

‘Systemic Catastrophe’: MIT Senior Researcher Warns Glyphosate Is a Slow Kill

BY [Marina Zhang](#) TIME July 7, 2022 [PRINT](#)
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A “systemic catastrophe” is senior researcher Dr. Stephanie Seneff’s verdict on [glyphosate](#), the active ingredient in the herbicide [Roundup](#), warning that the chemical is a slow kill for humans and other lifeforms.

Seneff, a senior researcher from the [Massachusetts Institute of Technology](#), has been studying this toxic chemical for around 10 years.



Dr. Stephanie Seneff (supplied by Stephanie Seneff)

She believes that the pervasive use of glyphosate in the United States and around the world in agriculture is the reason behind the dramatic increase in autism, diabetes, cancer, allergies, as well as many other chronic conditions.

The Mechanism of Glyphosate

Glyphosate was first used in Roundup, a herbicide developed by Monsanto in 1974.



Roundup weed killer is shown in Chicago, Ill., on May 14, 2019. (Scott Olson/Getty Images)

Upon its release, Monsanto marketed glyphosate as harmless to humans and other mammals. The company reasoned that glyphosate kills weed by disrupting the shikimate pathway, which is not present in animals and therefore would not be harmful.

“However, this pathway is present in gut bacteria,” Seneff wrote in [her first study on glyphosate](#).

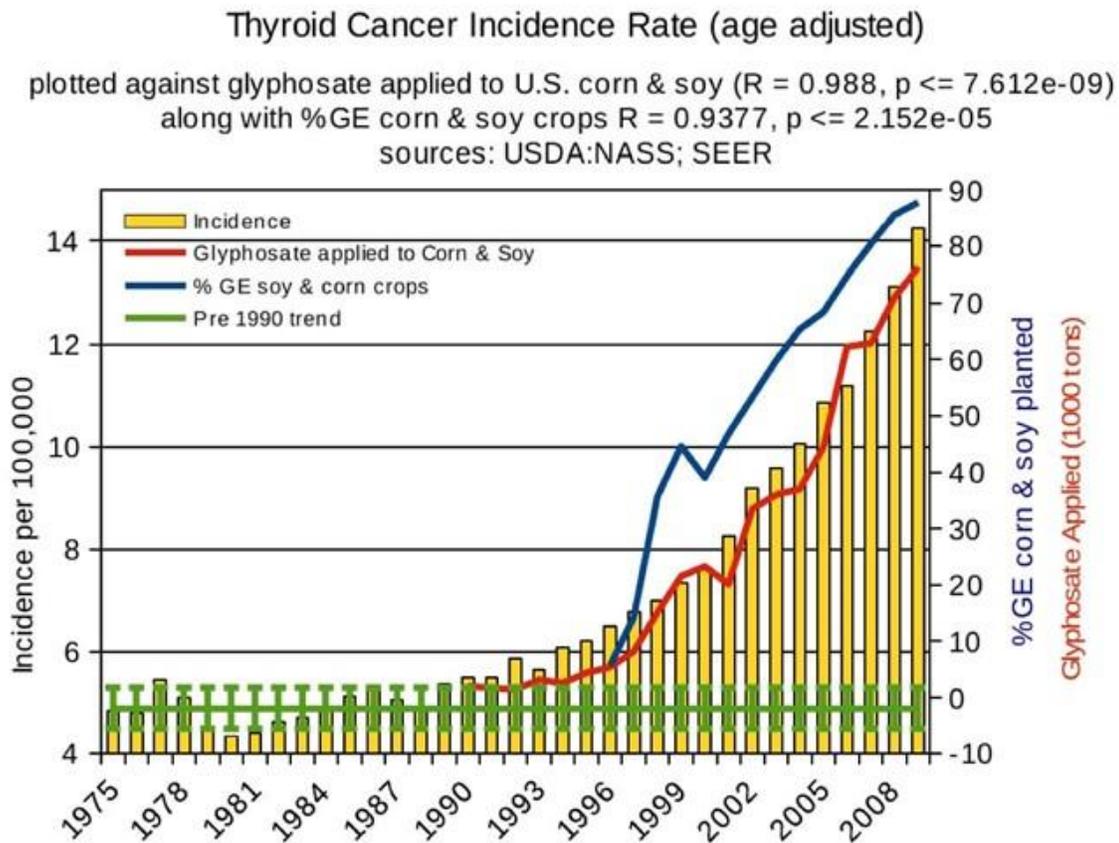
Recent research has revealed that human bodies have more bacteria than human cells, and our gut microorganisms play very important roles in maintaining our health.

“In addition to aiding digestion, the gut microbiota synthesizes vitamins, detoxify xenobiotics (foreign biotics),” maintains balance in the immune system, and prevents harmful bacteria from crossing into the gut, Seneff wrote.

Conversely, the food we eat also directly acts on gut microorganisms. Dietary fiber [has been shown](#) to promote the growth of healthy gut bacteria, while a diet high in sugar and processed fats promote bacteria involved in inflammation.

Knowing that glyphosate may be able to influence pathways in the gut bacteria and cause disturbances, Seneff reasoned that the yearly increase in bowel disorders, autism (which is highly correlated with impaired gut bacteria), allergies, and many other diseases may all be due to the diet we eat; a diet containing foods high in glyphosate.

She found yearly increases in disease cases, such as diabetes and various cancers, can be directly correlated with an increase in glyphosate use.



A slide from one of Dr. Seneff's presentations.

Glyphosate and Cancer

Over 60 years after Roundup first rolled onto the shelves and into agricultural lands and gardens, the public is beginning to understand the relationship between glyphosate and cancer.

Glyphosate is implicated in many cancers. One of the [earliest glyphosate studies](#) by Dr. Gilles-Éric Séralini, a French molecular biologist and friend of Seneff, showed that low doses of Roundup exposure over a lifetime lead to shorter lifespans and organ damage in rats.

Further, [laboratory studies](#) on human cells and sea urchin embryos have also shown that glyphosate caused DNA breakage, which is a major factor in cancer progression.

Even Monsanto's earlier papers showed organ damage and tumor growth in rats, though these results were not given much attention after the company submitted new studies showing no significant health impacts.

[Seneff's studies have linked](#) glyphosate with a myriad of cancers including, but not limited to, cancer in the breast, liver, colon, kidney, skin (melanoma), thyroid, and non-Hodgkin's lymphoma.

Non-Hodgkin's lymphoma (NHL), a cancer of the white blood cells, has appeared in many of the recent lawsuits against Monsanto, and Bayer—the current owner of the Roundup brand.

Seneff linked NHL with glyphosate exposure. For a long time [it was known](#) that farmers have a higher risk of developing NHL. Furthermore, a [2002 Swedish study](#) showed that glyphosate was directly linked to a three-fold increase in NHL.

Seneff's study posited that NHL may be due to glyphosate's effect on micronutrients, particularly from deficiencies in manganese.

Manganese is an important metal that we need in trace amounts. It can bond with other molecules, forming compounds. One particularly important compound is a manganese protein named Manganese superoxide dismutase (Manganese-SOD) that works in the body as an antioxidant.

Antioxidants are important molecules for anti-aging, neutralizing the action of radioactive oxygen species that do damage to cells and DNA and increase the risk of cancer. Manganese-SOD prevents this damage by bonding with and inhibiting the molecules, and also helps to kill cancer cells.

However, glyphosate can bond to metals such as manganese and magnesium. Therefore, it likely can also bind to manganese in manganese-SOD, disrupting its functions.

[Laboratory studies](#) have shown that manganese-SOD can reduce the growth of NHL cells in laboratories and can also protect against pancreatic cancer.

People with NHL are also often found with low concentrations of manganese-SOD and are treated with another manganese compound called cationic manganese porphyrins.

Seneff says that the manganese porphyrins work by mimicking the action of manganese-SOD, highlighting the importance of manganese-SOD and the disturbances glyphosate potentially may cause to the human body.

There is "strong evidence that glyphosate is likely contributing to the increased prevalence of multiple types of cancer in humans," Seneff wrote in her study ([pdf](#)).

"Forty years of glyphosate exposure have provided a living laboratory where humans are the guinea pigs and the outcomes are alarmingly apparent."

Glyphosate and Proteins

The diseases mentioned are not exclusive, Seneff is also highly confident that glyphosate's disturbance to the gut is what causes autism, coeliac, and other allergies and behavioral problems, with some of the people around her sharing stories of improvements in their children's behavioral and asthma problems after they switched their children's diet to organic foods.

However, the biggest concern and speculation Seneff and Samsel have made was that glyphosate may be [incorporated into human proteins](#), the very building blocks of our cells.

Proteins are made up of molecules called amino acids, which we obtain through the food we eat or through our cells.

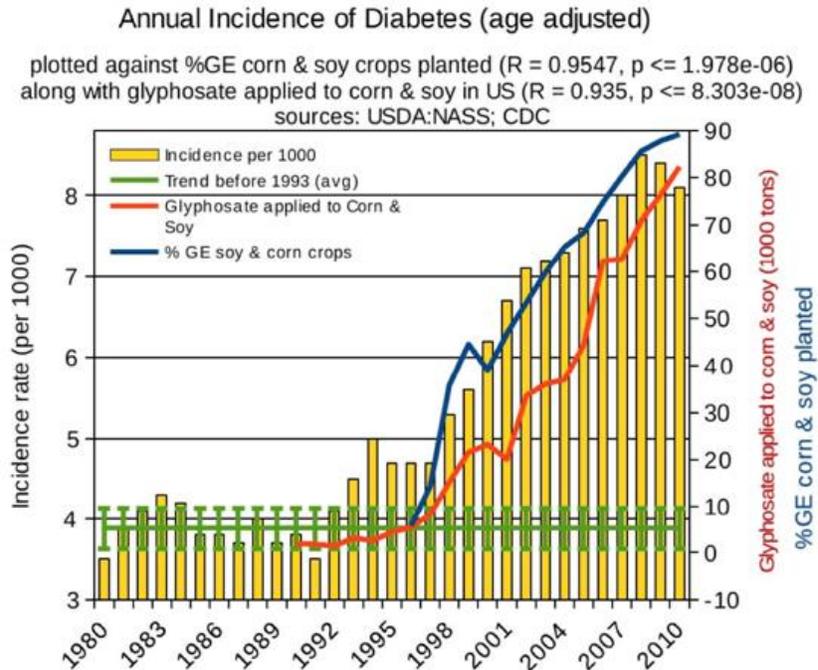
Seneff's studies speculate that glyphosate is structurally similar to an amino acid named glycine, and therefore cells may mistakenly take up glyphosate and build it into proteins, thinking that it is glycine.

[Previous studies](#) have observed that glyphosate, like glycine, can modulate certain receptors on neurons. Seneff and Samsel speculate that glyphosate's similar structure to glycine is what may have allowed it to do that.

Glycine is a very common amino acid, it can be found in many of our proteins, and plays a critical role in maintaining the function of very important proteins. Therefore, if the reality is as Seneff fears, that glyphosate can be substituted for glycine, it can cause critical changes to biochemical processes in the body.

For example, glycine is present in proteins that make energy for human cells. These proteins are in the mitochondria and change or damage to these proteins will cause them to dysfunction and send cells into stress and eventual death. Previous studies have observed that cells exposed to high doses of glyphosate caused mitochondrial damage and stress, suggesting that glyphosate may have directly played a part.

Further, Seneff believes that the increase in chronic diseases such as diabetes and other metabolic diseases are also related to increased use of glyphosate.



A slide from one of Dr. Seneff's presentations showing the increased incidence of diabetes.

Since glycine is present in proteins that regulate fat as well as insulin. If glyphosate replaced glycine in these proteins, these proteins will become impaired and lose their function in regulating fat and blood glucose, leaving the body open to metabolic disorders including obesity and diabetes.

Bumpy Journey

Many of Seneff's studies have been [heavily criticized](#) for making conclusions through correlations and speculations.

However, little research has been done to prove or disprove Seneff's fears, with many in the science and media field pushing back against her research and trying to have her peer-reviewed and published works removed through retraction.

Retraction is the process where journals remove published studies from the journal. Since retraction is often associated with a fraudulent research process with fabricated data and ethical violations, a retraction history is akin to a black mark in a researcher's career.

Seneff said she is very lucky to have none of her papers retracted, although some researchers that she knows have had their studies retracted.

[She said her first paper](#) on glyphosate was almost retracted. In that study, she referenced Dr. Gilles-Éric Séralini, a friend of hers and a key person in Seneff's journey on her research on glyphosate.

“He was really the one who blew the whistle on glyphosate,” Seneff said.

Séralini shed light on the [long-term harms](#) of Monsanto’s Roundup by replicating Monsanto’s study submitted to the Environmental Protection Administration (EPA).

In Monsanto’s studies, the researchers exposed rats to Roundup at low doses over three months and found no health effects when compared to rats not exposed to the herbicide.

“That was part of the approval process, and they actually had a rule, you don’t have to look beyond three months. Three months [and] no trouble; good to go,” Seneff said.

Séralini repeated the experiment, but he wanted to test the long-term effects and exposed the rats to Roundup over a lifetime.

“He was even not sure anything was going to happen,” Seneff said, “he told me that at three months, it was looking good.”

“There wasn’t really any evidence of any problem with the exposed group [exposed to Roundup] and he was worried the whole experience was just going to be a complete blast.”

However, at four months, there was a breakthrough.

“At four months, it (rats) started to show injuries, and by the end of the lifespan, the females have massive mammary tumors, the males had kidney damage and liver damage, and both genders had reproductive issues and early death,” she said.

Séralini found glyphosate was a slow kill. His published study was one of the first on the harms of glyphosate and gave Seneff the confidence at the start of her research, that she was on the right track.

A year after Séralini published his study, Seneff published her first study on glyphosate with Anthony Samsel and referenced Séralini’s paper in her study.

Her paper drew widespread criticism within the scientific community, many slammed her for being unqualified for health matters even though she had a bachelor’s degree in biology, and attacked the journal she published in as a “predatory journal.”

A few weeks after she published her first paper, Séralini’s study was retracted, and within the same week, her journal editor contacted her, asking if she would like to withdraw.

“That’s sort of a threat that they’re going to retract it if you don’t [withdraw],” Seneff said.

If she and Samsel chose to withdraw the paper, then they would not get a retraction in their faces and “won’t have this really nasty record of having a retracted paper.”

However, Seneff and Samsel declined.

“We said no thank you, basically.”

Unexpectedly, the journal “came back a week later and said, never mind, we don’t mean it,” said Seneff.

Instead, the journal published [a statement](#): “The policy for our journals is to widely ignore the blogosphere, where competing interests, corruption, and anonymity prevail. We do not allow personal attacks, defamatory statements, or comments of an aggressive tone.”

The editors asked researchers contesting articles published in the journal to “prepare a scientifically rigorous comment,” with authors of such comments “asked to declare all competing interests and their identity in the comment,” and to present “scientifically relevant previous publications on the subject.”

In the end, Seneff and Samsel’s first paper on glyphosate was not retracted.

“Our paper never got retracted, so I was really pleased about that,” said Seneff, sharing that the journal she published her second study in strongly defended her paper against critics who were trying to have her article removed.

Throughout Seneff’s journey, she has met other researchers sharing the same views as her around the world, forming small groups and supporting each other, collaborating and getting their papers published.

Hope for the Future

Seneff said she is very encouraged by the recent Supreme Court cases on Bayer’s lost appeal and the EPA being ordered by SCOTUS to re-evaluate if Roundup is carcinogenic.

Bayer AG, a pharmaceutical and herbicide giant that bought Roundup from Monsanto in 2018 and has since lost three million-dollar cases suing Roundup for allegedly causing cancer in consumers.

“I know it was good news for our side,” Seneff said, saying she is very excited with the progress legal cases are making in glyphosate discussions.

“I have had very little interest in the legal system in the past,” she said. “I’m a scientist, I like to read papers. I’m very remote from the legal aspects, I don’t know anything about the law. But I’m beginning to get a lot more interested because it does look like the law is the way to go.”

“But you have to get enough science to make a case. So, I feel like the work I did on glyphosate really helped their cause.”

She said in her book “Toxic Legacy,” Robert F. Kennedy, Jr. said that her research has been helping the consumers suing Roundup to win their cases.

To reduce glyphosate exposure, Seneff recommends eating organic food and drinking filtered water.

Since glyphosate is used to spray weeds, many plants such as corn, soy, canola, sugar beets, cotton and alfalfa are genetically modified so that they would not be harmed by glyphosate. This has significantly increased glyphosate content in plants with farmers also spraying the plants as opposed to only spraying the weeds.

Additionally, resistance to glyphosate in weeds has pushed glyphosate content even higher to combat the resistance. This has also harmed beneficial bacteria in the soil as well as earthworms, thereby reducing the nutrition in foods.

Seneff also recommended staying away from highways where there's a high exposure to car exhaust, as she suspects that the biofuel in petrol is also from plants exposed to glyphosate and therefore would carry trace amounts of it.

[Studies in Brazil](#) have shown that the glyphosate in the air around highways and agricultural areas using herbicides is not much different, she also said that countries that readily use biofuels have been observed to have a prominence of diseases she believes to be linked to glyphosate.

Nonetheless, Seneff said the substance is pervasive, and despite all her efforts to avoid exposure to glyphosate, she still tested positive for the substance when she did testing at home.

Seneff published her book on glyphosate titled "Toxic Legacy," in July 2021, in which she comprehensively explains her understanding of the harms glyphosate presents to the human body.