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ISIS Press Release 07/03/05

# Glyphosate Toxic & Roundup Worse

[Dr. Mae-Wan Ho](#) and [Prof. Joe Cummins](#) call for urgent regulatory review of the most widely used herbicide in the light of new scientific evidence

New research findings are raising serious concerns over the safety of the most commonly used herbicide, and should be sending shockwaves through proponents of genetically modified (GM) crops made tolerant to the herbicide, which now account for 75% of all GM crops in the world.

Worse yet, the most common formulation of the herbicide is even more toxic than the herbicide by itself, and is made by the same biotech giant that created the herbicide tolerant GM crops.

Broad-spectrum herbicide glyphosate (N-(phosphonomethyl)glycine), commonly sold in the commercial formulation Roundup (Monsanto company, St. Louis, Missouri USA) has been frequently used both on crops and non-crops areas world wide since it was introduced in the 1970s. Roundup is a combination of glyphosate with other chemicals including a surfactant (detergent) polyoxyethyleneamine that enhance the spreading of the spray droplets on the leaves of plants. The use of Roundup has gone up especially in countries growing Roundup-tolerant GM crops created by Monsanto.

Glyphosate kills plants by inhibiting the enzyme, 5-enolpyruvyl-shikimate-3-phosphate synthetase (EPSPS), essential for the formation of aromatic amino acids such as phenylalanine, tyrosine and tryptophan; which leads onto vitamins and many secondary metabolites such as folates, ubiquinones and naphthoquinones. It is believed to be rather specific in action and less toxic than other herbicides, because the shikimate pathway is not present in mammals and humans. However, glyphosate acts by preventing the binding of phosphoenol pyruvate to the active site of the enzyme, and phosphoenol pyruvate is a core metabolite present in all organisms: thus it has the potential to

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metabolic present in an organism, thus it has the potential to affect other metabolic pathways. This is borne out by many reports of toxicities associated with the herbicide reviewed in the Independent Science Panel Report, [The Case for a GM-free Sustainable World](#) [1].

An epidemiological study in the Ontario farming populations showed that glyphosate exposure nearly doubled the risk of late spontaneous abortions [2], and Prof. Eric-Giles Seralini and his research team from Caen University in France decided to find out more about the effects of the herbicide on cells from the human placenta.

They have now shown that glyphosate *is* toxic to human placental cells, killing a large proportion of them after 18 hr of exposure at concentrations below that in agricultural use [3]. Moreover, Roundup is always more toxic than its active ingredient, glyphosate; at least by two-fold. The effect increased with time, and was obtained with concentrations of Roundup 10 times lower than agricultural use.

The enzyme aromatase is responsible for making the female hormones estrogens from androgens (the male hormones). Glyphosate interacts with the active site of the enzyme but its effect on enzyme activity was minimal unless Roundup was present.

Interestingly, Roundup increased enzyme activity after 1 h of incubation, possibly because of its surfactant effect in making the androgen substrate more available to the enzyme. But at 18h incubation, Roundup invariably inhibited enzyme activity; the inhibition being associated with a decrease in mRNA synthesis, suggesting that Roundup decreased the rate of gene transcription. Seralini and colleagues suggest that other ingredients in the Roundup formulation enhance the availability or accumulation of glyphosate in cells.

There is, indeed, direct evidence that glyphosate inhibits RNA transcription in animals at a concentration well below the level that is recommended for commercial spray application. Transcription was inhibited and embryonic development delayed in sea urchins following exposure to low levels of the herbicide and/or the surfactant polyoxyethyleneamine. The pesticide should be considered a health concern by inhalation during spraying [4].

New research shows that a brief exposure to commercial glyphosate caused liver damage in rats, as indicated by the leakage of intracellular liver enzymes. In this study, glyphosate and its surfactant in Roundup were also found to act in synergy to increase damage to the liver [5].

Three recent case-control studies suggested an association between glyphosate use and the risk of non-Hodgkin lymphoma [6-8]; while a prospective cohort study in Iowa and North Carolina that includes more than 54 315 private and commercial licensed pesticide applicators suggested a link between glyphosate use and multiple myeloma [9]. Myeloma has been associated with agents that cause either DNA damage or immune suppression. These studies did not distinguish between Roundup and glyphosate, and it would be important for that to be done.

***There is now a wealth of evidence that glyphosate requires worldwide health warnings and new regulatory review. Meanwhile, its use should be reduced to a minimum as a matter of prudent precaution.***

## References

1. The Case for a GM-Free Sustainable World, Chapter 7, ISIS & TWN, London & Penang, 2003.
2. Savitz DA, Arbuckle, Kaczor D, Curtis KM. Male pesticide exposure and pregnancy outcome. *Am J Epidemiol* 2000, 146, 1025-36.
3. Richard S, Moslemi S, Sipahutar H, Benachour N. and Seralini GE. Differential effects of glyphosate and roundup on human placental cells and aromatase. *Environ Health Perspect.* 2005 Jun;113(6):716-20
4. Marc J, Le Breton M, Cormier P, Morales J, Belle R and Mulner-Lorillo O. A glyphosate-based pesticide impinges on transcription. *Toxicology and Applied Pharmacology* 2005, 203, 1-8.



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5. Benedetti AL, de Lourdes Vituri C, Trentin AG, Dominguesc MAC and Alvarez-Silva M. The effects of sub-chronic exposure of Wistar rats to the herbicide Glyphosate-Biocarb. *Toxicology Letters* 2004, 153, 227–32.
6. De Roos AH, Zahm SH, Cantor KP, et al. Integrative assessment of multiple pesticides as risk factors for non-Hodgkin's lymphoma among men. *Occup Environ Med* 2003, 60, E11  
<http://oem.bmjournals.com/cgi/content/full/60/9/e11>
7. Hardell L, Eriksson M, Nordstrom M. Exposure to pesticides as risk factor for non-Hodgkin's lymphoma and hairy cell leukemia: pooled analysis of two Swedish case-control studies. *Leuk Lymphoma* 2002, 43,1043–1049.
8. McDuffie HH, Pahwa P, McLaughlin JR, Spinelli JJ, Fincham S, Dosman JA, et al. 2001. Non-Hodgkin's lymphoma and specific pesticide exposures in men: cross-Canada study of pesticides and health. 2001, *Cancer Epidemiol Biomarkers Prev* 2001,10,1155–63.
9. De Roos AJ, Blair A, Rusiecki JA, Hoppin JA, Svec M, Dosemeci M, Sandler DP and Alavanja MC. Cancer incidence among glyphosate-exposed pesticide applicators in the agricultural health study. *Environ Health Perspect* 2005, 113, 49-54.

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