

Glyphosate and Cancer Risk

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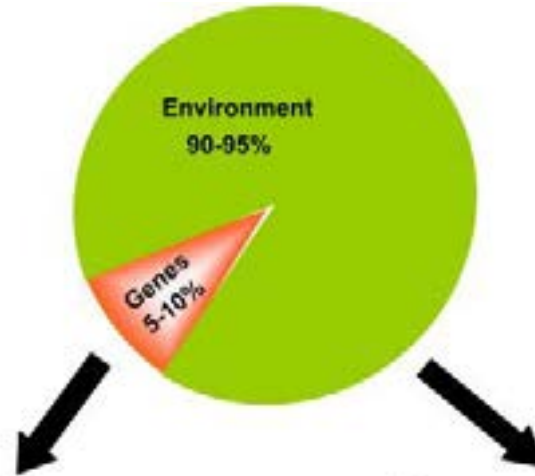


Cancer and Human Health

- Cancer is considered the most severe health condition for the following reasons:
 - As a result of the aging of the human population, cancer is today the **most common cause of death in the world**. (WHO, 2014)
 - There are many forms of cancer.
 - Cancer occurs in one of every 2 men and 3 women.
- Causes of cancer: genes, lifestyle, diet, chemicals.

The role of genes and environment in the development of cancer

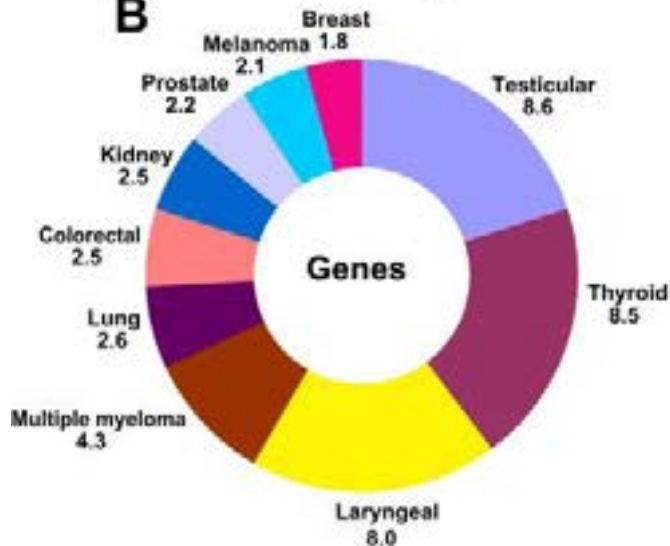
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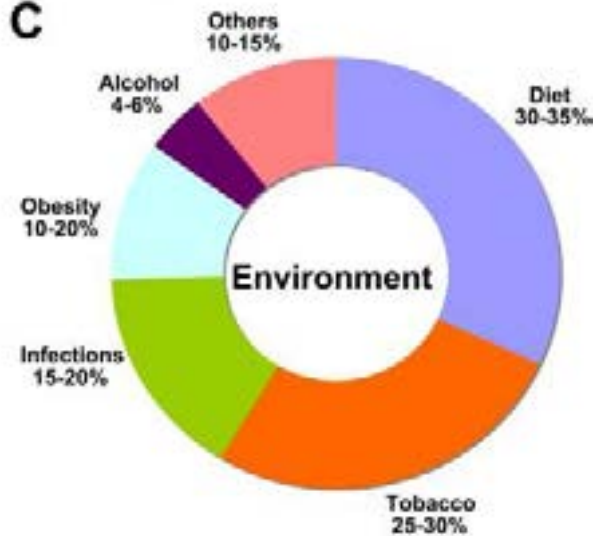
Familial risk ratios = risk to a relative of an affected individual divided by the population prevalence

Percentages = the attributable-fraction of cancer deaths due to the specified environmental risk factor

B



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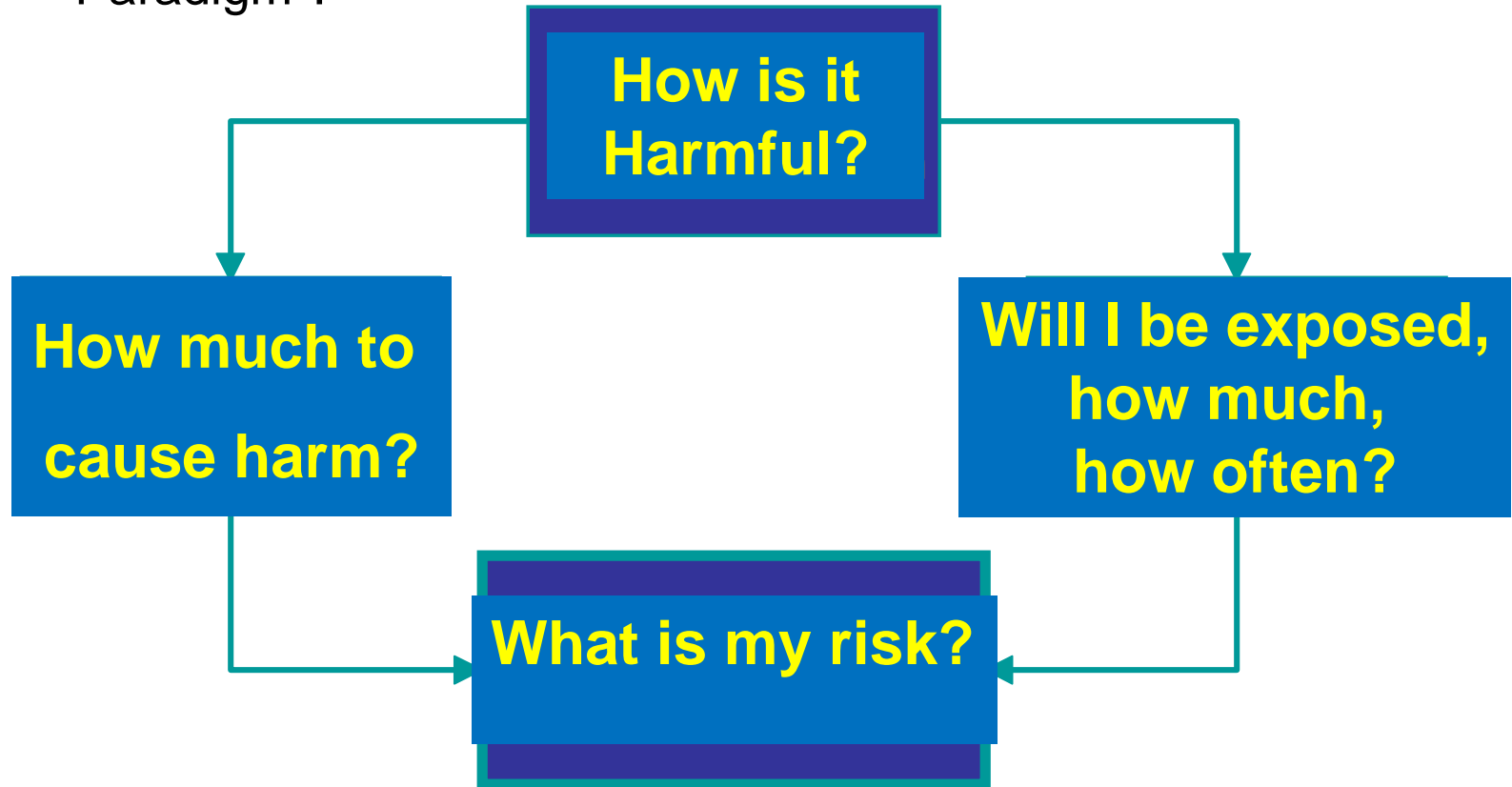


Cancer “Prevention”

- EPA cancer risk assessment goal:
prevent excess cancers due to
chemical exposure
- Often assumes daily exposure over a lifetime (~70 years)
- Cancer odds (all causes) – 1 in 2 (men); 1 in 3 (women)
- Acceptable **excess** cancer risk – 1 in 1 million (10^{-6})
- For each chemical, cancer odds – 1 in 2.000001 (men)

How Does the US Environmental Protection Agency (EPA) Assess Risk?

National Academy of Sciences (NAS) 4-step risk assessment Paradigm*:



* From the National Research Council's *Risk Assessment in the Federal Government: Managing the Process*, 1983.

EPA Office of Chemical Safety and Pollution Prevention harmonized test guidelines :

- 810 - Product Performance
- 830 - Product Properties
- 835 - Fate, Transport and Transformation
- 840 - Spray Drift
- 850 - Ecological Effects
- 860 - Residue Chemistry
- 870 - **Health Effects**
- 875 - Occupational and Residential Exposure
- 880 - Biochemicals
- 885 - Microbial Pesticide
- 890 - Endocrine Disruptor Screening Program



Specimen Label



Herbicide

For control of annual and perennial weeds and woody plants in forests, non-crop sites, and in and around aquatic sites; also for use in wildlife habitat areas, for perennial grass release, and grass growth suppression and grazed areas on these sites.

Avoid contact of herbicide with foliage, green stems, exposed non-woody roots or fruit of crops, desirable plants and trees, because severe injury or destruction may result.

Active ingredient(s):	
glyphosate ¹ N-(phosphonomethyl)glycine,	
isopropylamine salt	53.8%
Other ingredients	46.2%
Total ingredients	100.0%

¹ Contains 5.4 pounds per gallon glyphosate, isopropylamine salt (4 pounds per gallon glyphosate acid).

EPA Reg. No. 62719-324

Keep Out of Reach of Children

CAUTION PRECAUCION

Si usted no entiende la etiqueta, busque a alguien para que se la explique a usted en detalle. (If you do not understand the label, find someone to explain it to you in detail.)

Precautionary Statements

Hazards to Humans and Domestic Animals

Harmful If Inhaled

Avoid breathing spray mist. Remove contaminated clothing and wash before reuse. Wash thoroughly with soap and water after handling.

Personal Protective Equipment (PPE)

Applicators and other handlers must wear:

- Long-sleeved shirt and long pants
- Shoes plus socks.

Follow manufacturer's instructions for cleaning/maintaining PPE (Personal Protective Equipment). If no such instructions for washables, use detergent and hot water. Keep and wash PPE separately from other laundry.

Engineering Controls

When handlers use closed systems, enclosed cabs, or aircraft in a manner that meets the requirements listed in Worker Protection Standard (WPS) for agricultural pesticides [40 CFR 170.240 (d) (4-6)], the handler PPE requirements may be reduced or modified as specified in the WPS.

User Safety Recommendations

Users should:

- Wash hands before eating, drinking, chewing gum, using tobacco, or using the toilet.
- Remove clothing immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing.

First Aid

If inhaled: Move person to fresh air. If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably mouth-to-mouth if possible. Call a poison control center or doctor for further treatment advice.

Have the product container or label with you when calling a poison control center or doctor, or going for treatment. You may also contact 1-800-902-5504 for emergency medical treatment information.

Environmental Hazards

Do not contaminate water when cleaning equipment or disposing of equipment washwaters. Treatment of aquatic weeds can result in oxygen depletion or loss due to decomposition of dead plants. This oxygen loss can cause fish suffocation.

In case of leak or spill, soak up and remove to a landfill.

Physical or Chemical Hazards

Spray solutions of this product should be mixed, stored and applied using only stainless steel, aluminum, fiberglass, plastic or plastic-lined steel containers.

Do not mix, store or apply this product or spray solutions of this product in galvanized steel or unlined steel (except stainless steel) containers or spray tanks. This product or spray solutions of this product react with such containers and tanks to produce hydrogen gas, which may form a highly combustible gas mixture. This gas mixture could flash or explode, causing serious personal injury, if ignited by open flame, spark, welder's torch, lighted cigarettes or other ignition source.

Notice: Read the entire label. Use only according to label directions. Before using this product, read Terms and Conditions of Use, Warranty Disclaimer, Inherent Risks of Use, and Limitation of Remedies elsewhere on this label. If terms are unacceptable, return at once unopened.

Pesticide Registration process

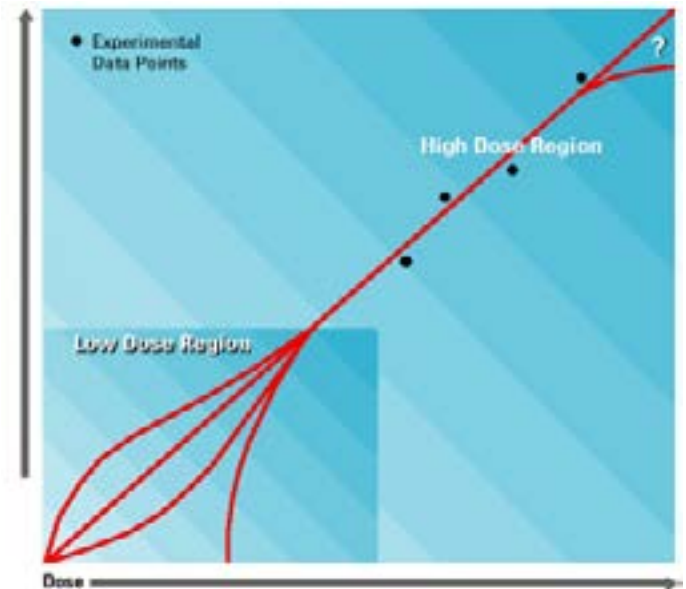
- Register or reregister a pesticide if it can be used “**without unreasonable adverse effects on human health or the environment.**”
- Pesticide registration in the U.S. is a dynamic process.
- As new science and information becomes available a pesticide product’s registration status may be changed.
- This is accomplished through the **EPA Office of Pesticide Programs** registration review process.
- Current goal – reevaluate each registered pesticide at least every 15 years.

Long-term Animal Study Assumptions

Animal models will predict cancer in humans.



High dose, short term, exposure of animals will predict adverse effects of low dose, long term, exposure in humans.



Does a chemical cause cancer?

Weight-of-the-evidence approach

- Summarize human and animal data: sufficient, limited, inadequate, no data, no evidence
- Look at other evidence: short-term tests, pharmacokinetics, structure-activity relationships...
- Classify overall weight-of-the-evidence

EPA 2005 Guidelines

Weight-of-evidence narrative

- EPA weight of evidence descriptors :
 - Carcinogenic to humans
 - Likely to be carcinogenic to humans
 - Suggestive evidence of carcinogenic potential
 - Inadequate information to assess carcinogenic potential
 - Not likely to be carcinogenic to humans

Roundup weedkiller 'probably' causes cancer, says WHO study

The Monsanto product - the world's most widely used herbicide - contains glyphosate, which may also be carcinogenic for non-Hodgkin's lymphoma

Staff and agencies

Saturday 21 March 2015 13.12 EDT

Roundup, the world's most widely used weedkiller, "probably" causes cancer, the World Health Organisation (WHO) has said.

The International Agency for Research on Cancer (IARC) - WHO's cancer agency - said that glyphosate, the active ingredient in the herbicide made by agriculture company Monsanto, was "classified as probably carcinogenic to humans".

It also said there was "limited evidence" that glyphosate was carcinogenic in humans for non-Hodgkin's lymphoma.

A fractured continent

As *Science* went to press, 10 governments had asked seed manufacturers to keep GM crops out. Others were considering the same, or Option 2, a national ban.

- Used Option 1
- Expected to use Option 1 and/or 2
- Grows GM maize



GMO Corn & Glyphosate

WHO IARC

Protests and cancer concerns raise doubts for Roundup's future in Europe (2015)



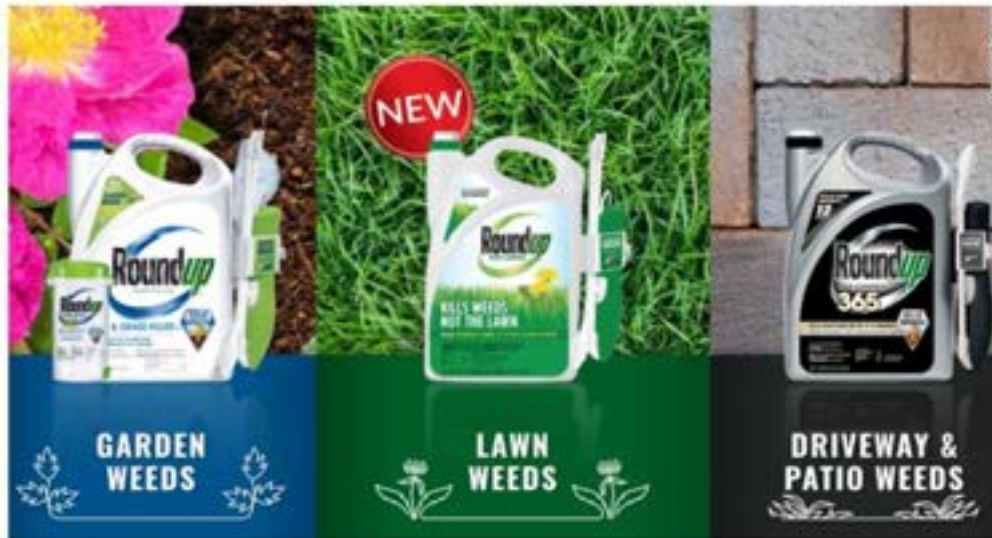
Credit: Reuters

Demonstrators participate in a protest march against Monsanto in Paris, France, May 23, 2015. People in 48 countries and 421 cities took part in protest marches against Monsanto and its glyphosate-containing Roundup herbicide.

He's dying of cancer. Now, he's the first patient to go to trial to argue Roundup made him sick

By Holly Yan, CNN

Updated 6:16 PM ET, Sun June 17, 2018



Monsanto says Roundup is safe and can't be linked to individual cancer cases.

(CNN) — On bad days, Dewayne Johnson is too crippled to speak. Lesions often cover as much as 80% of his body.

Doctors have said they didn't expect him to live to see this day. But Monday marks a milestone: Johnson, 46, is the first of hundreds of cancer patients to see his case against agrochemical giant Monsanto go to trial.

June 17, 2018

Johnson, 46, is the first of hundreds of cancer patients to see his case against Monsanto go to trial.

Does Glyphosate Cause Cancer?

- US National Institute of Health, National Toxicology Program (NTP) – **No evidence of carcinogenic activity**
- US Environmental Protection Agency (EPA) – **Not likely to be carcinogenic to humans**
- European Union, Canada, Australia, Japan – **No evidence of carcinogenicity**
- Joint FAO/WHO Meeting on Pesticide Residues (JMPR) – **glyphosate unlikely to pose a carcinogenic risk to humans from exposure through the diet**
- WHO International Agency for Research on Cancer (IARC) – **Probable human carcinogen**

WHO IARC Monographs Programme

Appointed expert working group meets for 7 to 8 days, determines likelihood that an agent can cause cancer in humans.

Agents classified by IARC, Vol. 1–114 (1976-2016)

- Red meat 1
- Ethanol in alcoholic beverages 1
- Solar radiation 1
- Wood dust 1
- Hairdresser or Barber 2A
- Glyphosate 2A
- Coffee 2B
- Gasoline 2B
- Radiofrequency electromagnetic fields (cell phones) 2B

Group 1	Carcinogenic to humans (118)
Group 2A	Probably carcinogenic to humans (75)
Group 2B	Possibly carcinogenic to humans (288)
Group 3	Not classifiable as to its carcinogenicity to humans (503)
Group 4	Probably not carcinogenic to humans (1)

Coffee drinkers, don't fret over California cancer warning



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By Ben Guarino and Eli Rosenberg
The Washington Post

APRIL 4, 2016, 8:26 AM

Storm clouds are brewing in California's coffee cups. Companies across the state will have to add a cancer-warning label to coffee, a judge ruled last week, because the drink contains a chemical called acrylamide.

Los Angeles County Superior Court Judge Elinu M. Berle sided with a nonprofit organization in a case against Starbucks, Peets and dozens of other coffee chains, saying that businesses that sold coffee were in violation of a state regulation called Proposition 65. Prop 65 requires businesses with at least 10 employees to disclose any carcinogens and toxic chemicals in their products.

ADVERTISEMENT

Coffee, cancer and Prop. 65

LOS ANGELES Superior Court Judge Elinu M. Berle ruled in March that coffee should carry the warning labels mandated by California's Proposition 65 because the brew contains acrylamide, a chemical that some studies found increases the incidence of cancer in rats. It was an unfortunate outcome of a ridiculous lawsuit by an opportunistic attorney.

Acrylamide is a naturally occurring chemical formed when coffee is roasted (and when starchy foods such as potatoes are cooked at high heat). **But the World Health Organization's International Agency for Research on Cancer, which reviewed 1,000 studies, reported last week that there is just no proof that coffee causes cancer.** Furthermore, there's a wealth of scientific data indicating that coffee consumption has health benefits and may even ward off premature death, perhaps because of the other chemicals present in the average cup of joe.

Berle's Chicken Little ruling was made possible by Proposition 65, the well-meaning but chunky Safe Drinking Water and Toxic Enforcement Act of 1986. It requires all but the smallest businesses to warn people when knowingly exposing them to any of the approximately 850 chemicals that are confirmed or suspected carcinogens.

This seems perfectly reasonable. Who

wants to be exposed unknowingly to something that might cause cancer? But warnings are required for chemicals listed in Proposition 65 unless it is shown that exposure isn't dangerous. Because the world is filled with chemicals that may in some instances and concentrations be dangerous but are difficult to avoid, California is littered with unhelpful and vague Proposition 65 warnings tacked up at office buildings, hospitals, parking lots and retailers, even online ones.

Fortunately for coffee drinkers, state regulators took the unprecedented — and most welcome — step Friday of announcing plans to exempt coffee from the warnings in light of the new WHO report. We lift a figurative cold brew to California's Office of Environmental Health Hazard Assessment for taking this extra step to clear up the confusion. We also appreciate the new warning signs the agency designed that identify at least one of the chemicals present by name and include an online link to more information about the exposure. The public badly needs more information about what it is being warned about and why.

But the fact that the agency had to make a rule just for coffee exposes a fundamental flaw in Proposition 65. The measure is so broad, its warnings may actually make it harder for Californians to assess the real dangers they encounter.



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Hazard vs Risk

- EPA, EU and other governments evaluate cancer risk; an estimate of the carcinogenic effects expected from exposure to a cancer hazard.
- WHO's IARC Monographs Programme evaluates cancer hazard; is an agent capable of causing cancer under some circumstances.
- WHO glyphosate cancer hazard determination based largely on epidemiology, did not consider most scientific studies evaluated for registration by US, Canada, EU, Australia, Japan.

A photograph showing a green tractor pulling a trailer and a combine harvester in a field at sunset. The sun is low on the horizon, creating a bright glow and silhouettes of the machinery. The sky is a mix of orange and blue.

**In glyphosate review, WHO cancer agency
edited out "non-carcinogenic" findings**

When IARC assessed glyphosate, significant changes were made between a draft of its report and the published version.

Multiple scientists' conclusions that their studies had found no link between glyphosate and cancer in laboratory animals was removed.

The agency won't say who made the changes or why.