

Infographic: Does consuming micro-traces of glyphosate (aka Roundup) in our food cause cancer? All 20 global regulatory and chemical oversight agencies say 'no', while anti-biotech activists spin the data

Glyphosate weedkiller, once marketed exclusively under the name RoundUp by its originator Monsanto, is the world's most popular herbicide, used by farmers and consumers alike. It's incredibly effective; no one disputes that. But for much of the past decade, it has been the focus of intense public debate stirred by claims by its detractors that it is a human cancer time bomb.

Nineteen independent regulatory agencies have reviewed and rejected such claims, although one agency, which does not evaluate the actual risk of the product as it is used, issuing a conflicting assessment—we will address that later in this summary analysis. But the unanimity within the mainstream science community has not stopped more than 125,000 litigants in the US alone claiming that the herbicide has damaged their health.

Bayer, which acquired Monsanto and its litigation docket in 2018, publicly stands by the herbicide formulation and will continue to sell it to farmers around the world. However, earlier this summer Bayer announced it is [pulling the product](#) for private residential use in an attempt to reduce further litigation risks. Glyphosate remains available worldwide in its generic form, sold by dozens of other companies, and is still widely used for commercial and agricultural purposes.

What does glyphosate do?

According to the [US Environmental Protection Agency](#), glyphosate is a:

... broad-spectrum herbicide that controls broadleaf, sedge, and grass weeds with minimal residual toxicity to crops or non-target vegetation. ... In addition to agricultural uses, glyphosate is important for noxious and invasive weed control in aquatic systems, pastures/rangelands, public lands, forestry, and rights-of-way applications. Glyphosate is the leading herbicide used to control invasive species in the United States. ... Glyphosate is also in numerous residential products and provides broad-spectrum weed control to users that include homeowners and landscaping operations. Millions of pounds of glyphosate are applied to non-crop sites every year.

Séralini affair

First registered for use in 1974, glyphosate soared in popularity in the 1990s after it was paired with the first generation of genetically modified commodity crops: soybeans, corn and cotton, which were designed to grow unaffected when sprayed with the weed-killing herbicide. It was and is renowned for its effectiveness and low toxicity, and was for decades considered in the agricultural industry as an almost miracle herbicide. As attacks on GM crops began to fade a decade ago, GM rejectionist critics turned their

focus away from the crops themselves to allied technologies, in this case glyphosate, suggesting that even if GM crops did not pose any health hazards the herbicides paired with them might.

Acute toxicity

Life-threatening one-time doses

SUBSTANCE	FOUND IN	Lethal dose (LD50 mg/kg)	CATEGORY
Water	... Water	90000	Practically non-toxic
Sucrose	Table sugar	30000	
Monosodium glutamate	Flavor enhancer, soy, cheese	16000	
Ethanol	Alcoholic beverages	7000	
Glyphosate	Herbicide (RoundUp)	5600	
Aluminum hydroxide	Antacid, vaccine adjuvant	>5000	
Fructose	Fruits, component of sucrose	4000	Slightly toxic
Spinosad	Organic insecticide	3700	
Sodium chloride	Table salt	3000	
Eugenol	Clove oil, organic pesticide	2700	
Paracetamol (acetaminophen)	Tylenol, Panadol	2400	
Vanillin	Vanilla bean, vanilla sugar	1600	
Hydrogen peroxide 70%	Bleach, disinfectant	1000	Moderately toxic
Theobromine	Chocolate, tea, guarana	950	
Copper sulfate	Organic fungicide	300	
Chlorpyrifos	Organophosphate insecticide	230	
Caffeine	Natural pesticide, coffee plant	190	
Lead	Batteries, cables, paints	155*	
DDT	Restricted insecticide	100	Highly toxic
Rotenone	Restricted organic pesticide	60	
Vitamin D3	Supplements, fish, mushrooms	37	
Nicotine	Natural pesticide, tobacco	10	
Mycotoxin T2	Plant pathogen, moldy grain	5	
Aflatoxin	Soil fungus, moldy foods	5	
Hydrogen cyanide	Fruit pits, bitter cassava	4	Highly toxic
Botulinum toxin	Botox, Clostridium botulinum	0.001	

Generally rat oral LD50 values. Botulinum: mouse and human, nicotine: human, cyanide: mouse.
 *Lead: LD50 not available, lowest human lethal dose included.

Sources: EFSA, WHO, EPA, NIH, NHS
 Read more: thoughtscapism.com

Chronic toxicity

Acceptable daily intake of minimal concern

SUBSTANCE	FOUND IN	Limit
Water	You know this one	5000
Sucrose	Table sugar	800
Ethanol	Alcoholic beverages	170
Monosodium glutamate	Cheese, soy, flavor enhancer	120
Sodium chloride	Table salt	600
Vanillin	Vanilla bean, vanilla sugar	10
Eugenol	Clove oil, organic pesticide	1
Glyphosate	Herbicide (RoundUp)	0.5
Copper sulfate	Organic fungicide	0.5
Aluminum hydroxide	Antacid, vaccine adjuvant	0.1
Paracetamol	Tylenol, Panadol	0.05
Spinosad	Organic insecticide	0.02
Hydrogen cyanide	Fruit pits, bitter cassava	0.01
DDT	Restricted insecticide	0.01
Lead	Batteries, cables, paints	0.00
Caffeine	Coffee, tea, chocolate	0.00
Vitamin D3	Supplements, fish	0.00
Chlorpyrifos	Organophosphate pesticide	0.00
Rotenone	Restricted organic pesticide	0.00
Nicotine	Natural pesticide, tobacco	0.00
Mycotoxin T2	Fusarium, moldy grain	0.00

Limits: Reference Dose (RfD or ADI), Reference Intake (RI), Upper Limit (UL), or Tolerable Daily Intake (TDI). Colours for readability (no official categories exist for these limits).

Sources: EFSA, WHO, EPA, NIH, NHS
 More at: thoughtscapism.com

The claim that glyphosate is cancer-causing—unsupported by more than 1,000 studies published at that point—got no traction in the science community or among the media until 2012 when a previously obscure French scientist published a paper in a mainstream journal claiming that rats fed RoundUp Ready GM corn caused tumors to form. Known as the “Séralini affair,” the publication created a media storm orchestrated in part by the author himself, French molecular biologist Gilles-Éric Séralini, a well known biotechnology rejectionist notorious for numerous sketchy research papers on GM crops and chemicals, most published in fringe journals. [[GLP profile of Séralini here.](#)]

First published in September 2012, the Séralini glyphosate article presented a two-year feeding study in

rats, and reported an increase in tumors among the rodents fed genetically modified corn and RoundUp. Scientists and regulatory agencies subsequently concluded unanimously that [the study's design was flawed and its findings unsubstantiated](#). The article was retracted by the original journal and then republished in a low-end 'pay for play' journal. [[The GLP has a review of the study and reactions in the science community](#)]

Does glyphosate pose serious harm to humans, which if true would raise doubts about the safety of herbicide tolerant GM crops? Is it carcinogenic? Despite the 100,000+ suits and literally tens of thousands of allegations and claims swirling through the web claiming glyphosate is a cancer-causing agent, a clear and almost unanimous scientific consensus has emerged on this issue underscoring a sizable gap between the scientific consensus and popular opinion.

Independent European Union assessment group finds glyphosate safe and not carcinogenic

To date, 19 prominent regulatory, health and chemical research organizations have reviewed the evidence and/or conducted independent studies. The latest—the European Union [Assessment Group](#) on Glyphosate, the agency responsible for recommending whether the EU should renew its usage next year—produced a 11,000-page report in June, 2021. Four member states—France, Hungary, the Netherlands and Sweden—oversaw the report. The independent EU group concluded that glyphosate was not a germ cell mutagen, not carcinogenic and posed no apparent threat of reproductive toxicity or organ toxicity. It's only finding of potential harm: applicators could face serious eye damage if the product is improperly applied.

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Glyphosate is not carcinogenic, EU report confirms

by [Britt E. Erickson](#)

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The agency submitted its findings to the European Food Safety Authority (EFSA) and the European Chemical Agency (ECHA) earlier this summer. EFSA and ECHA has since begun a peer-review process which it will complete before either approving or denying the renewal. Both agencies are expected to invite the public to voice their opinions on the matter later this month. The EU is expected to decide by December 2022 whether to renew use authorization of glyphosate.

The sweeping EU report has not quelled attacks on the weedkiller by anti-biotechnology advocacy groups and was largely ignored by the media despite the agency's independence and global prestige. These findings are also unlikely to impact the fate of the court cases filed by plaintiffs claiming that the weedkiller caused their cancers. Three court juries in the US so far have ruled that glyphosate, sold for decades as non-generic RoundUp (glyphosate went off patent in 2000) by Monsanto, caused the cancer of workers or

home owners who applied the herbicide. The cases did not address whether glyphosate might cause harm to humans exposed to miniscule (parts per billion or per trillion) traces found in food; no independent global agency has asserted that even though many anti-GM activists make that claim and the media often raises it in articles.

One outlier out of 19

Bayer made the decision to pull glyphosate from the residential market after a third attempt to appeal an earlier jury decision against the former Monsanto [was rejected](#). In June, a state appellate court in San Francisco affirmed a judgement against an Oakland couple who claimed the chemical gave them cancer. The appeals court did let stand an earlier trial judge's decision to reduce the award from \$2 billion to \$86 million. Bayer has [appealed the ruling](#) to the US Supreme Court, contending that EPA has approved glyphosate as safe to use and did not require a cancer warning on the label pre-empted California state law.

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A jury or appellate decision, while headline grabbing, does not substitute for scientific research or the judgement of independent scientists at regulatory agencies. Juries (and judges) often get science wrong. Science issues in court cases are guided by a somewhat obscure legal provision known as the Daubert Standard often used in litigating science and hazard claims. Daubert states that the judge of a case is responsible for determining what claims are admissible as scientific knowledge and as evidence in the case. Although 18 global agencies have reviewed more than 4,000 studies to date and found glyphosate not carcinogenic, Daubert was triggered by the controversial and much contested findings by one agency: the International Agency for Research on Cancer, a sub group of the United Nations. In 2015, IARC declared in what is known as a "hazard" study that glyphosate should be considered a "probable carcinogen" to applicators, such as farmers. IARC found some associations of glyphosate to non-Hodgkins lymphoma, although the data was contradictory (it was later revealed that an early draft of the IARC review found the data too noisy to conclude the association was persuasive).

Hazard studies are controversial and not used by country regulatory agencies anywhere in the world, which evaluate what is known as "risk". IARC does not assess whether a chemical or other agency is likely to cause a health issue as it is actually used; rather it examines whether a substance or activity could conceivably cause cancer at any exposure or dose, including at unrealistically high ones. [[Here is a GLP profile](#) of IARC and an analysis of how risk assessment differs from hazard assessment.] Over its 40-year history, IARC has assessed more than 1,000 substances and activities for hazard, and found only one that it did not link to cancer. Arsenic, beer, coffee, sunbathing, hairdressing, red meat, drinking hot beverages—all are possible or probable cancer causes, according to IARC. Drinking wine is considered far more hazardous to the public than glyphosate is to farmers.

IARC is controversial in the science community. Here is an analysis of IARC by [Reuters, which concluded IARC "confuses consumers"](#) with these hazard assessments. The subagency of WHO (which itself has

concluded in two separate risk reviews post-dating the IARC hazard assessment that glyphosate is not carcinogenic) has come under widespread fire for [cherry-picking data](#) and [conflicts of interest](#). Numerous articles have pointed out that IARC officials have worked as paid consultants to the trial lawyers and anti-GMO groups involved in the tort cases targeting Monsanto/Bayer. IARC's lead investigator signed on as a consultant to the glyphosate litigants in the US before IARC issued its assessment, considered a gross conflict of interest by the science community.

Consensus findings of 'no risk' in our food supply and not a carcinogen to applicators when used according to specifications

The Genetic Literacy Project has compiled the findings of the world's top regulatory and chemical research organizations including IARC's. They are [illustrated in this infographic](#). [Click [here](#) for a downloadable pdf version]

glyphosatedangersinfographic genetic literacy project june

The 19 regulatory and research agencies—all independent—that have reviewed existing studies or conducted long-term studies to assess if glyphosate poses a cancer risk in our food supply, including the [June 2021 report from the European Union](#), have unanimously concluded that there is no convincing evidence that glyphosate traces in our food pose a cancer risk. Eighteen of the 19 assessors have concluded that glyphosate poses no danger to applicators. Only one agency, IARC—which assesses ‘hazard’ independent of exposure—concluded that applicators, particular on farms, face cancer or other serious health risks. IARC’s conclusion that glyphosate poses likely harm to farmers directly contradicts the available data. The US government’s Agricultural Health Study (linked above) tracked applicators using glyphosate between 1993 and 2016. The study monitored more than 44,000 American farmers. It found reduced rates of cancer and no consistent association between glyphosate and solid tumors or lymphoid malignancies (including “non-Hodgkins lymphoma” claimed by IARC).

Note that almost all of the independent assessments of the potential health dangers posed by glyphosate were released after IARC’s controversial finding in 2015. Every assessment review undertaken since 2015 has forcefully contested IARC’s conclusions and in many cases devoted dozens of pages to refuting the outlier. Two of the most forceful came from Health Canada. In 2017, it reviewed the IARC assessment and rejected it as selective in its use of studies to reach a flawed conclusion. Under pressure from anti-GM activists groups, it reassessed the data again in 2019. Health Canada said it ‘left no stone unturned’ in its re-review. It went so far in its second analysis as to select a group of 20 independent scientists, who were not involved in the 2017 evaluation. Its conclusion:

After a thorough scientific review, we have concluded that the concerns raised by the objectors could not be scientifically supported when considering the entire body of relevant data. The objections raised did not create doubt or concern regarding the scientific basis for the 2017 re-evaluation decision for glyphosate. ... No pesticide regulatory authority in the world currently considers glyphosate to be a cancer risk to humans at the levels at which humans are currently exposed.

Court decisions are not scientific facts

Why do some juries hand down jury verdict that do not align with the science as appears the case in the ‘glyphosate causes cancer’ litigation? Simply said, the Daubert rule does not ensure that a jury will base its decision on scientific fact; it often leads to the opposite. Our tort system relies on lay juries attempting to make sense of complicated and often contradictory medical studies and expert opinions. That’s challenging. Both sides in sharply contested cases selectively cite studies favorable to their cause, but Daubert favors the exaggerators over button-down, stick-to-the facts scientists. No scientist authoring a reputable, peer reviewed study would use the kind of absolute statements of carcinogenicity as was advanced by the glyphosate plaintiffs. That leads to exploitation by aggressive “ambulance chasing” attorneys, such as by Baum Hedlund, the Church of Scientology law firm, partnering with notorious anti-vaccine lawyer Robert F. Kennedy, Jr., which are in the forefront of prosecuting the glyphosate cases. [[Read this analysis](#)]

for a review of the connection between the Church of Scientology, RFK, Jr., anti-vaccine activists and anti-biotechnology activists, who also attack the GLP.] As a result, juries often rule against companies and in favor of an aggrieved (and often dying) plaintiff even if the evidence that the chemical contributed to an illness is slim, ambiguous or non-existent. Some such decisions are thrown out on appeal, but many others, including those roundly criticized by mainstream scientists, are not, as Daubert has opened the door for controversial evidence to be introduced legally. Considering the unpredictability of the court system, many organizations or corporations facing such suits often do a cost-benefit analysis and agree to settlements that they do not believe are in accord with the science.

Since the first Church of Scientology—RFK, Jr. glyphosate lawsuit was filed, there have been more than 125,000 additional filings. Bayer consented to a \$10 billion grand settlement with the Baum Hedlund and other early plaintiffs, but 30,000 suits remain and more are on the way. Many of the lawsuits involve home residential users, which no study suggests face cancer risks. In its petition challenging the federal appellate court's decision upholding the Hardeman award, Bayer cited the global consensus that glyphosate is not a human carcinogen. According to Bayer, the Hardeman decision was based on selectively presented evidence and should be overturned because it will pollute all future cases.

Despite EPA's repeated findings — confirmed by national regulators around the world, including in Australia, the EU, Canada and New Zealand — a working group at the International Agency for Research on Cancer classified glyphosate in 2015 as 'probably carcinogenic to humans. ... EPA and other regulators reviewed and rejected IARC's conclusion, which did not identify either the circumstances under which glyphosate might cause cancer or the amount of exposure required. Still, based on that slender reed, many thousands of litigants (including respondent Edwin Hardeman) sued Monsanto asserting that it failed to warn them about the cancer risks of using Roundup. ... This case is a 'bellwether trial for the (Roundup) cases consolidated in a multidistrict litigation,' — meaning that the decision below will control thousands of other federal suits, and undoubtedly influence still others pending across the country. ... Together, the Ninth Circuit's errors mean that a company can be severely punished for marketing a product without a cancer warning when the near-universal scientific and regulatory consensus is that the product does not cause cancer and the responsible federal agency has forbidden such a warning. That is not, and should not be, the law.

Bayer contends that the US Court of Appeals allowed inappropriate testimony from less-than expert witnesses about RoundUp. Although Bayer is correct in its assessment of the scientific consensus that glyphosate is not carcinogenic, that may not be enough for SCOTUS to overturn lower court rulings. Doubt remains whether the overwhelming global science consensus on the alleged dangers posed by glyphosate will impact SCOTUS, which must evaluate whether the judge properly invoked Daubert and vetted the evidence; it can't vacate a jury decision without cause. Although the science favors the conclusion that glyphosate is safe, in court, science does not always prevail.