JOHN ELIAS BALDACCI
GOVERNOR

STATE OF MAINE
MAINE DEPARTMENT OF AGRICULTURE, FOOD & RURAL RESOURCES
BOARD OF PESTICIDES CONTROL
28 STATE HOUSE STATION
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SETH BRADSTREET
COMMISSIONER
HENRY JENNINGS
DIRECTOR

TO: Board Members
FROM: Lebelle Hicks PhD DABT
RE: Recent Correspondence regarding Glyphosate and Roundup

August 19, 2009
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Attached are sets of two e-mails relating to two glyphosate reports. The first refers to a recent study published in the journal, Toxicology: *Glyphosate-based herbicides are toxic and endocrine disruptors in human cell lines* by Gasnier C, Dumont C, Benachour N, Clair E, Chagnon MC, Séralini GE. Toxicology. 2009 Aug 21;262(3):184-91. Epub 2009 Jun 17. The abstract (attached) for this study was received from Barry Mower at ME DEP and John Harker, Ag, forwarded it from Nancy Oden. The abstract is followed by my response to Barry Mower and John Harker, the first e-mail, followed by an analysis by Crystal Gammon Environmental Health dated June 23rd and supplied by both Barry Mower and Nancy Oden.

The second e-mail trail involves a report of an embryologist from Argentina, Dr. Andres Carrasco, and his discussion with the media surrounding unpublished data from his lab. The Monsanto response from Kim Morin is also attached, as is Health Argentina's April 15th take on this news report.

## Abstract of Study from PubMed

1: Toxicology. 2009 Aug 21;262(3):184-91. Epub 2009 Jun 17.
Glyphosate-based herbicides are toxic and endocrine disruptors in human cell lines.
Gasnier C, Dumont C, Benachour N, Clair E, Chagnon MC, Séralini GE.
University of Caen, Institute of Biology, Lab. Biochemistry EA2608, Esplanade de la Paix, 14032 Caen cedex, France.

Glyphosate-based herbicides are the most widely used across the world; they are commercialized in different formulations. Their residues are frequent pollutants in the environment. In addition, these herbicides are spread on most eaten transgenic plants, modified to tolerate high levels of these compounds in their cells. Up to 400 ppm of their residues are accepted in some feed. We exposed human liver HepG2 cells, a well-known model to study xenobiotic toxicity, to four different formulations and to glyphosate, which is usually tested alone in chronic in vivo regulatory studies. We measured cytotoxicity with three assays (Alamar Blue, MTT, ToxiLight), plus genotoxicity (comet assay), anti-estrogenic (on ERalpha, ERbeta) and anti-androgenic effects (on AR) using gene reporter tests. We also checked androgen to estrogen conversion by aromatase activity and mRNA. All parameters were disrupted at sub-agricultural doses with all formulations within 24h. These effects were more dependent on the formulation than on the glyphosate concentration. First, we observed a human cell endocrine disruption from 0.5 ppm on the androgen receptor in MDA-MB453-kb2 cells for the most active formulation (R400), then from 2 ppm the transcriptional activities on both estrogen receptors were also inhibited on HepG2. Aromatase transcription and activity were disrupted from 10 ppm. Cytotoxic effects started at 10 ppm with Alamar Blue assay (the most sensitive), and DNA damages at 5 ppm. A real cell impact of glyphosate-based herbicides residues in food, feed or in the environment has thus to be considered, and their classifications as carcinogens/mutagens/reprotoxics is discussed.

Publication Types:
Research Support, Non-U.S. Gov't
PMID: 19539684 [PubMed - indexed for MEDLINE]

## Via E-mail

TO: John Harker and Barry Mower
FROM: Lebelle Hicks
August 19, 2009

John and Barry,

This is comes as no surprise, the aquatic toxicity of Roundup has historically been associated with the surfactant concentration for years. The aquatic formulations of glyphosate do not have the same surfactants. While the cell lines are not aquatic, I would expect that the surfactant would have a similar effect on cells in culture. As a rule, endocrine disrupter studies done on cell lines give you only part of the puzzle, does the chemical interact with the endocrine receptor, not does this reaction occur in the intact animal where you have metabolism and excretion going on in addition to the interaction with the receptor of choice.

I can put this paper on my list of articles to retrieve the next time I get to the UMO library, if you need it in a hurry, I'll see what I can do.

Lebelle

-----Original Message-----
**From:** Harker, John
**Sent:** Wednesday, August 19, 2009 6:50 AM
**To:** Hicks, Lebelle
**Subject:** FW: [sprayno] Glyphosate-based herbicides are toxic and endocrine disruptors in human cell lines

Lebelle,

Could you get a copy of this research article for me. I am interested to see it. Your comments, as well, would be appreciated.

John

Agricultural Resource Management Coordinator
Maine Department of Agriculture, Food and Rural Resources
28 State House Station
Augusta, Maine 04333

Telephone: 207-287-7620
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**From:** NANCY ODEN [mailto:cleanearth@myfairpoint.net]
**Sent:** Tuesday, August 18, 2009 8:47 PM
**To:** Harker, John
**Subject:** Fw: [sprayno] Glyphosate-based herbicides are toxic and endocrine disruptors in human cell lines

John - Here's one Glyphosate research paper I mentioned, but there are a couple of others that I will forward when I get a couple of minutes to look them up..... - Nancy

**FROM: Crystal Gammon Environmental Health,**
**supplied to the BPC by Barry Mower and Nancy Oden**

Popular herbicide more deadly to liver cells than its active chemical alone.

Aug 18, 2009

Gasniera C, C Dumontb, N Benachoura, E Claira, MC Chagnonb and GE Séralini. 2009. Glyphosate-based herbicides are toxic and endocrine disruptors in human cell lines. Toxicology doi:10.1016/j.tox.2009.06.006.

Synopsis by Negin P. Martin, Ph. D

Very low doses of some types of the herbicide Roundup can disrupt human liver cell function; the formulations' toxicity may be tied to their "inactive" ingredients rather than the active weed-killing ingredient glyphosate. French scientists report that a number of Roundup formulations tested at very dilute concentrations can alter hormone actions and cause human liver cells to die within 24 hours of treatment. The toxicity of some of the formulations was independent of how much glyphosate - the active herbicide in Roundup - they contained, suggesting it is other "inert" ingredients that may alone - or in combination with each other and/or the weedkiller - assault the cells. This study's results are similar to prior studies - as reported in a recent Environmental

Health News article (http://www.environmentalhealthnews.org/ehs/news/roundup-weed-killer-is-toxic-to-human-cells.-study-intensifies-debate-over-inert-ingredients) - that find human embryo cells are affected more by the Roundup formulations and an inert ingredient than by the active ingredient.

The levels of Roundup used in this study are similar to what is typically found in food crops or animal feed treated with Roundup. Because of this, it is possible that people, livestock and wildlife may be exposed to levels of the herbicide mix that can damage cells. Glyphosate is harmful to humans and animals even at a very low dose. It is often tested by itself in regulatory studies to determine if the Roundup formulation is toxic.

However, according to this study, levels of glyphosate in Roundup formulations are not good indicators of toxicity. The ingredients responsible for the increased potency of Roundup formulations seen in this study - as compared to purified glyphosate - remain unknown. The chemical formulas of herbicide additives are generally protected as trade secrets, and the researchers did not try to chemically identify them. Therefore, their effects cannot be easily investigated and they remain undetected in the environment.

Roundup was developed as a weapon against weeds. Many genetically modified (GM) plants have been developed to tolerate Roundup. Today, Roundup is the most widely used weedkiller in the world and 75 percent of all GM plants are engineered to resist the herbicide. Monsanto agricultural company produces both Roundup and Roundup-resistant GM plants.

Four Roundup formulations - Roundup Express 7.2 (R7.2), Bioforce (R360), Grands Travaux (R400) and Grands Travaux Plus (R450) - were tested in this study. All formulations were more potent than purified glyphosate (at similar levels to R360) in causing cell death. Surprisingly, R400 containing less glyphosate was more toxic to human liver cells than R450. In the study, exposure of a single gene regulated by either estrogen or androgen hormones demonstrated that all formulations disrupt hormone function more efficiently than purified glyphosate. The findings show that the formulations act against the hormones to produce anti-estrogenic and anti-androgenic effects.

## Schlein, Paul B

**From:** Hicks, Lebelle
**Sent:** Wednesday, August 19, 2009 11:52 AM
**To:** Schlein, Paul B
**Subject:** RE: Emailing: email-article_end-disrupt_oden_6-09_web.pdf, email-article_glyphosate_oden-mower-morin_6-09_web.pdf

**Attachments:** carrasco article seed-09-07-9.pdf

carrasco article seed-09-07-9....

Paul,

I did another search on A. Carrasco, embryologist from Argentina and identified the attached report. It appears that the interview he granted the local paper in Argentina, pre-dated his publication of the study, which would explain why we couldn't find it in the scientific literature.

Please include the appropriate section in the Board Package.

Lebelle

-----Original Message-----
From: Schlein, Paul B
Sent: Monday, August 03, 2009 11:27 AM
To: Hicks, Lebelle
Cc: Jennings, Henry; Fish, Gary
Subject: Emailing: email-article_end-disrupt_oden_6-09_web.pdf, email-article_glyphosate_oden-mower-morin_6-09_web.pdf

Hi Lebelle,

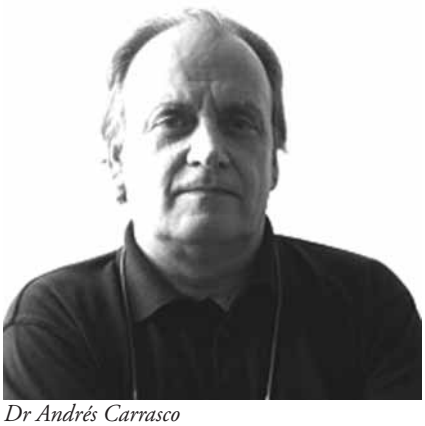
Here are the two articles we discussed at today's staff meeting.

Do you have that new university research funding article that John sent?

Thanks.
Paul

# "I expected a reaction but not such a violent one"

In April 2009 Andrés Carrasco, an Argentinian embryologist, gave an interview to the leading Buenos Aires newspaper *Página 12*, in which he described the alarming results of a research project he is leading into the impact of the herbicide glyphosate on the foetuses of amphibians. Dr Carrasco, who works in the Ministry of Science's Conicet (National Council of Scientific and Technical Investigations), said that their results suggested that the herbicide could cause brain, intestinal and heart defects in the foetuses. Glyphosate is the herbicide used in the cultivation of Monsanto's genetically modified soya, which now covers some 18 million hectares, about half of Argentina's arable land.[1]



*Dr Andrés Carrasco*

Carrasco said that the doses of herbicide used in their study were "much lower than the levels used in the fumigations". Indeed, as some weeds have become resistant to glyphosate, many farmers are greatly increasing the concentration of the herbicide. According to *Página 12*, this means that, in practice, the herbicide applied in the fields is between 50 and 1,540 times stronger than that used by Carrasco. The results in the study are confirming what peasant and indigenous communities – the people most affected by the spraying – have been denouncing for over a decade. The study also has profound consequences for the USA's anti-narcotics strategy in Colombia, because the planes spray glyphosate, reinforced with additional chemicals, on the *coca* fields (and the peasants living among them).

Three days after the interview, the Association of Environmental Lawyers filed a petition with the Argentine Supreme Court, calling for a ban on the use and sale of glyphosate until its impact on health and on the environment had been investigated. Five days later the Ministry of Defence banned the planting of soya in its fields. This sparked a strong reaction from the multinational biotechnology companies and their supporters. Fearful that their most famous product, a symbol of the dominant farming model, would be banned, they mounted an unprecedented attack on Carrasco, ridiculing his research and even issuing personal threats. He was accused of inventing his whole investigation, as his results have not yet been peer-reviewed and published in a prestigious scientific journal.

Carrasco was firm in his response: "When one is dealing with a subject of limited public interest, one can keep the study secret until all the last details have been resolved. But when one uncovers facts that are important for public health, one has an obligation to make an effort to publish the results urgently and with maximum publicity." Even so, he was clearly taken aback by the strength of the reaction. "It was a violent, disproportionate, dirty reaction", he said. "I hadn't even discovered anything new, only confirmed conclusions that others had reached. One has to remember, too, that the study originated in contacts with communities that have suffered the impact of agro-chemicals. They are the undeniable proof of the impact." He is not intimidated: "If I know something, I will not shut my mouth."

1. See *Seedling* January 2009, "Twelve Years of GM Soya in Argentina – a Disaster for People and the Environment'. http://www.grain.org/seedling/?id=578

**From:** Hicks, Lebelle
**Sent:** Monday, June 08, 2009 8:48 AM
**To:** Batteese, Robert; Jennings, Henry; Schlein, Paul B
**Subject:** RE: Round-Up and Argentina safety allegation

We've seen reports of the report and can't yet track down and English version

Lebelle

-----Original Message-----
**From:** Batteese, Robert
**Sent:** Friday, June 05, 2009 1:32 PM
**To:** Jennings, Henry; Hicks, Lebelle; Schlein, Paul B
**Subject:** FW: Round-Up and Argentina safety allegation

Something to keep you eyes and ears open for.

Bob Batteese, Director
Division of Plant Industry
Maine Dept. of Agriculture, Food & Rural Resources
28 State House Station
Augusta ME 04333-0028
Tel. 207-287-7550
http:www.maine.gov/agriculture/pi/

-----Original Message-----
**From:** MORIN, KIMBERLY A [AG/1000] [mailto:kimberly.a.morin@monsanto.com]
**Sent:** Thursday, June 04, 2009 12:41 PM
**To:** Bradstreet, Seth; Porter, Ned R; Batteese, Robert
**Subject:** Round-Up and Argentina safety allegation

Maine men,
Here is some information that has been making its way around the country. Thought you might want some additional facts about the safety of Roundup herbicide. Best - Kimberly

- According to a recent newspaper article, Andrés Carrasco, PhD, Prof. of Molecular Embryology Lab, School of Medicine, University of Buenos Aires conducted petri dish experiments using amphibian embryos. The newspaper reported that amphibian embryos were immersed in or injected with glyphosate and this in resulted malformations in the embryos.

- The only information available on these petri dish experiments to date are what have been written in newspaper articles, discussed on a local radio show or posted on a blog. Requested scientific details of the experiments have not yet been made public so that the Dr. Carraco's experimental methodology, findings and conclusions cannot be independently evaluated. Therefore, Monsanto cannot make specific comments on these petri dish experiments.

**Glyphosate has a long history of safe use.**

Glyphosate has been in the market for more than 35 years (33 years in Argentina); Glyphosate herbicides are backed by one of the most extensive worldwide human health, safety and environmental databases ever compiled for a pesticide product. This herbicide has been thoroughly reviewed and registered by regulatory agencies around the world.

**The results reported from this amphibian screening assay are contradicted by an extensive worldwide human health, safety and environmental database on glyphosate.**

There is no evidence of mutagenic, carcinogenic, reproductive toxicity or teratogenic effects in the wide spectrum of regulatory studies submitted to obtain approval for commercialization of products containing glyphosate (US EPA, 1993;

EU, 2002 and WHO 2004). In Argentina, it is a pre-requisite to submit these studies to SENASA for evaluation in order to obtain approval.

Regulatory authorities and independent experts around the world agree that glyphosate does not cause adverse reproductive effects in adults or birth defects in offspring of these adults exposed to glyphosate, even at very high doses. This conclusion is based on multiple studies in laboratory animals that have been conducted to examine the potential for such effects. These include studies in which laboratory animals, their offspring and the next generation of offspring have been examined for adverse effects. (WHO, 2004; US EPA, 1993; European Commission, 2000; Williams et al, 2000). Therefore no further testing is indicated as a result of the reported findings in a screening study in amphibian embryos.

## Available Information

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http://www.fao.org/ag/agp/agpp/Pesticid/JMPR/DOWNLOAD/2004_rep/report2004jmpr.pdf

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European Commission (2002) Report for the Active Substance Glyphosate, Directive 6511/VI/99, Jan. 21.
http://europa.eu.int/comm/food/fs/ph_ps/pro/eva/existing/list1_en.htm

U.S. EPA (2006) Glyphosate; Pesticide Tolerances. Final Rule; Environmental Protection Agency. Federal Register 62 (154): 42921-42928.

Williams GM, Kroes R, Munro IC (2000) Safety evaluation and risk assessment of the herbicide Roundup and its active ingredient, glyphosate, for humans. Reg Toxicol Pharmacol 31(2):117-165.

THE STORY UNDERNEATH

Inter Press Service News Agency

Wednesday, August 19, 2009 19:25 GMT



**HEALTH-ARGENTINA:**
**Scientists Reveal Effects of Glyphosate**

**Marcela Valente**

**BUENOS AIRES, Apr 15 (IPS) - Glyphosate, the herbicide used on soybeans in Argentina, causes malformations in amphibian embryos, say scientists here who revealed the findings of a study that has not yet been published.**

"The observed deformations are consistent and systematic," Professor Andrés Carrasco, director of the Laboratory of Molecular Embryology at the University of Buenos Aires medical school and lead researcher on the National Council of Scientific and Technical Research (CONICET), told IPS.

Reduced head size, genetic alterations in the central nervous system, an increase in the death of cells that help form the skull, and deformed cartilage were effects that were repeatedly found in the laboratory experiments, said the biologist.

The news was reported Monday by the Argentine newspaper Página 12.

The scientist explained to IPS that the conclusions were from "a research study that came up with precise data," but that the final report was not yet ready for publication.

Nevertheless, he believed it was necessary to make the results public due to "a question of general interest."

Glyphosate is the active ingredient in Roundup, an herbicide produced by U.S. biotech giant Monsanto, which developed Roundup Ready Soy, genetically modified to withstand high doses of the non-selective weed-killer.

Monsanto's head of communications in Argentina, Fernanda Pérez Cometto, told IPS that the company has "several studies that show that the herbicide is harmless to humans, animals and the environment."

But the company "will not issue an opinion" until the University of Buenos Aires study is published, she said.

"It is essential to know what kind of methodology was used, which is why we have asked the laboratory for a copy of the study," said Pérez Cometto.

She insisted, however, that Monsanto's herbicide was tested in 1996 by authorities in Argentina, who reported that it was unlikely to pose an "acute risk."

"Obviously it is a substance that must be used correctly, with the safeguards listed on the label, just like insect repellent or bleach. You can't drink a glass of herbicide and expect it to have no effect," she added.

Carrasco explained that in the first phase of the experiment, amphibian embryos were submerged in a solution of herbicide diluted in water in a proportion that was 1,500 times weaker than that used today on genetically modified soybeans in Argentina - the country's main crop. The embryos suffered head deformations.

In the second stage, embryonic cells were injected with glyphosate diluted with water, without the additives that go into the commercial product. The impact was even more negative, showing that the active ingredient accounts for the toxicity, rather than the additives, the biologist said.

"One should be able to suppose, with certainty, that the same thing that happens to amphibian embryos can happen to humans," said Carrasco, whose team of specialists in biology, biochemistry and genetics has been working on the study for 15 months.

"It is clear that glyphosate is not innocuous and that it does not degrade or break down, but accumulates in cells," he said.

A potent mix of glyphosate sprayed from airplanes is one of the tools used by the Colombian government to eradicate illegal coca crops.

But the destructive effects of the spraying on crops, livestock and people in areas across the border in Ecuador have prompted complaints by the Ecuadorean government.

Some 200 million litres a year of glyphosate are used in Argentina. Soybeans cover around 50 percent of all farmland - nearly 17 million hectares - and are the country's main export product. The herbicide is mainly applied by aerial spraying.

Agronomist Jorge Gilbert with the National Institute of Agricultural Technology (INTA) told IPS that glyphosate, like other chemicals used to combat weeds or pests, "is not good or bad in and of itself, but depends on how it is applied."

INTA, a government agency that provides technical advice to farmers, has never taken a critical position towards genetically engineered soy. To the contrary, many of its professionals believe the introduction of herbicide-resistant seeds represented an advance in rural development.

But environmental and social organisations have been complaining for at least five years that populated areas near fields of genetically modified soybeans have suffered a sharp increase in the number of cases of cancer, birth defects, lupus, kidney disease, and respiratory and skin ailments.

The Grupo de Reflexión Rural (GRR – Rural Reflection Group), a local NGO that launched a "Stop the Spraying!" campaign in 2006 in the provinces where soybeans are most extensively planted, published a report this year based on the accounts of rural doctors, experts and the residents of dozens of farming towns.

GRR lawyer Osvaldo Fornari told IPS that the federal courts were presented with the report and asked to investigate the approval process for herbicides and pesticides. He also said that based on the cases of people whose health has allegedly been affected, the "precautionary principle" should be applied, and the use of Roundup should be preventively banned.

President Cristina Fernández ordered the creation of a committee made up of staff from the Health Ministry, the Secretariats of the Environment and Agriculture, and INTA, to investigate the health and environmental impacts of glyphosate. (END/2009)