

Monsanto's Roundup Linked to Cancer - Again

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(Image: [Jared Rodriguez / Truthout](#))

A brilliant and celebrated inventor, [John Franz](#), gave us an herbicide, Roundup, which has [changed](#) the face of agriculture. This herbicide has become the foundation for an entirely novel approach to farming - biotech agriculture - that has expanded rapidly throughout the globe.

Monsanto makes seeds for soy, corn, canola, cotton, alfalfa and sugar beets that are genetically engineered to be [tolerant to Roundup](#). The seeds are marketed in 120 countries. Throughout the world, Roundup is sprayed heavily as a weed killer without fear of damaging the cash

crops, which have been engineered to survive the herbicide's effects.

"The change in how agriculture is produced has brought, frankly, a change in the profile of diseases. We've gone from a pretty healthy population to one with a high rate of cancer, birth defects and illnesses seldom seen before."

Roundup seemed, at first, to be the perfect herbicide. It blocks the EPSP *synthase* enzyme, which prevents the synthesis of amino acids that plants need for growth. Since animals don't have this enzyme, it was initially hypothesized that they would be safe from Roundup's effects.

Unfortunately, Roundup has now been shown to affect much more than the EPSP synthase enzyme. The herbicide has been proven to cause [birth defects](#) in vertebrates, including in humans, and it may also be the cause of a fatal [kidney disease epidemic](#).

An increasing number of studies are now linking the herbicide to cancer.

Roundup Linked to Increased Cancer in "Soy Republic"

Roundup is now heavily sprayed in what is known as the "[Soy Republic](#)," an area of Latin America larger than the state of California. This region has undergone a profound transformation since genetically modified (GM) crops were first introduced in 1996. Some 125 million acres in Argentina, Brazil, Bolivia, Uruguay and Paraguay are now devoted to GM soy production.

Doctors serving these areas have documented an alarming increase in cancers. A group of dedicated physicians formed an organization, Doctors of Fumigated Towns. They held a [national conference](#) in August of 2010 in Córdoba, the center of Argentina's soy region. The Department of Medical Sciences of the National University at Córdoba sponsored the conference. An estimated 160 doctors from throughout the country attended.

Dr. Medardo Avila Vazquez, a pediatrician specializing in environmental health, explained his [concerns](#):



"The change in how agriculture is produced has brought, frankly, a change in the profile of diseases. We've gone from a pretty healthy population to one with a high rate of cancer, birth defects and illnesses seldom seen before. What we have complained about for years was confirmed and especially what doctors say about the sprayed towns and areas affected by industrial agriculture. Cancer cases are multiplying as never before in areas with massive use of pesticides."

Dr. Avila Vazquez blamed the biotech agricultural corporations for placing their profits over the public's health:

"The tobacco companies denied the link between smoking and cancer, and took decades to recognize the truth. The biotech and agrochemical corporations are the same as the tobacco industry; they lie and favor business over the health of the population."

It was the health of the population that concerned Dr. Damian Verzeñassi, professor of social and environmental health from the National University at Rosario. In 2010, he began a house-to-house epidemiological study of 65,000 people in Santa Fe, also in Argentina's soy region. He found [cancer](#) rates two to four times higher than the national average, with increases in breast, prostate and lung cancers.

Dr. Verzeñassi commented on his findings: "[Cancer has skyrocketed](#) in the last fifteen years."

Much the same was found in Chaco, Argentina's poorest province. In 2012, two villages were compared, the heavily sprayed farming village of Avia Terai and the non-sprayed ranching village of Charadai. In the farming village, 31 percent of residents had a family member with cancer while only 3 percent of residents in the ranching village had one.

Carlos Fria lives in Avia Terai. He has complained about glyphosate spraying in close proximity to his home:

"If the wind changes, the agrochemicals come into the house. My uncle just died of cancer. My wife too, passed away from cancer. Now many, many people are [dying of cancer](#). It didn't used to be like that. In my opinion, this has to do with the poison they put on the fields."

Roundup Linked to Lymphoma

Research has also been done in the United States, Canada, Europe, Australia and New Zealand investigating possible links between glyphosate, Roundup's active ingredient, and cancer. A large number of studies have focused on glyphosate's possible association with non-Hodgkin's lymphoma.

Scientists from the [International Agency for Research on Cancer \(IARC\)](#) have analyzed studies spanning almost three decades. The IARC is the branch of the World Health Organization that promotes cancer research. Scientists throughout the world with skills in epidemiology, laboratory sciences and biostatistics are brought together to identify the causes of cancer so that preventive measures may be instituted. The agency views cancers as linked, directly or indirectly, to environmental factors.

The research shows that Roundup is linked to a host of cancers in those living in the heavily sprayed regions of Latin America. It has also been linked to B cell lymphoma, and to brain cancer.

In April of 2014, scientists at the IARC published their review of [twenty-five years of research](#) on the relationship between pesticide exposure and non-Hodgkin's lymphoma. They found a positive association between organo-phosphorus herbicides, like glyphosate, and this cancer. The B cell lymphoma sub-type, in particular, was strongly associated with glyphosate exposure.

Roundup Linked to Brain Cancer

The linkage to lymphoma is the most recent research raising concerns about glyphosate's connection to cancer. Scientists from the [Agency for Toxic Substances and Disease Registry](#), a branch of the US Department of Health and Human Services, specialize in illnesses caused by toxic substances. They published the results of the US Atlantic Coast Childhood Brain Cancer Study in 2009. Children with [brain cancer](#) from Florida, New Jersey, New York and Pennsylvania were compared to age matched controls. The researchers found that if either parent had been exposed to Roundup during the two years before the child's birth, the chances of the child developing brain cancer doubled.

Roundup and Cancer: Human Observations Summarized

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While the epidemiological studies show close correlation, they cannot prove causality. The gold standard for scientific proof is a randomized controlled trial, which would be unethical in this instance. You cannot ethically expose humans to an herbicide. Scientists therefore use a variety of experimental models to assess cancer risk.



Roundup Causes DNA Damage, Errors During Cell Division

Cancer risk can be evaluated by experiments that measure Roundup's ability to induce DNA damage.

One of the initial steps in the development of cancers is often damage to our DNA. Each of our cells gets its operating instructions from its DNA. If the DNA is damaged, the faulty operating instructions can re-program cells to divide rapidly and chaotically. When this happens, cells become transformed into cancers.

A number of experiments have been done using various animal models, all showing the same results: after exposure to Roundup, cells exhibited DNA damage. This was true in [fruit fly](#) larvae, in [mice](#), in the blood cells of the European [eel](#) and in the [lymphocytes of cows](#).

Another experimental model that has been used to judge glyphosate's cancer risk focuses on the herbicide's impact on cell division. Cells are vulnerable to being turned into cancers if an error is made during this delicate process. In the process of cell division, the DNA must be copied precisely. Each daughter cell must receive from its parent cell an identical copy of the DNA. If a mistake is made, the daughter cells will receive faulty DNA copies. Cells with damaged DNA can turn into cancers.

In a 2004 study done at the National Scientific Research Center and the University of Pierre and Marie Curie in France, Roundup caused significant [errors](#) in the cell division of sea urchin embryos. The scientists commented that these abnormalities are hallmarks of cancer and delivered a particularly chilling warning: The concentration of Roundup needed to cause these errors was 500 to 4,000 times lower than the dose to which humans may be exposed by aerial spraying or handling of the herbicide.

Roundup Damages Human DNA

The most worrisome of the DNA studies are the ones that show DNA damage in humans.

Dr. Fernando Manas, a biologist at the National University of Rio Cuarto in Argentina, has been investigating the effects of pesticides for years. He believes that glyphosate spraying is causing [cancer](#) by inducing DNA damage. His research has documented genetic damage in those exposed. When Dr. Manas studied pesticide sprayers working in the soy industry in Córdoba, he found significantly more DNA damage in their lymphocytes than in those of an unexposed group of controls. Roundup was one of the most commonly used pesticides.

The pesticide sprayers in Córdoba, the Ecuadorians living in Sucumbíos, and the normal volunteers all developed Roundup-induced DNA damage in their lymphocytes.

Genetics researchers from the Pontifical Catholic University in Quito, Ecuador evaluated Ecuadorians living in the Sucumbíos district in northern Ecuador for evidence of DNA damage. This area was heavily sprayed with Roundup by the Colombian government to eradicate illicit crops. Those exposed to the herbicide developed a number of acute symptoms, including abdominal pain, vomiting, diarrhea, fever, heart palpitations, headaches, dizziness, numbness, insomnia, depression, shortness of breath, blurred vision, burning of eyes, blisters and rash. When compared to a control group, they also showed significantly more [DNA damage](#).

Interestingly, scientists have known since 1998 that when normal human lymphocytes were exposed to Roundup in a test tube, the lymphocytes developed [DNA damage](#).

The pesticide sprayers in Córdoba, the Ecuadorians living in Sucumbíos, and the normal volunteers all developed Roundup-induced DNA damage in their lymphocytes. A cancer of the lymphocytes is known as a "lymphoma," the very same type of cancer that the International Agency for Research on Cancer showed to be strongly associated with glyphosate exposure.

Roundup Boosts Cancer in Tissue Culture Studies

Another method that scientists have used to assess Roundup's cancer risk is to expose cells grown in "tissue culture" to the herbicide. Sheets of cells are grown on a small dish with nutrients. Glyphosate is added and its effects are observed.

In 2010, researchers in India exposed mouse skin cells grown in tissue culture to Roundup. When the herbicide was added, the cells became [cancerous](#).

Scientists in Thailand studied the impact of Roundup on human estrogen-responsive breast cancer cells in tissue culture. They published their results in 2013. Hormone-responsive breast cancer cells are known to grow when exposed to estrogen. Roundup also stimulated these cells to grow. The herbicide was able to bind to the cancer's estrogen receptors, thus mimicking the effects of estrogen and accelerating tumor growth.

Roundup Causes Cancer in Test Animals

Roundup's effects have been assessed in studies with a variety of test animals for more than three decades.



One of the earliest studies was done in 1979-1981, under the auspices of the United Nations Environmental Program, the International Labor Organization and the World Health Organization. Rats exposed to low levels of the herbicide developed [testicular cancer](#). A larger dose did not produce the cancer. Unfortunately, at the time of the experiment, it was not understood that certain substances have more potent effects at lower doses than at higher doses. The evaluators erroneously dismissed the results showing the low-dose effect.

In a study from the Institute of Biology at the University of Caen in France, researchers studied glyphosate's effects on rats. Originally published in 2012, the resulting report was retracted after the biotech agriculture [industry](#) complained. After extensive review failed to show any fraud or problem with the data, the report was re-published in 2014. In this study, Roundup was shown to double the incidence of mammary gland tumors. These [cancers](#) developed much faster in rats exposed to Roundup than in controls. There was also an increase in cancers of the pituitary gland.

Rounding Up the Evidence

Epidemiological studies in humans, in the soy regions of Argentina and in Europe, the United States, Canada, Australia and New Zealand have shown Roundup to be linked to an increase in cancer risk. There is a strong association between Roundup and B cell lymphoma, brain cancer and a variety of other cancers in those living in heavily sprayed areas.

In addition to these epidemiological observations, laboratory studies have shown that Roundup causes DNA damage, disturbs cell division, increases cancer growth in tissue culture and induces cancer when fed to test animals.

Proving Causality

Does the evidence linking Roundup to cancer prove causality? In the 1964 landmark [Surgeon General's Report](#), which for the very first time linked tobacco to cancer, Surgeon General [Dr. Luther Terry](#) presented criteria for the establishment of a cause and effect relationship in a scientific study.

To meet Dr. Terry's criteria, an association must be strong, specific and consistent. Cause must precede effect. And the association must be biologically plausible.

Biotech agriculture's most powerful backer, it seems, is the government of the United States.

How well does the association between Roundup and cancer fit these criteria?

Roundup exposure is consistently and specifically associated with precancerous abnormalities in a wide variety of experimental settings. Epidemiological observations show a tight linkage between glyphosate and cancer. In the laboratory research, as well as in the epidemiological studies in the field, exposure to the herbicide precedes the development of the abnormalities. There are plausible biological mechanisms that explain how glyphosate can transform cells into cancers.

In citing the Surgeon General's report, Drs. Wild and Seber, in their highly regarded statistics textbook, *Chance Encounters*, provide an example of a [strong association](#). If an "illness is four times as likely among people exposed to a possible cause as it is for those who are not exposed," the association is considered strong.

Most of the glyphosate exposure experiments and epidemiological observations show a doubling of cancer risk. This leaves some room for doubt.

But who, given the science, would want to expose their loved ones to Roundup?

The State of the Science vs. the Science of the State

Roundup has now been conclusively proven to cause birth defects and to be closely linked to cancer. If we do not want this herbicide to accumulate in our [water](#), land, and food, we need to stop using it.

In the final sad irony, when the cancer cells reach their growth peak, they kill their host and die in the process.

The science is clear, but powerful economic interests have, thus far, prevailed. The executives of the biotech agricultural corporations and their backers have [ignored or denied](#) the science documenting Roundup's harm.

Biotech agriculture's most powerful backer, it seems, is the government of the United States.

This official policy was explained in a 2010 US State Department [cable](#) from former Secretary of State Hillary Clinton:

"Our biotech outreach objectives for 2010 are to increase access to, and markets for, biotech as a means to help address the underlying causes of the food crisis, and to promote agricultural technology's role in mitigating climate change and increasing biofuel production."

The US government has been willing to exercise its muscle in support of the biotech agricultural corporations.

In El Salvador, for example, the United States recently pressured the government to buy Monsanto's GM seeds or



risk losing \$277 million in development aid. El Salvador refused and stood firm, preferring to buy the seeds from its own struggling farmers.

Cancer's Lessons

There is a disturbing parallel between the exponential growth of biotech agriculture and the spread of a cancer in the human body.

Cancers are cells that reproduce rapidly and haphazardly with no regard for the greater good of the organism. Cancer cells consume valuable energy, starving out normal cells. They grow so wildly and so quickly that they crowd out their neighbors. They send off emissaries to start new cancer colonies. They make harmful substances that damage healthy cells. They spread relentlessly. In the final sad irony, when the cancer cells reach their growth peak, they kill their host and die in the process.

Like a cancer, biotech agriculture has crowded out its neighbors and is spreading relentlessly. Also like a cancer, it makes harmful substances. Roundup is one of them. As more acreage comes under GM cultivation, we can expect Roundup use to continue to increase.

Roundup kills plants, causes birth defects in vertebrates, and is linked to cancer. Can a living planet withstand the continuous assault from this poison any more than the human body can withstand the attack from an aggressive cancer?

Do we need to fight biotech agriculture with the same persistence, commitment and force that we bring to bear in battling cancers?

The author thanks Vivien Feyer for contributions to this article.

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