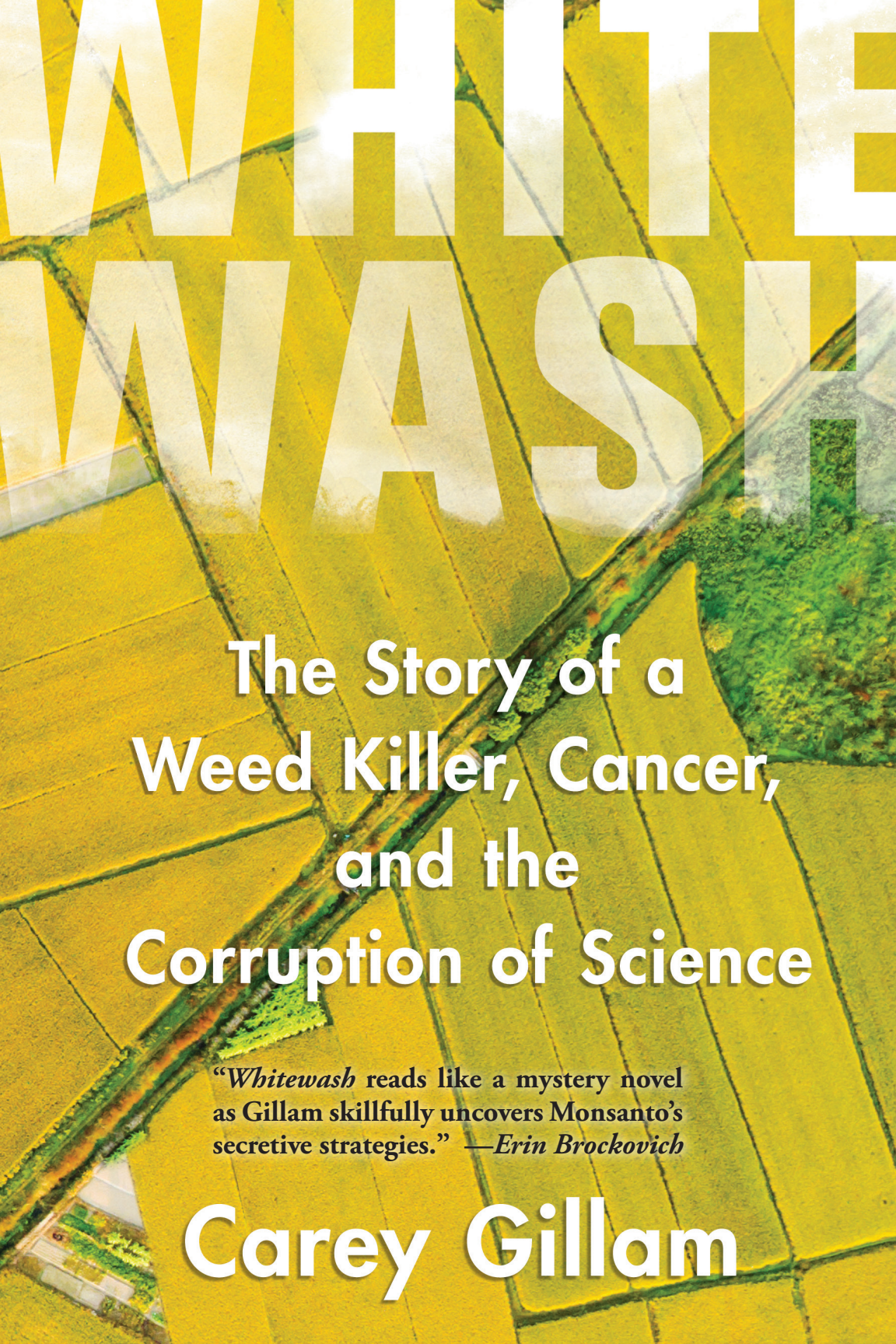
WHITE
WASH
The Story of a
Weed Killer, Cancer,
and the
Corruption of Science
"*Whitewash* reads like a mystery novel as Gillam skillfully uncovers Monsanto's secretive strategies." —*Erin Brockovich*
Carey Gillam

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Whitewash

Whitewash

THE STORY OF A WEED KILLER, CANCER, AND THE CORRUPTION OF SCIENCE

Carey Gillam

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For the farmers who have given me their time, shared their wisdom, and helped me understand the obstacles they face as they work to feed us all.

Agriculture . . . is our wisest pursuit, because it will in the end contribute most to real wealth, good morals and happiness.

—Thomas Jefferson,
letter to George Washington, 1787

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Preface

It's been nearly twenty years since I first walked into the corporate headquarters of Monsanto Company, a visit that would become one of many over the course of my career as a national correspondent for Reuters, one of the oldest and largest news agencies in the world. Meeting with top executives, scientists, and marketing experts at Monsanto, perhaps the world's best-known agricultural powerhouse, was part of a job that called on me to help keep international audiences informed about the ins and outs and evolutions of agriculture in the United States. The types of seeds farmers plant in their fields and the chemicals they use to treat their crops are big business, amounting to billions of dollars in revenues for Monsanto and the other companies that sell them. But the fundamentals of growing food ultimately have much larger implications. Not only do farmers' choices influence commodity pricing and trade relationships, but they also ultimately affect the health and well-being of all of us. The food we eat, the water we drink, the landscape of our environment, all are connected to these seemingly simple choices made by farmers in their fields.

Before my 1998 move to the farm state of Kansas to write about agriculture for Reuters, I spent a good deal of my journalism career delving into the financial wheeling and dealing of the big banking, commercial real estate, and insurance industries. I also spent a fair share of my time chasing chaos—I covered the death and devastation wrought by Hurricane Katrina; floods, fires, and droughts; and the countless tornadoes that roared across rural America. And I was dispatched to duck bullets, bricks, and bottles in the race-torn riots of Ferguson, Missouri, and elsewhere.

When assigned to cover the "ag beat," I was at first a bit reluctant. I was skeptical that it could bring the intrigue and excitement I had experienced with the prior work I had done. And I had a lot to learn. My education in food production and farming meant not just sitting down with executives at companies such as Monsanto and its rivals Dow AgroSciences and DuPont but also listening to, and studying the work of, agricultural economists, soil and plant scientists, experts on seed germplasm, and—of course—farmers. My favorite times as an ag journalist have been spent in blue jeans and mud boots, traipsing through higher-than-my-head cornstalks with farmers and riding inside the cabs of combines alongside the hardworking, often tough-talking men and women who understand better than anyone the risks and rewards of modern food production. I have immense respect and gratitude for these farmers who devote their lives to toiling in unforgiving fields, where the harvest bounty often depends on the whims of Mother Nature and the bulk of the profits go to deep pockets much higher up the food chain. And I stand a bit in awe of the scientists who spend their careers studying how to do more with less, how to grow enough food for an expanding world population in ways that could not even have been imagined a generation ago.

When I started down that reporting road, I was an eager student, nearly as impressed with the advanced technologies of modern agriculture

as with the people who work the land. I was someone who had never given much thought to what went into the products I purchased at the grocery store. I didn't buy organically grown produce, as it seemed too expensive, and I didn't spend time fretting over invisible chemicals that might lurk in my lunch. The debate about the then-nascent technique of making transgenic changes to food crops was a mystery to me. And I was a devoted consumer fan of Monsanto's hit herbicide product, Roundup, using it liberally in my suburban backyard to keep weeds at bay. Wide-eyed is the best way to describe my reaction to seeing Monsanto's "corn chipper" in action and to those initial visits to biotechnology crop demonstration fields. I became a fan of the company's chief technology officer, an engagingly brilliant, bald-headed scientist named Robb Fraley, and I always enjoyed my many chats with the affable Brett Begemann, who grew up on a Missouri grain and livestock farm before rising through the ranks to eventually become Monsanto's president.

But over the years, as my research and reporting expanded to include doubts about the benefits of genetically modified organisms and the risks associated with the chemicals used on them, I became a target of Monsanto's ire. Company representatives and industry surrogates alternately sought to bully me, charm me, intimidate me, and cajole me to write news stories in ways that parroted industry talking points. They told me there was no justification for reporting both sides of the debates over Monsanto's crops and chemicals because the science was settled, all was well, and anyone who questioned that was thwarting Monsanto's mission to "feed the world." When I would not adopt the desired narrative, surrogates attempted to assault my character and credibility and made efforts to derail my career. Monsanto executives and representatives from Monsanto-funded organizations sought unsuccessfully to convince my editors to yank me off my beat, to block further coverage of the issues. They could rarely, if ever, find errors in my reporting. The problem, they would complain, was one of "bias."

As you'll see in reading this book, the only bias I hold is for the truth. What I've learned, what I know with certainty, is that when powerful corporations control the narrative, the truth often gets lost, and it's up to journalists to find it and bring it home. That's what I've tried to do with this book. For decades, companies have whitewashed many of the facts about the crops and chemicals that they have helped make a central part of modern agriculture. Yes, there are rewards, but there are also risks—many. And without transparency, none of us can make informed decisions about what we eat and what policies we do or do not want to support.

My admiration for American farmers has never waned. But this journey through our nation's food system has left me with a very real fear—for my children, for your children—over what the future holds. It is undeniable that we've allowed our food, our water, our soil, our very selves to become dangerously doused with chemicals, and one of the most pervasive of those pesticides is the subject of this book.

Scientists call it glyphosate. Consumers know it as Roundup. It's a weed killer, but it's killing much more than weeds. And the regulatory agencies charged with protecting the public from these dangers have acted—intentionally or not—in ways that have protected corporate products and profits instead of people. It's not a feel-good story. But it is one that has to be told.

INTRODUCTION

A Silent Stalker

If we are going to live so intimately with these chemicals—eating and drinking them, taking them into the very marrow of our bones—we had better know something about their nature and their power.

—Rachel Carson, *Silent Spring*

Since the mid-1990s, one of the largest and loudest public policy debates in the United States and Europe has been over the introduction of genetically engineered crops. Questions about the safety of these crops—for humans, animals, and the environment—have raged across continents, roiling markets and dividing nations and states over how to view this type of tinkering with nature. The debate has led to increasing consumer awareness of, and activism against, the industrialized farming practices that produce our food, and numerous books have documented an array of concerns over genetically modified crops.

But shadowing the controversy over genetically modified organisms (GMOs) is what I believe to be the *true* health and environmental

calamity of modern-day biotech agriculture—the flood across our landscape of the pesticide known by chemists as glyphosate and by the rest of us simply as Roundup. From the day genetically engineered crops were introduced, they were designed with one primary purpose in mind—to withstand treatments of glyphosate, the highly efficient and effective weed-killing ingredient in Monsanto Company's Roundup branded herbicides. Farmers using Monsanto's Roundup Ready seeds along with Roundup herbicide could knock weeds out of their fields without worrying about killing their crops. Then and now, most of the genetically modified crops grown in the world carry the glyphosate-tolerant trait, enabling and encouraging farmers to choose to use this herbicide over any other on their farm fields. It was a brilliant move by Monsanto and made the company billions of dollars in combined sales of seeds and herbicide. But it has cost the rest of us, and generations yet to come, in ways impossible to calculate.

Just as dichlorodiphenyltrichloroethane, or DDT—now banned because of environmental and health risks—once was widely used as an insecticide the world over and declared "a benefactor of all humanity,"[1] glyphosate was heralded as a "one in a 100-year discovery that is as important for reliable global food production as penicillin is for battling disease."[2]

And just as the truth of DDT's dangers eventually came to light, the devastation wrought by years of nearly unchecked use of Roundup and other glyphosate-based weed killers has emerged as another example of how influential corporate interests can trump protection of the public.

The story of how this once obscure chemical became a common household name shows that the lessons of Rachel Carson and her book *Silent Spring* appear to have been forgotten as man-made dependence on glyphosate and other synthetic pesticides wreaks havoc on people, animals, and the land. As before, it begins with power, money, and politics, which have combined to accelerate glyphosate's use to unprecedented

levels and have inserted this toxic pesticide into the diets of people around the world. Many have suffered deadly diseases linked to glyphosate, while scientists who raise red flags about these risks have been bullied and ostracized. Their experiences are recorded in these pages, as are efforts by regulators to straddle the fence between protecting public health and appeasing moneyed interests. Internal documents and communications, obtained through Freedom of Information Act (FOIA) requests, make clear how corporate players and a consortium of public and private scientists have manipulated regulators and lawmakers into green-lighting ever-higher uses of this chemical even as danger signs mounted.

Amid the growing crisis, consumers are awakening to the fact that they must hold regulators and lawmakers accountable for the levels of glyphosate and other pesticides in the foods we all eat. Concerns about glyphosate residues were part of the push for GMO labeling, and they drove consumer and environmental groups to petition regulators in the European Union and the United States to block further use of the chemical in 2016. European Parliament members took the concerns so seriously that in early 2016 they had their urine tested for glyphosate—finding alarming results—and some U.S. moms and researchers started testing breast milk and an array of foods. Fears about glyphosate also have started to affect international trade. Oatmeal products from the United States were rejected in the spring of 2016 by food inspectors in Taiwan because they contained glyphosate traces. Glyphosate is such a hot topic that industry players established a Twitter feed for the pesticide in March 2015.

Use of glyphosate has skyrocketed in the past twenty years, in part because as Monsanto's patent on the chemical was nearing expiration in the year 2000, the company introduced glyphosate-tolerant soybeans, corn, canola, sugar beets, and other crops, linking its new crop technology to its older chemical agent. Genetically engineered alfalfa,

a common food for livestock, is also regularly doused with glyphosate now. Monsanto also encouraged farmers to use glyphosate—not on top of crops but as a traditional herbicide—in the production of hundreds of other foods that are not genetically engineered, including wheat, oats, vegetables, fruits, and nuts. U.S. farmers alone applied about 276 million pounds in 2014, compared with 40 million pounds in 1995, according to published research, and use globally has more than doubled in just the past ten years.[3] Around the globe, glyphosate is now registered for use in 130 countries and is manufactured by dozens of producers following Monsanto's lead. It is considered the most heavily used agricultural chemical in history.[4]

The popularity of glyphosate has been a boon for companies using it in their herbicide products. But emerging research in recent years is showing a host of unforeseen problems for people and the environment, including evidence that glyphosate may be a human carcinogen and that residues of this potentially cancer-causing chemical are frequently found in an array of popular foods, including cereals and snacks. Heavy use of glyphosate has also been showing detrimental effects on soil biology, which in turn affects the health and nutritional profile of crops. And use of the chemical has spawned what scientists and farmers have nicknamed "superweeds"—weeds that can grow several feet tall, choking off important food crops, and that are largely impervious to efforts to wipe them out. These superweeds now cost U.S. farmers billions of dollars per year in added labor and chemicals and lost production. The evidence is still evolving but already makes it clear that this weed killer, which for decades was believed to be benign—"safe enough to drink," according to some promoters—is endangering public and environmental health much more than the altered DNA of the crops it is tied to. It is not the most inherently dangerous of pesticides on the market, but its broad use for everything from farm fields to golf courses gives it a reach into every avenue of our lives, far deeper than that of other agrochemicals.

Indeed, recent government and academic research shows that glyphosate is pervasive in water, in air, and in our food. Just how much of the pesticide we've been consuming has been hard to determine, thanks largely to a U.S. regulatory community that has repeatedly said there is no need to test for glyphosate because the agrochemical industry has proven it to be so safe. In fact, glyphosate stands out as the one widely used pesticide that has not been included in years of annual government surveys of pesticide residues in food. Both the U.S. Food and Drug Administration (FDA) and the U.S. Department of Agriculture (USDA) annually test thousands of food products for hundreds of different types of pesticide residues, but both routinely have refused to test for glyphosate.

It's also notable that as the USDA and FDA have been declining to test for glyphosate residues over the past twenty years, the U.S. Environmental Protection Agency (EPA), which regulates pesticides, has been approving industry requests for higher and higher allowable levels of glyphosate residues in food. In 2013, for example, the EPA, at the request of Monsanto, raised the legally allowed amount of glyphosate residues in food considered safe to levels far higher than in other countries.

Disquiet about the safety of this widely used pesticide is global. Scientists and academics around the world have been trying to sound an alarm for years as growing use of glyphosate has tracked with mounting evidence of its dangers. The scientists warn that animal and epidemiology studies published in the past decade raise serious concerns about glyphosate's safety. There are strong indications that the chemical could trigger endocrine disruption, hormone system disturbances that have been linked to some cancers, birth defects, and developmental problems in children.

This book takes readers deep into the data and reveals not only how corporations keep a tight rein on regulators but also how they push "science" that supports their profit-focused interests to the forefront—all while burying evidence of harm. Documents obtained from inside

government agencies and state university research programs provide numerous examples of how the agrochemical industry has secretly funded "independent" professors and other scientists to lobby on behalf of glyphosate's safety; how the industry has quietly set up front groups and think tanks to support its interests; and how it has attacked and tried to discredit scientists who have spoken out. Its reach even extends into the USDA and EPA and the suppression of scientific findings by government agricultural researchers.

This particular pesticide—glyphosate—is only one of scores of chemicals that have taken root in our lives, offering profits for the corporations that sell them but perils for people exposed to them. Indeed, there is a large and expanding body of evidence tying various pesticide exposures to elevated rates of chronic diseases, including a range of cancers, diabetes, neurodegenerative disorders such as Parkinson's disease and Alzheimer's disease, birth defects, and reproductive disorders.

But the story of the world's most widely used weed killer illustrates how destructive the consequences can be when we allow the balancing of risk and reward to tip too far in the direction of danger.

CHAPTER 1

What Killed Jack McCall?

Standing on the ridge overlooking her coastal California farm, Teri McCall sees her late husband, Jack, nearly everywhere. There, atop the highest hill, is where the couple married in 1975—two self-described "hippies" who knew more about how to surf than to farm. Midway up the hill, on a lush plateau surrounded by the lemon, avocado, and orange trees Jack planted, sits the 800-square-foot house the then-young Vietnam War veteran built for his bride and a family that grew to include two sons and a daughter. One of those sons now lives there with his own wife and small son. Solar panels Jack set up in a sun-drenched stretch of grass help power the farm's irrigation system.

Down there, nestled in a velvety green valley, is the century-old farmhouse Jack and Teri made their home after Jack's parents died. The two-story white Victorian boasts a front porch wide enough for rocking chairs and potted flowers and for friends to gather. Jack and Teri spent countless quiet nights on that porch, watching stars light up the sky, which is always so dark out here in the countryside. Over the front door is a stained-glass window Jack installed that features a heart and flowers. Inside, a plaque etched with the word "Blessed" hangs over the bedroom door.

Teri was only seventeen when she met twenty-three-year-old Jack just after he returned from Vietnam. He had been a first lieutenant in the 101st Airborne Division and received both a Bronze Star and a Distinguished Flying Cross for his service. When Teri saw him, though, he didn't look like a soldier but more like a big kid, laughing and playing Frisbee with friends. She remembers being almost instantly smitten by his rugged good looks and easy smile. It took five years before they became more than friends, and then forty years passed all too quickly.

"Literally hundreds of times a day, something reminds me of him," McCall tells me as I stand beside her on the ridge one bright spring morning a few months after Jack's death. Her tears start to flow. "That's part of why it's so hard to believe . . . to know that even if I search the whole world, look everywhere, I can't find him now." She shakes her head. "So hard to believe I can never see him again."[1]

~

Anthony "Jack" McCall, age sixty-nine, died on December 26, 2015, after a painful and perplexing battle with an aggressive form of non-Hodgkin lymphoma, a type of cancer that forms in the lymphatic system and can appear almost anywhere in the body. The loss is certain, fixed forever in his family's heartbreak. But questions about why and how he was stricken—a man who never smoked, who stayed fit, and who had no history of cancer in his family—swirl around his use of the popular weed killer Roundup and its active ingredient, glyphosate.

McCall shunned pesticide use on his farm, except for Roundup. He didn't like the idea of synthetic chemicals floating around the orchard, where he grew apricots, peaches, plums, and apples, or near his precious avocados. But Roundup was marketed as having extremely low toxicity, nothing that a small farmer like Jack needed to worry about. He would drive twenty to thirty miles from his farm, just outside the

seaside village of Cambria, to Morro Bay, or often into San Luis Obispo, to buy his favorite weed killer. He would then apply it himself, spraying the pesticide all around the farm to beat back worrisome weeds. He even recommended Roundup to friends in the small Cambria community, telling them it was supposed to be much safer than alternatives and touting its effectiveness.

In fact, this chemical called glyphosate has for many years been the most widely used herbicide in the world, in part because ever since its introduction in 1974 it has been marketed as one of the safest of all pesticides ever brought to market. Its developer, Monsanto Company, and other companies that started selling glyphosate-based herbicides after Monsanto's patent expired have collected billions of dollars in global sales off the well-known consumer and agricultural mainstay for eradicating troublesome weeds. Declared to be as safe as table salt, Roundup and other glyphosate products became the remedy of choice for millions of consumers, farmers, gardeners, and groundskeepers around the globe. It has been a preferred choice for use in city parks and on school playgrounds and to keep golf courses weed free. Monsanto has also promoted its weed killer for use in zoos.

But the death of McCall, and the illnesses and deaths of other farmers and glyphosate users like him, have come amid revelations of a number of hidden dangers associated with the chemical, including links to non-Hodgkin lymphoma. And what began as a trickle of worry has widened into a flood of outrage against Monsanto and the regulators who have deemed glyphosate safe. Soon after her husband's death, McCall's widow, Teri, joined a movement of thousands of people who are bringing wrongful death lawsuits against Monsanto—people from around the United States who claim that Roundup can cause cancer and that Monsanto has tried to cover up the risks.

As the fortieth anniversary of glyphosate's introduction to the market was notched in 2014, protests over its use mounted, not just in

America but also abroad. By early 2016, protesters in the United States, Europe, South America, and elsewhere were calling on regulators to restrict or ban glyphosate, citing scientific research linking it to a range of health and environmental ills. Regulators and private organizations started analyzing food, water, air, and soil for glyphosate residues, and fears about use of glyphosate on genetically engineered crops gave added ammunition to a grassroots groundswell calling for required labeling of foods containing genetically modified organisms (GMOs).

The evidence of glyphosate's dangers began building soon after the herbicide was introduced, but it wasn't until Monsanto's commercialization of genetically engineered crops designed to be sprayed directly with glyphosate—so-called Roundup Ready crops—that glyphosate use took off and, with it, signs of trouble.

The lawsuits began after a team of World Health Organization (WHO) cancer experts announced, in March 2015, that they had determined glyphosate was a probable human carcinogen. That team, from WHO's International Agency for Research on Cancer (IARC), said a review of many scientific studies showed that glyphosate had a positive association with non-Hodgkin lymphoma (NHL). This association was noteworthy because incidences of NHL had spiked over the past several decades, making it the tenth most common cancer worldwide, with nearly 386,000 new cases diagnosed in 2012. The statistics are especially concerning for those living in North America, where incidence rates are highest.[2]

Many scientists have been studying the rise in NHL seen over the past forty years, especially for farmworkers exposed to pesticides. And many have warned that glyphosate and Roundup could be contributing to a range of diseases and ailments. IARC's work did not constitute solid proof that glyphosate causes NHL or other health problems, of course, but it did offer authoritative analysis of research examining correlations between the pesticide and disease. The IARC team said their

conclusions were based on "sufficient evidence of carcinogenicity" in studies of lab animals, "limited evidence" in humans, and evidence that glyphosate "caused DNA and chromosomal damage in human cells."[3]

"We should all minimize our use as much as possible," said Professor Lin Fritschi, an epidemiologist affiliated with Curtin University in Australia who specializes in studying occupational causes of cancer. Fritschi was part of the IARC team that evaluated glyphosate. "The people most at risk are people who use glyphosate a lot, such as farmers and gardeners, and they are the ones who should try and reduce their use," she said.[4]

In February 2016, Teri McCall became one of many people to act upon those warnings by taking their claims of glyphosate-related illnesses and deaths to court. Though Jack's death certificate blamed metastatic large cell lymphoma for his passing, his family believes the actual culprit was the chemical.

"Roundup was supposed to be safe," Teri's lawsuit states. "The truth, however, is far more insidious. The active chemical in Roundup, glyphosate, is a carcinogen, and Monsanto has known this fact for decades."[5]

Legal observers believe that the roughly 1,000 cancer claims filed between 2015 and early 2017 mark what is to become a mountain of legal actions targeting Monsanto and Roundup. Plaintiffs in several of the lawsuits make the same allegation, that Monsanto spent decades covering up signs of harm associated with the weed killer, even promoting falsified data. Monsanto "knew or should have known . . . that exposure to Roundup and specifically, its active ingredient glyphosate, could result in cancer and other severe illnesses and injuries," plaintiffs claim.[6] Monsanto has denied the allegations.

Many of the cases were centralized in federal court in San Francisco, to be handled by one judge in what promises to be a long and winding battle that could take years to litigate. Monsanto says that it empathizes with anyone facing cancer but insists there is no reliable

scientific evidence showing that exposure to glyphosate or Roundup branded products can cause cancer. But the team of lawyers representing the plaintiffs say that Monsanto knowingly failed to warn customers about many dangers Roundup posed for human health. The lawyers—and several scientists—contend that Roundup is more dangerous than glyphosate alone because of an added ingredient that Monsanto used for many years to help the glyphosate adhere to plants. Some research has shown that this added ingredient, polyethoxylated tallow amine (POEA), can be extremely damaging to human cells. Regulators did not require extensive safety tests on the combination of glyphosate and POEA, and Monsanto did little such testing, plaintiffs allege. But this "secret soup," the plaintiffs claim, can be deadly.

Internal e-mails and other documents obtained by the plaintiffs' attorneys during the first rounds of court-ordered discovery show how hard Monsanto has worked over the years to defend itself against safety concerns associated with Roundup. In some e-mails, company executives discussed ghostwriting favorable research manuscripts that would appear to be authored by acclaimed independent scientists. In others, executives discussed recruiting and paying experts who would lend credibility to Monsanto's claims of product safety; and in one, a Monsanto executive stated how "useful" a certain senior official of the U.S. Environmental Protection Agency (EPA) could be in "glyphosate defense."[7] Court records show that same official went to work for Monsanto-related organizations almost immediately after retiring from the EPA. Taken together, the documents paint an alarming picture indicating that year after year, at crossroads after crossroads, when research raised concerns about glyphosate, Monsanto's response was to turn away from the warnings and work harder to promote more use of the chemical. EPA documents show that Monsanto even protested the worker safety rules the agency said needed to accompany glyphosate products, calling such cautionary requirements "unjustified."[8] The company also resisted

recommendations from an EPA toxicologist that the word "Danger" be used instead of "Warning" on Roundup labels.[9]

Monsanto has argued that its internal communications taken individually do not accurately reflect the company's actions or intentions, and company attorneys tried to keep the documents sealed. But the federal judge overseeing the multidistrict litigation ruled that many could be made part of the public court file.

Mother, grandmother, and former coffee farmer Christine Sheppard hopes she lives long enough to see the outcome of her lawsuit against the company. Though her NHL was in remission when we last spoke, Sheppard's life changed irreparably when she was stricken with a vicious version of the cancer, which would steal not only her health but also the idyllic retirement she and her husband, Kenneth, had carved out for themselves on a coffee plantation in Hawaii. She was a healthy and happy forty-seven-year-old working as director of marketing for a software company, and her husband, slightly older, was an engineering manager at a hardware company, when the two decided they'd had enough of the fast pace of the high-tech industry and they'd try their hand at farming. The couple left their home in San Diego, California, and plowed their hefty savings into a five-acre former coffee farm on the Big Island of Hawaii, in the Kona coffee-growing region. They moved to the farm in 1996.

"The weeds were so high that we could hardly wade through them, and the coffee was trees instead of bushes, tall with many branches twisted together," Sheppard recalled.[10] To tackle the weeds, the Sheppards strapped on backpack herbicide applicators and walked through the groves, spraying Roundup generously. They repeated this routine at different points throughout the years to keep weeds at bay.

"We were just carrying on the practices that were common in the area," she said. "Roundup was standard for the coffee-growing region and was recommended by the University of Hawaii's agricultural agent

there. The department of agriculture would put on conferences on how to spray it so it didn't hurt the coffee trees. We were told it was safe enough to drink and we didn't need to wear protective gear."

For many years, the Sheppards felt they were living their dream. They learned the coffee business quickly, built a website to market their fresh-roasted beans online, and sold the coffee to visitors who toured their farm. Sheppard became so involved that she was elected president of the area's Kona Coffee Council, and her husband acted as director of education, organizing seminars and workshops for other farmers. The farm also came to be an animal sanctuary of sorts as the couple brought home a menagerie of dogs, cats, donkeys, and goats. "Our life on the farm was wonderful," Sheppard recalled.

They were making a plan to transition their coffee to organic, purely as a marketing move, according to Sheppard, when her health took a sudden and worrisome turn. One leg swelled and throbbed, she was frequently fatigued, and she began having night sweats. At first she thought her symptoms marked the onset of menopause; then she thought she might have blood poisoning. A doctor prescribed blood thinners, to no avail. Subsequent tests revealed the startling diagnosis: Sheppard had stage 4 large B-cell non-Hodgkin lymphoma, with roughly a 10 percent chance of survival.

It was August 2003, and she immediately started on months of chemotherapy. By the summer of 2004, the couple had sold the farm, which they could no longer manage, and moved back to California for expensive and exhausting experimental treatments. The treatments ultimately were successful enough to move Sheppard into remission in 2005. She's been left with lasting neuropathy, which causes severe foot and hand pain; loss of balance; and a host of other ailments that make it difficult for her to get through a day without medications. And the couple's savings have been exhausted on medical bills. For years, Sheppard said, she would "beat on the walls and wonder 'why me?'"—until

the spring of 2015, when she read about Roundup's ties to non-Hodgkin lymphoma.

"My anger is still pretty raw," Sheppard told me. "The way Monsanto is reacting, their efforts to discredit things, are typical of what the tobacco industry did when information was coming out about links to lung cancer. I know they're going to fight hard. And they've got deep pockets."

Monsanto faces a long list of people who attribute their cancers to Roundup. Texan Joselin Barrera, a daughter of migrant farmworkers, believes growing up in an environment where the pesticide was regularly sprayed gave her non-Hodgkin lymphoma. Elias de la Garza, a former migrant farmworker and landscaper, also from Texas, similarly claimed his NHL was due to Roundup exposure. Judi Fitzgerald, a horticultural worker diagnosed with leukemia in 2012, also filed suit. California sod farm worker Brenda Huerta, who was diagnosed with NHL in 2013, also sued Monsanto for allegedly hiding the dangers of glyphosate.

John Sanders worked for thirty years managing weeds in orange and grapefruit groves in Redlands, California, before he developed NHL. Frank Tanner owned a landscaping business in California and started using Roundup in 1974; he was diagnosed with NHL after years of spraying glyphosate. Both are suing.

Orange County, California, resident Goldie Perkins sued Monsanto in July 2016, claiming the non-Hodgkin lymphoma she was diagnosed with in July 2014 was caused by exposure to Roundup products that she started using in the 1970s. Perkins echoed others in her assertion that scientific fraud helped get and keep glyphosate products on the market for decades.

From all over the country, from small towns to large cities, people are alleging connections between disease and glyphosate-based Roundup and say they were intentionally led to trust in the safety of a product that was not truly safe. "Monsanto assured the public that Roundup

was harmless. In order to prove this, Monsanto championed falsified data and attacked legitimate studies that revealed its dangers," states one lawsuit, filed by Enrique Rubio, who claims he got cancer after nearly twenty years of regular exposure to Roundup while working in strawberry and vegetable fields in Oregon, California, and Texas. "Monsanto led a prolonged campaign of misinformation to convince government agencies, farmers, and the general population that Roundup was safe," his lawsuit states.[11]

Monsanto fought to have the cases thrown out, but as of this writing they are moving forward, and legal experts warn that glyphosate-related liability litigation could persist for decades. Lawyers working on the cases say they believe they will prove that Monsanto has deliberately concealed information about the dangers of its herbicide, an implication that, if proven, could reverberate around the world, given the global pervasiveness of the chemical. The lawyers and many observers familiar with glyphosate's history expect the litigation to rival mass tort actions seen over harms associated with dichlorodiphenyltrichloroethane (DDT), asbestos, and polychlorinated biphenyls (PCBs).

Monsanto argues that forty years of studies show glyphosate to be extremely safe and not cancer-causing. The company has asserted that IARC's findings were based on "junk science" and that politically motivated scientists have unfairly maligned the chemical.[12] Monsanto hired its own team of experts in 2015 to review the safety of glyphosate and said they found no cancer links.

But IARC was not the first to link glyphosate to cancer. The EPA's own scientists had the very same concerns back in the mid-1980s. A 1985 internal memo details how agency scientists themselves classified glyphosate as a possible human carcinogen. It was six years later, after extensive input from Monsanto, that the agency switched its tune and declared instead that it found "evidence of non-carcinogenicity for humans."[13] The change was made over the objections of some peer review members involved in the classification.

By the mid-1990s, Monsanto was facing accusations about Roundup's safety by New York's attorney general, Dennis Vacco, who grew up working on his family's 3,000-acre farm raising snap beans and Concord grapes. Vacco sued Monsanto for allegedly using "false and misleading advertising," including assurances that Roundup could safely be used in areas where children and pets play.[14] The attorney general also challenged Monsanto for using phrases like "You can feel good" about using its glyphosate-based herbicides because they were "practically nontoxic." Monsanto did not admit wrongdoing but agreed to pay $50,000 and to stop making such advertising claims in New York. Advertising in other states was not affected.

Aaron Johnson, a farmworker from Hawaii who was diagnosed with non-Hodgkin lymphoma in 2014, said he relied on those claims of safety during the roughly twenty years that he spent living and working amid the pineapple, macadamia, and papaya farms of Pahoa, Hawaii. "They would say it was safe as table salt. That was a common belief," recalled Johnson, who is one of the plaintiffs in the Roundup litigation. He loved his life on the island, surfing and hiking and taking a morning jog through the fields before work each morning. When the sickness set in, Johnson said, he was blindsided by the news that he had blood cancer. He initially was told he had but three months to live. Johnson spent the next year undergoing chemotherapy and bone marrow transplant treatment before being declared by doctors to be in remission in 2015. He now tends to a small orchard of his own, hand-weeding and shunning any chemical herbicides, especially Roundup.

"I think that they've known since the '70s this stuff can cause cancer. And now, on the scale that it has been distributed and used . . . this molecule is everywhere, in our food, our water," Johnson said. "They say it can be found in every person. As time goes on we're going to find out that it is a lot bigger than people can even imagine right now. All for profit—all for the sake of making billions a year off this one product. I don't understand how they've been able to get away with it."[15]

Legal experts say it will take much more than heartrending stories to demonstrate that Monsanto bears responsibility for the disease that tore apart so many lives. Proving that Roundup caused an individual's cancer, and that the company knew of and covered up evidence of carcinogenicity, is a big legal hill to climb. Monsanto claims the best science proves the safety of its herbicide and argues that regulators around the world are on its side. With more than $15 billion in revenues in 2015 and a long track record of victories in court battles over other complaints about its practices and products, Monsanto has been undeterred by the mountain of lawsuits. Its arsenal to combat adversaries will become even stronger if a planned merger between Monsanto and Germany's Bayer AG is completed.

Still, the dozens of attorneys pushing the cases forward say they have strong evidence that Roundup is just the latest example of a pattern by Monsanto of making false safety claims and covering up evidence about a dangerous substance. Indeed, the Roundup litigation closely mirrors courtroom battles Monsanto fought for years involving the polychlorinated biphenyls, or PCBs, it once manufactured.

Plaintiffs in those cases claimed PCB exposure caused them to fall ill while Monsanto hid the risks. Monsanto claimed, as it has done in the Roundup cases, that plaintiffs could not definitively link illnesses to PCB exposure. But the court-ordered discovery process required Monsanto to turn over internal documents that demonstrated the company was aware of health and environmental hazards even as it worked to keep the public in the dark and manipulated scientific studies to downplay the risks of PCB exposure.

A St. Louis, Missouri, jury in May 2016 ordered Monsanto and affiliates to pay $46 million in the cases of three people from Alaska, Michigan, and Oklahoma who said that exposure to PCBs gave them or their loved ones non-Hodgkin lymphoma. As with glyphosate, Monsanto was the primary U.S. maker of PCBs, until Congress outlawed

them in 1979. And like glyphosate, PCBs were once used prolifically, for everything from industrial equipment to food product packaging. Hundreds of other PCB cases have been tried or are progressing through courts. Monsanto still faces legal claims by state officials in Washington who allege the company's production of PCBs contaminated more than 600 sites around the state, polluting waterways as well as soil and air. The state contends Monsanto hid its knowledge of the dangers of PCBs for years.

In 2003, Monsanto and a company it spun off called Solutia, along with a company called Pharmacia, through which Monsanto operated briefly as a subsidiary, agreed to pay roughly $700 million to address claims by more than 20,000 plaintiffs over PCB contamination in Anniston, Alabama, where the company operated a PCB manufacturing plant.[16] Studies linked PCBs to diabetes and liver disease in the Anniston area, though Monsanto had said for years that PCBs were not endangering public health.[17]

Some scientists and environmental activists who have long followed the trails of chemical pollution believe the evolution of glyphosate also mirrors that of DDT, a common pesticide most famous for its ability to wipe out malaria-carrying mosquitoes. DDT was also used in agriculture and in residential areas, and, like glyphosate, it was viewed for decades as a near-magical chemical before it fell from favor amid evidence of dire health and environmental consequences. DDT was award winning—the 1948 Nobel Prize in Physiology or Medicine went to Swiss chemist Paul Hermann Müller, who discovered its insecticidal properties in 1939. The dangers of DDT took years to fully emerge, although—like glyphosate—DDT raised early red flags with scientists. After decades of use, DDT was found to be an endocrine disruptor, and, like glyphosate, it was classified as "probably" carcinogenic to humans by the World Health Organization's cancer experts. Scientific research also linked DDT to miscarriages, liver damage, and other health problems,

and by 1972 the pesticide once declared a "benefactor to all humanity" had been banned for most uses. Still today, regulatory tests routinely find traces of DDT residues in food.

Don Huber, professor emeritus of plant pathology at Purdue University, believes that glyphosate may be even more toxic than DDT. "Future historians may well look back on our time and write about us . . . how willing we were to sacrifice our children and jeopardize future generations based on false promises and flawed science just to benefit the bottom line of a commercial enterprise," he said. "We need to recognize what the concerns are, what's happening, and then we need to change."[18]

While there is great debate over the safety of glyphosate, there is little doubt about its pervasiveness. By 2013, glyphosate use was so widespread that U.S. government researchers were documenting it in our air and waterways as well as in human and animal urine, including that of dairy cows. An analysis of state water agency data by the nonprofit Environmental Working Group found glyphosate in tap water in at least six states, flowing through water utilities that serve more than 650,000 people. People getting their drinking water from utilities in Bakersfield, California, and New Port Richey, Florida, were among those exposed.[19] Glyphosate residues have also been found by various organizations in a range of commonly consumed products, including wine, cereals, and snacks. Although everyone who eats risks glyphosate exposure, agricultural workers who toil in fields where the pesticide is used face the greatest exposures.

Harrington Investments, a California-based investment advisory firm that focuses on socially responsible investments, believes Monsanto can and should do more to reassess glyphosate's impacts. John Harrington, who leads the firm, has filed multiple shareholder resolutions asking Monsanto's management team to conduct fresh studies on glyphosate's consequences for both people and the environment, but each request has been rejected.

"They have a long history of egregious behavior," Harrington said about Monsanto. "They operate with no regard for the potential harm that may result from their actions—profit is their sole objective. Monsanto is the quintessential example of a corporation that exists exclusively to maximize materialistic self-interest, regardless of the consequences to society."[20]

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Jack McCall's death was felt throughout his small community of Cambria, an old mining town at the mouth of the Santa Rosa Creek, midway between the bustling cities of San Francisco and Los Angeles. The community, home to about 6,000 people, is dotted with vineyards and wineries, verdant pastureland, and rolling hills of brilliant yellow flowers, and it is blessed with easy access to the rocky beaches of the Pacific Ocean.

Everyone in Cambria knew Jack, it seemed. He worked for years as a town postman to help make ends meet, volunteered in a local church, and was a fixture at the local farmers' market, where he offered fresh fruit for sale or traded avocados for vegetables to take home for dinner.

Longtime family friend and neighbor Shanny Covey said that while Jack was worried about other pesticides, he believed that glyphosate was safe. He used it over and over and recommended it to Covey and other friends and farmers. He was so confident of the safety of his fields that he would take his grandson Wyatt for tractor rides around the farm. Three years before Jack's death, the McCall family dog, Duke, developed lymphoma and died at the age of six. Duke had typically romped alongside McCall and played in the areas where McCall used glyphosate to treat weeds. But no one suspected at the time that the weed killer could harm the dog.

When Jack was diagnosed with non-Hodgkin lymphoma in 2015, his oncologist warned Teri not to try to research the particularly fast-moving and rare form of NHL Jack had—anaplastic large-cell lymphoma, or ALCL.

The prognosis was so dire it would be better for Teri not to know. Teri did the research anyway.

Some of what she learned, she already knew: ALCL revealed itself slowly at first, with symptoms easy to discount—fever, backache, loss of appetite, and fatigue. It could start in the skin, or the lymph nodes, or in organs anywhere in the body. And it could kill.

"I saw that it was aggressive, but I still was determined that we were going to lick it," she recalled. "He wanted to talk about making plans for me, for the family, in case he didn't make it. But I avoided that. I always thought there would be more time. I didn't know he was dying."

It was Christmas Eve 2015 when Jack was admitted to the hospital for what would be the final time after he suffered a massive stroke. Cancer had spread from an initial lump in his neck throughout his body, and he was weak from chemotherapy and other treatments. His body simply could not take any more. Family and friends gathered at his bedside on Christmas Day to say their goodbyes before Jack slipped into a coma that he would not come back from. He died the day after Christmas when Teri allowed his doctors to remove life support. "I wanted to tell him not to leave me, but I couldn't do that to him," Teri recalled. "I couldn't make it harder for him to go."

Paul McCall, who stepped in to run the farm in his father's place, was the first to make a connection between his father's disease and Roundup, stumbling onto IARC's findings during an Internet search. He read about the strong links found between glyphosate and NHL and read more and more until the rage and grief overwhelmed him. It was too late to help his father. But Paul decided there would be no more Roundup used on the farm. He started warning friends and neighbors about the herbicide as well. He knows his suspicions don't prove the chemical is the killer, but he refuses to take what he sees as more risks. "I threw it all out. I just use dish soap mixed with some vinegar and salt now. It works just as well," he said. "It's no secret Roundup is bad for you. They got rid of DDT. They need to get rid of this too."