Public Hearing Testimony for Bill # 6519 – An Act Concerning the Labeling of Genetically Modified Foods – March 15, 2013

Thank you for the opportunity to speak about the GMO labeling issue and Bill Numbers 6527 and 6519. In this testimony, I think I can include both bills.

I would like to talk about the negative impact that not labeling our food can have and is having on our health.

Because the FDA does not test the ingredients in our foods and because the FDA seems to have abdicated its role in keeping U.S. citizens safe from corporations who do not have our best interests at heart, there is no testing prior to release and no accountability for the actions of corporations creating what is a very poor excuse for food. These corporations are more concerned with their executive's outrageous salaries and bottom lines for Wall Street financiers.

The FDA ignored 25 of their own scientists who warned the H.W. Bush administration about GMO foods prior to their release in 1994. This means the foods were introduced illegally into our food chain. As a result of this egregious error the public health in this country has been steadily going down hill ever since. It is impossible for our medical establishment to know what is happening to our population unless there is testing and the results are known to our doctors and scientists who do try to protect us.

Doctors and nutritionists have seen a steady increase in allergies, autism, asthma, gastrointestinal problems, infertility and many more new diseases since these foods were introduced. The unintended consequences of allowing this to continue is dire! Let me give you an example:

When I was five and a half years old (in 1950) my mother was trying to have fun by offering certain candies and frozen fruits during the major holidays (Christmas, Easter, etc.) but I would inevitably end up with very painful ear-aches each and every time. Holidays became nights of horrendous pain instead of evenings full or warm memories. My mother took me to the ear

doctor who, during that appointment, put the cone of the x-ray machine right between my eyes and in a few minutes I had been radiated in order to shrink my adenoidal tissue, with the conventional wisdom being, this would relieve the problem.

The conventional wisdom was wrong!! Subsequently, we discovered that I was allergic to food preservatives, food dyes and the chemicals added for flavorings. The radiation dose, given by the doctor, who didn't know anything about these substances added to our foods, was thought at the time to be appropriate. Unfortunately, the dose of radiation was too high for a child of 5 ½ years old, the remedy was called a "medical mistake" and it had major long term consequences.

I would like to remind you that conventional wisdom is quite fallible! There is a disconnect from the manufacturers of these untested GMO laden foods and the medical profession who doesn't have any tests results from independent research from which they can diagnose certain symptoms. As a result of not having accurate test results and accurate information from the manufacturers we are setting up our medical system for failure. How can they diagnose properly without this information? Instead we're getting misdiagnosis, over prescribing of pharmaceuticals that might not be necessary and "medical mistakes" that in 20 – 30 years will reap untold disasters for those who are children now or who were children back in 1996.

Thirty years later after the overdose of radiation, I had a 9 ½ hour operation to remove a meningioma tumor the size of a large lemon, right between my eyes in my brain. Now I have to also monitor my thyroid for the possibility of cancer. I spent ten years slowly losing my health before the operation and seven years after the operation before I was back to normal. But, I was one of the lucky ones.

Had my mother and the doctor known about these dyes, preservatives and fragrance chemicals, she might not have sought medical attention but only changed my food habits. Labels are today's answer for this problem. We have

to inform our public of what is in their food so they can protect themselves from the items they cannot eat or should not eat for health reasons.

Things have not changed. Conventional wisdom says we need to increase our food supply with GE foods. I think that's extremely unwise and completely unnecessary but until the government changes our agricultural policies, we need to have labels. It doesn't look like we're going to have a precautionary rule any time soon.

Our most vulnerable population of children and women of child bearing age should be entitled to know what's in their foods so they can avoid the ones that aren't good for children and the ones that could affect a women's fertility and pregnancy. Where we had one fertility clinic once, we now have fourteen. We now have second and third generation women, since these foods were brought into production, who can't conceive without invitro fertilization. We also have a town in Iowa, in the middle of the cornbelt, that hasn't had a live birth in five years. These are all the same issues found in independent animal studies that have been done. There are those who believe that our government is trying to control population growth this way. If so, the FDA needs to be reprimanded and held accountable for their actions.

There are a great number of people who are being diagnosed incorrectly and inadvertantly by doctors who basically don't know much about nutrition and certainly don't know about GMOs and how they are affecting us. They're over prescribing pharmaceuticals that won't cure them because they don't really know what's wrong with their patients or what's causing their ailments. They don't know what they don't know!! This is a dangerous trend and has been going on for years. Our medical system is predicated on treating symptoms without knowing the underlying causes for those symptoms. But these are new causes with new symptoms in a great many cases.

Our DNA is being changed by foods that don't come from nature which causes increasing amounts of inflammation and even causes new diseases. How can doctors keep up with the changes if they have no scientific studies to refer to?

We need to call a halt to this kind of irresponsibility on the part of our, bought and paid for by Monsanto, FDA, USDA and EPA.

Because the EU countries label the GMOs in their food supply they don't have the same kinds of increases in medical needs that this country is seeing. Let's not forget the U.S. is now 37th on the list of medical care. We've gone from one of the healthiest to one of the sickest nations.

We don't really want to eat foods produced from seeds that are coated with pesticides that kill bees and that have been genetically altered with "out of species" viruses, bacteria, etc. and some that have pesticides in every cell of the plant. These are not created by hybridization or by nature itself. Chemical companies have created these seeds to sell chemicals that are sprayed on millions of acres of our farmland. These are not made for reasons of good nutrition but for profiteering purposes only. Do we really want to be eating foods that come from seeds of a company that told us DDT and Agent Orange were safe? There certainly isn't any reason to trust these companies. Labels will help us know.

Fortunately, we now have some independent studies from France and China that are adding to the mounting evidence that these foods should be labeled so we know what we're eating. There is another new study out recently about glyphosate. The testing that has been done on it was only performed on the glyphosate itself rather than with all the other elements it is combined with for the Roundup product. When combined with these other elements it apparently becomes even more toxic. This presents a very serious risk to all

Americans and particularly our children and and women of child bearing age who are our most vulnerable to the insidious dangers of these foods and the pesticides that are poured on them while they're growing.

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Let us remember the effects from these chemicals may not show up for 10-25 years later. This is an insidious form of chemical poisoning and the manufacturers know it.

We all can help by insisting on the labeling of GMOs and voting out those who don't plan on supporting these bills. We are not asking you to ban these foods – only we ask you to allow us to know what's in out food so that we may make an informed choice. And, let's do it THIS YEAR. Thank you very much for your time.

Ellen McCormick
Weston, CT Resident

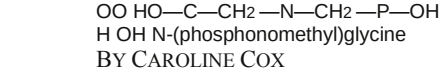
Please see the following articles to support our testimonies:

JOURNAL OF PESTICIDE REFORM/ WINTER 2004 • VOL. 24, NO. 4 × **HERBICIDE FACTSHEET**

GLYPHOSATE

Glyphosate herbicides (one common brand name is Roundup) are the mostly commonly used herbicides in the U.S. and the world. In agriculture they are widely used with genetically-modified glyphosate-tolerant crops, but they are also widely used in yards, gardens, and other nonagricultural areas.
Symptoms of exposure to glyphosate include eye irritation, burning eyes, blurred vision, skin rashes, burning or itchy skin, nausea, sore throat, asthma and difficulty breathing, headache, lethargy, nose bleeds, and dizziness.
Glyphosate and glyphosate-containing herbicides caused genetic damage in laboratory tests with human cells, as well as in tests with laboratory animals.
Studies of farmers and other people exposed to glyphosate herbicides have shown that this exposure is linked with increased risks of the cancer non-Hodgkin's lymphoma, miscarriages, and attention deficit disorder. For each of the hazards identified in these studies there are also laboratory studies with results that are consistent with the studies of exposed people.
There is also laboratory evidence that glyphosate herbicides can reduce production of sex hormones.
Studies of glyphosate contamination of water are limited, but new results indicate that it can commonly contaminate streams in both agricultural and urban areas.
Problems with drift of glyphosate herbicides occur frequently. Only one other herbicide causes more drift incidents.
Glyphosate herbicides caused genetic damage and damage to the immune system in fish. In frogs, glyphosate herbicides caused genetic damage and abnormal development.
Application of glyphosate herbicides increases the severity of a variety of plant diseases.

Figure 1
Glyphosate



N-(phosphonomethyl)glycine

BY CAROLINE COX

Glyphosate (see Figure 1) her- bicides are "among the world's most widely used herbicides."[1] and glyphosate is "the world's leading agrochemical."[2] Although glyphosate herbicides have been popular since they were first marketed in 1974, their use in agricul- ture has expanded recently with the increased use of crops that have been genetically modified to tolerate gly- phosate treatment.[3]

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Roundup is a popular brand name for glyphosate herbicides,[1] although many other brand names are used.[4]
Glyphosate is marketed in more than 100 countries by a variety of manufacturers, but Monsanto Company has been and continues to be the major
Caroline Cox is NCAP's staff scientist.
commercial supplier worldwide.[3]

Use Estimates

The U.S. Environmental Protection Agency (EPA) recently estimated that annual use of glyphosate in the U.S. is between 103 and 113 million pounds.[5]
Glyphosate is used more than any other pesticide. It is the most com- monly used agricultural pesticide, and the second most commonly used pesticide around and in homes and
gardens. Home and garden use totals over 5 million pounds per year.[5]
According to Monsanto Company, there are more approved uses for glyphosate than for any other herbicide.[1]

How Does Glyphosate Kill Plants?

Glyphosate blocks the activity of an enzyme used by plants to make cer- tain important amino acids. Without these amino acids, the plant cannot make proteins required for various life processes, resulting in the death of the plant.[1,6]
Glyphosate is a broad spectrum her- bicide, so it kills most types of plants.[6]

Overview

It is often said that "there is no indication of any human health con- cern"[4] for glyphosate and that gly- phosate "is virtually nontoxic to mam- mals, birds, fish, insects, and most

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bacteria."[7] However, this herbicide can actually pose significant hazards to human and environmental health. This article summarizes the research docu- menting those hazards, with a focus on research published since 2000.

Inert Ingredients

Like most pesticides, commercial glyphosate herbicides contain ingredi- ents other than glyphosate which, ac- cording to U.S. pesticide law, are called "inert."[8] Publicly available information about the identity of these ingredients in glyphosate products is incomplete.
For information about the hazards of some of the inert ingredients in commercial glyphosate products, see "Inert Ingredients," at right. Research studies about glyphosate sometimes use commercial glyphosate herbicide products, and other times use glyphosate alone. In this article we identify as accurately as possible which was used in each study discussed.

Symptoms of Exposure

According to reports made to the California Pesticide Illness Surveillance Program, symptoms of exposure to glyphosate herbicides include eye irri- tation and inflammation, burning eyes, blurred vision, skin rashes, burning or itchy skin, nausea, sore throat, asthma and difficulty breathing, headache, leth- argy, nose bleed, and dizziness.[9]
"Irritation" can seem like a less se- rious symptom than those caused by other pesticides. However, it can be significant. For example, Italian der- matologists in 2004 reported treating a patient who knelt on the ground where her son had just sprayed a glyphosate-containing herbicide. She then put on clothing that had been on the ground where he had sprayed and napped. Within hours her skin was burning and she developed a blis- tering rash on her back, legs, and feet that lasted for a month.[10,11]

Ability to Cause Genetic Damage (Mutagenicity)

Four laboratory studies published in the late 1990s demonstrated the abil- ity of glyphosate and glyphosate-con- taining herbicide products to cause

""INERT" INGREDIENTS IN GLYPHOSATE HERBICIDES

Inert ingredients in commercial glyphosate herbicide products, with examples of their hazards, include the following:

- **5-Chloro-2-methyl3(2H)-iso- thiazolone**[1] caused genetic dam- age and allergic reactions in labo- ratory tests.[2]
- **FD&C Blue No. 1**[1] caused ge- netic damage and skin tumors in laboratory tests.[3]
- **Glycerine**[1] caused genetic dam- age in tests with human cells and laboratory animals. It also reduced fertility in laboratory tests.[4]
- **3-Iodo-2-propynyl butyl carbam- ate**[1] caused thyroid damage and decreased growth in laboratory tests.[5]
- **Light aromatic petroleum distillate (Chemical Abstract Services No. 64742-95-6)**[1] re- duced fertility and growth of new- borns in

laboratory tests.[6]

• **Methyl p-hydroxybenzoate**[1] caused genetic damage in laboratory tests.[7] • **Polyoxyethylene alkylamine**[1] is an eye irritant.[8] It is also toxic to fish.[9] • **Propylene glycol**[1] caused genetic damage, reduced fertility, and anemia in laboratory tests.[10] • **Sodium sulfite**[1] caused genetic damage in tests with both laboratory animals and human cells.[11] • **Sodium benzoate**[1] caused ge- netic damage in tests with hu- man cells and laboratory ani- mals. It also caused developmen- tal problems and reduced new- born survival in laboratory tests.[12] • **Sodium salt of o-phenylphenol**[1] is a skin irritant. It also caused genetic damage and cancer in laboratory tests.[13]

• **Sorbic acid**[1] is a severe skin irri- tant and caused genetic damage in laboratory tests.[14]

1. U.S. EPA. Office of Prevention, Pesticides, and Toxic Substances. 2004. Response to Freedom of Information Act request of October 19, 2004. Washington, D.C. Response dated November 17.
2. National Institute for Occupational Safety and Health. 2003. RTECS: 4-Isothiazolin-3-one, 5- chloro-2-methyl-. www.cdc.gov/niosh/rtecs/nx7c76b2.html.
3. National Institute for Occupational Safety and Health. 2000. RTECS: Ammonium, ethyl (4-(p- (ethyl(m-sulfobenzyl)amino)-alpha-(o-sulfophenyl)benzylidene)-2,5-cyclohexadien-1-ylidene)(m- sulfobenzyl)-, hydroxide, inner salt, disodium salt. www.cdc.gov/niosh/rtecs/bq481908.html.
4. National Institute for Occupational Safety and Health. 2003. RTECS: Glycerol. www.cdc.gov/ niosh/rtecs/ma7ad550.html.
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6. National Institute for Occupational Safety and Health. 1998. RTECS: Solvent naphtha (petro- leum), light aromatic. www.cdc.gov/niosh/rtecs/wf33e140.html.
7. National Institute for Occupational Safety and Health. 2003. RTECS: Benzoic acid, p-hydroxy-, methyl ester. www.cdc.gov/niosh/rtecs/dh256250.html.
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11. National Institute for Occupational Safety and Health. 2003. RTECS: Sodium sulfite. www.cdc.gov/ niosh.rtecs/we20ce70.html.
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13. National Institute for Occupational Safety and Health. 2003. RTECS: 2-Biphenylol, sodium salt. www.cdc.gov/niosh/rtecs/dv757e20.html.
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Figure 2

Ability to Cause Genetic Damage in Human Blood Cells

5
4
3
2
1
0

Source: Bolognesi, C. et al. 1997. Genotoxic activity of glyphosate and its technical formulation Roundup. J. Agric. Food Chem. 45:1957-1962.

Figure 3

Ability to Cause Cancer

4
3
2
1
0
Unexposed
Exposed

Note: Line on and above bar is a 95% confidence interval.

Source: De Roos, A.J. et al. 2003. Integrative assessment of multiple pesticides as risk factors for non-Hodgkin's lymphoma among men. Occup. Environ. Med. 60(9):E11.

Exposure to glyphosate herbicides has caused genetic damage in laboratory tests, and use of glyphosate by farmers is associated with an increased incidence of lymphoma.

exposed to glyphosate more than two days per year was two times greater than the risk for men who were either unexposed or exposed for less than two days per year. The study was conducted at the Univer- sity of Saskatchewan (Canada).[18]

• A 2002 study of Swedish men showed that glyphosate exposure was significantly associated with an increased risk of non-Hodgkin's lym- phoma. The study was conducted by oncologists at Örebro University (Sweden).[19]

• A 2003 review of three earlier studies of Midwestern farmers showed that exposure to glyphosate was associ- ated with an increased incidence of non-Hodgkin's lymphoma. The studies were conducted by the National Cancer Institute.[20] (See Figure 3.)

A fourth study, an analysis of re- sults from the Agricultural Health Study, did not find an association be- tween non-Hodgkin's lymphoma and glyphosate exposure. However, the incidence of another cancer, multiple myeloma, showed a "suggestive asso- ciation" with glyphosate exposure. The Agricultural Health Study is sponsored by the National Institutes of Health and EPA.[21]

Several mechanisms by which glyphosate herbicide exposure could cause cancer have recently been iden- tified. Researchers at the University of Minnesota found that both glyphosate and Roundup caused a rapid increase in cell division[11] in human breast can- cer cells.[22] In addition, scientists at the Centre National de la Recherche Scientifique (France) showed that five glyphosate-containing

herbicide prod- ucts disrupted cell division in sea ur- chin embryos, which are commonly used as a model system for studying cell division. The type of disruption found in this study is "a hallmark of tumor cells and human cancers."[23]

EPA classifies glyphosate as a Group E pesticide. This classification means that the agency has found "evidence of non-carcinogenicity for humans."[24]

Effects on Pregnancy

Glyphosate exposure has been linked to increased risks of miscarriages genetic damage.[12-15] Two of the studies, both done by scientists at Italy's Instituto Nazionale per la Ricerca sul Cancro exposed mice to glyphosate and a Roundup herbi- cide by injection.[12,13] One study also exposed human blood cells to the same chemicals.[12] The first study showed that in mice both glyphosate and the Roundup herbicide damaged DNA (the genetic material in cells) in the liver and kidney and caused a dif- ferent kind of genetic damage in bone marrow cells. Both substances also caused a third type of genetic damage in human blood cells. (See Figure 2.) In general, the Roundup used in these experiments was more potent than glyphosate.[12] The second study showed that a Roundup herbicide dam- aged DNA in the liver and kidney of mice.[13]

The other two studies were done at the Universita della Basilicata (Italy). Both used blood cells, one from cows and the other from humans. Both showed that glyphosate caused a sig- nificant increase in the number of ab- normal chromosomes.[14,15]

A more recent (2004) study from the Institute of Biology and Environ- mental Sciences (Germany) showed that DNA damage occurred in human connective tissue cells[11] when they were exposed to glyphosate and hy- drogen peroxide, a molecule that is commonly found in living things.[16]

The National Institute for Occupa- tional Safety and Health describes glyphosate as a "mutagen."[17]

Ability to Cause Cancer (Carcinogenicity)

Three recent studies have demon- strated a link between glyphosate ex- posure and non-Hodgkin's lymphoma, a type of cancer:[18-20]

• A 2001 study of Canadian men showed that the risk of non- Hodgkin's lymphoma for men

AAmount of genetic damage (sister chromatid exchanges per cell)
Unexposed
Exposed to glyphosate
Exposed to a Roundup herbicide
Risk of non-Hodgkin's lymphoma (odds ration)

(spontaneous abortions).[11] In a study of Ontario, Canada farm families, glyphosate use in the three months prior to conception was associated with an increased risk of late (between the 12th and 19th weeks of pregnancy) miscarriages. (See Figure 4.) The study was conducted by researchers from Health Canada and Carleton University (Canada).[25]

Glyphosate-containing herbicides have also caused pregnancy problems in laboratory tests. In a 2003 study conducted by scientists from two Bra- zilian universities, a Roundup herbi- cide fed to pregnant rats during the middle part of their pregnancy caused an increase in the number of offspring with abnormal skeletons. The increase in abnormalities was significant at all dose levels tested in this experiment.[26]

Effects on Hormones

Hormones are chemical messengers that regulate all biological processes, including the reproductive system.[27]

Scientists at Texas Tech University studied the effect of a glyphosate- containing herbicide on hormone pro- duction. They looked at hormone pro- duction by Leydig cells, located in the testes, because these cells "play a crucial role in male reproductive function." The scientists showed that exposure to a Roundup herbicide reduced sex hormone production in these cells by 94 percent.[28] (See Figure 5.)

Association with Attention Deficit Disorder

Exposure of parents to glyphosate has been linked with an increased in- cidence of attention deficit disorder in children. A 2002 study conducted by researchers at the University of Min- nesota found "a tentative association between ADD/ADHD [attention defi- cit disorder] and use of this herbicide"[29] by Minnesota farm families.[29]

The results of two laboratory stud- ies are consistent with the results of the University of Minnesota study in that they show glyphosate and glyphosate herbicides cause brain and nerve damage. One study, conducted at the Universidad Nacional de San Luis (Argentina) showed that feeding pregnant rats glyphosate-contaminated water caused changes in the activity of several enzymes in the brains of their fetuses.[30] A second study, from the University of Liverpool (United Kingdom) showed that Roundup ex- posure inhibited the growth and de- velopment of nerve cells.[31]

Soil Persistence

Glyphosate's persistence in soil var- ies widely. According to data com- piled by the USDA's Agricultural Re- search Service, glyphosate's half-life varies from 2 to 174 days.[32] (The half- life is the amount of time required for half of the applied glyphosate to

break down or move away from the treat- ment area.)

Contamination of Water

Glyphosate is not included among the pesticides being studied by the U.S. Geological Survey's (USGS's) Na- tional Water-Quality Assessment Pro- gram,[33] so there are no comprehen- sive national statistics about contami- nation of rivers and streams by glyphosate. A regional study, however, indicates
that glyphosate can be a common con- taminant. In a USGS Toxic Substances Hydrology Program survey of Midwest streams in 2002, glyphosate was found in over a third of the samples col- lected. The primary breakdown prod- uct of glyphosate was found in over two-thirds of the samples. The study also showed that glyphosate contami- nated water from spring through fall and described glyphosate in samples taken at harvest time as "unexpected"[34] because researchers had "presumed that glyphosate would degrade by this late in the growing season."[34]

USGS has also found glyphosate contamination in a study of urban streams in King County, Washington. Glyphosate was found in all six streams that were tested in this study.[35]

Drift

Drift incidents involving glyphosate are common. In 1999, the American Association of Pesticide Control Offi- cials surveyed state pesticide regulatory

Figure 5

Ability to Disrupt Sex Hormone Production

500
400
300
200
100
0
Unexposed
Exposed

Source: Walsh, L.P. 2000. Roundup inhibits steroidogenesis by disrupting steroidogenic acute regulatory (StAR) protein expression. Environ. Health Persp. 108:769-776.

Figure 4

Ability to Cause Miscarriages

3
Note: Line on and above bar is a 95% confidence
2 interval.
1
0
Unexposed
Exposed

Source: Arbuckle, T.E., L.Lin, and L.S. Mary. 2001. An exploratory analysis of the effect of pesticide exposure on the risk of spontaneous abortion in an Ontario farm population. Environ. Health Persp. 109:851-857..

Exposure to glyphosate herbicides is linked with an increase in the risk of miscarriage. In addition, a glyphosate herbicide reduced sex hormone production in a laboratory test.

RRisk of miscarriage (odds ratio)
Progesterone (nanograms per milliliter)

Figure 6

Effects on Sexual Development of Frogs

Unexposed
Exposed
male female intersex

Source: Howe, C.M. et al. 2004. Toxicity of glyphosate-based pesticides to four North American frog species. Environ. Toxicol. Chem. 23:1928-1938.

agencies and asked which pesticides were most commonly involved in pes- ticide drift complaints. Glyphosate was the second most common pesticide; only the herbicide 2,4-D caused more complaints.[36]

Even the labels on glyphosate her- bicides acknowledge drift problems. For example, the Roundup Pro label states "Avoid contact of herbicide with foliage, green stems, exposed non- woody roots or fruit of crops, desir- able plants and trees, because severe injury or destruction may result. Avoid drift. Extreme care must be used when applying this product to prevent in- jury to desirable plants and crops."[37]

Researchers at Carleton University (Canada) and Environment Canada who studied glyphosate drift describe its potential effects as "severe ecologi- cal changes."[38]

Effects on Birds

Glyphosate use can impact birds when the plants killed by the treat- ment are plants that birds use for food or shelter. Glyphosate treatment of for- ests after logging reduced the nesting success of songbirds, according to a study conducted by biologists at the University of British Columbia and the Canadian Wildlife Service.[39] According to reviews by the U.S. Geological Sur- vey, treatment

of cattail marshes with Rodeo (a glyphosate herbicide used in wet areas) has reduced populations of the marsh wren[40] and the sora.[41]

Effects on Fish

Glyphosate-containing herbicides can cause genetic damage in fish, and also disrupt their immune systems.

A study conducted at the Univer- sidade de Brasília (Brazil) showed that injection of a Roundup herbicide in Tilapia increased damaged chromo- somes in red blood cells.[42,43]

A study conducted at the Univer- sity of Alexandria (Egypt) showed that exposure to Roundup reduced two measures of immune system function in spleen cells from Tilapia. The re- duction occurred at all dose levels tested in this experiment.[44]

Effects on Insects

Glyphosate can cause genetic

Exposure to glyphosate herbicides caused tad- poles to develop with abnormal sex organs.

damage in insects. In a study of fruit flies, significant increases in mutations occurred when larvae were exposed to glyphosate during development. The experiment was conducted by re- searchers from Akdeniz University (Turkey) and the Universitat Autonoma de Barcelona (Spain).[45]

Effects on Spiders

Spider populations can be reduced by herbicide treatment when the her- bicide kills the vegetation they use for shelter. An experiment conducted by zoologists from Oxford University and the Royal Agricultural College (United Kingdom) looked for this kind of ef- fect in the edges of agricultural fields. These margins "play an important ag- ricultural role in providing a refuge for beneficial invertebrate predators"[46] which prey on pest insects in the fields. The zoologists found that treatment with a Roundup herbicide reduced spider numbers by over 50 percent.[46]

Effects on Frogs

Glyphosate herbicides can harm amphibians in a variety of ways,

including causing genetic damage and disrupting their development.[47-49]

A 1997 study showed that a Roundup herbicide caused damage to DNA (genetic material) in bullfrog tad- poles. The University of Windsor (Canada) biologists who conducted the study concluded that its "genotoxicity at relatively low concentrations" was of concern.[47]

A 2003 study showed that a gly- phosate-containing herbicide caused both mortality and malformations of a common neotropical tadpole. The study was conducted by scientists at three research institutes in Argentina.[48]

A 2004 study showed that "envi- ronmentally relevant" concentrations of several Roundup herbicides caused a common North American tadpole not to grow to its normal size and to take longer than normal to develop. In ad- dition, between 10 and 25 percent of the Roundup-exposed tadpoles were intersex (having abnormal sex organs). The study was conducted by biologists at Trent University, Carleton Univer- sity, and the University of Victoria (Canada).[49] (See Figure 6.)

Plant Diseases

Use of glyphosate herbicides has been linked to increased problems with a variety of plant diseases.

For example, glyphosate herbicides increased the severity of fusarium head blight in cereal crops,[50] the severity and frequency of sudden death syn- drome in soybeans,[51] the severity of Pythium root rot in sugarcane,[52] and the severity of white mold in soybeans.[53] These studies were conducted by scientists at Agriculture and Agri-Food Canada, Iowa State University, Louisi- ana State University, and Michigan State University.[50-53]

Resistance

Resistance is the "inherited ability of a plant to survive and reproduce following exposure to a normally le- thal dose of herbicide."[54] The devel- opment of herbicide resistance is an increasing problem worldwide.[55]

The first glyphosate-resistant weeds were reported in 1996 in Australia. There are now 6 glyphosate-resistant weeds reported from 7 countries.[56]

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Public Hearing Testimony for Bill # 6519 – An Act Concerning the Labeling of Genetically Modified Foods – March 15, 2013

USDA Scientist Reveals All

Glyphosate Hazards to Crops, Soils, Animals, and Consumers

Don Huber painted a devastating picture of glyphosate and GM crops at UK Parliament
Dr Eva Sirinathsinghji

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In less than an hour, Don Huber, professor emeritus at Purdue University and USDA senior scientist (see Box) delivered to the UK Houses of Parliament a damning indictment of glyphosate agriculture as a most serious threat to the environment, livestock, and human health [1].

Don Huber

Don Huber, Emeritus Professor at Purdue University and senior scientist on USDA's National Plant Disease Recovery System, has been a plant physiologist and pathologist for over 40 years. His academic career began with 8 years as a cereal pathologist at the University of Idaho, and the next 35 years at Purdue University where he specialised in soil-borne disease control, physiology of disease, and microbial ecology. For the past 20 years, he has conducted extensive research into the effects of glyphosate on crops, in response to the increase in crop diseases on glyphosate-applied fields.

Since his letter to the US Secretary of State Tom Vilsak was leaked in February 2011,

there has been a great deal of controversy over what Huber described as a pathogen "new to science" and abundant in glyphosate-tolerant GM crops (see [2] Emergency! Pathogen New to Science Found in Roundup Ready GM Crops?, *SiS* 50). As he concluded in the letter: "We are now seeing an unprecedented trend of increasing plant and animal diseases and disorders. This pathogen may be instrumental to understanding and solving this problem".

His talk linked glyphosate to reduced nutrient availability in plants, increasing plant diseases, the emergence of a new pathogen, animal illness and possible effects on human health (see [3, 4] Glyphosate Tolerant Crops Bring Death and Disease, Scientists Reveal Glyphosate Poisons Crops and Soil, *SiS* 47).

Pathogen new to science

The conversion of US agriculture to monochemical herbicide practice has resulted in the extensive use of glyphosate herbicides. Coincidentally, farmers have been witnessing deterioration in the health of corn, soybean, wheat and other crops, and epidemics of diseases in small grain crops. All are associated with the extensive use of glyphosate, which has increased further since the introduction of glyphosate-tolerant, Roundup Ready (RR) crops.

Glyphosate immobilises nutrients required to maintain plant health and resistance to disease. This weakening of the plants defence could explain the infestation of GM crops with the new pathogen, which has now been observed in horse, sheep, pigs, cows, chicken, multiple animal tissues including reproductive parts (semen, amniotic fluid), manure, soil, eggs, milk, as well as the common fungal pathogen that is currently infesting RR crops, *Fusarium solani fsp glycines mycelium.* All are coming into contact with glyphosate either through direct exposure or consumption through animal feed. It is also highly abundant in crops suffering from plant Goss' wilt and sudden death syndrome.

The pathogen can be cultured in the lab, and has been isolated from livestock foetal tissue, replicated in the lab and re-introduced back into the animals. It appears to be very common and may well be interacting with the effects of glyphosate on both plants and animals, exacerbating disease and causing reproductive failure in livestock (see below). Although great expectations have been placed on Huber to publish his

findings, he insists that before this can be done, further resources are necessary to be able to characterise the 'entity' and identify what type of species it is, including sequencing of its genome. This is a slow process and once complete, it is his intention to publish the work in a peer-reviewed journal.

Understanding glyphosate's mode of action

Recognising glyphosate's mechanism of action is the key to understanding how it may exert detrimental effects on the health of crops, animals, and the environment alike. Glyphosate is a broad-spectrum herbicide that interacts with a range of physiological processes in the plant and its environment. Although it is most commonly recognised to work through inhibition of the plant enzyme 5-enolpyruvylshikimate-3-phosphate synthase (EPSPS) involved in the production of aromatic amino acids in the shikimate pathway, it was actually first patented as a strong metal-chelator that binds to metals including manganese, magnesium, iron, nickel, zinc and calcium, many of which are important micronutrients acting as co-factors for plant enzymes in different physiological processes including the plants' defence system. Indeed, it is actually through chelation of manganese that the EPSPS enzyme is inhibited.

Rendering plants more susceptible to disease through glyphosate's pathogenic activity is actually the way it exerts its herbicidal activity. This is done not just through immobilising nutrients in the plant but also impacting the agricultural system as a whole. Consistently, if glyphosate does not reach the root of a plant or the plant is grown in a sterile soil, the plant is not killed.

Once in the soil, glyphosate is later immobilised through the chelation of cations, and is therefore very stable and not easily degraded. However, phosphorus (including phosphorus fertilisers) can desorb the herbicide, making it active once again in the soil.

Glyphosate interferes negatively with many components of agriculture

Huber stressed that agriculture is an integrated system of many interacting components, which together determine crop health and therefore yield. This concept

is undervalued, and the sooner this is recognised, the sooner we will be able to reap the full genetic potential of our crops.

The three main components of an agricultural system are 1) the biotic environment including beneficial organisms for example, nitrogen-fixing microbes and mineralizers; 2) the abiotic environment including nutrients, moisture, pH; and 3), defence against pathogens that damage crops. The genetic potential of a plant can be achieved by minimising the stress placed on these components through improving plant nutrition and physiology and prevention of diseases and pests.

We have been repeatedly told that to meet the world's needs for food production we must resort to GM crops and chemical agriculture. However, glyphosate detrimentally interacts with all the agricultural components, so much so that an estimated 50 percent of the potential crop yields are currently being lost (see Figure 1).

Figure 1 Interactions of glyphosate with plant and soil biology; adapted from Huber's presentation

As shown in figure 1, glyphosate interacts with a wide range of health determinants, which intensifies stress and reduces crop yields. Not only does it accumulate in the plant tissues (shoot and root tips, reproductive structures and legume nodules), it accumulates in the roots where it then leaks into the soil and harms beneficial microorganisms in the soil including those that act as biological controls of pathogens. The obvious consequence is the increased virulence of soil-borne pathogens that lead to disease.

Glyphosate immobilises nutrients critical for plant defence system and other functions

One of Huber's important discoveries was the close correlation of all the known conditions affecting the disease 'take-all' with the availability of manganese to the plant and its physiological effect on resistance to this pathogen.

Micronutrients are the activators or inhibitors of many critical physiological functions. Thus, a deficiency or change in availability of these regulatory elements can greatly

affect plant growth and resistance to diseases and pests. Those metabolic pathways producing secondary anti-microbial compounds, pathogen-inhibiting amino acids and peptides, hormones involved in cicatrisation (walling off pathogens), callusing, and disease escape mechanisms can all be compromised by glyphosate.

Micronutrients are also necessary for other processes in a plant. Manganese for example is not only involved in co-activating the EPSPS enzyme, with up to 25 other enzymes known to be affected by manganese chelation. Such enzymes are necessary for photosynthesis, in assimilating carbon dioxide in the electron transport chain, along with zinc. It also helps in the synthesis of chlorophyll and in nitrate assimilation. Numerous enzymes requiring other mineral co-factors are also affected, among them enzymes of the shikimate pathway, to which EPSPS belongs, are responsible for plant responses to stress and the synthesis of defence molecules against pathogens, such as amino acids, lignins, hormones, phytoalexins, flavenoids and phenols.

Consistent with what is known about the role of micronutrients and glyphosate, the levels of key minerals have been measured in transgenic RR soybeans and found to be lower than those in isogenic non-transgenic varieties. Manganese was reduced by as much as 45 %, while iron was reduced by 49 % [5]. Similar deficiencies in mineral content have been found in non-GM varieties, suggesting that the glyphosate, and not the RR transgene, is responsible for reducing mineral availability [6]. Glyphosate reduces photosynthesis, water uptake, amino acid production as well as lignin, a molecule conferring mechanical strength of the plant and crucial for conducting water through plant stems [7, 8].

As Huber stated, the consequences of these nutrient deficiencies is that "crops don't look as good, are not as productive or rigorous, and are slower growing" (see Figure 2). He noted yield drags of 26 % for RR soybeans. Furthermore, with current concerns for global warming, plants that are up to 50 % less water-efficient, such as RR crops, are counter-productive and can only exacerbate problems.

Huber stressed that there is nothing in the glyphosate tolerant crops that operates on the glyphosate applied to them. Consequently, although they have enough resistance to prevent them from dying (conferred by the EPSPS transgene), their overall physiological function is compromised by glyphosate. It therefore affects GM as well as non-GM crops through residual levels of glyphosate in the ground.

In addition to chelating nutrients in the plants, glyphosate can lower mineral content through damaging beneficial soil organisms, including microbes producing indole-acetic acid (a growth-promoting auxin), earthworms, mycorrhizae associations, phosphorus & zinc uptake, microbes such as *Pseudomonads, Bacillus* that convert insoluble soil oxides to plant-available forms of manganese and iron, nitrogen-fixing bacteria *Bradyrhizobium, Rhizobium*, and organisms involved in the biological control of soil-borne diseases that reduce root uptake of nutrients.

Figure 2 Effects of long-term glyphosate on crop health; adapted from Huber's presentation

Glyphosate increases incidence and virulence of soil-borne pathogens

Thirty-four diseases have been reported in the scientific literature to increase in incidence as a result of glyphosate weed-eradication programmes. They affect a wide variety of crops from cereals to bananas, tomatoes, soybean, cotton, canola, melon and grapes [9]. Some of these diseases are considered 'emerging' or 're-emerging' as they had not caused serious economic losses in the past. This has worrying implications for the agricultural sector with the US now in its fourth year of epidemics of Goss' wilt and sudden death syndrome and eighteenth year of epidemic of *Fusarium* fungal colonisation resulting in root rot and *Fusarium* wilt. Not only does glyphosate affect disease susceptibility, there is also evidence of increased disease severity. Examples include 'take-all'; *Corynespora* root rot in soybean; *Fusarium spp* diseases, including those caused by *Fusarium* species that are ordinarily non-pathogenic. Head-scab caused by *Fusarium spp* of cereals increases following glyphosate application, which is also now prevalent in cooler climates when previously it was limited to warmer climates.

Food and Feed Safety Concerns

Nutrient-deficient, transgenic plants suffering from disease that also harbour herbicide residues, presents an array of possible safety hazards to animals and humans. According to Huber, possible harm include direct toxicity of glyphosate itself, which has been shown to cause endocrine disruption, DNA damage,

reproductive and developmental toxicities, neurotoxicity, cancer, and birth defects (see [10]Glyphosate Toxic and Roundup Worse,*Si*S26; [11]Death by Multiple Poisoning, Glyphosate and Roundup,*Si*S42; [12]Ban Glyphosate Herbicide*Now*.*Si*S43; [13]Lab Study Establishes Glyphosate Link to Birth Defects,*Si*S48). Furthermore, allergies are on the rise, and animals are showing allergy responses, including inflamed irritated stomachs (Figure 3), discoloration of stomach lining, leakage of intestines as well as behavioural symptoms of irritability and anti-social behaviour in cows (abnormal for herd animals). Inflammatory bowel disease in humans has risen 40 percent since 1992, which may be related to consumption of GM foods, although this has not yet been proven.

Figure 3 Stomach shows allergic response of discolouration and inflammation in GMO fed pig (right) compared with control (left)

The increase in infestation of crops with fungal pathogens that produce toxins is an added concern. Mycotoxins, including fusarium toxins as well as aflatoxins released by *Aspergillus* fungi are carcinogenic and have forced imports of wheat into the US due to unsafe levels found in domestic harvests.

Triple whammy of reproductive toxicity caused by glyphosate

In 2002, the Cattlemen's Association gave a statement to US Congress on the serious and puzzling rises in reproductive problems. It said: "high numbers of foetuses are aborting for no apparent reason. Other farmers successfully raise what look to be normal young cattle, only to learn when the animals are butchered that their carcasses appear old and, therefore, less valuable...The sporadic problem is so bad both in the United States and abroad that in some herds around 40-50 percent of pregnancies are being lost.. [and] the viability of this important industry is threatened."

Glyphosate appears to be able to induce reproductive failures through three separate mechanisms. The first, mentioned above is the endocrine dysfunction caused by direct toxicity of glyphosate.

The second is the reduced nutrient content having consequential effects on the nutritional status of animals. Manganese in animals, as in plants, is an essential

nutrient, and deficiencies have been associated with a variety of diseases as well as reproductive failures, which are becoming increasingly common in livestock. One study performed in Australia following two seasons of high levels of stillbirths in cattle found that all dead calves were manganese deficient [14]. Furthermore, 63 percent of babies with birth defects were also deficient. Manganese is known to be important for mobilising calcium into bones, correlating with abnormal bone formation in these calves.

Third, the unknown pathogenic 'entity' may be associated with inducing pseudo-pregnancies. As far back as 1998, a suspect agent was found in reproductive tissue of livestock. It has now been isolated in high concentrations from semen, amniotic fluid as well as placental tissue. It has also been found in aborted foetal tissue. Some farms are reporting up to 50 percent fewer conceptions in animals due to increased miscarriages and pseudo-pregnancies. Although evidence of the widespread presence of this new pathogen is clear, Don Huber suggested the need for further research to understand not only what kind of pathogen it is, but importantly, the effects it is having on the health of plants as well as animals.

To conclude

Over 100 peer reviewed papers have been published by Huber and other scientists on the detrimental effects of glyphosate. Glyphosate increases disease in plants (as well as animals), prompting Huber to write to the Secretary of Agriculture. It may be linked to many health problems in animals and humans, which are an added cost to all the failed promises of a new agricultural technology that would feed the world. As Huber concluded, the "public trust has been betrayed."

Source: Institute of Science in Society

http://www.organicconsumers.org/articles/article_27101.cfm

Roundup more toxic than officially declared - new study

Thursday, 21 February 2013 21:31

Public Hearing Testimony for Bill # 6519 – An Act Concerning the Labeling of Genetically Modified Foods – March 15, 2013

The most widely used herbicide in the world contains compounds more toxic than declared - new research shows
CRIIGEN PRESS RELEASE
Caen, France, Feb. 21st, 2013

In a new research(1) published in the highly ranked scientific journal Toxicology, Robin Mesnage, Benoit Bernay and Professor Gilles-Eric Seralini, from the University of Caen, France, have proven (from a study of nine Roundup-like herbicides) that the most toxic compound is not glyphosate, which is the substance the most assessed by regulatory authorities, but a compound that is not always listed on the label, called POE-15. Modern methods were applied at the cellular level (on three human cell lines), and mass spectrometry (studies on the nature of molecules). This allowed the researchers to identify and analyse the effects of these compounds.

Context: Glyphosate is supposed to be the "active ingredient" of Roundup, the most widely used herbicide in the world, and it is present in a large group of Roundup-like herbicides. It has been safety tested on mammals for the purposes of regulatory risk assessment. But the commercial formulations of these pesticides as they are sold and used contain added ingredients (adjuvants). These are often classified confidential and described as "inerts". However, they help to stabilize the chemical compound glyphosate and help it to penetrate plants, in the manner of corrosive detergents. The formulated herbicides (including Roundup) can affect all living cells, especially human cells. This danger is overlooked because glyphosate and Roundup are treated as the same by industry and regulators in long-term studies. The supposed non-toxicity of glyphosate serves as a basis for the commercial release of Roundup. The health and environmental agencies and pesticide companies assess the long-term effects on mammals of glyphosate alone, and not the full formulation. The details of this regulatory assessment are jealously kept confidential by companies like Monsanto and health and environmental agencies.

Conclusion and consequences: This study demonstrates that all the glyphosate-based herbicides tested are more toxic than glyphosate alone, and explains why. Thus their regulatory assessments and the maximum residue levels authorized in the environment, food, and feed, are erroneous. A drink (such as tap water contaminated by Roundup residues) or a food made with a Roundup tolerant GMO (like a transgenic soya or corn) were already demonstrated as toxic in the recent rat feeding study (2) from Prof. Séralini team. The researchers have also published responses to critics of the study (3). This new research explains and confirms the scientific results of the rat feeding study.

Overall, it is a great matter of concern for public health. First, all authorizations of Roundup-type herbicides have to be questioned urgently. Second, the regulatory assessment rules have to be fully revised. They should be analyzed in a transparent and contradictory manner by the scientific community. Agencies that give opinions to government authorities, in common with the pesticide companies generally conclude safety. The agencies' opinions are wrong because they are made on the basis of lax assessments and much of the industry data is kept confidential, meaning that a full and transparent assessment cannot be carried out. These assessments are therefore neither neutral nor independent. They should as a first step make public on the Internet all the data that underpin the commercial release and positive opinions on the use of Roundup and similar products. The industry toxicological data must be legally made public.

Adjuvants of the POE-15 family (polyethoxylated tallowamine) have now been revealed as actively toxic to human cells, and must be regulated as such. The complete formulations must be tested in long-term toxicity studies and the results taken into account in regulatory assessments. The regulatory authorisation process for pesticides released into the environment and sold in stores must urgently be revised. Moreover, since the toxic confidential adjuvants are in general use in pesticide formulations, we fear according to these discoveries that the toxicity of all pesticides has been very significantly underestimated.

This study was conducted in the University of Caen with the structural support of CRIIGEN in the European Network of Scientists for Social and Environmental Responsibility (ENSSER www.ensser.org <http://www.ensser.org >).

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