TACTIC 1: Corrupting Science

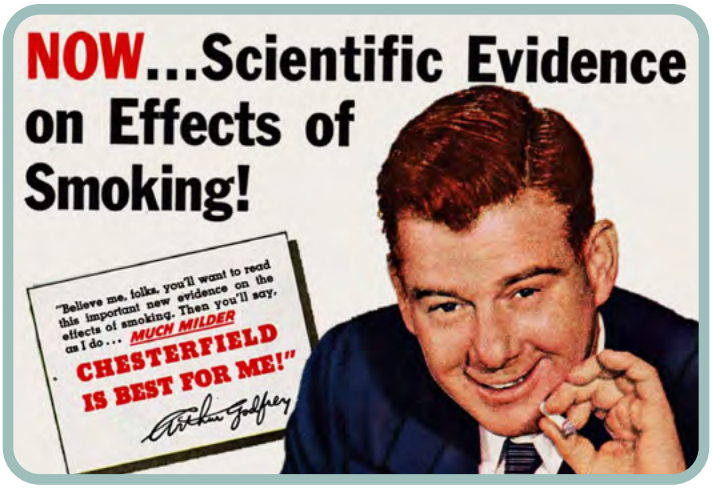
"It is not an exaggeration to say that in the product defense model, the investigator starts with an answer, then figures out the best way to support it."

David Michaels
The Triumph of Doubt: Dark Money and the Science of Deception

"Doubt is our product," quipped a tobacco industry executive in a now infamous 1969 memo.[73]

More than a decade earlier, the science on cigarettes was already clear: smoking caused cancer. But to avoid regulation and keep its products on the market, the tobacco industry worked for decades to create doubt about the science linking cigarettes to health harms. To do so, the tobacco industry's PR firm Hill & Knowlton hatched an initiative, the Tobacco Institute Research Center (TIRC), that would go on to spend the next 40 years, and $300 million, designing and conducting research on cigarettes.[74] Funded by and working in the interest of the industry, the Center "had no interest in answering a scientific question," noted Harvard historian Allan Brandt. The "goal was to maintain vigorous control over the research program, to use science in the service of public relations." These tobacco industry efforts, Brandt wrote, "would ultimately become the cornerstone of a large range of efforts to distort scientific processes for commercial ends during the second half of the 20th century."[75]

As the tobacco industry wove its influence through research and academic institutions for decades, the fossil fuel industry used similar PR tactics. "If you really want to change someone's mind in a big way, you don't give them a single fact or point to a contradiction in an argument," explained the Climate Reality Project in a 2019 report about the climate denial machine, "you tell them a story that gives them a new worldview."[76] Pushing faux-research and white papers through right-wing, anti-environmental regulation think tanks like the Cato Institute, Heritage Foundation, Heartland Institute, and others, the oil industry has been working to promote a worldview that denies climate science and the threat of the fossil fuel industry.[77]



For decades, the pesticide industry has relied on similar tactics — and some of the same groups — to create a false narrative of certainty about the safety and necessity of their products. The industry is not just following the science-denial playbook of Big Tobacco and Big Oil, pesticide companies helped invent it. Internal corporate documents discovered in litigation related to pesticides have provided evidence of how companies denied, manipulated, and covered up evidence of harm to keep their products on the market.[78]

"Science is supposed to be constant, apolitical, and above the fray," writes David Michaels, an

epidemiologist and the longest-serving head of the U.S. Occupational Safety and Health Administration, in the *Boston Review*.[79] But over the past several decades, he writes, we've seen the rise of "science-for-sale specialists" and a "'product-defense industry' that sustains them — a cabal of apparent experts, PR flaks, and political lobbyists who use bad science to produce whatever results their sponsors want."[80] Michaels describes this trend as "mercenary science," in which scientific studies are designed not to better understand the world, but to defend products and protect corporations.

Michaels and others have long noted the danger of industry influence on science and how it distorts public policy and impacts public health. In this section, we examine how Monsanto worked over decades to shape the science, regulatory reviews, and public perceptions of glyphosate.

An 'unprecedented' strategy to save glyphosate

In 2015, when the World Health Organization's IARC classified glyphosate as a probable human carcinogen, Monsanto deployed an "unprecedented and harsh strategy" to push back on the ruling, wrote Jonathan Samet, Dean of the Colorado School of Public Health, in a 2019 paper. "The Monsanto strategy parallels those used by the tobacco industry and others," Samet wrote, "but the glyphosate story is notable for its intensity, its reach to working group members, and the immediacy and scope of litigation in the United States related to non-Hodgkin's lymphoma." [81]

> *"In order to save glyphosate, the Monsanto corporation has undertaken an effort to destroy the United Nations' cancer agency by any means possible."*
>
> *Le Monde*

In an award-winning investigative series for *Le Monde,* journalists Stéphane Horel and Stéphane Foucart detail the strategies Monsanto used "to interfere with science, influence the regulatory process and orchestrate PR campaigns to defend their products." They summed up their findings: "In order to save glyphosate, the Monsanto corporation has undertaken an effort to destroy the United Nations' cancer agency by any means possible."[82]

But Monsanto's efforts to shape the science on glyphosate date back much farther. Internal documents and investigative reporting in the wake of the IARC ruling reveal evidence of the company working to shape the scientific research on glyphosate for decades.

Long-standing concerns about glyphosate

> *"You cannot say that Roundup is not a carcinogen. We have not done the necessary testing on the formulation to make that statement."*
>
> Donna Farmer, Monsanto

"Glyphosate is one of the most studied herbicides in the world," Bayer claims on its website.[83] The herbicide, the company claims, "has been subject to rigorous testing and oversight by regulatory authorities" whose "conclusions consistently support the safety of glyphosate and glyphosate-based herbicides when used as directed." Indeed, as Bayer notes, regulatory authorities in the U.S., Europe, and elsewhere have stated glyphosate does not pose a cancer risk. But how robust were those reviews? Whose research were they based on? Were they conducted with transparency and using the best scientific methods?

Evidence from the Roundup cancer trials undercuts Bayer's rhetoric — and before it Monsanto's — about rigorous scientific scrutiny and regulatory oversight. In videotaped testimony, Monsanto's longtime CEO Hugh Grant admitted the company never conducted an epidemiological analysis of glyphosate

to determine if people who used it had an increased risk of cancer.[84] The record shows that the company also did not conduct studies on formulated Roundup products — the chemical combination of glyphosate and other ingredients such as surfactants — to determine cancer risk.[85]

Yet concerns about cancer date back to the chemical's earliest days on the market. A 1983 Monsanto study found that mice exposed to glyphosate developed rare tumors at statistically significant rates.[86,87] Based on concerns about kidney tumors in the mice, EPA toxicologists signed a consensus review of glyphosate in March 1985, stating they were classifying glyphosate as a Category C carcinogen, a substance "possibly carcinogenic to humans."[88] But after Monsanto pressured the agency, EPA's top brass overruled its own scientists' concerns,[89] assuring instead that glyphosate posed no cancer risk — a position EPA still holds today.[90]

While Monsanto employees publicly declared certainty about the safety of glyphosate, behind the scenes they acknowledged uncertainties in the science. Monsanto toxicologist Donna Farmer emailed to colleagues in 2003: "you cannot say that Roundup is not a carcinogen. We have not done the necessary testing on the formulation to make that statement."[91] A year earlier, Monsanto toxicologist Dr. William Heydens had written to a Monsanto consultant: "What I've been hearing from you is that this continues to be the case with these studies — Glyphosate is OK but the formulated product (and thus the surfactant) does the damage."[92]

Years later, Heydens would acknowledge "vulnerabilities" in the science that could trigger a cancer warning for glyphosate from the IARC. In a 2014 email, Heydens wrote: "while we have vulnerability in the area of epidemiology, we also have potential vulnerabilities in the other areas that IARC will consider, namely, exposure, genotox, and mode of action." Heydens would know. In 1999, he did not conduct the tests necessary to understand these risks, despite the advice of an outside expert to do so.[93] These internal communications among Monsanto executives suggest a remarkable lack of willingness to do the necessary testing, even as Monsanto scientists and consultants noted concerns. Revelations about how Monsanto scientists handled its research on glyphosate prompted U.S. District Court Judge Vince Chhabria, who oversaw multi-district legislation involving cancer risk of glyphosate-based Roundup herbicides, to observe in 2019: "...there is strong evidence from which a jury could conclude that Monsanto does not particularly care whether its product is in fact giving people cancer, focusing instead on manipulating public opinion and undermining anyone who raises genuine and legitimate concern about the issue."[94]

So how did Monsanto influence the science? In the following pages, we describe numerous examples from internal Monsanto documents, showing how employees worked behind the scenes to shape the scientific record and influence regulatory reports to bolster one core message: glyphosate is safe. These strategies included courting friendly scientists to write papers favorable to the company — even ghostwriting scientific papers and influencing a meta-analysis — while keeping the company's role hidden. The documents also show how the company used the scientific literature they had helped create to influence federal agencies, including the U.S. Environmental Protection Agency, and tried to prevent a domestic ruling on glyphosate they feared would align with IARC's. In this section, we also show how the company used this science to manufacture a broader public narrative about glyphosate safety and the genetically modified seeds designed to resist it.

Cultivating friendly scientists

In the late 1990s, Dr. James Parry, an expert on genotoxicity hired by Monsanto to review studies on glyphosate, concluded the chemical could be genotoxic, meaning it could induce genetic mutation, chromosomal breaks or chromosomal rearrangements that have the potential to cause cancer. In a series of internal emails from 1999, Monsanto executives discussed whether to "drop Parry" or "work closely with him" to edit the presentation of information.[95] Monsanto's Heydens advised his colleagues: "let's step back and look at what we are really trying to achieve here. We want to find/develop someone who is comfortable with the genotox profile of glyphosate/Roundup and who can be influential with regulators and

Scientific Outreach operations when genotox issues arise."[96] Heydens continued, "My read is that Parry is not currently such a person, and it would take quite some time and $$$/studies to get him there... We simply aren't going to do the studies Parry suggests... we should *seriously* start looking for one or more other individuals to work with." [emphasis in original] Notably, Heydens added: "we are currently very vulnerable in this area."

Internal emails indicate that the Monsanto team ultimately did decide to "drop Parry" and find another scientist to write about genotoxicity. In a September 1999 email, Monsanto toxicologist Donna Farmer suggested that the "only person" who could "dig us out of this 'genotox hole' is the Good Dr. Kier."[97] It would seem the doctor delivered. In 2013, Dr. Kier, a former Monsanto scientist, co-authored a review paper concluding that glyphosate-based herbicides "do not appear to present significant genotoxic risk."[98] Emails reveal that Monsanto scientists played a significant role in shaping that paper: One helped draft the paper and several others worked with Kier to "re-group and redesign" it to clarify the key message that "glyphosate is not genotoxic."[99]

In correspondence about the paper, Monsanto executives discussed how adding a co-author would give "substantial expertise and credibility to this critical paper." They floated the name of Dr. David Kirkland, an independent consultant, and noted including him would cost the company an additional £14,000, the equivalent to about $22,000 today.[100] Kirkland is listed as a co-author on the published paper. While the acknowledgments note that Kier and Kirkland were paid consultants of the industry-funded Glyphosate Task Force, and that Kier was a former Monsanto employee, it also states that the "authors had sole responsibility for the writing and content of the paper and the interpretations and opinions expressed in the paper are those of the authors."

Ghostwriting scientific papers

The Kier and Kirkland paper is just one example of how Monsanto employees shaped the peer-reviewed scientific literature on glyphosate. Additional internal documents reveal how widespread this practice was. In an article in the *Journal of Public Health Policy*, Carey Gillam and Sheldon Krimsky note "multiple email exchanges authored by Monsanto employees that discuss, as an ostensibly normal business practice, 'ghostwriting' papers that, when published, appear to be authored by independent academic scientists or consultants with academic credentials."[101]

These papers have in turn shaped the public's understanding of Monsanto herbicides — and regulators' policy frameworks around them. One of the most influential of these studies was an April 2000 paper published in *Regulatory Toxicology and Pharmacology*. Characterized by the authors as "a comprehensive safety evaluation and risk assessment for humans" of glyphosate and its use in Roundup, allegedly independent scientists Gary Williams, Robert Kroes, and Ian Munro concluded that "Roundup herbicide does not pose a health risk to humans."[102] Regulators around the world have relied on this paper as foundational proof of the safety of glyphosate.

> *"Now the hard work by public affairs begins."*
>
> Lisa Drake, Monsanto

But how independent are these authors and their findings? In an email the summer before the paper's publication, Monsanto's William Heydens shared with co-author Gary Williams that he "sprouted several new gray hairs during the writing of this thing." Heydens also noted he would be attaching "text, tables and references."[103] In the wake of the paper's publication, Lisa Drake, Monsanto's lead on government affairs, sent out a congratulatory email to her colleagues with the subject line: "Kudos on Publication of Roundup Tox[icology] Paper."[104] In the email, Drake praised her colleagues and cited seven of them for "their hard work over three years of data collection, writing, review and relationship building with the papers' authors." She singled out another five colleagues for "their moral and budget support and counsel and advice." She also thanked specific consultants "for helping us pull this together through infinite edits and

reviews." Now that the paper was published, Drake noted, the "public affairs strategy begins to kick in globally," what Monsanto called its "freedom to operate" initiative to promote sales of its glyphosate-based herbicides.[105]

A February 2015 email would further reveal Monsanto's role in the paper: As the IARC panel prepared to release its report on glyphosate, Monsanto's Heydens discussed commissioning a meta-study to respond to what the company expected would be a negative carcinogenicity ruling. One option for "keeping costs down," he noted, would involve "us doing the writing and [authors'] would just edit & sign their names so to speak. Recall that is how we handled Williams, Kroes and Munro in 2000."[106] (We discuss the meta-study further in the next section.)

To this day, Monsanto has maintained the independence of the 2000 paper's authors. Monsanto claims the company "did not ghostwrite"[107] the paper and the medical school where one of the paper's co-authors is on faculty found "no evidence" the authors "violated the schools' prohibition against authoring a paper ghostwritten by others."[108] But the email record quoted above suggests a different story.

> *The paper "would be more powerful if authored by non-Monsanto scientists."*
>
> William Heydens, Monsanto

Hiding Monsanto's involvement in 2016 meta-analysis

In the spring of 2015, two months after IARC designated glyphosate a probable human carcinogen, William Heydens wrote to Monsanto colleagues about "what could be done" about the genotoxicity concerns. In an email with the subject line, "Post-IARC Activities to Support Glyphosate," Heydens floated the idea of conducting a meta-analysis — a statistical analysis that combines the results of multiple scientific studies. He noted that the manuscript would be "initiated by [Monsanto] as ghost writers" and that it "would be more powerful if authored by non-Monsanto scientists."[109]

A year later, in 2016, *Critical Reviews in Toxicology* published an "independent review" of the science on glyphosate. In the disclosures, the authors state: "Neither any Monsanto company employees nor any attorneys reviewed any of the Expert Panel's manuscripts prior to submission to the journal."[110] That statement was disproven in the fall of 2017 when internal Monsanto records came to light showing Monsanto scientists' extensive involvement in drafting and editing the papers,[111] as well as selecting the authors and paying at least one of them.[112]

In response to these revelations, the journal's publisher Taylor & Francis initiated a review and its team of legal and ethical experts found the authors had hidden Monsanto's true involvement in the papers. Internal emails reveal a protracted disagreement between the publishing group, which wanted to retract at least three of the five papers, and the journal editor Roger McClellan who refused to do so, citing concerns about his reputation and the "sensitive" position Monsanto was in with trials underway involving glyphosate.[113, 114]

As of the summer of 2022, the journal has not retracted the papers.[115] In September 2018, the journal Editor-in-Chief and Publisher posted an "expression of concern" over the declarations made in the original papers. "We have not received an adequate explanation as to why the necessary level of transparency was not met on first submission," they wrote. "When reading the articles, we recommend that readers take this context into account."[116] Monsanto's influence on the review papers is now public only because of litigation and the release of these internal emails.

These examples of corporate influence over the science of glyphosate raise the question: How many other studies that shape what we believe about the safety of pesticides have had hidden corporate influence? Peer-reviewed journals are considered the gold standard in science. These studies form the basis not just for news stories and regulatory decisions, but for bodies of knowledge, and common understandings, about whether products pose risks or not. Their

influence is profound. This is why companies like Monsanto work to shape these sources of information: They matter.

Capturing the U.S. Environmental Protection Agency

The cornerstone of Monsanto's (now Bayer's) defense of glyphosate has been that safety assessments conducted by regulatory agencies in the U.S. and Europe cleared the chemical of cancer concerns. But internal company and government documents show how Monsanto not only exerted influence over the science on which those agencies' rulings are based, but also on the very processes of the agencies themselves.

> *"Glyphosate is a clear case of 'regulatory capture' by a corporation acting in its own financial interest while serious questions about public health remain in limbo."*
>
> *In These Times*

An investigation by journalists Valerie Brown and Elizabeth Grossman in *In These Times* of government documents dating back 40 years reveals how Monsanto influenced EPA decisions on glyphosate. "Throughout the 1970s," Brown and Grossman write, "EPA staff repeatedly raised red flags about the inadequacy of testing data that Monsanto was submitting in support of glyphosate's original registration," but, they report, those concerns were buried or overruled, often by higher ups within the agency.[117]

In one early incident, an EPA scientist raised concerns in a 1978 memo about a study conducted by one of Monsanto's contract labs. The lab not only failed to record what happened in the experiment but also reported on specimens that were supposedly taken from the uteri of *male* rabbits — an organ not found in male rabbits. "This is only the most egregious example of the unreliable data made available to the EPA during its original regulatory review in the 1970s," Brown and Grossman report. The journalists note that many other memos they examined were either "incomplete" or had "otherwise unacceptable toxicology screening tests."

Brown and Grossman conclude: "Glyphosate is a clear case of 'regulatory capture' by a corporation acting in its own financial interest while serious questions about public health remain in limbo. The record suggests that in 44 years — through eight presidential administrations — EPA management has never attempted to correct the problem."[118]

Trying to stop a "domestic IARC"

Internal records show that Monsanto executives also counted on allies within the EPA to help keep its products on the market. For example, Monsanto emails show a persistent effort by multiple officials within the EPA to try to stop the Agency for Toxic Substances and Disease Registry (ATSDR), a department of the U.S. Department of Health and Human Services, from reviewing the science on glyphosate.[119] In June 2015, Monsanto's science and policy lead Eric Sachs sent a text message to former EPA toxicologist Mary Manibusan to inquire if she knew anyone in the ATSDR to help the company.[120] Manibusan replied, "Sweetheart - I know lots of people. You can count on me." Sachs responded: "We're trying to do everything we can to keep from having a domestic IARC occur w [sic] this group. may [sic] need your help."[121] (After a long stint at the EPA, Manibusan went to work for Exponent, one of the big product defense firms that "combine science with public relations to help clients avoid regulation and litigation," as former OSHA head David Michaels explained to *Fast Company*.[122] Under the Trump administration, Manibusan was back at EPA.)[123]

Monsanto executives also engaged Jess Rowland, a senior EPA official who oversaw the agency's cancer assessment for glyphosate, and key author of a report that found glyphosate unlikely to be carcinogenic. In one email, a Monsanto regulatory affairs executive claimed that Rowland boasted about his efforts to stop the ATSDR review: "If I can kill this, I should get a medal."[124] In a letter filed with the court in 2017, a 30-year career EPA toxicologist Marion Copley accused Rowland of playing "political conniving games with the science" to favor pesticide manufacturers. Citing evidence

> *"Sweetheart - I know lots of people. You can count on me."*
>
> EPA toxicologist Mary Manisbusan to Monsanto's Eric Sachs

from animal studies and the data, Copley wrote: "It is essentially certain that glyphosate causes cancer."[125]

While Rowland may have helped delay the ATSDR review of glyphosate, he was not able to stop it; the agency released its draft report in 2018 and a final toxicological profile on glyphosate in 2020, noting links between glyphosate and cancer.[126] Nevertheless, the EPA continues to assert that glyphosate does not cause cancer.[127] However, in 2022, the Ninth Circuit Court of Appeals found that the EPA disregarded its own rules when assessing glyphosate, and ordered the agency to re-examine glyphosate's impacts on health and the environment.[128]

Influencing global government safety assessments

Like the EPA, the European Food Safety Authority (EFSA) and the European Chemicals Agency have said glyphosate is not likely to be carcinogenic to humans — and like the EPA, those regulatory authorities have come under scrutiny for corporate influence. A March 2017 report by environmental and consumer groups argued that European regulators relied improperly on research that was directed and manipulated by pesticide companies.[129] A 2019 study commissioned by Members of the European Parliament, for example, found that entire sections of a glyphosate assessment conducted by Germany's Federal Institute for Risk Assessment had been plagiarized from Monsanto studies.[130] The German agency study, which found no cancer risk, played a key role in EFSA's decision to reauthorize the chemical.

Pesticide industry conflicts also surfaced with the United Nations' Joint FAO/WHO Meeting on Pesticide Residues (JMPR), which determined in 2016, a year after the IARC ruling, that glyphosate is unlikely to pose a cancer risk through diet. Both the chairman and co-chairman of the JMPR panel on glyphosate concurrently held unpaid leadership positions with the International Life Sciences Institute (ILSI).[131, 132] Documents obtained by U.S. Right to Know further revealed that ILSI had received more than $1 million in 2012 from Monsanto and CropLife International, the pesticide trade industry group whose members include Monsanto.[133] As a WHO official told *The Guardian*, which reported on the documents, "ILSI is not an independent body. That is very clear. Private companies are supporting it and its structure."[134] (The scientists said their positions with ILSI were unpaid and did not constitute a conflict, and so did not need to be reported in public disclosures.)[135]

> *"It is extremely worrying to see that up to 50% of some chapters of the German regulator's assessment were actually written by Monsanto."*
>
> Bart Staes, EU Member of Parliament

Fraud and corruption has also come to light at laboratories the pesticide industry relied on to conduct risk assessments for government agencies in both the U.S. and Europe. In February 2020, revelations surfaced that 24 scientific studies submitted to European regulators to prove the safety of glyphosate came from a large German laboratory that has been accused of fraud and other wrongdoing in service of corporations trying to get their products approved by regulatory agencies.[136] Similar problems arose in the U.S. many years earlier, when Industrial Bio-Test (IBT) Laboratories, a leading chemical research firm, was caught falsifying data for pesticide risk assessments. An EPA audit found that some studies IBT conducted for Monsanto on glyphosate were invalid.[137] The company repeated the studies and no IBT data is used to support glyphosate registration today; however, the scandal — which included criminal convictions for three former officials of IBT Labs — added to the public distrust of the corporate-controlled system for assessing chemical risk.[138]

Crafting a PR narrative for GMO foods

As Monsanto scientists worked behind the scenes to shape the scientific record on glyphosate, they also developed a public relations narrative about genetically modified crops (GMOs), most of which are engineered to tolerate glyphosate-based herbicides. That narrative, too, was designed to emphasize safety and ward off regulation and government oversight. A September 2013 email from Monsanto scientist John Vicini offers a view into the company's approach. Vicini shared with his colleagues a draft paper he had written about animal consumption of GMOs. He described the paper as "a first draft of a manuscript that I prepared with the intention of submitting either as a co-author with some global faculty in animal science or turn it over to them and just be a ghost writer."[139] Vicini wrote, "I do not need to be on it and think that a non-[Monsanto] paper is the best-case scenario." The paper was "not Nobel Prize science," Vicini noted, "but it is intended to provide two simple messages: 1) billions of animals are consuming large amounts of GM crops every day for long periods and, 2) the forecasted health effects are not apparent in publicly available datasets."[140]

A year later, Alison van Eenennam, an animal geneticist at the University of California, Davis, published a paper in the *Journal of Animal Science and Biotechnology* that was based on the same datasets that Vicini was referring to and echoed the messages he sought to promote.[141] That van Eenennaam was a former Monsanto employee was not noted by the journal.[142]

The paper's conclusions appear to have been part of a coordinated PR push. Before the official publication date, Monsanto collaborator Jon Entine (whose group now receives money from Bayer) published a lengthy article in *Forbes* claiming that van Eenennam's study was the "most comprehensive study of GMOs and food ever conducted" and proved that "the debate about GMO safety is over."[143]

Claims that the "debate is over" or that there is a "consensus of safety" about GMOs are topline arguments of the pesticide industry and its PR allies.[144] However, these claims

> *"The paper is not Nobel Prize science but it is intended to provide two simple messages."*
>
> John Vicini, Monsanto

are "not supported by an objective analysis of the refereed literature," according to a statement signed by 300 independent scientific researchers and scholars.[145] These researchers assert that there is "no consensus on GMO safety." They described blanket safety assurances as "an artificial construct that has been falsely perpetuated" by industry stakeholders.[146]

Making general claims about the safety of genetic engineering is "unscientific, illogical, and absurd," wrote Belinda Martinau, a geneticist who helped develop the first genetically engineered food, in a letter to the *New York Times*; "because each product is different ...the safety of each one must be assessed individually."[147] The World Health Organization concurs, according to its FAQ: "it is not possible to make general statements on the safety of all GM foods" because "individual GM foods and their safety should be assessed on a case-by-case basis."[148]

Genetic engineering, including newer genome-editing techniques, have "unpredictable outcomes," says Michael Antoniou, a molecular geneticist at King's College London. To understand health impacts, he said, "You basically need to conduct a long term feeding trial in animals and see what happens ... and that's just not going on anywhere in the world for regulatory purposes, at all."

It is important to also note: due to patents involved, studies on genetically engineered seeds and crops are largely controlled by companies that own the intellectual property rights, since in most cases researchers must ask for permission to research patented materials.[149] As noted previously, just four companies — Bayer, Corteva (formerly DowDuPont), BASF and Syngenta/ChemChina — controlled 75 percent of plant breeding research, 60 percent of the commercial seed market, and 76 percent of global agrichemical sales in 2019.[150]

The bottom line, according to the researchers' "no consensus" statement: scientific research in the field of GM crop safety "is nuanced; complex; often contradictory or inconclusive; confounded by researchers' choices, assumptions, and funding sources, and in general has raised more questions than it has currently answered." In their view, decisions about food and agriculture "should not be based on misleading and misrepresentative claims made by an internal circle of likeminded stakeholders," but rather should be "supported by strong scientific evidence on the long-term safety of GM crops and foods … obtained in a manner that is honest, ethical, rigorous, independent, transparent, and sufficiently diversified to compensate for bias."[151]

Relying on insufficient science

The examples described in Tactic 1: Corrupting Science demonstrate some of the many methods Monsanto employees used to influence the science on glyphosate. These examples raise questions about the validity, rigor, and bias in the studies conducted, or influenced, by Monsanto to assess the safety of their products. In the words of former *Nature* editor Mark Buchanan, the strategies Monsanto used to shape the science on glyphosate may have been "desperate" and "underhanded" — but they were also "perfectly legal." Companies can get away with selling dangerous products, he said, because the "current science regulators rely on for toxicity testing is wildly out of date."[152]

A 2021 report from the Institute of Cancer Research at the Medical University of Vienna underscores this point in regard to glyphosate research. Researchers reviewed 53 safety studies on glyphosate submitted to regulators by large chemical companies, and found that most of the studies do not comply with modern international standards for scientific rigor.[153, 154] Most of the studies did not even include tests that are most able to detect cancer risks.

In the next two tactics, we describe how Monsanto, using the scientific findings they helped craft, worked with a range of third-party allies, including leading academic institutions, to disseminate their messaging about the safety and necessity of glyphosate and the genetically engineered crops at the core of their business model.

> *"The quality of these studies, not of all, but of many of these studies is very poor."*
>
> Siegfried Knasmueller,
> Institute of Cancer Research, Medical University of Vienna