

# GMO Toxicology Report

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New Research: GMO Food Far Worse Than We Think

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## New Research: GMO Food Far Worse Than We Think

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Disturbing new research published in the Journal of Applied Toxicology indicates that genetically modified (GM) crops with "stacked traits" -- that is, with multiple traits such as glyphosate-herbicide resistance *and* Bacillus thuringiensis (Bt) insecticidal toxins engineered together into the same plant, are likely far more dangerous to human health than previously believed, due to their synergistic toxicity.

Resistance to glyphosate, the active ingredient in the herbicide Roundup, has been engineered into many GM plants, so that fields can be sprayed indiscriminately with herbicide without destroying the crops. While the GM glyphosate-resistant plants survive, they subsequently contain residues of glyphosate and its various metabolites (e.g. aminomethylphosphonic acid) that present a significant health threat to the public.

In this latest study the glyphosate-containing herbicide Roundup was tested on human embryonic kidney cells at concentrations between 1 to 20,000 parts per million (ppm). It was found that concentrations **as low as 50 ppm per million**, which the authors noted were "far below agricultural dilutions," induced cell death, with the 50% of the cells dying at 57.5 ppm.

The researchers also found that the insecticidal toxin produced by GM plants known as Cry1Ab was capable of causing cell death at 100 ppm concentrations.

Taken together the authors concluded:

In these results, we argue that modified Bt toxins are not inert on nontarget human cells, and that they can present combined side-effects with other residues of pesticides specific to GM plants.

These disturbing findings follow on the heels of recent revelations that Roundup is *several orders of magnitude* more toxic than previously believed. Only 5 days ago (Feb. 14) the journal Archives of Toxicology reported that Roundup is toxic to human DNA even when diluted to concentrations **450-fold lower than used in agricultural applications**.

This effect is likely due to the presence of the surfactant polyoxyethyleneamine within the Roundup formulation which may dramatically enhance the absorption of glyphosate into exposed human cells and tissue.

New research released ahead of print and published in the journal Archives of Toxicology indicates that Roundup, the most common formulation of the herbicide glyphosate, is not

only *more toxic* than its constituent ingredients, but is capable of damaging DNA within a human cell line when diluted down to **450-fold lower concentrations** than presently used in GMO agricultural applications. In the researchers' own words, Roundup has "genotoxic effects after short exposure to concentrations that correspond to a 450-fold dilution of spraying used in agriculture."

The chemical - **glyphosate** - is the highest selling herbicide in the world and has been identified as having a wide range of potential adverse health effects -- largely minimized and/or under-reported -- which include over two dozen diseases. Glyphosate's primary properties of concern are its carcinogenicity, genotoxicity and endocrine disruptive actions. Roundup contains a surfactant known as polyoxyethyleneamine which functions to reduce the surface tension between Roundup and the cells exposed to it, making the cellular membranes more permeable to absorbing glyphosate and other chemicals within the formula. The surfactant in Roundup may therefore be responsible for increasing the toxicity of glyphosate **by several orders of magnitude higher** than it exhibits by itself.

This new research sheds light on a fundamental problem associated with toxicological risk assessments of agrichemicals (and novel manmade chemicals in general), namely, these assessments do not take into account the reality of synergistic toxicologies, i.e. the amplification of harm associated with multiple chemical exposures occurring simultaneously. Moreover, toxicological risk assessments on novel chemicals are based on the concept of determining "an acceptable level of harm," instead of protecting those who would be exposed to a chemical by implementing the precautionary principle, i.e. if there is reason to believe that a chemical *could* cause harm (determined by animal and in vitro studies) then they *should* be regulated as if they do cause harm to humans. The precautionary principle would require that the manufacturers of these chemicals prove their product is safe to humans before being allowed to release it onto the market or into the environment, rather than putting the burden of proving it unsafe on the consumer and/or exposed populations, as is presently the case.

Glyphosate exposure is now ubiquitous due to the fact that 88,000 tons of it were used in US in 2007 alone, and likely billions of additional pounds globally. Accumulating evidence

indicates it is resistant to biodegradation and now contaminates the air, rain and groundwater throughout the areas where it has been applied.

**Glyphosphate pollution is so omnipresent in the US that the frequency of detection ranged from 60 to 100% in both air and rain.**

**Glyphosate can be detected in the urine of farmers and their families in farms where Roundup pesticide is used.**

**Glyphosate pesticide (Roundup) exposure is a risk factor for non-Hodgkin lymphoma and Hairy Cell leukemia.**

**Glyphosate pesticide (Roundup) exposure is a risk factor for non-Hodgkin lymphoma.**

**Glyphosphate exposure has been linked to rhinitis among pesticide applicators.**

**Large scale bioenergy crop expansion results in levels of chemicals in the environment unsafe for human and ecological health.**

**Prepubertal exposure to commercial formulation of the herbicide glyphosate alters testosterone levels and testicular morphology.**

**There is evidence that there is a genotoxic risk potential associated with exposure to glyphosate in areas where the herbicide is applied.**

**The environmental metabolite of glyphosate, Aminomethylphosphonic acid, exhibits genotoxicity.**

**Glyphosphate poisoning resulting in aseptic meningitis has been reported.**

**Parkinsonism after chronic occupational exposure to glyphosate has been reported.**

**"Aminomethylphosphonic acid, a metabolite of glyphosate, causes injury in glyphosate-treated, glyphosate-resistant soybean."**

**"Glyphosate and AMPA exhibited high vertical mobility in the treated soil, quickly reaching high concentrations in subsurface horizons where the degradation is slower."**

"lyphosate-based herbicides are "info-disruptors" that alter the ability of males to detect and/or react fully to female signals."

Commercial glyphosate herbicides exhibit genotoxicity in fish.

Endocrine and toxic effects of Roundup, not just glyphosate, can be observed in mammals, and Roundup adjuvants enhance glyphosate bioavailability and/or bioaccumulation.

Ginkgo biloba protects against glyphosate toxicity in mice.

Glyphosate and especially Roundup Ultra bioaccumulates and causes oxidative stress in freshwater worms.

Glyphosate has the potential to contribute to groundwater contamination.

Glyphosate herbicides exhibit a wide range of toxicities to tadpoles.

Glyphosate impairs male offspring reproductive development.

Groundup herbicide exhibits toxicity in North American frog species and results in malformations in tadpoles due perhaps to its endocrine disrupting activity.

Roundup herbicide may contribute to widespread amphibian declines due to its significant toxicity on tadpoles.

The herbicide glyphosate (and its metabolite) was found in all plant species tested.

The herbicide Roundup may cause disorder in the morphophysiology of the male genital system of animals.

Roundup exposure may adversely affect human reproduction and fetal development in case of contamination.

"2,4-Dichlorophenoxyacetic acid (2,4-D)–resistant crops and the potential for evolution of 2,4-D–resistant weeds."

Glyphosate has been linked to lymphatic cancer.

Glyphosate herbicides may exhibit sublethal adverse effects on non-pest insects.

Glyphosphate has liver damaging properties.

Roundup contains compounds which exhibit significant toxicity to bacteria, microalgae, protozoa and crustaceans.

Roundup has a direct toxicological effect on freshwater microbial communities, dramatically altering the ratios of organisms found there.

Roundup herbicide is more toxic than its constituent parts and is genotoxic in concentrations that correspond to a 450-fold dilution of spraying used in agriculture.

27 Diseases associated with Glyphosate (Roundup)

<b><u>Lymphoma: Non-Hodgkin</u></b>
<b><u>Hormonal Disorders: Children</u></b>
<b><u>DNA damage</u></b>
<b><u>Testosterone: Too Low</u></b>
<b><u>Hairy Leukoplakia</u></b>
<b><u>Lymphoma</u></b>
<b><u>Pesticide Toxicity</u></b>
<b><u>Prenatal Chemical Exposures</u></b>
<b><u>Chemical Exposure</u></b>
<b><u>Rhinitis</u></b>
<b><u>Endocrine Diseases</u></b>
<b><u>Glyphosate Toxicity</u></b>
<b><u>Liver Cancer</u></b>
<b><u>Mercury Poisoning</u></b>
<b><u>Postnatal Care: Breastfeeding</u></b>
<b><u>Pregnancy: Environmental Exposures</u></b>
<b><u>Meningitis: Aseptic</u></b>
<b><u>Parkinsonism</u></b>
<b><u>Chemically-Induced Liver Damage</u></b>
<b><u>Infertility: Male</u></b>
<b><u>Male Reproductive Development Abnormalities</u></b>
<b><u>Skin Cancer</u></b>
<b><u>Kidney Damage</u></b>
<b><u>Lipid Peroxidation</u></b>
<b><u>Liver Damage</u></b>
<b><u>Lymphatic Cancer</u></b>
<b><u>Oxidative Stress</u></b>