therapies were approved as safe by the then government oversight agencies and since the early 1970's the FDA. I am not contending it is or should be a perfect system. The point being made is that frequently uninformed or financially adulterated people will contend that agricultural chemical weapons and genetically engineered crops MUST be safe because they have been approved for release and sale by our government oversight agencies.

Whenever large sums of money are involved, oversight duties seem to get tainted. The CBS 60 Minutes expose on the revolving door policy between executives in industry and the FDA/USDA was a sad testament to this reality.

The previous sections of this article dealt with glyphosate and its consequences to our food chain, personal health and environment. This section will address the issue of genetic engineering of crops. This

is a very hotly debated topic around the world. One must understand that rarely is there a public debate or discussion or even a small meeting discussion about genetically engineered crops in the scientific arena. What discussions do take place are political, social and philosophical.

This is exactly what the industry wants because such debates are easily influenced by high tech cinema, statements that tug at one's emotional heart and purse strings and religious philosophy.

It amazes me how many anti-GMO groups will cite religious moral grounds for opposing GMO (genetically modified organisms) the same as they oppose discrimination, abortion, gay marriage, etc. There is no science in such postures. This social arena brings the debate down simply to political clout and the outcome is determined by who can spend the most money for the most cinematic chacterization of their political position. This is exactly

what the pro-genetic engineering club wants, a political rather than a scientific debate (because they CANNOT win a scientific debate) and so it has been since the initial introduction of GMO crops.

I really enjoy technology. I like my cell phone convenience, my computer, the ability to get on an airplane and fly around the world, the convenience of atmosphere controlled climate in my home and office, the fact that I can Skype friends in other countries and have a live video conversation with them.

I am thankful for the marvelous medical devices I have at my disposal to evaluating patients, from open MRI now available for less than $400 to full body thermography and breast thermography more sensitive than mammograms, to light therapy devices that quench inflammation and speed the healing of wounds. And that is just in the civilian sector. As a flight doc in the US Air Force reserves I am aware of technologies far

beyond what we have access to in the civilian sector 10 to 20 years in advance.

I have learned the scientific method. My masters degree is a masters of science in public health having done a thesis and having learned to critically review the literature. As a scientist, not just a physician, a flight doc, a vo-ag instructor and crop consultant, I recognize that technology is not necessarily needed, safe or viable just because it is 'technological", the latest thing offered by industry for our supposed improved lifestyle.

I was equally guilty as my colleagues in medicine to prescribe Rezulin when it first came out touted as the best thing since sliced bread in diabetic treatment drugs. It was great right up to the point that patients dropped dead from liver failure. Rezulin was quickly taken off the market never to return, yet it got to the market supposedly after rigorous scientific scrutiny, three phases of clinical trials and a whole lot of

hype from the manufacturer. Fortunately none of my patients were on it long enough to suffer fatal consequences, but it taught me to use more common sense, think about the mechanisms of action, the potential adverse effects, the differences between patients and discard the hype from the manufacturers. The longer I practice medicine, the more I witness that the FDA's/USDA's approval or disapproval of therapies, devices and products are far more politically determined than scientifically determined.

I take the common sense scientific approach in looking at genetically engineered crops or GMO's. Keep in mind that I have and do prescribe insulin, recombinant DNA or GMO manufactured insulin, to my insulin dependent patients. It is much better than the porcine insulin we had before the advent of the GMO insulin; but, rDNA insulin is not without its dangers and adverse patient outcomes. I have a recent patient that is allergic to this GMO insulin. "Essentially the same" does not mean something IS the

same. Identical twins may be essentially the same, but they are not THE same.

It is contended that genetically engineered crops are just an extension of varieties derived from plant breeding techniques used since humans began plant breeding and selection programs. Genetic engineering of crops is not in any way the same as plant breeding.

Genetic engineering is an **INFECTIVE** process where genetic material is vectored into the cell nucleus via an invasive mechanical device or microorganism such as agrobacterium or clavibacter. It is a completely random event. Because the genetic material is not acquired through the natural process involving meiosis and fertilization, there are no control codons associated with the infecting genetic material. There is nothing to regulate this infective genetic material to turn it on or off. Consequently, genetic engineers must attach

an activator to the genetic material to turn on the cells replication of this material.

To do this they attach a virus, most commonly the cauliflower mosaic virus removed from its normal protein coating as it is found in nature. This naked virus is the "ON" switch for the infected genetic material vectored into the plant cell nucleus by the agrobacterium or clavibacter. No "OFF" switch is present. Replication of the infective genetic material is always "ON".

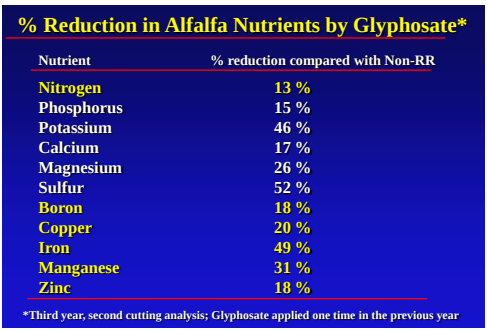
Added to this infective complex is an antibiotic marker gene so that antibiotic can be added to the cell culture to kill any cells that were not successfully infected with this genetic complex. Those cells that remain living after antibiotic administration have the infective gene complex and antibiotic resistance.

This infective genetic complex is like a "wart" on the or in the genetic material of this infected plant. It remains in every cell

subsequently produced in the plant. These cells are then grown out in cell culture to complete plants, cloned and replicated to eventually produce seed and on to commercial replication. Every cell of every plant will have this infective complex including the virus and the antibiotic resistant marker gene.

The mere presence of this "wart-like" "baggage" complex (the trait for herbicide resistance or bt toxin production) in the nucleus of each plant cell requires more energy for the cell to function.

Zobiole et al, 2008, 2009, showed that the mere presence of the (glyphosate resistant) GR gene in the cell of a corn or soybean or beet plant reduces manganese metabolism efficiency by as much as 30 percent. Copper, iron and zinc were also found to be lower in GR/RR isolines. Huber also reported that GR soybeans require as much as 50 percent more water than their non-GMO isolines.



From Huber, December 2011.

Every touted benefit of genetically engineered crops from higher yields, fewer pesticides to salt and drought tolerance, from greater disease resistance to lower cost and greater safety for genetically engineered crops has all been proven false repeatedly with USDA-ARS and Land Grant University research . In fact, quite the opposite has occurred. More pesticides are

being used overall, especially glyphosate causing more serious crop, animal and human health problems. Seed and per acre licensing costs are higher than those spent for non-GMO crops and yields of non-GMO crops compared side by side to GMO crops are better and much more profitable for the farmer. "Report claims no yield advantage for Bt crops**."** *Nature Biotechnology*, 27: 588-589, 2009.

Additionally, plant diseases are on the rise. Diseases thought to be "wimpy" or no longer concerning, such as Goss's Wilt in corn, have now resurfaced with a vengeance. The "why?" for this is quite straight forward. Since genetic engineering is an **infective** process nothing like normal plant breeding, researchers must first select the weakest, most susceptible isoline genetic varieties in order to have any hope of success with the **infective** genetic engineering process. The result is an industry full of susceptible, weak genetic isolines with more disease susceptibility.

In our free-enterprise like society, it is certainly the farmer's right to choose to spend more money for seed and chemical if he so chooses. It is his free right to have lower yields than he could with non-GMO crops all so he can fit in well with his peers, church group and family and not receive social grief about his farming practices. I am on board with that position. However, the issue of growing GMO crops is not that simple. It is not just a matter of having lower yields, lower nutrient value crops, more disease pressure and more costs with GMO crops than with non-GMO crops. In part IV I will address the more pressing issue against GMO crops, adverse human and animal health consequences.

Part IV.

The real issue at hand is the safety or complete lack thereof with genetically engineered crops, GMO's. GMO crops are NOT essentially the same as non-GMO crops by any stretch of the biophysics and immunological imagination. They are no more *essentially the same* than are insects and people immunologically and biophysically or genetically the same for that matter. This is the food plague.

Because genetically engineered crops are **infected** with a virally activated foreign gene complex, it is correctly seen by the immune system of all mammals as foreign protein material, as antigenic. Seen as such it elicits a defensive immune response from the consuming mammal, every time, all the time.

This immune response is seen first in the gut of the mammal by way of inflammation, inflammatory bowel. The degree to which

this occurs is determined by the inherent inflammation already taking place in the mammal upon introduction of the GMO product and by the inherent ability of mammal to elicit an immune response. Inflammation is the universal response to consuming GMO "foods." Every study done, including those by the industry itself show adverse reactions by animals to GMO crops.

What happened to "essentially the same?" Essentially the same would mean there are NO adverse reactions to the crops. Seralini, et.al did a meta-analysis of all the invivo studies (19) published on GMO corn and soybean trials and found that liver and kidney abnormalities were seen in the GMO fed animals with females having livers targeted and males having kidneys targeted. Gilles-Eric Séralini, Robin Mesnage, Emilie Clair, Steeve Gress1, Joël Spiroux de Vendômois, Dominique Cellier. **Genetically modified crops safety assessments: present limits and possible improvements.**

Séralini et al. Environmental Sciences Europe 2011, 23:10 http://www.enveurope.com/content/23/1/10

Ermakova and Surov at the Russian Academy of Sciences studying pregnant rats and hamsters, respectively, found the same problems. More concerning they found that by the third generation, the animals were sterile.

Farmers who are paying attention to their animal production and have either by suggestion or by "accident" have noted that their animals perform better, are calmer, have fewer health problems when fed non-GMO beans and corn than when fed GMO beans and corn. Wild animals, including mice, rats, deer, and ducks if given the choice, will consume non-GMO crops and avoid GMO crops.

Industry sales people contended that the foreign modified proteins would not be a problem even if consumed because they

would not survive the digestive system. Again, science trumps sales hype.

A Canadian study last year showed that 93% of pregnant women had the Cry1(b) protein from genetically engineered Bt crops in their blood and in the blood of 80% of their fetuses did. (This is the Bacillus thuringiensis toxin inducing protein with which genetic engineered crops are infected, including most commercial sweet corn, targeting insects that attack the particular crop. It is an insecticide inducing protein)

More importantly, the quantities of this protein in their blood were greater than could be accounted for by the quantity ingested. This meant that not only did the protein survive digestion just fine, but also the genetic material to produce this protein was horizontally transferred (industry also claimed this could not happen) to the indigenous gut bacteria of the pregnant women and consequently producing this protein on their own, which forever they will

produce. Aris, A., Leblanc, S. "Maternal and fetal exposure to pesticides associated to genetically modified foods in Eastern Townships of Quebec, Canada." *Reprod Toxicol*. 2011 May;31(4):528-33. Epub 2011 Feb 18.

More concerning is an animal feeding study of three different species of mammals with the Cry1(b) protein from GMO crops is about to be published. It shows conclusively that animals fed this protein developed **pathological intestinal liquefaction** and their behavior resembled those of the most **acute autistic characteristics**. Sadly the researcher has been threatened and intimidated for submitting this research for publication.

And if all this were not enough, the most recent scientific study out of France by Seralini et al showed that with just a 10% genetically engineered diet, 50% of male and 70% of female rats developed mammary tumors, live and kidney disease and earlier

death.
http://research.sustainablefoodtrust.org/wp-content/uploads/2012/09/Final-Paper.pdf.

Ladies and gentlemen, genetically modified foods are the Food Plague. This is not a debate about philosophy, political correctness, human economic and technological progress. This is a crisis about toxic food of the worse kind, that this toxic "Frankenfood" will induce permanent internal inflammation, that this infective "Frankenfood" induces permanent antigen production via horizontal gene transfer to our gut bacteria.

GMO crops are toxic in and of themselves aside from the increased use of glyphosate or any other chemical weapons. Science is our guide and science has proven over and over that GMO crops are toxic to mammals. The first, yet unintentional human trial of GMO materials occurred in 1987 with l-

tryptophan. 37 plus deaths and over 1500 cases of EMS were documented. Every affected person consumed only the genetically engineered l-tryptophan.

Like x-ray exposure, GMO foods seem harmless at first exposure, but its deadly consequences become apparent as time passes. Like x-radiation, infertility is one of those consequences for subsequent generations. We can ill afford to continue this massive human experiment. Each and every consumer can act by voting at the grocery store.

Avoid purchasing GMO foods like the plague they truly are. Demand your grocers obtain only labeled food products, purchase only non-GMO grains for your animals. Write to your legislators and demand they enact mandatory labeling laws. Become informed; look up the references listed throughout this article. Note that most of these authors are USDA, USDA-ARS and Land Grant University researchers or

medical researchers publishing in peer reviewed scientific journals. Wright to your local state politicians, Outman and Emmons, and ask them why they are either uninformed or deliberately ignoring the plethora of scientific literature in this matter.

May 19, 2009 the American Academy of Environmental Medicine (AAEM) issued the following statement: *"Avoid GM (genetically modified) foods when possible... Several animal studies indicate serious health risks associated with GM food... There is more than a casual association between GM foods and adverse health effects.* ***There is causation****...The strength of association and consistency between GM foods and disease is confirmed in several animal studies."*

I realize that this four-part article may challenge many readers and lead others to contend, "what are we to do about all the weeds, diseases, insect pests and need to feed an ever expanding world?" A few

years ago Paul Waggoner from the University of Connecticut stated that we can feed 10 Billion people on less land, with less environmental impact than we do presently. [Paul E. Waggoner, How Much Land Can Ten Billion People Spare for Nature? (Ames, Iowa: Council for Agricultural Science and Technology, February 1994).]

We already have the technologies to solve these pesky problems, increase yields and reduce costs per unit of production. Nutrition is the foundation to this solution technology, but of course nutrition doesn't sell a lot of chemical weapons, elicit farming awards from industry/Extension Services nor garner braggadocio coffee shop discussions.

The work of Callahan and Chabboussou, Huber and Kremer and the plethora of University and USDA researchers already confirms the nutrition key to solving these farming problems. Farmers around the world are already implementing these

holistic approaches repeatedly achieving yield above their area standards while reducing or outright eliminating the "need" for chemical weapons. I regularly hear uninformed persons state, "…well if this is true, why aren't all farmers doing it?" The answer is simple and complex at the same time. If diet and exercise are so great for your health why doesn't everyone practice it? If smoking is so bad for your health, why do people still continue to do it?

I find that the real progressive farmers are implementing holistic measures. The real change comes from the consumer. The most important vote is the one cast daily at the grocery store. What we buy determines what farmers will grow. If we demand better nutritional value in our food by our buying habits, the farmer will produce it or go out of business. It is that simple and more and more farmers are doing so.

The mere fact that we have the increasing number of farmer's markets, health food

stores, Whole Foods stores, CSA's and organic and pesticide free, grass-fed opportunities we have today is purely because of consumer demand and voting with their purchasing dollars. Good change comes from the grass roots, from the bottom up.

About the author: Dr. Arden Andersen, D.O., practices general family medicine in Elkhart, Indiana. He has a masters of science in public health and is board certified in public health. He is a flight surgeon in the USAF Reserves and spends about a quarter of his time as a agricultural consultant and teacher. His undergraduate degree is in agricultural education. He has authored numerous articles and books including *The Anatomy of Life and Energy in Agriculture, Science In Agriculture, and Real Medicine, Real Health* as well as several audio and video courses. He truly understands the link between soil health and

human health; between farm management and environmental reclamation and carbon sequestration. He travels the world teaching farmers, instructing consumers, and speaking to healthcare professionals about food quality and the link between soil health and human health.