APPENDIX A

FOR PUBLICATION

UNITED STATES COURT OF APPEALS
FOR THE NINTH CIRCUIT

Nos. 19-16636 and 19-16708
D.C. Nos. 3:16-cv-00525-VC and 3:16-md-02741-VC

EDWIN HARDEMAN,
Plaintiff-Appellee/
Cross-Appellant,

v.

MONSANTO COMPANY,
Defendant-Appellant/
Cross-Appellee.

Appeal from the United States District Court
for the Northern District of California
Vince G. Chhabria, District Judge, Presiding

Argued and Submitted
October 23, 2020—San Francisco, California
Filed May 14, 2021

OPINION

Before: Michael D. Hawkins, N. Randy Smith,
and Ryan D. Nelson, Circuit Judges.

Opinion by Judge R. Nelson;
Dissent by Judge N.R. Smith

R. NELSON, Circuit Judge:

Monsanto Company manufactures Roundup, a pesticide with the active ingredient glyphosate. Since 2015, thousands of cancer victims have sued Monsanto in state and federal court, alleging that Roundup caused their non-Hodgkin's lymphoma. This appeal arises out of the first bellwether trial for the federal cases consolidated in a multidistrict litigation.

The jury returned a verdict in favor of plaintiff Edwin Hardeman, awarding him $5,267,634.10 in compensatory damages and $75 million in punitive damages. The district court reduced the jury's punitive damages award to $20 million.

Monsanto appeals, arguing the Federal Insecticide, Fungicide, and Rodenticide Act ("FIFRA") preempts Hardeman's failure-to-warn claims; the district court made a series of evidentiary and jury instruction errors; the district court erred in denying judgment as a matter of law; and the punitive damages award violates California law and the Due Process Clause. Hardeman cross-appeals, arguing the jury's $75 million punitive damages award was constitutional.

We affirm the district court and hold that (1) Hardeman's state failure-to-warn claims are not preempted by FIFRA; (2) the district court ultimately applied the correct standard from *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579 (1993), and did not abuse its discretion in admitting Hardeman's expert testimony; (3) the district court did not abuse its discretion in admitting the International Agency for Research on Cancer's classification of glyphosate as probably carcinogenic and three regulatory rejections of that classification but excluding evidence from other regulatory bodies; (4) the district court's jury instruc-

tion on causation, though erroneous, was harmless; (5) Monsanto was properly denied judgment as a matter of law because evidence shows the carcinogenic risk of glyphosate was knowable at the time of Hardeman's exposure; and (6) evidence supports a punitive damages award, punitive damages were properly reduced, and the reduced award—while close to the outer limits—is constitutional.

I

A

Under FIFRA, the United States Environmental Protection Agency ("EPA") enforces "the use, … sale[,] and labeling[] of pesticides." *Bates v. Dow Agrosciences LLC*, 544 U.S. 431, 437 (2005) (citation omitted). A state may "not impose or continue in effect any requirements for labeling or packaging in addition to or different from those" required by FIFRA. 7 U.S.C. § 136v(b).

FIFRA requires pesticide manufacturers to register their products with EPA. 7 U.S.C. § 136a(a). EPA makes registration determinations after considering available scientific data, § 136a(c)(1)(F), (c)(2)(A); 40 C.F.R. § 158.500, and FIFRA requires EPA to re-review a pesticide's registration, including its effects on human health, every fifteen years, § 136a(g)(1)(A). FIFRA states, however, that "[i]n no event shall registration of an article be construed as a defense for the commission of any offense under this subchapter." § 136a(f)(2). Rather, "[a]s long as no cancellation proceedings are in effect," registration of a pesticide is merely "prima facie evidence that the pesticide, its labeling and packaging comply with the registration provisions of the subchapter." *Id.*

EPA can also institute cancellation proceedings, 7 U.S.C. § 136d(b), or take other enforcement action against the manufacturer of a registered pesticide if the agency determines the product is "misbranded." *Bates*, 544 U.S. at 439. Remedies for misbranding include civil and criminal penalties. *Id.* at 439 n.11 (citing 7 U.S.C. § 136l). A duly registered pesticide can be misbranded if the label "does not contain adequate instructions for use, or if its label omits necessary warnings or cautionary statements." *Bates*, 544 U.S. at 438 (citation omitted). "Because it is unlawful under the statute to sell a pesticide that is registered but nevertheless misbranded, manufacturers have a continuing obligation to adhere to FIFRA's labeling requirements." *Id.* (citations omitted). This obligation includes a duty to seek approval to amend a label that does not contain all "necessary warnings or cautionary statements." *Id.* (citation omitted).

Starting in 1974, EPA registered pesticides containing glyphosate, the active ingredient in Roundup.[1] EPA, *Glyphosate Proposed Interim Registration Review Decision* 4 (Apr. 2019) ("*Proposed Interim Registration Review*"). In 1985, an EPA review of a mouse study found "[g]lyphosate was oncogenic in male mice," causing rare tumors. EPA classified glyphosate as a possible human carcinogen. Since then, however, EPA has repeatedly approved the use of glyphosate as a pesticide, each time concluding that it is not likely to be carcinogenic to humans. *See Nat'l Fam. Farm Coal. v. EP*A, 966 F.3d 893, 905 (9th Cir. 2020).

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[1] Though commonly referred to as an herbicide, Roundup is defined as a pesticide under 7 U.S.C. § 136(t), (u). Roundup contains glyphosate, water, and other ingredients called "surfactants."

In the early 1990s, EPA reevaluated glyphosate's effects on human health as part of its regular review of glyphosate's registration. After considering numerous carcinogenicity studies in rats and mice—including new evidence submitted by Monsanto—EPA changed its designation of glyphosate to a "Group E carcinogen" signifying "evidence of non-carcinogenicity in humans."

In 2015, a working group at the International Agency for Research on Cancer ("IARC"), an agency of the World Health Organization, issued a report classifying glyphosate as a "Group 2A" agent, meaning it is "probably carcinogenic to humans" based on glyphosate's "limited evidence" of cancer in humans and "sufficient evidence" of cancer in experimental animals. IARC's classification was a "hazard identification," the first step of a public health assessment designed to identify cancer hazards. That hazard determination asked whether glyphosate "is capable of causing cancer under some circumstances," but did not include a "risk assessment" gauging the carcinogenic effects from real-world human exposure. Since IARC's classification, other national and international agencies charged with reviewing pesticides—such as the European Union's European Chemicals Agency ("ECA"), European Food Safety Authority ("EFSA"), and the national health authorities of Australia, Canada, Germany, and New Zealand—have reported that scientific evidence does not show glyphosate causes cancer.

When the IARC report was released, EPA was conducting its registration review of glyphosate, during which it examined various scientific studies, including those IARC considered. In 2017, EPA published its proposed conclusion: Glyphosate was not likely to be carcinogenic to humans. But, that same year, pursuant to Proposition 65, California law categorized glyphosate

as a chemical known to the state to cause cancer. Cal. Off. of Env't Health Hazard Assessment, *Glyphosate*, ("Glyphosate Proposition 65"), https://oehha.ca.gov/proposition-65/chemicals/glyphosate. That classification triggered a state law requirement to attach a warning label to glyphosate products. *See id.*; Cal. Health & Safety Code § 25249.6.

In April 2019—one month after the jury verdict in this case—EPA noted that commenters "expressed concerns that glyphosate formulations are more toxic than glyphosate alone." *Proposed Interim Registration Review* at 10. EPA explained that "there are few research projects that have attempted to directly compare technical grade glyphosate to the formulations under the same experimental design," but "[i]f at any time, information becomes available that indicates adverse human health effects of concern for exposure to glyphosate or its formulations, EPA intends to review it and determine the appropriate regulatory action." *Id.* at 11.

About five months after the jury verdict, EPA issued a letter to all registrants of glyphosate-containing products. Letter from Michael L. Goodis, EPA, Office of Pesticide Programs (Aug. 7, 2019) ("2019 letter"). The 2019 letter was not the product of any formal proceeding, was not published in the Federal Register, did not cite any new scientific findings, and took no position on whether Roundup causes cancer. Instead, this letter challenged California's inclusion of glyphosate in Proposition 65 as contrary to "EPA's determination that glyphosate is 'not likely to be carcinogenic to humans.'" *Id.* at 1. Given this determination, EPA "considers the Proposition 65 warning language" that glyphosate is carcinogenic "to constitute a false and misleading statement" that violates FIFRA's prohibition against

"misbranded" substances. *Id.* 1–2 (citing § 136(q)(1)(A)). The letter concluded with EPA instructing registrants to remove such warning statements from labels of glyphosate-based pesticides. *Id.* at 2.

B

In 2016, Hardeman sued Monsanto alleging that his use of Roundup—which started in the 1980s and ended in 2012—led to his diagnosis of non-Hodgkin's lymphoma ("NHL") in early 2015. Hardeman's case is one of approximately 5,000 in federal court alleging that Roundup causes NHL. The Judicial Panel on Multidistrict Litigation consolidated those cases for pretrial proceedings in the Northern District of California. Hardeman's case was the first of these consolidated cases to go to trial.

NHL is a cancer that affects white blood cells in the immune system. Approximately 70% or more of NHL cases are idiopathic, meaning they develop for unknown reasons. However, some causes of NHL—such as hepatitis C ("HCV")—are well established. Hardeman had HCV for 25 to 40 years before developing NHL.

Hardeman alleged Monsanto's failure to warn him of the carcinogenic risks of Roundup caused his NHL. Monsanto moved to dismiss, arguing that Hardeman's claims were preempted by FIFRA given EPA's registration of glyphosate, approval of the Roundup label, and classification of glyphosate as non-carcinogenic. The district court denied Monsanto's motion. Monsanto raised preemption again in a motion for summary judgment, which the district court likewise denied.

The district court bifurcated the pretrial proceedings. The first phase addressed "general causation"—whether glyphosate can cause NHL at exposure levels

humans might experience. The second phase addressed "specific causation"—whether Hardeman's exposure to Roundup caused his NHL.

The district court granted in part and denied in part Monsanto's motion to exclude Hardeman's general causation experts, allowing three of Hardeman's experts to testify—Dr. Portier, Dr. Ritz, and Dr. Weisenburger. These experts introduced their general causation opinions with scientific evidence from epidemiology (study of disease in human populations), toxicology (animal studies), and genotoxicology (cell studies); applied the Bradford Hill criteria;[2] and used meta-analyses that combined and analyzed the results of case-control studies.

The district court, however, acknowledged that significant problems with Hardeman's experts' analyses made it a "very close question" whether their testimony was admissible to support general causation. *In re Roundup Prods. Liab. Litig.*, 390 F. Supp. 3d 1102, 1108 (N.D. Cal. 2018). The district court interpreted the Ninth Circuit's approach to *Daubert* as requiring "slightly more room for deference to experts in close cases than might be appropriate in some other Circuits." *Id.* at 1113 (citations omitted). Ultimately, the district court concluded Hardeman's three experts'

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[2] The Bradford Hill criteria are nine factors generally accepted as relevant to assessing causation, such as: (1) the strength of the association; (2) consistency; (3) specificity; (4) temporality; (5) biological gradient or dose response; (6) biological plausibility; (7) coherence with other scientific knowledge; (8) experimental evidence; and (9) analogy. *See In re Roundup Prods. Liab. Litig.*, 390 F. Supp. 3d 1102, 1116 (N.D. Cal. 2018) (citing Austin Bradford Hill, *The Environment and Disease: Association or Causation?*, 58 Proceedings of the Royal Society of Medicine 295 (1965)).

opinions were relevant and reliable, satisfying Federal Rule of Evidence 702 and *Daubert*.

The district court later denied Monsanto's motion to exclude Hardeman's specific causation experts. Hardeman's experts performed differential diagnosis, a methodology by which a physician "rules in" all potential causes of a disease, "rules out" those for "which there is no plausible evidence of causation, and then determines the most likely cause among those that cannot be excluded." *Wendell v. GlaxoSmithKline LLC*, 858 F.3d 1227, 1234 (9th Cir. 2017). Hardeman's experts considered various risk factors beyond Roundup exposure that could explain his disease, including age, race, obesity, hepatitis B ("HBV"), and HCV, as well as idiopathic origin—i.e., no known cause. They concluded Roundup caused Hardeman's NHL by ruling in Roundup based on general causation expert opinions and ruling out HCV and idiopathy[3] as causes of Hardeman's NHL. The district court admitted the experts' opinions, noting this circuit affords experts "wide latitude in how they practice their art when offering causation opinions." *In re Roundup*, 358 F. Supp. 3d at 960 (citing *Wendell*, 858 F.3d at 1237).

Monsanto requested a bifurcated trial, with the first phase addressing whether Roundup caused Hardeman's cancer (without reference to any regulatory decisions regarding glyphosate or Roundup) and the second phase addressing liability and damages (where

[3] As to idiopathy, the district court held that "[i]t is sufficient for a qualified expert, in reliance on his clinical experience, review of a plaintiff['s] medical records, and evaluation of the general causation evidence, to conclude that an 'obvious and known risk factor[]' is the cause of that plaintiff's disease." *In re Roundup Prods. Liab. Litig.*, 358 F. Supp. 3d 956, 960 (N.D. Cal. 2019) (quoting *Wendell*, 858 F.3d at 1235).

the jury could see some of that evidence). Monsanto moved to exclude all evidence regarding IARC's report, which detailed the agency's classification of glyphosate as probably carcinogenic, as irrelevant and likely to confuse and distract the jury. But if IARC evidence were admitted, Monsanto argued, the district court should admit evidence that numerous regulatory agencies around the world concluded that glyphosate is safe.

Ultimately, the district court excluded IARC's report but admitted IARC's classification of glyphosate as probably carcinogenic to mitigate the prejudice caused to Hardeman due to bifurcation of the trial. The district court also admitted conclusions from EPA, EFSA, and ECA that glyphosate was safe but excluded conclusions from other regulatory bodies as cumulative.

At trial, Hardeman's experts testified that his exposure to glyphosate caused his NHL. Monsanto's experts testified that little evidence links glyphosate to cancer in humans and that Hardeman's HCV most likely caused his cancer or his cancer was idiopathic.

The district court issued a "substantial factor" causation instruction. The jury was instructed that, to rule for Hardeman, it must find that glyphosate exposure was a but-for cause of his cancer or one of two or more factors that independently could have caused his cancer.

After Phase One (on causation), the jury returned a verdict that Roundup exposure was a "substantial factor" in causing Hardeman's NHL. After Phase Two (on liability and damages), the jury found that Monsanto failed to warn about Roundup's NHL risk and Hardeman was entitled to punitive damages. The jury awarded Hardeman $5,267,634.10 in compensatory damages and $75 million in punitive damages.

In post-trial motions, Monsanto argued that the district court improperly excluded evidence of foreign regulatory approvals of glyphosate, which allegedly deprived the jury of the scope of evidence reinforcing Monsanto's view of the science. The district court explained that such evidence about foreign regulators would have been cumulative under Federal Rule of Evidence 403 and denied Monsanto's motion to overturn the verdict and for judgment as a matter of law. But the district court reduced the punitive damages award of $75 million to $20 million. These appeals followed.

II

Whether Hardeman's state claims are preempted is reviewed de novo. *Nathan Kimmel, Inc. v. DowElanco*, 275 F.3d 1199, 1203 (9th Cir. 2002). Monsanto argues that Hardeman's failure-to-warn claims are preempted by FIFRA, under which states cannot "impose … any requirements for labeling or packaging *in addition to or different from*" the requirements in FIFRA itself. § 136v(b) (emphasis added); *see also* U.S. Const. art. VI, cl. 2 (federal law "shall be the supreme Law of the Land … any Thing in the Constitution or Laws of any State to the Contrary notwithstanding"). We conclude that Hardeman's failure-to-warn claims based on Roundup's labeling are consistent with FIFRA and thus are neither expressly nor impliedly preempted.

A

FIFRA does not expressly preempt Hardeman's claims because FIFRA's requirement that a pesticide not be misbranded is consistent with, if not broader than, California's common law duty to warn. *Bates* employs a two-part test to determine whether FIFRA preempts a state law claim. 544 U.S. at 444. First, the

state law must be a requirement "*for labeling or packaging*." *Id.* (quoting § 136v(b)). Second, the state law must impose a labeling or packaging requirement that is "*in addition to or different from*" those required under FIFRA. *Id.* (quoting § 136v(b)). Because Hardeman's complaint is based on Monsanto's failure to provide an adequate warning on a label under California law, part one of this test is satisfied.

As to part two of the *Bates* test, "a state-law labeling requirement is not pre-empted by § 136v(b) if it is equivalent to, and fully consistent with, FIFRA's misbranding provisions." 544 U.S. at 447. State law is "equivalent to" and "fully consistent with" FIFRA where both impose "parallel requirements," meaning that a violation of the state law is also a violation of FIFRA. *Id.; see also id.* at 454 ("[A] manufacturer should not be held liable under a state labeling requirement subject to § 136v(b) unless the manufacturer is also liable for misbranding as defined by FIFRA."). Thus, if a violation of California's duty to warn would also be a violation of FIFRA's misbranding provision, then they impose parallel requirements fully consistent with each other. *Id.* at 454 ("To survive pre-emption, the state-law requirement need not be phrased in the *identical* language as its corresponding FIFRA requirement … ."). To that end, elements of California's duty to warn and FIFRA's misbranding provision are compared below.

FIFRA's misbranding provision requires a pesticide label "contain a warning or caution statement which may be necessary and if complied with … is adequate to protect health and the environment." § 136(q)(1)(G). Similarly, California common law re-

quires a manufacturer to warn either of any health risk[4] that is "known or knowable" (in strict liability) or those risks "a reasonably prudent manufacturer would have known and warned about" (in negligence). *Conte v. Wyeth, Inc.*, 85 Cal. Rptr. 3d 299, 310 (Ct. App. 2008). Thus, FIFRA—which requires a warning "necessary" and "adequate to protect health"—is broader than California's requirement under negligence (no warning needed if unreasonable to do so)[5] and is, at minimum, consistent with California's requirement under strict liability (no warning needed if risk not known or knowable). *See id.*; § 136(q)(1)(G). Because FIFRA's misbranding requirements parallel those of California's common law duty, Hardeman's failure-to-warn claims effectively enforce FIFRA's requirement against misbranding and are thus not expressly preempted. *See* § 136(q)(1)(G); *Bates*, 544 U.S. at 447–48 (citing favorably Justice O'Connor's explanation in *Medtronic*, 518 U.S. 470, that "a state cause of action that seeks to enforce a federal requirement 'does not impose a requirement that is "different from, or in addition to," requirements under federal law'").

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[4] Because a risk of cancer is a risk contemplated by FIFRA as "necessary" and "adequate to protect health," § 136(q)(1)(G), (x), (bb), we need not address the possibility that California common law may require a manufacturer to warn of a risk not contemplated by FIFRA's misbranding provision.

[5] Though "it may be necessary as a matter of [state] law to prove that th[e] violations were the result of negligent conduct … such additional elements of the state-law cause of action would make the state requirements narrower, not broader, than the federal requirement. While such a narrower requirement might be 'different from' the federal rules in a literal sense, such a difference would surely provide a strange reason for finding pre-emption of a state rule insofar as it duplicates the federal rule." *Medtronic, Inc. v. Lohr*, 518 U.S. 470, 495 (1996).

Monsanto, however, argues that because EPA repeatedly registered Roundup for sale without a cancer warning on the label, a jury's decision that Roundup should include such a warning would effectively impose a requirement "in addition to or different from" that required by FIFRA, and so the state law is preempted. Granted, EPA is highly involved in the pesticide registration process, which includes approval of product labels. And EPA will not register a pesticide unless it determines that the label "compl[ies] with" FIFRA's "requirements." § 136a(c)(5)(B). But this argument misses the point for two reasons.

First, EPA's approval of a label—one step in a larger registration process—is not conclusive of FIFRA compliance. FIFRA specifies:

> In no event shall registration of an article be construed as a defense for the commission of any offense under this subchapter. As long as no cancellation proceedings are in effect registration of a pesticide shall be *prima facie evidence* that the pesticide, its labeling and packaging comply with the registration provisions of the subchapter.

§ 136a(f)(2) (emphasis added).[6] Because EPA has not instituted any cancellation proceedings against Mon-

[6] Section 136a(f)(2) distinguishes this case from *Riegel v. Medtronic, Inc.*, 552 U.S. 312 (2008), which held that the Medical Device Amendments ("MDA") to the Federal Food, Drug, and Cosmetic Act ("FDCA") expressly preempted claims challenging the safety and effectiveness of a medical device that received premarket approval from the Food and Drug Administration ("FDA"). *Id.* at 315, 330. Like FIFRA's preemption provision, the MDA preempts certain state requirements that are different from, or in addition to, certain federal requirements. *See* 21 U.S.C. § 360k(a)(1). But the MDA does *not* contain a provision like

santo, EPA's approval of Roundup's label is prima facie evidence of FIFRA compliance. *See id.* And looking at FIFRA holistically, this makes sense—if mere EPA approval of a label were determinative of FIFRA compliance, then FIFRA's misbranding provision and regulations imposing a duty to report "additional factual information regarding unreasonable adverse effects" would serve no purpose. § 136d(a)(2); *see also* § 136(q)(1) (detailing when a pesticide is misbranded); 40 C.F.R. § 159.152 (imposing duty to report additional information on adverse effects). So even though EPA approved Roundup's label, a judge or jury could disagree and find that same label violates FIFRA. And because EPA's labeling determinations are not dispositive of FIFRA compliance, they similarly are not conclusive as to which common law requirements are "in addition to or different from" the requirements imposed by FIFRA. *See* § 136v(b); *cf. Bates*, 544 U.S. at 451 ("Private remedies that enforce federal misbranding requirements would seem to aid, rather than hinder, the functioning of FIFRA."); *Indian Brand Farms, Inc. v. Novartis Crop Prot. Inc.*, 617 F.3d 207, 222 (3d Cir. 2010) (explaining that *Bates* "established that mere inconsistency between the duty imposed by state law and the content of a manufacturer's labeling approved by the EPA at registration did not necessarily mean that the state law duty was preempted").

Second, the EPA actions that Monsanto alleges preempt Hardeman's claims do not carry the force of law. As noted in *Bates*, "[a] requirement is a rule of law that must be obeyed." 544 U.S. at 445. To establish requirements that can preempt state law under § 136v(b),

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FIFRA's § 136a(f)(2), which clarifies that the agency's approval of a label is not determinative of compliance with the statute.

agency action must have the force of law. *See Wyeth v. Levine*, 555 U.S. 555, 576, 580 (2009). In other words, only where there is a relevant EPA action *carrying the force of law* are state failure-to-warn claims prohibited from imposing requirements inconsistent with that action.[7] Monsanto tries to circumvent this caveat by arguing that although EPA's approval of Roundup's label was not a rulemaking, it happened "in the context of [a] registration process" that "has the hallmarks of formal agency action." *See* § 136a; 40 C.F.R. § 155.50(b)–(c). But, as explained above, FIFRA expressly states that EPA's decision to approve a label during the registration process raises only a rebuttable presumption that the pesticide and its label comply with FIFRA. § 136a(f)(2). It would defy logic to say a rebuttable presumption carries the force of law necessary to have preemptive effect, as doing so would deny any ability to rebut the presumption.

Nor does EPA's 2019 letter, sent after the conclusion of Hardeman's trial to all registrants of products containing glyphosate, carry the force of law. Generally, "Congress contemplates administrative action with the effect of law when it provides for a relatively formal administrative procedure tending to foster the fairness and deliberation that should underlie a pronouncement of such force." *United States v. Mead Corp.*, 533 U.S.

[7] Monsanto relies on *Bates's* explanation that a failure-to-warn claim alleging that a label should have stated "DANGER" instead of "CAUTION" would be preempted "because it is inconsistent with 40 C.F.R. § 156.64 (2004), which specifically assigns these warnings to particular classes of pesticides based on their toxicity." 544 U.S. at 453. But this example deals with agency action that has the force of law—FIFRA regulation 40 C.F.R. § 156.64. Here, however, neither EPA's approval of Roundup's label during registration nor EPA's 2019 letter carries the force of law necessary to preempt Hardeman's failure-to-warn claims.

218, 230 (2001). But the 2019 letter—stating that EPA believes any pesticide label with a cancer warning due to the presence of glyphosate will be misbranded—did not follow any "formal administrative procedure" that would give the letter the force of law.[8] *See id.* The 2019 letter was issued without any written notice, gave no hearing or opportunity to respond, and lacked any sort of dispute-resolution process. *See Merck Sharp & Dohme Corp. v. Albrecht*, 139 S. Ct. 1668, 1679 (2019). Instead, the 2019 letter is similar to the letter in *Fellner v. Tri-Union Seafoods, LLC*, which lacked preemptive effect because the FDA "merely expressed an informal policy opinion in a letter, and it did so only after [the plaintiff's] injuries were allegedly suffered." 539 F.3d 237, 255 (3d Cir. 2008).[9]

Thus, we affirm the district court's conclusion that Hardeman's state failure-to-warn claims are "equivalent to" and "fully consistent with" FIFRA and there-

[8] EPA's 2017 determination that glyphosate is not carcinogenic does not magically give the "force of law" to this 2019 letter on misbranding. EPA's 2017 determination was given in the context of glyphosate "undergoing Registration Review" after evaluating glyphosate's carcinogenic potential. EPA, *Revised Glyphosate Issue Paper: Evaluation of Carcinogenic Potential* 12 (Dec. 2017) ("Registration Review also allows the agency to incorporate new science."). Even if the 2017 determination stems from more formal procedures, it is not necessarily at odds with the future failure-to-warn claim because it was made as part of EPA's registration decision, which only supports presumptive (not conclusive) compliance with FIFRA. *See* § 136a(f)(2).

[9] In contrast, EPA's cancellation proceedings, for example, may have the force of law given that § 136d(b) lays out a formal notice and hearing process, and no comparable prima facie evidence restriction applies. *See* § 136a(f)(2) (stating that registration is "prima facie evidence" of FIFRA compliance "[a]s long as no cancellation proceedings are in effect"). But no cancellation proceedings were in effect here.

fore not expressly preempted. *See Bates*, 544 U.S. at 449 ("The long history of tort litigation against manufacturers of poisonous substances adds force to the basic presumption against pre-emption. If Congress had intended to deprive injured parties of a long available form of compensation, it surely would have expressed that intent more clearly."). The Supreme Court decided *Bates* over fifteen years ago, and regulatory preemption in other contexts has developed considerably in the interim. For FIFRA preemption, however, currently *Bates* controls.

B

Because Monsanto could comply with both FIFRA and California law, FIFRA did not impliedly preempt Hardeman's state failure-to-warn claims.

1

A state failure-to-warn claim is impliedly preempted if the relevant federal and state laws "irreconcilably conflict." *Merck*, 139 S. Ct. at 1679 (quoting *Rice v. Norman Williams Co.*, 458 U.S. 654, 659 (1982)). "[S]tate and federal law conflict where it is impossible for a private party to comply with both state and federal requirements." *PLIVA, Inc. v. Mensing*, 564 U.S. 604, 618 (2011) (internal quotation marks and citation omitted). To demonstrate an "irreconcilabl[e] conflict," Monsanto must present "clear evidence" that (1) the agency was "fully informed" of "the justifications for the warning" the plaintiff demands, (2) the agency has "informed the … manufacturer that [it] would not approve changing the … label to include that warning," and (3) the agency's action "carr[ies] the force of law." *Merck*, 139 S. Ct. at 1678–79. However, because EPA's actions—such as registering Roundup, approving Roundup's label, and issuing the 2019 letter—do not

have the force of law, Monsanto fails part (3) of *Merck's* "clear evidence" of "irreconcilabl[e] conflict" test and cannot show preemption. *See supra* Section II.A.

2

Monsanto also argues that Hardeman's claims are impliedly preempted because, under EPA's regulations, Monsanto could not have unilaterally changed Roundup's label, making it impossible for Monsanto to comply with both FIFRA and California's common law duty to warn. Monsanto relies primarily on *PLIVA*, a case concerning the federal regulatory scheme governing generic drugs. 564 U.S. 604. But, as explained in *PLIVA*, "different federal statutes and regulations may … lead to different pre-emption results." *Id.* at 626. Here, FIFRA's regulatory regime for pesticides differs meaningfully from the regulatory scheme governing generic drugs in *PLIVA* and, as a result, Monsanto's implied preemption argument fails.

Under the regulatory scheme at issue in *PLIVA*, generic drug manufacturers have an "ongoing federal duty of sameness," according to which they must use the same labeling as the corresponding name-brand drug. *Id.* at 613 (internal quotation marks and citations omitted). Generic drug manufacturers do not draft their products' initial labeling and do not have the power to revise labeling. *See id.* As the Supreme Court explained, "[i]f [the generic drug manufacturers] had [asked the FDA for help], and if the FDA decided there was sufficient supporting information, and if the FDA undertook negotiations with the brand-name manufacturer, and if adequate label changes were decided on and implemented, then the [generic drug] [m]anufacturers would have started a Mouse Trap game that eventually led to a better label." *Id.* at 619.

But, in *PLIVA*, the generic drug manufacturer could not "independently satisfy … state duties for pre-emption purposes" because it "cannot satisfy its state duties without the Federal Government's special permission and assistance, which is dependent on the exercise of judgment by a federal agency." *Id.* at 623–24 (explaining that "[t]he only action the [generic drug] [m]anufacturers could independently take" was "asking for the FDA's help").

Unlike the FDCA and FDA regulatory scheme for generic drug manufacturers, FIFRA and the EPA regulatory scheme provide that pesticide manufacturers are responsible for drafting their own product labels, § 136a(c)(1)(C), and do not need to maintain the same labeling as another manufacturer. Once a pesticide is registered, the manufacturer has a "continuing obligation to adhere to FIFRA's labeling requirements." *Bates*, 544 U.S. at 438 (citations omitted). When a label needs to be changed, the manufacturer has the responsibility to change the label by drafting and submitting the label to EPA for approval, 40 C.F.R. § 152.50(e), which EPA "shall" approve if it determines the change will not violate FIFRA, § 136a(f)(1). This is a far cry from the "special permission and assistance" needed from the FDA in *PLIVA* to change a generic drug label, a process constrained by a duty of sameness and the added step of agency deliberations with name-brand manufacturers. *See* 564 U.S. at 623-24.

Moreover, EPA permits pesticide manufacturers to make certain changes to labels without prior approval. *See id.* at 623. Specifically, manufacturers can make minor modifications to labeling without prior EPA approval if EPA is notified of the change. 40 C.F.R. § 152.46(a); EPA, Office of Pesticide Programs, *Pesticide Registration Notice 98-10* (Oct. 22, 1998) ("PRN 98-

10"). Thus, unlike the generic drug manufacturers in *PLIVA*, pesticide manufacturers "can act sufficiently independently under federal law" when amending a label. *See PLIVA*, 564 U.S. at 623.

Though Monsanto contends that "[a]dding a warning about cancer would hardly qualify as a 'minor modification,'" EPA has repeatedly permitted pesticide manufacturers to use the notification procedure to add notices related to cancer to their products' labels.[10] Nevertheless, Monsanto counters that there is no "single example where EPA has allowed a registrant to use the notification process" where EPA previously "found the relevant chemical was *not* carcinogenic, much less where it determined a cancer warning would render a label false and misleading," referring to the 2019 letter.

But neither EPA's 2017 finding that glyphosate is not carcinogenic nor the 2019 letter (which do not carry the force of law) divert Monsanto to a different process for amending a label beyond those normally followed by pesticide manufacturers under FIFRA and its regulations, as described above. Considering the responsibil-

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[10] For instance, pursuant to PRN 98-10, pesticide manufacturer Bayer CropScience notified EPA "of a minor labeling amendment for LARVIN Technical," informing EPA that "[a]s required by California Proposition 65, the following statement has been added to the label, 'This product contains a chemical known to the state of California to cause cancer.'" Letter from Larry R. Hodges, Registration Manager, Bayer CropScience, to EPA, Office of Pesticide Programs 4 (Nov. 29, 2012), www3.epa.gov/pesticides/chem_search/ppls/000264-00343-20131217.pdf. In response, EPA's Registration Division "conducted a review of this request for its applicability under PRN 98-10 and finds that the action(s) requested fall within the scope of PRN 98-10." Letter from Jennifer Gaines, EPA, Office of Pesticide Programs, to Larry Hodges, Bayer CropScience 2 (Dec. 17, 2012), www3.epa.gov/pesticides/chem_search/ppls/000264-00343-20131217.pdf.

ity FIFRA places on manufacturers to update pesticide labels and that EPA has allowed pesticide manufacturers to add cancer warnings to labels through the notification process without prior approval, it is not *impossible* for Monsanto to add a cancer warning to Roundup's label. *See PLIVA*, 564 U.S. at 623; *see also Wyeth*, 555 U.S. at 573 (explaining that "[i]mpossibility pre-emption is a demanding defense").

III

Whether the district court applied the correct legal standard under *Daubert* is reviewed de novo, and the district court's decision to admit expert testimony is reviewed for abuse of discretion. *Estate of Barabin v. AstenJohnson, Inc.*, 740 F.3d 457, 462 (9th Cir. 2014) (en banc), *overruled on other grounds by United States v. Bacon*, 979 F.3d 766 (9th Cir. 2020) (en banc). We hold that the district court ultimately applied the correct legal standard under *Daubert* and did not abuse its discretion by admitting Hardeman's general and specific causation expert testimony.

A

Under Federal Rule of Evidence 702, expert testimony must be reliable to be admissible. *Daubert*, 509 U.S. at 589. Scientific evidence is reliable when "the principles and methodology used by an expert are grounded in the methods of science." *Clausen v. M/V New Carissa*, 339 F.3d 1049, 1056 (9th Cir. 2003). When determining reliability, district court judges can consider the following non-exclusive factors: (1) "whether the theory or technique employed by the expert is generally accepted in the scientific community;" (2) "whether it's been subjected to peer review and publication;" (3) "whether it can be and has been tested;" and (4) "whether the known or potential rate of error is acceptable."

Daubert v. Merrell Dow Pharms., Inc., 43 F.3d 1311, 1316 (9th Cir. 1995) (citing *Daubert*, 509 U.S. at 593–95). "Th[is] inquiry is 'flexible,'" *Wendell*, 858 F.3d at 1232 (quoting *Daubert*, 509 U.S. at 594), and "should be applied with a 'liberal thrust' favoring admission," *Messick v. Novartis Pharms. Corp.*, 747 F.3d 1193, 1196 (9th Cir. 2014) (quoting *Daubert*, 509 U.S. at 588).[11]

Monsanto contends that, by relying on a misguided reading of *Wendell* and *Messick*, the district court misinterpreted *Daubert* to be more forgiving of experts' extrapolations than this circuit allows. But, in reaching its conclusions, the district court followed this court's precedent and thus cannot be faulted for following binding case law. Monsanto's specific critiques are addressed below.

First, according to Monsanto, the district court erroneously stated there is "slightly more room for deference to experts" in close cases, *In re Roundup*, 390 F. Supp. 3d at 1113, and that courts in this circuit are "more tolerant of borderline expert opinions," *In re Roundup*, 358 F. Supp. 3d at 959.

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[11] This liberal thrust favoring admission is not without limits. "Just as the district court cannot abdicate its role as gatekeeper, so too must it avoid delegating that role to the jury." *Estate of Barabin*, 740 F.3d at 464 (holding that district court erred by "pass[ing] its greatest concern about [the expert's] testimony to the jury to determine" and there was little "indication that the district court assessed, or made findings regarding, the scientific validity or methodology of [another expert's] proposed testimony"); *see also United States v. Valencia-Lopez*, 971 F.3d 891, 899 (9th Cir. 2020) (holding that district court erred in admitting expert testimony without making a reliability determination by dismissing the expert's deficiencies as "going to the weight, not admissibility, of [the expert's] testimony" (quoting *Nease v. Ford Motor Co.*, 848 F.3d 219, 230 (4th Cir. 2017))).

As an initial matter, this court is not an outlier following a more flexible *Daubert* approach than other circuits. The cases on which the district court relied do not establish otherwise. For instance, in the Fourth Circuit case relied on by the district court, the expert failed to provide a proper scientific basis for her differential diagnosis by "focus[ing] almost exclusively on the fact that [plaintiff] took the drug and later developed the disease, rather than explaining what led her to believe that it was a substantial contributing factor as compared to other possible causes." *In re Lipitor (Atorvastatin Calcium) Mktg., Sales Pracs. & Prods. Liab. Litig.*, 892 F.3d 624, 645 (4th Cir. 2018). But if we compare the expert in *Lipitor* to, for instance, the expert in *Messick*, the cases are readily distinguishable. Unlike the *Lipitor* expert, the expert in *Messick* provided a scientific basis for his conclusion by "refer[ing] to his own extensive clinical experience as the basis for his differential diagnosis, as well as his examination of [plaintiff's] records, treatment, and history." 747 F.3d at 1198.

Similarly, in the Sixth Circuit case relied on by the district court, the expert's causation analysis was insufficient because literature had only hypothesized but did not find a link between the chemical and disease. *Tamraz v. Lincoln Elec. Co.*, 620 F.3d 665, 677–78 (6th Cir. 2010). The *Tamraz* court explained, "the problem is not that [the expert] failed to cite studies about [the chemical] causing [the disease] … or could not quantify how much [of the chemical] would lead to how much [of the disease]; the problem is that he failed to cite *any* non-speculative evidence for his conclusion." *Id.* at 674. In contrast, the experts in *Wendell* did not present that deficiency, as they "relied not just on … studies—which not only examined reported cases but also used statisti-

cal analysis to come up with risk rates—but also on their own wealth of experience and additional literature." 858 F.3d at 1236. Thus, the Fourth Circuit and Sixth Circuit cases on which the district court relied are not at odds with this court's *Daubert* approach.

To the extent the district court relied on *In re Zoloft (Sertraline Hydrochloride) Products Liability Litigation*, 858 F.3d 787, 800 (3d Cir. 2017), and *McClain v. Metabolife International, Inc.*, 401 F.3d 1233, 1244–45 (11th Cir. 2005), to show those courts adopted the any step principles,[12] those cases do not reveal a more flexible *Daubert* approach in this circuit. We have explained that "expert evidence is inadmissible where the analysis is the result of a faulty methodology or theory as opposed to imperfect execution of laboratory techniques whose theoretical foundation is sufficiently accepted in the scientific community to pass muster under *Daubert*." *City of Pomona v. SQM N. Am. Corp.*, 750 F.3d 1036, 1047–48 (9th Cir. 2014) (internal quotation marks and citation omitted). Imperfect application of methodology may not render expert testimony unreliable because "'[a] minor flaw in an expert's reasoning or a slight modification of an otherwise reliable method' does not render expert testimony inadmissible." *Id.* at 1048 (quoting *Amorgianos*, 303 F.3d at 267 (adopting the any step principles)) (alteration in original). The reasoning guiding the any step principles

[12] "The *Daubert* 'requirement that the expert testify to scientific knowledge—conclusions supported by good grounds for each step in the analysis—means that any step that renders the analysis unreliable under the *Daubert factors renders the expert's testimony inadmissible*.'" *Amorgianos v. Nat'l R.R. Passenger Corp.*, 303 F.3d 256, 267 (2d Cir. 2002) (quoting *In re Paoli R.R. Yard PCB Litig.*, 35 F.3d 717, 745 (3d Cir. 1994)); *see also Zoloft*, 858 F.3d at 797; *McClain*, 401 F.3d at 1245.

is not dissimilar; namely, "[t]he judge should only exclude the evidence if the flaw is large enough that the expert lacks 'good grounds' for his or her conclusions." *Amorgianos*, 303 F.3d at 267 (quoting *Paoli*, 35 F.3d at 746).

Despite its incorrect assumption that this court is more permissive than others in admitting *Daubert* testimony, the district court still employed the correct legal standard for reliability when it admitted Hardeman's expert testimony. For instance, the district court's slight "deference to experts" with "borderline … opinions" was proper under *Daubert*: "[T]he interests of justice favor leaving difficult issues in the hands of the jury and relying on the safeguards of the adversary system … to 'attack[] shaky but admissible evidence.'" *Wendell*, 858 F.3d at 1237 (quoting *Daubert*, 509 U.S. at 596) (alteration in original). The Supreme Court has not directed courts to follow a different rule since it first decided *Daubert* almost 28 years ago.

Second, Monsanto takes issue with the district court's suggestion that courts in this circuit can admit opinions "that lean strongly toward the 'art' side of the spectrum." *In re Roundup*, 358 F. Supp. 3d at 959 (citation omitted). Though that may seem strange out of context, the district court was only reiterating our precedent following *Daubert*. *See Messick*, 747 F.3d at 1198 ("Medicine partakes of art as well as science … ."). The district court did not suggest that courts in this circuit allow "art" as a separate, standalone category divorced from logic and science. Rather, in referencing "art," the district court followed *Wendell* and *Messick's* instructions that a testifying expert can rely on his own extensive clinical experience under *Daubert*. *See Wendell*, 858 F.3d at 1237 ("Where, as here, two doctors who stand at or near the top of their field and have ex-

tensive clinical experience with the rare disease or class of disease at issue, are prepared to give expert opinions supporting causation, we conclude that *Daubert* poses no bar based on their principles and methodology."); *Messick*, 747 F.3d at 1198 (allowing "extensive clinical experience" to form basis of differential diagnosis opinion).

Monsanto attempts to distinguish *Wendell* by arguing that it only allows experts to rely on clinical experience in exceptional circumstances not present here, particularly cases involving rare diseases with insufficient epidemiological data. Considering that *Wendell* drew the concept of "art" from *Messick*, a case which did not involve a rare disease, we do not find that the application of art is limited to exceptional circumstances.

The district court allowed experts to rely on clinical experience, or "art," only when conducting differential diagnosis to render specific causation opinions. Allowing experts to rely on clinical experience while conducting differential diagnosis, as the district court did here, is consistent with *Messick*. *See* 747 F.3d at 1198 ("[T]here is nothing wrong with a doctor relying on extensive clinical experience when making a differential diagnosis.").

Monsanto further tries to distinguish *Messick* by emphasizing that the expert there relied on clinical experience as well as an examination of medical literature and plaintiff's records. But Hardeman's experts did the same thing here, if not more, by relying on epidemiological, animal, and cell studies. Acknowledging this, Monsanto counters that "there are numerous epidemiological studies on the association between glyphosate and Hardeman's subtype of non-Hodgkin's lymphoma that

obviated the need for any reliance on 'art.'" But Monsanto contradicts its own argument, asserting *Wendell* and *Messick* "state that experience can *supplement* reliable scientific studies and medical literature." On this point, Monsanto is right: Hardeman's experts' clinical experience could supplement the epidemiological studies on which they relied.

Thus, the district court applied the correct legal standard under *Daubert* by following our precedent and fulfilling its "special obligation to determine the reliability of an expert's testimony." *Elsayed Mukhtar v. Cal. State Univ., Hayward*, 299 F.3d 1053, 1063 (9th Cir. 2002) (internal quotation marks and citation omitted), *overruled on other grounds by Estate of Barabin*, 740 F.3d 457.

B

To establish general causation, Hardeman's experts needed to show that glyphosate can cause NHL at exposure levels people realistically may have experienced. Here, Hardeman's general causation experts relied on three types of studies: epidemiological,[13] animal, and cellular. Animal studies are relevant evidence of causation where there is a sound basis for extrapolating conclusions from those studies to humans in real-world conditions. *See Domingo ex rel. Domingo v. T.K.*, 289 F.3d 600, 606 (9th Cir. 2002). Similarly, cell studies can support more substantial evidence of causation. Therefore, animal and cell studies can help show causation so long as there is evidence of an association be-

[13] Epidemiology is "the field of public health and medicine that studies the incidence, distribution, and etiology of disease in human populations." Michael D. Green et al., *Reference Guide on Epidemiology, in* Reference Manual on Scientific Evidence 551, 551 (3d ed. 2011) ("Reference Manual").

tween glyphosate and NHL in humans within the epidemiological literature. This means that to be admissible testimony, the experts must have reliably based their general causation opinions on epidemiological evidence showing a connection between glyphosate and cancer. As discussed below, the district court did not abuse its discretion in concluding that Hardeman's experts satisfied this requirement.

Monsanto maintains that the experts did not use the epidemiological evidence reliably because they (1) dismissed the Agricultural Health Study ("AHS") and (2) focused on case-control studies that did not sufficiently account for confounding factors. These criticisms, however, are not enough to render the expert opinions unreliable.

First, Monsanto criticizes Hardeman's experts for ignoring the AHS, which Monsanto considers to be the most powerful evidence on the relationship between glyphosate and NHL. That study was a cohort study conducted by the National Institutes of Health that considered a range of pesticide exposures on 57,000 participants over several years. The AHS found no statistically significant association between glyphosate and NHL and showed no dose-response relationship, meaning "no evidence of higher rates of [NHL] with more days of exposure."

Nonetheless, Hardeman's experts had a reasonable basis for placing less weight on the AHS. For instance, an epidemiologist employed by Monsanto wrote years before the AHS results were announced that "the exposure assessment in the AHS will be inaccurate" because the AHS will have "spurious exposure-disease findings due to exposure misclassification." Similarly, Monsanto's toxicologist, Donna Farmer, recognized

that "[m]any groups have been highly critical of the study as being a flawed study, in fact some have gone so far as to call it junk science. … [T]he bottom line is scary … there will be associations identified … just because of the way this study is designed."

These criticisms from Monsanto employees resemble those from Hardeman's experts that the AHS is flawed and unreliable. Though Monsanto changed its tune on the AHS because the misclassification concerns were allegedly addressed using "sensitivity analyses" as the study progressed, the overlapping criticisms still show that Hardeman's expert opinions on the AHS are within "the range where experts might reasonably differ." *Kumho Tire Co. v. Carmichael*, 526 U.S. 137, 153 (1999). Accordingly, the district court did not abuse its discretion in concluding that "the epidemiology evidence is open to different interpretations" such that "an expert who places more weight on the case-control studies than the AHS cannot be excluded as categorically unreliable for doing so." *In re Roundup*, 390 F. Supp. 3d at 1126.

Second, Monsanto criticizes Hardeman's experts for relying on three case-control studies: De Roos (2003), McDuffie (2001), and Eriksson (2008), which allegedly contain serious flaws. Although case-control studies are "prone to recall bias,"[14] Hardeman's experts gave the district court valid reasons to discount this concern. For example, the experts explained that epidemiology studies overall found associations only be-

[14] "[R]ecall bias[] occurs where people with a disease … are differently able to recall past exposures than are people who never get sick; generally, the assumption is that the cases will recall greater levels of exposure, as those who become ill are more likely to ruminate about the possible causes of their disease." Reference Manual at 585–86.

tween glyphosate and NHL, but not between glyphosate and other cancers asked about in the studies. The experts pointed out that, if participants were predisposed to think glyphosate caused cancer and consequently exhibited recall bias, the studies would have reported associations for glyphosate and other cancers. Hardeman's experts also relied upon studies that sought to validate self-reports of pesticide exposure and found similar recall accuracy between controls and cases. Considering this evidence, the district court did not abuse its discretion in finding the "possible presence of recall bias" is "not significant enough to require an expert categorically to weight [the case-control studies] less heavily than the AHS." *In re Roundup*, 390 F. Supp. 3d at 1133.

Monsanto criticizes the De Roos study specifically for "not properly account[ing] for [NHL's] latency period" because the study analyzed data collected between 1979 and 1986, but NHL takes "at least five to ten years to develop" and Roundup was put on the market in 1974. As the district court pointed out, a potential confounding variable[15] is an important reason a study might show an association between glyphosate and NHL shortly after glyphosate was put on the market.

The De Roos study, however, reduced the risk of confounding by adjusting for many other pesticides. While Hardeman's experts acknowledged that it is "always possible" that the observed association was the result of confounding not accounted for in De Roos, the adjustment for many other pesticides in De Roos made it "significantly less likely" that a pesticide other than glyphosate caused the observed association. As a re-

[15] Confounding variables are other factors that could explain an observed association between a substance and the disease.

sult, the district court properly scrutinized the reliability of De Roos and did not abuse its discretion in concluding that, "at least for the studies that adjust for other pesticide exposures [i.e., De Roos], the relatively short period between glyphosate exposure and cancer development is not a concern so significant as to disqualify an expert who gives significant weight to the case-control studies in rendering a causation opinion." *In re Roundup*, 390 F. Supp. 3d at 1123.

Nonetheless, Monsanto argues that Hardeman's experts still did not sufficiently consider confounding factors while evaluating epidemiology. According to Monsanto, "McDuffie did not account for the effect of exposure to pesticides beyond glyphosate *at all*" and, "while Eriksson did provide some results adjusted for the effect of other pesticides, the adjusted results did not show a statistically significant link between glyphosate and [NHL]."

But while the district court acknowledged that "exclusive consideration of numbers unadjusted for other pesticides, when adjusted numbers are available, would be disqualifying," *In re Roundup*, 390 F. Supp. 3d at 1140, Hardeman's experts did not do that here. For instance, "Dr. Portier addressed the most significant concern—the possibility that pesticides other than glyphosate caused the observed cases of NHL—by focusing on data adjusted for potential confounding by various other pesticides." *In re Roundup*, 390 F. Supp. 3d at 1133; *see also id.* at 1140–41, 1143 (discussing Dr. Ritz and Dr. Weisenburger). Further, even where adjustment for other pesticides resulted in loss of statistical significance, the results still showed a positive associa-

tion between glyphosate and NHL.[16] Thus, contrary to Monsanto's criticisms, the general causation expert opinions were sufficiently supported by reliable epidemiological evidence, so admitting these experts' testimony was not an abuse of discretion.

C

To establish specific causation, experts needed to show that Hardeman's NHL was caused by glyphosate, rather than some other factor. To do so, Hardeman's experts—Dr. Weisenburger, Dr. Shustov, and Dr. Nabhan—used "differential diagnosis," which starts with ruling in "all potential causes, then rul[ing] out the ones as to which there is no plausible evidence of causation, and then determin[ing] the most likely cause among those that cannot be excluded." *Wendell*, 858 F.3d at 1234; *see also Clausen*, 339 F.3d at 1057. Here, Hardeman's experts reliably used differential diagnosis because they ruled in glyphosate based on the epidemiological evidence supporting the general causation opinions and ruled out alternative causes, such as idiopathy and HCV.

1

Monsanto argues that Hardeman failed to adequately rule out idiopathy, considering that 70% or

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[16] Monsanto criticizes Dr. Weisenburger for relying on a single favorable odds ratio from the "earliest iteration" of the North American Pooled Project. But such reliance is not enough to render Dr. Weisenburger's entire testimony unreliable. *See, e.g.*, *Wendell*, 858 F.3d at 1233 (explaining that district courts should not look "too narrowly at each individual consideration, without taking into account the broader picture of the experts' overall methodology"). The district Court properly considered this issue before concluding Dr. Weisenburger's testimony was sufficiently reliable.

more of NHL cases have unknown causes. Monsanto acknowledges that an expert can rule out idiopathy by reliably concluding that the known factor (here, glyphosate) is a "substantial cause," which can be shown when a strong association exists between the disease and that known risk factor. *See Wendell*, 858 F.3d at 1235, 1237 (even though expert "was not entirely able to rule" out idiopathy, he could conclude a "known risk factor[]" was a substantial cause because "literature show[ed] that patients exposed to" the drugs in question were "at an increased risk for" the disease). But here, Monsanto argues that Hardeman's experts did not reliably conclude that glyphosate was a substantial cause because no strong association existed between glyphosate and NHL, forcing the experts to rely on two flawed studies and their own subjective judgment.

Specifically, Monsanto argues that Hardeman's experts did not rule in glyphosate as a substantial cause because, unlike the experts in *Wendell*, they did not show a sharp enough increased risk of cancer for those exposed to glyphosate. Monsanto focuses on Hardeman's experts' inability to present a study with an adjusted odds ratio above 2.0. But we have never suggested that a hardline increase in a risk statistic, or even an adjusted odds ratio above 2.0, is necessary for finding a strong association. *See id.* at 1234. To the contrary, flexibility is warranted considering the contextual nature of the *Daubert* inquiry. Thus, it was not an abuse of discretion to admit expert testimony—that glyphosate is a substantial cause—partly based on the epidemiological studies from the general causation opinions, where the general causation opinions showed a "robust connection between glyphosate and NHL." *In re Roundup*, 358 F. Supp. 3d at 960.

Next, Monsanto criticizes Hardeman's experts for relying on "two flawed studies"—McDuffie and Eriksson—linking glyphosate and NHL. Monsanto focuses on the experts' two attempted uses for those studies: (1) to assign a quantified risk to Hardeman based on the studies' "unadjusted numbers" and (2) to show that Hardeman's risk ratio must have exceeded 2.0 because he exceeded the exposure minimums from the two studies (i.e., two days per year or ten lifetime days of exposure). But this focus is misplaced. Though relying on McDuffie and Eriksson for those propositions may have been problematic, that is not what happened here. The district court explicitly considered these issues and properly exercised its gatekeeping function by precluding the experts from using the studies in those two ways.

Instead, the district court allowed Hardeman's experts to rely on McDuffie and Eriksson to show a dose-response relationship between glyphosate and NHL. And Hardeman's experts presented a sufficient basis for using these studies (though unadjusted for other pesticides) to show such a relationship. For instance, Dr. Weisenburger clarified, if a chemical "shows a dose response, it's very likely an etiologic agent because it's … unusual that a chemical would cause a disease and not have a dose response. So when you see a dose response, that gives you some assurance that it really is causing the disease."

Had the experts relied only on McDuffie and Eriksson to show glyphosate is a substantial cause of NHL, their specific causation opinions may have been unreliable. However, Hardeman's experts relied not only on McDuffie and Eriksson but also other epidemiological evidence (like De Roos) supporting a strong association, as well as their clinical experience and review of

plaintiff's medical records. Thus, as a whole, the evidence provided a sufficient basis for reliably ruling out idiopathy by concluding glyphosate was a substantial cause of Hardeman's NHL. *See Wendell*, 858 F.3d at 1233–34 (ruling out idiopathy for disease with 70% idiopathy rate where expert relied on clinical experience, literature, and medical records).

2

Monsanto also argues that Hardeman's experts did not reliably rule out HCV as an alternate cause. HCV is an established cause of NHL. Even though Hardeman was treated for HCV in 2005 and 2006, Monsanto claims that he was vulnerable to cellular damage caused by the virus for many years, including NHL. But, as Dr. Weisenburger explained, to cause cancer, the virus must be active, and there was no evidence that Hardeman's HCV had been active for the decade preceding his NHL diagnosis. And this conclusion, as determined by the district court, had significant support in the scientific literature.

Further, Dr. Weisenburger's underlying methodology for reaching this conclusion was sound. He relied on Hardeman's medical records and his clinical experience and reviewed scientific literature (including seven studies) as the basis for ruling out HCV. *See Messick*, 747 F.3d at 1199 ("[D]ifferential diagnosis grounded in significant clinical experience and examination of medical records and literature can certainly aid the trier of fact and cannot be considered to be offering 'junk science.'"). Thus, Dr. Weisenburger reliably ruled out HCV as an alternate cause of Hardeman's NHL, and the district court did not abuse its discretion in admitting Hardeman's expert testimony on specific causation.

IV

The district court's decision to admit IARC's glyphosate classification as a "probable carcinogen" but exclude contrary conclusions from other regulatory bodies is reviewed for abuse of discretion. *Estate of Barabin*, 740 F.3d at 462. The district court made that decision to mitigate prejudice to Hardeman after granting Monsanto's request to bifurcate the trial.

Monsanto argues that admitting IARC's classification was an error because the classification's minimal probative value was outweighed by unfair prejudice and juror confusion, which was allegedly exacerbated by the district court's exclusion of various foreign regulatory agencies' rejections of IARC's classification. We disagree.

Under Rule 403, the district court can "exclude relevant evidence if its probative value is substantially outweighed by a danger of one or more of the following: unfair prejudice, confusing the issues, misleading the jury, undue delay, wasting time, or needlessly presenting cumulative evidence." Fed. R. Evid. 403. "A district court's Rule 403 determination is subject to great deference, because the considerations arising under Rule 403 are susceptible only to case-by-case determinations, requiring examination of the surrounding facts, circumstances, and issues." *United States v. Hinkson*, 585 F.3d 1247, 1267 (9th Cir. 2009) (en banc) (internal quotation marks and citation omitted).

According to Monsanto, IARC's classification had minimal probative value because it did not rely on new data or gauge cancer risk from real-world glyphosate exposure. But this misses the point: IARC's classification was admitted to mitigate prejudice to Hardeman from the trial's bifurcation. Monsanto had specifically

requested bifurcation to preclude evidence of its "attempting to influence regulatory agencies and manipulate public opinion regarding glyphosate." Without IARC's classification, "jurors w[ould] be left wondering, during the causation phase, how glyphosate could possibly be dangerous if it ha[d] gone largely unregulated for decades." Further, the district court minimized the risk of prejudice to Monsanto by only admitting IARC's classification, not the underlying details, and admitting the continued approval of glyphosate from three other regulators—EPA, EFSA, and ECA. Importantly, the district court instructed the jury to "not defer" to the conclusions of any of these regulatory bodies because they were not a substitute for the jurors' "own independent assessment of the evidence." While other regulatory agencies had also rejected IARC's classification, the district court did not err in concluding that evidence of additional regulators' post-IARC conclusions would have been cumulative. Admitting all foreign regulatory conclusions would have invited the jury to weigh competing regulatory findings rather than independently assess the scientific evidence.

Even if these evidentiary decisions were erroneous, any error was harmless because it was "more probable than not that the … admission of the evidence did not affect the jury's verdict." *United States v. Ramirez-Robles*, 386 F.3d 1234, 1244 (9th Cir. 2004) (internal quotation marks and citations omitted). Considering the strong limiting instruction and the expert testimony linking glyphosate to cancer, the jury would likely have reached the same causation verdict even without evidence of IARC's classification or with more evidence of regulatory agency rejections of that classification. Therefore, we affirm the decision to admit the

conclusions from IARC, EPA, EFSA, and ECA, and to exclude evidence from additional regulatory agencies.

V

Monsanto also challenges the district court's causation jury instruction. We review de novo whether that instruction correctly states the law. *Peralta v. Dillard*, 744 F.3d 1076, 1082 (9th Cir. 2014) (en banc). We conclude that the district court's causation jury instruction was inconsistent with the Judicial Council of California Civil Jury Instructions ("CACI") and California case law. We conclude, however, that any error was harmless. *See Caballero v. City of Concord*, 956 F.2d 204, 206 (9th Cir. 1992).

The district court's causation jury instruction included a substantial factor and but-for causation instruction, drawing from CACI 430, and a concurrent independent causes instruction.[17] The first paragraph

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[17] The jury was instructed as follows:

> To prevail on the question of medical causation, Mr. Hardeman must prove by a preponderance of the evidence that Roundup was a substantial factor in causing his non-Hodgkin's lymphoma. A substantial factor is a factor that a reasonable person would consider to have contributed to the harm. It must be more than a remote or trivial factor. It does not have to be the only cause of the harm. Subject to the additional instructions below, conduct is not a substantial factor in causing harm if the same harm would have occurred without that conduct.
>
> The following additional instructions apply if you believe that two or more NHL-causing factors operated independently on Mr. Hardeman:
>
> If you conclude that Mr. Hardeman has proven that his exposure to Roundup was sufficient on its own to cause his NHL, then you must find for Mr. Hardeman even if you believe that other factors were also sufficient on

of this instruction (on substantial factor and but-for causation) adopted the same language as CACI 430, the model "substantial factor" instruction. The district court's instruction included CACI 430's final optional sentence on but-for causation that reads, "[c]onduct is not a substantial factor in causing harm if the same harm would have occurred without that conduct." But CACI 430's "Directions for Use" instruct courts to "not include the [but-for instruction] in a case involving concurrent independent causes," which the district court did here. As such, "the but-for test is inappropriate in cases when two forces are actively operating and each is sufficient to bring about the harm." *Lopez v. The Hillshire Brands Co.*, 254 Cal. Rptr. 3d 377, 383–84 (Ct. App. 2019) (quoting *Major v. R.J. Reynolds Tobacco Co.*, 222 Cal. Rptr. 3d 563, 579 (Ct. App. 2017)). And this makes sense considering that the two instructions tend to contradict each other when used together.

Here, the district court's causation jury instruction erroneously incorporated the optional final sentence of CACI 430. The concurrent independent causation instruction was appropriate—otherwise, the jury might not have found causation, even if it thought Roundup caused Hardeman's cancer, because HCV may have been an additional cause. *See Viner v. Sweet*, 70 P.3d 1046, 1051 (Cal. 2003) (explaining there is an exception to but-for cause for "multiple forces operating at the same time and independently, each of which would have been sufficient by itself to bring about the harm"). But because the concurrent independent causation instruction inherently conflicted with but-for causation, the

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their own to cause his NHL. On the other hand, if you conclude that Mr. Hardeman has not proven that his exposure to Roundup was sufficient on its own to cause his NHL, then you must find for Monsanto.

district court's jury instruction did not state the law entirely correctly. *See Peralta*, 744 F.3d at 1082. We recognize the district court tried to alleviate this conflict by adding the introductory language of "[s]ubject to the additional instructions below," before providing the but-for causation instruction, but we still find that language confusing, such that the instruction was "misleading." *Id.*

An erroneous instruction does not require reversal, however, when "the error is more probably than not harmless." *Caballero*, 956 F.2d at 206 (citation omitted). That standard is "less stringent than review for harmless error in a criminal case" and "more stringent than review for sufficiency of the evidence." *Id.* at 207. Because the instruction given likely did not prejudice Monsanto, the harmlessness standard is met. For instance, if the jury did not view the but-for instruction as a bar to finding causation, then it applied the appropriate causation standard. And even if the jury interpreted the optional but-for sentence from CACI 430 to mean Hardeman could only prevail if Roundup was a but-for cause, then it would have also found legal causation under the more flexible concurrent independent causation standard. Thus, we affirm because the error in the causation instruction was likely harmless.

VI

Monsanto argues it was entitled to judgment as a matter of law on the failure-to-warn claims because it did not know and could not have known that glyphosate caused cancer in 2012 (when Hardeman stopped using Roundup). But reviewing de novo and "view[ing] the evidence in the light most favorable to [Hardeman] … and draw[ing] all reasonable inferences in h[is] favor," *Lakeside-Scott v. Multnomah Cnty.*, 556 F.3d 797, 802

(9th Cir. 2009), we conclude that sufficient scientific evidence was presented to the jury to support that the association between glyphosate and cancer was "knowable" by 2012.

To prevail on his failure-to-warn claim, Hardeman was required to prove that the link between Roundup and cancer was "known or knowable in light of the generally recognized and prevailing best scientific and medical knowledge available at the time of manufacture and distribution." *Anderson v. Owens–Corning Fiberglas Corp.*, 810 P.2d 549, 558 (Cal. 1991). While the "scientific landscape" was "more favorable" to Monsanto before 2012, there was sufficient scientific evidence presented to the jury that the link between glyphosate and cancer was "knowable."

For instance, as early as 1985, EPA classified glyphosate as a possible human carcinogen after reviewing a mouse study finding that "[g]lyphosate was oncogenic in male mice," causing rare tumors. Even though EPA changed its designation of glyphosate to non-carcinogenic in 1991, several studies found an association between glyphosate and cancer in the 1990s. In the late 1990s, Monsanto hired Dr. Parry, a genotoxicologist, who found evidence that glyphosate may be genotoxic and urged Monsanto to conduct specific tests on Roundup's genotoxicity. Though Monsanto never conducted all the tests Dr. Parry requested,[18] various independent scientific studies linking glyphosate and cancer were released by 2012. Thus, sufficient evidence was presented to the jury that the association between glyphosate and cancer was, at minimum, "knowable" by

[18] Years later, in 2009, Monsanto toxicologist Donna Farmer said, "you cannot say that Roundup does not cause cancer … [because] we have not done carcinogenicity studies with 'Roundup.'"

2012, and Monsanto was therefore not entitled to judgment as a matter of law.

VII

Finally, we address both parties' challenges to the punitive damages award. We review whether California law permits a jury's decision to award punitive damages for substantial evidence. *Kaffaga v. Estate of Steinbeck*, 938 F.3d 1006, 1013 (9th Cir. 2019). We review de novo, with an "[e]xacting appellate review," the constitutionality of a punitive damages award. *State Farm Mut. Auto. Ins. Co. v. Campbell*, 538 U.S. 408, 418 (2003) (citing *Cooper Indus., Inc. v. Leatherman Tool Grp., Inc.*, 532 U.S. 424, 436 (2001)). "[W]e defer to the district court's 'findings of fact unless they are clearly erroneous.'" *Arizona v. ASARCO LLC*, 773 F.3d 1050, 1054 (9th Cir. 2014) (quoting *Cooper Indus.*, 532 U.S. at 440 n.14). Based on this review, we hold that (1) California law permits a punitive damages award because substantial evidence was presented to the jury that Monsanto acted with malice, and (2) though the $75 million punitive damages award was constitutionally excessive, the reduced $20 million award comports with the outer limits of the Due Process Clause.

A

Punitive damages were permissible under California law because substantial evidence was presented that Monsanto acted with malice by, among other things, ignoring Roundup's carcinogenic risks. *See Kaffaga*, 938 F.3d at 1018.

Punitive damages are permissible under California law when there is "clear and convincing evidence that the defendant has been guilty of oppression, fraud, or

malice." Cal. Civ. Code § 3294(a). As relevant here, "malice" means "despicable conduct which is carried on by the defendant with a willful and conscious disregard of the rights or safety of others." § 3294(c)(1).

That definition of malice requires that we examine what constitutes "despicable conduct" and "conscious disregard." "Despicable conduct" is conduct "so vile, base, contemptible, miserable, wretched or loathsome that it would be looked down upon and despised by most ordinary decent people." *Pac. Gas & Elec. Co. v. Super. Ct.*, 235 Cal. Rptr. 3d 228, 236 (Ct. App. 2018) (internal quotation marks and citation omitted). "Conscious disregard" requires that the defendant "have *actual knowledge* of the risk of harm it is creating and, in the face of that knowledge, fail to take steps it knows will reduce or eliminate the risk of harm." *Id.* (internal quotation marks and citation omitted). But whether a "defendant is aware of the probable dangerous consequences of [its] conduct and [it] willfully fails to avoid such consequences" can be "proved either expressly through direct evidence or by implication through indirect evidence from which the jury draws inferences." *Pfeifer v. John Crane, Inc.*, 164 Cal. Rptr. 3d 112, 135 (Ct. App. 2013) (quoting *Angie M. v. Super. Ct.*, 44 Cal. Rptr. 2d 197, 204 (Ct. App. 1995)).

Substantial evidence of Monsanto's malice was presented to the jury, supporting punitive damages under § 3294(a). For example, internal emails were presented supporting that Monsanto was consciously aware of the potential health risks associated with Roundup. One email, from Monsanto toxicologist Mark Martens, read, "I don't know for sure how suppliers would react—but if somebody came to me and said they wanted to test Roundup I know how I would react—with serious concern." A second email, from Monsanto toxicologist Wil-

liam Heydens, read, "[g]lyphosate is OK but the formulated product (and thus the surfactant) does the damage." And a third email, from Monsanto toxicologist Donna Farmer, read, "you cannot say that Roundup is not a carcinogen … [because] we have not done the necessary testing on the formulation to make that statement." These emails provide the substantial evidence necessary to support punitive damages based on Monsanto's awareness that Roundup posed a potential health risk.

There was also substantial evidence sufficient for a jury to find that Monsanto "fail[ed] to take steps it kn[ew] w[ould] reduce or eliminate the risk of harm." *Pac. Gas & Elec. Co.*, 235 Cal. Rptr. 3d at 236 (internal quotation marks and citation omitted). For instance, after its own hired expert, Dr. Parry, found that glyphosate—alone and when mixed with other chemicals in Roundup—had increased genotoxic risks, evidence was sufficient to infer that Monsanto largely failed to perform further studies. Instead, Monsanto helped author an article downplaying glyphosate's health and safety concerns. Even though "it is also possible to draw a contrary conclusion" that Monsanto was ignorant or negligent (but not malicious),[19] the "jury's verdict must be upheld [because] it is supported by substantial evidence" that Monsanto consciously disregarded Roundup's potential harm. *See Pavao v. Pagay*, 307 F.3d 915, 918 (9th Cir. 2002).

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[19] Monsanto also argues that it cannot be deemed to have acted with malice because it complied with regulations. But "[a] defendant's compliance with, or actions consistent with, governmental regulations or determinations about a product do not necessarily eviscerate a claim for punitive damages." *Johnson & Johnson Talcum Powder Cases*, 249 Cal. Rptr. 3d 642, 678 (Ct. App. 2019).

B

We next turn to the amount of punitive damages that would still comport with the Due Process Clause. Hardeman argues that the district court erred by reducing the jury's $75 million punitive damages award to $20 million. And Monsanto contends that even the reduced punitive damages award was unconstitutional under the Due Process Clause. Consistent with our "[e]xacting appellate review," *State Farm*, 538 U.S. at 418 (citing *Cooper Indus.*, 532 U.S. at 436), we lay out some fundamental principles underlying the constitutionality of punitive damages awards.

"Compensatory damages and punitive damages serve different purposes; compensatory damages redress concrete loss caused by the defendant's wrongful conduct, while punitive damages are aimed at deterrence and retribution." *Planned Parenthood of Columbia/Willamette Inc. v. Am. Coal. of Life Activists*, 422 F.3d 949, 953 (9th Cir. 2005) (citing *State Farm*, 538 U.S. at 416*; Cooper Indus.*, 532 U.S. at 432). Further, "[t]he Supreme Court has instructed us to go 'no further' if a 'more modest punishment' for the 'reprehensible conduct' at issue 'could have satisfied the State's legitimate objectives' of punishing and deterring future misconduct." *Lompe v. Sunridge Partners, LLC*, 818 F.3d 1041, 1065 (10th Cir. 2016) (quoting *State Farm*, 538 U.S. at 419–20). Ultimately, we are mindful that in applying the Due Process Clause, it is "a *constitution* we are expounding." *Tabares v. City of Huntington Beach*, 988 F.3d 1119, 1122 (9th Cir. 2021) (quoting *McCulloch v. Maryland*, 17 U.S. 316, 407 (1819)).

When punitive damages are "grossly excessive," they violate the Due Process Clause. *State Farm*, 538 U.S. at 416. Whether punitive damages are "grossly

excessive" depends on three factors: "(1) the degree of reprehensibility of the defendant's misconduct; (2) the disparity between the actual or potential harm suffered by the plaintiff and the punitive damages award; and (3) the difference between the punitive damages awarded by the jury and the civil penalties authorized or imposed in comparable cases." *Id.* at 418 (citing *BMW of N. Am., Inc. v. Gore*, 517 U.S. 559, 575 (1996)).

1

The weightiest factor is "the degree of reprehensibility of the defendant's conduct." *Gore*, 517 U.S. at 575. The district court found "Monsanto's approach to the safety of its product was indeed reprehensible." *In re Roundup Prods. Liab. Litig.*, 385 F. Supp. 3d 1042, 1047 (N.D. Cal. 2019). The district court's finding was reasonable and supported by the facts presented to the jury. Thus, the question is to what degree Monsanto's actions were reprehensible. We determine the reprehensibility of Monsanto's conduct by considering the following five factors: whether "[1] the harm caused was physical as opposed to economic; [2] the tortious conduct evinced an indifference to or a reckless disregard of the health or safety of others; [3] the target of the conduct had financial vulnerability; [4] the conduct involved repeated actions or was an isolated incident; and [5] the harm was the result of intentional malice, trickery, or deceit, or mere accident." *State Farm*, 538 U.S. at 419 (citing *Gore*, 517 U.S. at 576–77).

Several aggravating factors associated with reprehensible conduct are present based on the evidence at trial. First, the harm inflicted on Hardeman—cancer—was physical, not purely economic. Hardeman has already been well compensated for damages resulting from his physical injury. Indeed, $5,066,667 of the com-

pensatory damages—about 96% of the jury's $5,267,634.10 total compensatory award—was based on noneconomic harm. *See In re Roundup*, 385 F. Supp. 3d at 1045. The district court found the $2 million in compensatory damages related to future noneconomic harm were "borderline" high because Hardeman's cancer was in remission. *Id.* And while remission is "no guarantee," testimony showed his cancer is unlikely to return. *Id.* But, as the district court explained, this concern was "mitigate[d]" because "the jury likely intended the future award to compensate a longer period of suffering." *Id.* These factual findings by the district court, which are reasonable and not clearly erroneous, highlight the reprehensibility of causing serious physical harm and the need to deter future harm. While Hardeman was well compensated for past and future harm, the serious nature of the harm supports finding that Monsanto's actions were reprehensible.

Second, the district court's factual conclusion that Monsanto ignored safety risks is not clearly erroneous and also supports reprehensibility. For example, the district court found that "Monsanto's behavior betrayed a lack of concern about the risk that its product might be carcinogenic." *Id.* at 1047. In addition, it found that "the evidence at trial painted the picture of a company focused on attacking or undermining the people who raised concerns, to the exclusion of being an objective arbiter of Roundup's safety." *Id.* But the district court also found mitigating evidence. Notwithstanding the jury's verdict for Hardeman, the district court explained that "the metaphorical jury is still out on whether glyphosate causes NHL." *Id.* Indeed, "there is credible evidence on both sides of the scientific debate" which "surely diminish[es]—to a degree—Monsanto's culpability." *Id.* Moreover, "[t]he scientific

landscape was even more favorable to Monsanto during the time Mr. Hardeman was using Roundup." *Id.*

We also agree with the district court that no evidence was presented that Monsanto knew Roundup in fact caused cancer. Monsanto never conducted studies that may have indicated (as its scientists suspected) that Roundup was carcinogenic. And regulators, like EPA, have repeatedly found glyphosate to not have carcinogenic risks. But, as the district court found, the evidence supports that Monsanto knew Roundup *might* cause cancer, hence its concern and reluctance to, for instance, conduct Dr. Parry's recommended studies. We have no quibble with any of the district court's findings of fact. Ultimately, evidence of Monsanto's conduct—downplaying concerns and failing to fully assess Roundup's safety after being alerted to possible risks—supports that Monsanto acted with "indifference to or a reckless disregard of the health or safety of others." *State Farm*, 538 U.S. at 419.

Third, *State Farm* asks us to look at Hardeman's financial vulnerability. *Id.* It goes without saying that this is a case of a large corporation and an individual—not two corporations on equal footing. Having said that, this factor is not particularly relevant in a mostly noneconomic damages case like this one. *See Lompe*, 818 F.3d at 1066 ("But as a practical matter, the financial vulnerability factor does not have particular relevance … where the harm [plaintiff] suffered was physical rather than a reprehensible exploitation of financial vulnerability through fraud or other financial misconduct."). The district court below did not analyze this factor. We do not find this factor helpful one way or another to establish reprehensibility.

Fourth, the district court did not clearly err in finding that Monsanto's "conduct involved repeated actions" instead of "an isolated incident." *See In re Roundup*, 385 F. Supp. 3d at 1047 (quoting *State Farm*, 538 U.S. at 419). Evidence was presented that Monsanto repeatedly sold Roundup without a warning label. *Id.* Thus, this factor supports reprehensibility because "repeated misconduct is more reprehensible than an individual instance of malfeasance." *Gore*, 517 U.S. at 577.

Fifth, the district court recognized Monsanto's actions exhibited malice but also made findings of fact that mitigated this factor. The district court noted there was no evidence "that Monsanto hid evidence from the EPA or, alternatively, that it had managed to capture the EPA." *See In re Roundup*, 385 F. Supp. 3d at 1047. There was also no evidence "that Monsanto was in fact aware that glyphosate caused cancer but concealed it, thus distinguishing this case from the many cases adjudicating the conduct of the tobacco companies." *Id.* Nonetheless, there was evidence of Monsanto's malice. As the district court found, "[d]espite years of colorable claims in the scientific community that Roundup causes NHL," emails showed "Monsanto employees crassly attempting to combat, undermine or explain away challenges to Roundup's safety." *Id.* And "not once was [the jury] shown an email suggesting that Monsanto officials were actively committed to conducting an objective assessment of its product." *Id.* We do not find the district court's findings of fact clearly erroneous.

Based upon the district court's findings, four of the five factors support that Monsanto's actions were reprehensible. But in two of those factors, there were significant mitigating considerations which suggest that

Monsanto's actions, while reprehensible, were not "particularly egregious." *See Gore*, 517 U.S. at 582.

2

We next examine the disparity between harm to Hardeman and the punitive damages award by looking to the Supreme Court's guidelines on appropriate ratios. *State Farm*, 538 U.S. at 424. The Supreme Court has explained that "[s]ingle-digit multipliers are more likely to comport with due process, while still achieving the State's goals of deterrence and retribution." *Id.* at 425. "[A]n award of more than four times the amount of compensatory damages might be close to the line of constitutional impropriety." *Id.* (citing *Pac. Mut. Life Ins. Co. v. Haslip*, 499 U.S. 1, 23–24 (1991)). But there are "no rigid benchmarks that a punitive damages award may not surpass" and greater ratios might "comport with due process where 'a particularly egregious act has resulted in only a small amount of economic damages.'" *Id.* (quoting *Gore*, 517 U.S. at 582).

Here, the jury awarded $5,267,634.10 in compensatory damages and $75 million (approximately 14.2 times the compensatory amount) in punitive damages. But Monsanto's conduct—though plausibly viewed as reprehensible—was not "particularly egregious" as to warrant a damages ratio above the single-digit range, especially considering the absence of evidence showing a *known* safety risk was intentionally concealed. *See id.* Thus, we have little trouble holding that the jury's 14.2 to 1 ratio violated due process.

The $5,267,634.10 compensatory damages award was substantial. *See, e.g.*, *Ramirez v. TransUnion LLC*, 951 F.3d 1008, 1037 (9th Cir. 2020), *cert. granted in part on other grounds*, No. 20-297, 2020 WL 7366280 (U.S. Dec. 16, 2020) (describing $8 million compensato-

ry damages award as "quite substantial"); *Lompe*, 818 F.3d at 1069 ("[C]ompensatory damages have often been considered 'substantial' when they are over $1,000,000."). "When compensatory damages are substantial, then a lesser ratio, perhaps only equal to compensatory damages, can reach the outermost limit of the due process guarantee." *State Farm*, 538 U.S. at 425. But "*State Farm*'s 1:1 compensatory to punitive damages ratio is not binding, no matter how factually similar the cases may be." *Hangarter v. Provident Life & Accident Ins. Co.*, 373 F.3d 998, 1014 (9th Cir. 2004). Considering these precedents, we have held that "[i]n cases where there are significant economic damages and punitive damages are warranted but behavior is not particularly egregious, a ratio of up to 4 to 1 serves as a good proxy for the limits of constitutionality." *Planned Parenthood*, 422 F.3d at 962.

Even though "substantial" compensatory damages were awarded here, the evidence justifies a damages ratio higher than 1 to 1. Monsanto intentionally downplayed and ignored calls to test Roundup's carcinogenic risks, and the jury determined that Roundup caused Hardeman's cancer. Coupled with the physical damage—cancer—these factors suggest a damages ratio up to 4 to 1 "serves as a good proxy for the limits of constitutionality." *Id.*; *see State Farm*, 538 U.S. at 425 ("The precise award in any case, of course, must be based upon the facts and circumstances of the defendant's conduct and the harm to the plaintiff.").

3

Third, the district court speculated that fines for failure to warn of a product's risk under FIFRA and the California Health and Safety Code could potentially "over time[] become quite high" because "both state

and federal law calculate penalties per violation." *In re Roundup*, 385 F. Supp. 3d at 1048; *see also* 7 U.S.C. § 136j(a)(1)(E); 40 C.F.R. § 19.4; Cal. Health & Safety Code § 25249.7. We note the need to avoid speculation in analyzing this factor. *See State Farm*, 538 U.S. at 428 (rejecting consideration of speculative future penalties unrelated to plaintiffs' harm). The parties failed below, and again on appeal, to explain what the relevant civil fines are, how they would be calculated, and even whether they would be warranted. *See In re Roundup*, 385 F. Supp. 3d at 1048. Monsanto points out, however, that no civil or criminal fines have been imposed, apparently by any federal or any state agency, including California.

Though California in 2017 categorized glyphosate as a chemical known to the state to cause cancer, *see* Glyphosate Proposition 65, it is also not clear that Monsanto would have been subject to civil fines under California law in 2012. Because neither party presents argument or evidence, we agree with the district court that this guidepost is not "particularly helpful here." *See id.* at 1048 ("[A]bsent an explanation from either party about how these penalties would be calculated, it is difficult to use them as a benchmark.").

* * *

We hold that the jury's $75 million punitive damages award was "grossly excessive" given the mitigating factors found by the district court. *See State Farm*, 538 U.S. at 416. Considering the evidence of reprehensibility, however, we hold that the district court's reduced $20 million punitive damages award (a 3.8 to 1 damages ratio), while at the outer limits of constitutional propriety, ultimately comports with due process. *Planned Parenthood*, 422 F.3d at 962; *see also Ramirez*, 951

F.3d at 1037 (upholding 4 to 1 ratio where $8 million compensatory damages awarded).

Though we uphold the district court's $20 million punitive damages award, we emphasize that the award is "close to the line of constitutional impropriety." *See State Farm*, 538 U.S. at 425. Considering the number of cases pending in this Roundup multidistrict litigation, we recognize a smaller punitive damages award in other cases may safely satisfy due process concerns by still imposing the appropriate punishment and achieving the goals of deterrence and retribution. *Cf. Lompe*, 818 F.3d at 1065 ("The Supreme Court has instructed us to go 'no further' if a 'more modest punishment' for the 'reprehensible conduct' at issue 'could have satisfied the State's legitimate objectives' of punishing and deterring future misconduct." (quoting *State Farm*, 538 U.S. at 419–20)); *see, e.g.*, *Johnson v. Monsanto Co.*, 266 Cal. Rptr. 3d 111, 129 (Ct. App. 2020), *as modified on denial of reh'g* (Aug. 18, 2020), *review denied* (Oct. 21, 2020) (reducing punitive damages award in a Roundup case to a 1 to 1 ratio with compensatory damages of $10.3 million and where facts of Monsanto's reprehensibility were likely stronger than this case).

VIII

We are aware this appeal involves a bellwether trial with potentially thousands of federal cases to follow. But many of our holdings are fact-specific. Different Roundup cases may present different considerations, leading to different results. For example, were there evidence that EPA took certain enforcement action against Monsanto after a cancer warning was added to Roundup's label, perhaps the preemption analysis would lead to a different outcome. And while our holding that expert testimony was admissible here may be

applicable to other Roundup cases, much of this expert testimony was unique to Hardeman's specific case. Thus, it would not be unreasonable for the district court to revisit the admissibility of expert testimony based upon the facts raised in future cases. Similarly, despite the punitive damages upheld here, a smaller punitive damages award in future cases may better comport with due process. Ultimately, we agree that the district court in this case either reached the correct result or need not be reversed.

AFFIRMED.

N.R. SMITH, Circuit Judge, dissenting to section VII.B.

After a *mandated* de novo review of the district court's punitive damages award, determining if the amount was constitutionally excessive (not simply determining whether the award was acceptable or reasonable), I must dissent. Let me explain.

Punitive damages are "'quasi-criminal,' operat[ing] as 'private fines' intended to punish the defendant and to deter future wrongdoing." *Cooper Indus., Inc. v. Leatherman Tool Grp., Inc.*, 532 U.S. 424, 432 (2001) (quoting *Pacific Mut. Life Ins. Co. v. Haslip*, 499 U.S. 1, 19 (1991)). "Exacting appellate review ensures that an award of punitive damages is based upon an 'application of law, rather than a decisionmaker's caprice.'" *State Farm Mut. Auto. Ins. Co. v. Campbell*, 538 U.S. 408, 418 (2003). As the majority has stated, "the Supreme Court has instructed us to go 'no further' if a 'more modest punishment' for the 'reprehensible conduct' at issue 'could have satisfied the State's legitimate objectives' of punishing and deterring future misconduct." *Lompe v. Sunridge Partners, LLC*, 818 F.3d 1041, 1065 (10th Cir. 2016) (quoting *State Farm*, 538 U.S. at 419–20). In order to determine de novo whether the punishment is "grossly excessive," the Supreme Court requires us "to consider three guideposts: (1) the degree of reprehensibility of the defendant's misconduct; (2) the disparity between the actual or potential harm suffered by the plaintiff and the punitive damages award; and (3) the difference between the punitive damages awarded by the jury and the civil penalties authorized or imposed in comparable cases." *State Farm*, 538 U.S. at 417–18. Of course, we always defer to the district court's findings of fact unless they are clearly erroneous. *Cooper Indus.*, 532 U.S. at 440 n.14.

The district court made the following findings of fact, upon which one must make the analysis:

a. The jury found it was more likely than not that Roundup (the glyphosate therein) was a "substantial factor" in causing Hardeman's NHL. In order to evidence that Roundup was a substantial factor in this cause, Hardeman's experts only performed a differential diagnosis. Differential diagnosis is a methodology by which a physician "rules in" all potential causes of a disease, "rules out" those for "which there is no plausible evidence of causation, and then determines the most likely cause among those that cannot be excluded."

b. NHL is a cancer that affects white blood cells in the immune system. Approximately 70% or more of the NHL cases are idiopathic, meaning they develop for unknown reasons. However, some causes of NHL, such as hepatitis C (HCV), are well established. Hardeman had HCV for 25 to 40 years before developing NHL.

c. Hardeman was diagnosed with NHL in early 2015. He started using Roundup in the 1980s but ended his use in 2012. During the time Hardeman was using Roundup, the scientific landscape (of whether it could cause cancer) was more favorable to Monsanto than at the time of trial. In 2012, EPA had little to no evidence that glyphosate was at all carcinogenic in humans. Not until 2015 did the International Agency for Research on Cancer ("IARC") suggest that

glyphosate was probably carcinogenic to humans.

d. Even today, there is credible evidence on both sides with regard to whether glyphosate causes NHL as documented by the repeated approvals of glyphosate by EPA, the European Chemicals Agency, Health Canada, and other worldwide regulatory agencies.

e. There is no evidence that Monsanto was in fact aware that glyphosate caused cancer; that Monsanto concealed it from EPA; or that Monsanto somehow had "captured" those in EPA, such that EPA would not take a position contrary to Monsanto.

f. The record at best shows that Monsanto knew Roundup might cause cancer but made minimal efforts to determine whether the scientific evidence (finding glyphosate may cause NHL) was accurate.

g. However, Monsanto did attack or undermine those who raised concerns for Roundup's safety.

h. Monsanto has sold Roundup without a warning label.[1]

i. The award of future noneconomic damages was not based on physical pain or impairment but was limited to "anxiety, mental

[1] The district court noted that Monsanto continues to sell Roundup without a warning label. However, "the conduct that harmed [plaintiff] is the only conduct relevant to the reprehensibility analysis." *State Farm*, 538 U.S. at 424.

suffering, loss of enjoyment of life, emotional distress, and inconvenience."

j. Hardeman's NHL is now in remission, his prognosis is "very good" and it is "extremely unlikely" that his NHL will return.

See In re Roundup Prod. Liab. Litig., 385 F. Supp. 3d 1042, 1047 (N.D. Cal. 2019).

1. The degree of reprehensibility of Monsanto's conduct.

Considering each of the three guideposts, the degree of reprehensibility is "[t]he most important indicium of the reasonableness of a punitive damages award." *See State Farm*, 538 U.S. at 419. The degree of reprehensibility is determined by considering (1) "the harm caused was physical as opposed to economic"; (2) "the tortious conduct evinced an indifference to or a reckless disregard of the health or safety of others"; (3) the target of the conduct had financial vulnerability"; (4) "the conduct involved repeated actions or was an isolated incident"; and (5) "the harm was the result of intentional malice, trickery, or deceit, or mere accident." *Id.* Applying the facts (as determined by the district court) de novo to these five considerations, Monsanto's conduct from the 1980s to 2012 did not constitute the degree of "reprehensible conduct" that would warrant an award of punitive damages at a 3.8:1 ratio. *See id.* Reviewing these five considerations instead demonstrates a low degree of reprehensibility.

First, while Hardeman suffered from physical harm (NHL), he was well compensated for it by the jury. Importantly, the physical harm suffered was not based on acts or threats of violence, *see Florez v. Delbovo*, 939 F. Supp. 1341, 1348 (N.D. Ill. 1996) (explaining that

"acts of violence or threats of bodily harm" are "the most reprehensible" (citing *BMW of N. Am., Inc. v. Gore*, 517 U.S. 559, 575 (1996)), or "from some physical assault or trauma," *see State Farm*, 538 U.S. at 426. Further, (as demonstrated below) Monsanto did not engage in deliberate conduct to exploit Hardeman and expose him to a risk of cancer. *Cf. Bullock v. Philip Morris USA, Inc.*, 131 Cal. Rptr. 3d 382, 396 (Ct. App. 2011) (concluding "that in a case involving physical harm, the physical or physiological vulnerability of the target of the defendant's conduct is an appropriate factor to consider in determining the degree of reprehensibility, particularly if the defendant deliberately exploited that vulnerability").

Second, one must determine whether Monsanto's conduct evinced "indifference to or a reckless disregard of the health or safety of others." *State Farm*, 538 U.S. at 419. In California, Hardeman had to demonstrate that Monsanto "had been guilty of oppression, fraud, or malice," in order to be awarded punitive damages from Monsanto. Cal. Civ. Code § 3294(a). Section 3294(c)(1) outlines that Monsanto's conduct must have been undertaken "with a willful and conscious disregard of the rights or safety of others." A conscious disregard "requires that the defendant have actual knowledge of the risk of harm it is creating and, in the face of that knowledge, fail[ed] to take steps it kn[ew would] reduce or eliminate the risk of harm." *Ehrhardt v. Brunswick, Inc.*, 231 Cal. Rptr. 60, 65 (Ct. App. 1986). Given this standard, although ignoring evidence that Roundup might cause cancer could be substantial evidence to establish punitive damages against Monsanto, there was and still exists "credible evidence on both sides of the debate" about whether Roundup actually does cause cancer. During the time that Hardeman used Roundup,

the evidence was scant that Roundup may cause cancer, but Monsanto did disregard it. However, its conduct does not demonstrate (nor did the court find) that Monsanto intentionally targeted Hardeman.

Third, there is no evidence in the record that the target of the conduct (Hardeman) had financial vulnerability. *See Clark v. Chrysler Corp.*, 436 F.3d 594, 604 (6th Cir. 2006) ("The financial vulnerability of a target is particularly relevant when the harm inflicted is economic in nature."). The wealth of Monsanto cannot justify an award of punitive damages absent a connection of its "financial resources and the physical injury suffered" by Hardeman. *See id.*

Fourth, Monsanto's failure to place a warning on Roundup's label does not constitute "repeated actions."[2] *See Gore*, 517 U.S. at 577. "[E]vidence that a defendant has repeatedly engaged in prohibited conduct while knowing or suspecting that it was unlawful would provide relevant support for an argument that strong medicine is required to cure the defendant's disrespect for the law." *Id.* at 576–77. At the time Hardeman used the product, Monsanto was not engaging in unlawful conduct. At that time, EPA had little to no evidence that glyphosate was carcinogenic in humans. In fact (again), there is credible evidence (to this day) on both sides with regard to whether glyphosate causes NHL. Notably, IARC did not decide to classify glyphosate as "probably carcinogenic to humans" until 2015 (three years after Hardeman stopped using Roundup). *See In re Roundup Prod. Liab. Litig.*, 385 F. Supp. 3d at 1047. Further, after California's passage of Proposition 65 (requiring a warning label for glypho-

[2] As previously noted, the district court seems to rely on conduct that occurred post 2012 in determining the reprehensibility.

sate), Michael L. Goodis, EPA, Office of Pesticide Programs, sent a letter to registrants (like Monsanto) challenging Proposition 65 as contrary to "EPA's determination that glyphosate is 'not likely to be carcinogenic to humans.'" *Proposed Interim Registration Review* at 11. The letter charged that the Proposition 65 warning was a "false and misleading statement" and violated the Federal Insecticide, Fungicide, and Rodenticide Act ("FIFRA").

Fifth, Monsanto did not act with "intentional malice, trickery, or deceit." *See State Farm*, 538 U.S. at 419. As the district court found, Monsanto acted with indifference, but Monsanto did not engage in intentional acts, trickery, or deceit.[3] *See Williams v. First Advantage LNS Screening Sols. Inc*, 947 F.3d 735, 754 (11th Cir. 2020) (concluding that "[a]t worst, Defendant acted recklessly, but without any intent to harm Plaintiff"). In fact, Monsanto's actions were not contrary to "government regulations." *See Johnson & Johnson Talcum Powder Cases*, 249 Cal. Rptr. 3d 642, 678 (Ct.

[3] Even the majority does not conclude that Monsanto acted with "intentional malice, trickery, or deceit." *See* Maj. Op. 53. Rather, it describes Monsanto's conduct as "malice." *Id.* at 56. However, "malice," as found by the district court, means a "conscious disregard of the rights or safety of others." *See In re Roundup Prod. Liab. Litig.*, 385 F. Supp. 3d at 1046 (quoting Cal. Civ. Code § 3294(c)(1)). Thus, there is no evidence that the harm suffered by Hardeman was the "result of intentional malice"; Monsanto did not "*intend*[] to cause injury" to Hardeman. *See Gober v. Ralphs Grocery Co.*, 40 Cal. Rptr. 3d 92, 106 (Ct. App. 2006). Nevertheless, despite a lack of evidence of this "important criterion," the majority still concludes that a punitive damages award at outer constitutional boundaries for this case of significant compensatory damages was appropriate. *See Rhone-Poulenc Agro, S.A. v. DeKalb Genetics Corp.*, 345 F.3d 1366, 1371 (Fed. Cir. 2003) (noting that this "factor has become an important criterion of what the Constitution accepts as reprehensible conduct").

App. 2019), *review denied* (Oct. 23, 2019). Although compliance with regulations cannot "eviscerate a claim for punitive damages," *id.*, it does evidence that the harm "was [not] the result of intentional malice, trickery, or deceit," *State Farm*, 538 U.S. at 419. As the district court found, the association between Roundup and NHL "remains under scientific investigation" and there was no evidence of intentional acts on the part of Monsanto. *Id.; cf. Satcher v. Honda Motor Co.*, 52 F.3d 1311, 1316–17 (5th Cir. 1995) (precluding punitive damages when there was a genuine dispute in the scientific community).

Lastly, in reviewing these considerations, "some wrongs are more blameworthy than others," such as "violence," "trickery and deceit," or "intentional malice" and are more deserving of a higher punitive damages ratio. *See Gore*, 517 U.S. at 575. We have suggested that this "hierarchy of reprehensibility" starts "with acts and threats of violence … , followed by acts taken in reckless disregard for others' health and safety, affirmative acts of trickery and deceit, and finally, acts of omission and mere negligence." *Swinton v. Potomac Corp.*, 270 F.3d 794, 818 (9th Cir. 2001) (citation and quotation marks omitted). Thus, "[i]n order to justify a substantial punitive damage award, a plaintiff ordinarily must prove that the defendants' conduct falls at the upper end of the blameworthiness continuum, or, put another way, that the conduct reflects a high level of culpability." *Zimmerman v. Direct Fed. Credit Union*, 262 F.3d 70, 82 (1st Cir. 2001).

No review of these considerations reflects "a high level of culpability." *Id.* Thus, Monsanto's low degree of reprehensibility cannot constitutionally justify the district court's substantial punitive damages award.

2. The disparity between harm suffered and punitive damages award.

"The second and perhaps most commonly cited indicium of an unreasonable or excessive punitive damages award is its ratio to the actual harm inflicted on the plaintiff." *Gore*, 517 U.S. at 580. In determining punitive damages for each case, the Supreme Court has outlined that "the precise award" of such damages "must be based upon the facts and circumstances of the defendant's conduct and the harm to the plaintiff." *State Farm*, 538 U.S. at 425. Although the Court has not drawn a "bright-line ratio" for punitive damages, the Court's jurisprudence suggests "that, in practice, few awards exceeding a single digit-ratio between punitive and compensatory damages, to a significant degree, will satisfy due process." *Id.* "A higher ratio may … be justified in cases" where (1) "the injury is hard to detect," (2) "the monetary value of noneconomic harm might have been difficult to determine," or (3) "a particularly egregious act has resulted in only a small amount of [compensatory] damages." *Gore*, 517 U.S. at 582. The Court then clarified the outer boundaries for such an award: "an award of more than four times the amount of compensatory damages might be close to the line of constitutional impropriety." *Id.* However, it also emphasized an outermost limit in making such an award, stating "when compensatory damages are substantial, then a lesser ratio [less than 4:1], perhaps only equal to compensatory damages, can reach the *outermost limit of the due process guarantee*." *Id.* (emphasis added).

The compensatory damages in this case are substantial ($5,267,634.10) and the reasons to justify a higher ratio do not exist. Thus, a punitive damages amount equal to compensatory damages reaches the Supreme Court's outermost limit for punitive damages.

The California Supreme Court provides further guidance, especially focusing on a case where there is a relatively low reprehensibility. It said that "a ratio of one to one might be the federal constitutional maximum in a case involving … relatively low reprehensibility and a substantial award of noneconomic damages: 'When compensatory damages are substantial, then a lesser ratio, *perhaps only equal to compensatory damages*, can reach the outermost limit of the due process guarantee.'" *Roby v. McKesson Corp.*, 219 P.3d 749, 769 (Cal. 2009) (quoting *State Farm*, 538 U.S. at 425). In this case, the district court reduced the jury's 14.2:1 punitive damages award to nearly a 4:1 ratio, which is generally reserved for a higher degree of reprehensible conduct. *Id.* Monsanto's conduct here did not include (1) acts or threats of violence; or (2) acts of trickery or deceit, evidencing a low degree of reprehensibility.

Even in a case that involved conduct that was highly reprehensible, the California Court of Appeal concluded that "the permissible ratio of punitive to compensatory damages" should be reduced when the noneconomic damages "appear[ed] to include a punitive component." *See Bankhead v. ArvinMeritor, Inc.*, 139 Cal. Rptr. 3d 849, 866–67 (Ct. App. 2012) (allowing punitive damages award at a 2.4:1 ratio). The Supreme Court agrees. *See State Farm*, 538 U.S. at 425–26, 429 (explaining that "in light of the substantial compensatory damages awarded (a portion of which contained a punitive element), a punitive damages award at or near the amount of compensatory damages" was justified).

The jury awarded substantial past and future noneconomic damages totaling $5,066,667, which contain a punitive element. The district court recognized this fact when it noted that the $2,000,000 in future noneconomic damages was "borderline," because it was

"somewhat difficult to rationalize the conclusion that the suffering he will face is, effectively, two-thirds of the suffering he has already endured." *In re Roundup Prod. Liab. Litig.* 385 F. Supp. 3d. at 1045. Thus, a punitive damages award of 3.8:1 exceeded the constitutionally permissible limits. *See State Farm*, 538 U.S. at 425; *Roby*, 219 P.3d at 769. The ratio of punitive damages should be reduced to a 1:1 ratio. *See id.*

3. The difference between the punitive damages awarded and the civil penalties authorized or imposed in similar cases.

The third guidepost also supports punitive damages equal to the compensatory damages award. Sanctions for comparable misconduct can be determined by either the "civil or criminal penalties that could be imposed for comparable misconduct," *Gore*, 517 U.S. at 583, or "the existence of other civil awards against the defendant for the same conduct," *Haslip*, 499 U.S. at 22; *see also Ismail v. Cohen*, 899 F.2d 183, 186 (2d Cir. 1990) ("Reference to other awards in similar cases is proper.").

One has difficulty comparing civil or criminal penalties with this punitive damages award. During the time Hardeman used Roundup, there were no federal or state criminal or civil penalties for Monsanto's conduct. Neither the federal government nor the State of California had imposed any penalties for the possibility that glyphosate may cause cancer.[4] Although Monsanto's

[4] Criminal and civil penalties may be imposed under federal and state law. *See* 7 U.S.C. §§ 136j(a)(1)(E), 136l(a)(1); 40 C.F.R. § 19.4; Cal. Health & Safety Code §§ 25249.6, 25249.7(a). Under federal law, civil penalties may be assessed up to $5,000 for each offense. 7 U.S.C. § 136*l*(a)(1); *see also* 40 C.F.R. § 19.4 (2012). Criminal penalties may result in either imprisonment of one year, a $50,000 fine, or both. *Id.* § 136*l*(b)(1). California law imposes a

conduct following the harm can be considered in setting the punitive damages award, *see Johnson & Johnson Talcum Powder Cases*, 249 Cal. Rptr. 3d at 678, California did not list glyphosate as a chemical known to cause cancer until 2017.[5] It is similarly difficult to determine how the federal government or California would apply or calculate fines (which is probably one of the reasons neither party really addressed this issue).

Comparing this case to the only other litigated case against Monsanto regarding the sale of Roundup supports a 1:1 ratio. *See Johnson v. Monsanto Co.*, 266 Cal. Rptr. 3d 111, 135 (Ct. App. 2020). In *Johnson*, the plaintiff developed cancer in 2014 after using Roundup. *Id.* at 116–17. Johnson sought damages, based on Monsanto's knowledge regarding Roundup's carcinogenicity. *Id.* at 117. Reviewing the evidence, the district court reduced compensatory damages to $10,253,309.32 and awarded punitive damages at a 1:1 ratio. *Id.* at 129. The damages awarded (for essentially "the same conduct") in *Johnson* provide a worthy comparison in assessing the constitutionality of this punitive damages award. *See Haslip*, 499 U.S. at 22; *see also* Restatement (Second) of Torts § 908 cmt. e (1979) (noting that "[i]t seems appropriate to take into consideration both the punitive damages that have been awarded in prior suits and those that may be granted in the future, with greater weight being given to the prior awards").

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civil penalty up to $2,500 per day for each violation. Cal. Health & Safety Code § 25249.7(a).

[5] California Health & Safety Code section 25249.6 prohibits any "person in the course of doing business [from] knowingly and intentionally expos[ing] any individual to a chemical known to the state to cause cancer or reproductive toxicity without first giving clear and reasonable warning to such individual."

Finally, our sister circuits have come to similar conclusions when dealing with substantial compensatory damages (even when the conduct is highly reprehensible). For example, in *Boerner v. Brown & Williamson Tobacco Co.*, the Eighth Circuit concluded that, despite American Tobacco's "highly reprehensible" conduct, the "punitive damages award [of $15,000,000] [wa]s excessive when measured against the substantial compensatory damages award [of $4,025,000]." 394 F.3d 594, 603 (8th Cir. 2005). Thus, it "conclude[d] that a ratio of approximately 1:1 would comport with the requirements of due process." *Id.*; *Saccameno v. U.S. Bank Nat'l Ass'n*, 943 F.3d 1071, 1090 (7th Cir. 2019), *cert. denied sub nom. Saccameno v. Ocwen Loan Servicing, LLC*, 140 S. Ct. 2674 (2020) (holding that "a considerable compensatory award for the indifferent, not malicious, mistreatment" and evidence that the "award reflects emotional distress damages that 'already contain [a] punitive element'" "should not exceed 1:1"); *Bridgeport Music, Inc. v. Justin Combs Pub.*, 507 F.3d 470, 490 (6th Cir. 2007) ("Given the large compensatory damages award of $366,939, a substantial portion of which contained a punitive element, and the low level of reprehensibility of defendants' conduct, a ratio of closer to 1:1 or 2:1 is all that due process can tolerate in this case."); *see also Clark*, 436 F.3d at 607 (holding that "because the compensatory damage award here is not particularly large, a 1:1 ratio is inappropriate. But due to the lack of several of reprehensibility factors, any ratio higher than 2:1 is unwarranted").

4. Conclusion:

I start where I began. Because we are mandated to review de novo the district court's award of punitive damages, one must undertake the review. In light of the three guideposts, the district court's $20,000,000

punitive damages award exceeds the line of constitutionality. The facts found by the district court do not support a 3.8:1 ratio to compensatory damages. Most notably, Monsanto's conduct is not particularly reprehensible in light of the ongoing scientific debate. The compensatory damages are substantial; thus, punitive damages in an amount equal to compensatory damages reaches the outermost limit of the due process guarantee. Criminal and civil penalties and punitive damages awarded in other cases do not suggest a higher award. We then should go no further; this punishment will satisfy the State's legitimate objectives for imposing such damages.

APPENDIX B

UNITED STATES DISTRICT COURT
NORTHERN DISTRICT OF CALIFORNIA

MDL No. 2741
Case No. 16-md-02741-VC

IN RE: ROUNDUP PRODUCTS LIABILITY LITIGATION

This document relates to: ALL ACTIONS
Filed March 7, 2019

PRETRIAL ORDER NO. 101: ORDER RE MONSANTO'S MOTION FOR SUMMARY JUDGMENT ON NON-CAUSATION GROUNDS

Beyond its motion for summary judgment on causation, Monsanto moved for summary judgment against the three bellwether plaintiffs on four other grounds. Specifically, Monsanto contended that: (i) the plaintiffs' claims are expressly preempted by federal law; (ii) the plaintiffs' claims are impliedly preempted; (iii) the evidence is insufficient to support a jury verdict for the plaintiffs on their failure-to-warn claims; and (iv) the evidence is insufficient to support a punitive damages award. The Court previously informed the parties that Monsanto's motion on these issues would be denied; this ruling now explains why.

Monsanto also seeks summary judgment against one specific plaintiff, Gebeyehou, for the additional reason that his claims are barred by the statute of limitations. The Court will rule on that motion following the completion of supplemental briefing.

I.

The Court previously rejected Monsanto's argument that the plaintiffs' failure-to-warn claims are expressly preempted by the Federal Insecticide, Fungicide, and Rodenticide Act. *See Hardeman v. Monsanto Co.*, 216 F. Supp. 3d 1037, 1038-39 (N.D. Cal. 2016). States are permitted to impose their own pesticide labeling requirements as long as those requirements are not "in addition to or different from" those mandated by FIFRA. 7 U.S.C. § 136v(b). Thus, state labeling schemes that are "equivalent to, and fully consistent with, FIFRA's misbranding provisions" do not run afoul of preemption. *Bates v. Dow Agrosciences LLC*, 544 U.S. 431, 447 (2005). As relevant here, FIFRA requires manufacturers to provide a warning that "may be necessary and if complied with ... is adequate to protect health." 7 U.S.C. § 136(q)(1)(G). California law—which asks whether a risk is known or knowable (for strict liability) or reasonably should have been known (for negligence)—is consistent with this requirement. *See Hardeman*, 216 F. Supp. 3d at 1038; *see also Conte v. Wyeth, Inc.*, 168 Cal. App. 4th 89, 101-02 (2008).

Monsanto now raises a different express preemption theory: it contends that FIFRA requires that a label provide warnings only for "widespread and commonly recognized" uses of a product, while California law imposes a broader requirement to warn of risks from any use that is "reasonably foreseeable." Monsanto's argument reflects a misreading of the statute. The phrase "widespread and commonly recognized" comes not from the misbranding provision, § 136(q)(1)(G), but rather from the cross-referenced registration provision, § 136a(d). When determining whether a pesticide should be registered for restricted versus general use, the EPA must consider the effects a pesticide will have

"when applied in accordance with its directions for use, warnings and cautions and for the uses for which it is registered, or for one or more of such uses, or in accordance with a *widespread and commonly recognized* practice." 7 U.S.C. §§ 136a(d)(1)(B), (C) (emphasis added). But while a label must specify a product's use classification, nothing in the statute suggests that warnings should be limited to those relevant to the "widespread and commonly recognized" uses of a product. *See* 40 C.F.R. § 156.10(a)(1)(ix). Indeed, FIFRA's misbranding provision states that labels must include health warnings "*together with* any requirements imposed under section 136a(d)." 7 U.S.C. § 136(q)(1)(G) (emphasis added). California law is not preempted by the additional federal requirement that pesticide labels specify their use classification.

II.

Monsanto argues that even if the plaintiffs' claims are not expressly preempted, they are barred under the doctrine of impossibility preemption. Relying on a trio of cases involving the Federal Food, Drug, and Cosmetic Act, Monsanto contends that the plaintiffs' warning and design defect claims are preempted because Monsanto cannot change Roundup's label or design without first obtaining approval from the EPA. *See Mut. Pharm. Co. v. Bartlett*, 570 U.S. 472 (2013); *PLIVA, Inc. v. Mensing*, 564 U.S. 604 (2011); *Wyeth v. Levine*, 555 U.S. 555 (2009). In the event the plaintiffs prevail, Monsanto believes it will be trapped between a state obligation not to sell the existing version of Roundup and a federal obligation not to sell an altered version of Roundup without prior agency approval. *See Mut. Pharm. Co.*, 570 U.S. at 480 (explaining that "the Court has found state law to be impliedly pre-empted where it is 'impossible for a private party to comply

with both state and federal requirements'" (quoting *English v. Gen. Elec. Co.*, 496 U.S. 72, 79 (1990))).

To begin, Monsanto's implied preemption theory is difficult—if not impossible—to square with *Bates v. Dow Agrosciences LLC*, 544 U.S. 431 (2005). *See Ansagay v. Dow Agrosciences LLC*, 153 F. Supp. 3d 1270, 1281-82 (D. Haw. 2015). In *Bates*, the Supreme Court outlined the scope of FIFRA's express preemption provision with respect to state failure-to-warn claims, and further held that FIFRA did not preempt state claims for defective design and breach of warranty. Although the decision centered on the scope of FIFRA's express preemption provision, the implied preemption question was also before the court. *See* Brief for Respondent, *Bates v. Dow Agrosciences LLC*, 544 U.S. 431 (2005) (No. 03-388), 2004 WL 2758217, at *36; *see also Ansagay*, 153 F. Supp. 3d at 1281-82. Moreover, in reversing the lower court's conclusion that the plaintiffs' claims had been preempted, the Court necessarily rejected the possibility of implied preemption. *See Bates*, 544 U.S. at 459 (Thomas, J., concurring in part and dissenting in part) (noting that the majority decision "comports with th[e] Court's increasing reluctance to expand federal statutes beyond their terms through doctrines of implied pre-emption").

Even if not foreclosed by *Bates*, Monsanto's argument fails on the merits. In relying on a line of FDCA cases, Monsanto elides a critical aspect of FIFRA's statutory scheme: FIFRA allows states to regulate or ban pesticides that have been federally approved. 7 U.S.C. § 136v(a); *see also Bates*, 544 U.S. at 446 (noting that "a state agency may ban the sale of a pesticide if it finds, for instance, that one of the pesticide's label-approved uses is unsafe"). Monsanto acknowledges this fact, but nevertheless argues that while California can

ban Roundup, it cannot impose any duties that might indirectly prevent Monsanto from selling Roundup in California (even temporarily). *See Mut. Pharm. Co.*, 570 U.S. at 488 (noting, in the context of the FDCA, "that an actor seeking to satisfy both his federal- and state-law obligations it not required to cease acting altogether in order to avoid liability"). But if California can stop Monsanto from selling Roundup entirely, surely it can impose state-law duties that might require Monsanto to seek EPA approval before selling an altered version of Roundup in California. By contrast, nothing in the FDCA allows a state to ban a drug. *See Zogenix, Inc. v. Patrick*, No. 14-11689-RWZ, 2014 WL 1454696, at *2 (D. Mass. Apr. 15, 2014) (concluding that if the State "were able to countermand the FDA's determinations and substitute its own requirements, it would undermine the FDA's ability to make drugs available to promote and protect the public health"); *cf. PLIVA, Inc.*, 564 U.S. at 626 (refusing to "distort the Supremacy Clause in order to create similar preemption across a dissimilar statutory scheme").

III.

Putting aside preemption, Monsanto argues that it is entitled to summary judgment on the failure-to-warn claim because the plaintiffs have failed to present "competent evidence" that any risk from glyphosate was "known or knowable" by the scientific community at the time the plaintiffs used Roundup. *See Valentine v. Baxter Healthcare Corp.*, 68 Cal. App. 4th 1467, 1483-84 (1999). Monsanto relies almost entirely on the epidemiological data to make this claim. Even granting Monsanto's argument that epidemiology provides the most reliable evidence of causation, it is certainly not the only evidence of causation in this case. Moreover, the epidemiology is far from undisputed. To take just

one example, the De Roos (2003) study supports a conclusion that glyphosate is a risk factor for NHL, yet Monsanto fails to mention it in its motion. Monsanto cannot prevail on a motion for summary judgment by simply ignoring large swaths of evidence.

It is difficult to see how there could be no evidence that the risks of glyphosate were "knowable" given the Court's denial of Monsanto's motion to exclude the plaintiffs' causation experts. Of course, the *Daubert* causation inquiry is not identical to the question of whether there was a "known or knowable" risk from glyphosate. But the Court previously determined that the plaintiffs' experts offered reliable opinions that glyphosate causes NHL, and they did so relying almost entirely on scientific evidence that existed when the plaintiffs were using Roundup. Moreover, the plaintiffs have presented a great deal of evidence that Monsanto has not taken a responsible, objective approach to the safety of its product. Thus, assuming a jury finding that Roundup causes NHL, there is sufficient evidence for the plaintiffs to argue that Monsanto could have reached this conclusion on its own had it investigated the issue responsibly and objectively.

IV.

For similar reasons, the plaintiffs presented sufficient evidence at summary judgment to support a punitive damages award against Monsanto. Although the evidence that Roundup causes cancer is quite equivocal, 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 concerns about the issue.

IT IS SO ORDERED.

Date: March 7, 2019 [handwritten signature]
Honorable Vince Chhabria
United States District Court

APPENDIX C

UNITED STATES DISTRICT COURT
NORTHERN DISTRICT OF CALIFORNIA

MDL No. 2741
Case No. 16-md-02741-VC

IN RE: ROUNDUP PRODUCTS LIABILITY LITIGATION

This document relates to: ALL ACTIONS
Filed February 24, 2019

PRETRIAL ORDER NO. 85: DENYING MONSANTO'S MOTION FOR SUMMARY JUDGMENT ON SPECIFIC CAUSATION

The Court previously denied Monsanto's motion for summary judgment on general causation, concluding that the opinions of the plaintiffs' experts were shaky but admissible. The question now is whether the plaintiffs have cleared the specific causation hurdle—that is, whether they have presented evidence from which a reasonable jury could conclude that exposure to glyphosate caused the non-Hodgkin's lymphoma of the three bellwether plaintiffs: Edwin Hardeman, Sioum Gebeyehou, and Elaine Stevick. To defeat Monsanto's motion for summary judgment on this issue, the plaintiffs must present at least one admissible expert opinion to support their specific causation argument. It is again a close question, but the plaintiffs have barely inched over the line. All three of the plaintiffs' specific causation experts may testify at trial, although, as dis-

cussed below, some aspects of their opinions will not be admitted.[1]

I.

The plaintiffs' specific causation experts use a "differential diagnosis" as the basis for their opinion that exposure to glyphosate caused these plaintiffs' NHL. A differential diagnosis is simply a framework for identifying the most probable cause of a disease.[2] *See Wendell v. GlaxoSmithKline LLC*, 858 F.3d 1227, 1234 (9th Cir. 2017). To conduct a differential diagnosis, a physician "rules in" all potential causes of a disease, "rules out" those for "which there is no plausible evidence of causation, and then determines the most likely cause among those that cannot be excluded." *Id.* The Ninth Circuit has repeatedly approved the use of a differential diagnosis under *Daubert*, provided, of course, that it is applied reliably. *See Clausen v. M/V New Carissa*, 339 F.3d 1049, 1057 (9th Cir. 2003). Monsanto does not dispute that the plaintiffs' experts may use a differen-

[1] This ruling presumes the reader is familiar with the experts' testimony and the Court's general causation ruling. *See In re Roundup Products Liability Litigation*, No. 16-md-02741-VC, 2018 WL 3368534 (N.D. Cal. July 10, 2018).

[2] It appears that courts have used the term "differential diagnosis" to describe two separate tasks: identifying a plaintiff's disease and identifying the cause of that disease. While differential diagnosis accurately describes the first task, differential etiology more accurately describes the latter. *See Tamraz v. Lincoln Elec. Co.*, 620 F.3d 665, 674 (6th Cir. 2010). Here, there is no dispute that all three plaintiffs have been accurately diagnosed with NHL. Because the operative question is what *caused* their NHL, the relevant analysis is a differential etiology, rather than a differential diagnosis. Nevertheless, in this ruling the Court will follow the parties and experts in this case (not to mention the terminology typically used in Ninth Circuit opinions) and stick with "differential diagnosis."

tial diagnosis as the basis for their opinions, but instead argues that both their "ruling in" and "ruling out" were unreliable.

A.

At the ruling-in stage, the question is "which of the competing causes are *generally* capable of causing the" disease. *Clausen*, 339 F.3d at 1057-58. And here, the Court already determined that the plaintiffs offered admissible expert opinions that glyphosate is capable of causing NHL. Thus, Monsanto's primary criticism of the ruling-in process—namely, that the specific causation experts improperly ruled in glyphosate exposure by cherry-picking favorable epidemiological studies—is off point. As this Court has previously ruled, the specific causation experts are permitted to build from the plaintiffs' admissible general causation opinions. And the admissible general causation opinions grappled with the full body of evidence. Thus, it does not matter that the specific causation experts mentioned only a subset of the epidemiological studies in their reports; at trial, their basis for ruling in glyphosate will be the general causation opinions. This result is the byproduct of the decision to bifurcate pretrial proceedings between general and specific causation—a decision that Monsanto urged.[3]

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[3] The plaintiffs' three specific causation experts are testifying from different postures. Dr. Andrei Shustov was not involved in the general causation proceedings, and his specific causation opinion is therefore the only one he has offered in this case. Dr. Chadhi Nabhan did offer a general causation opinion, but it was excluded on the basis that he failed to offer his own analysis of the relevant studies, instead relying excessively on IARC's conclusions. *See In re Roundup Products Liability Litigation*, 2018 WL 3368534, at *32-33. Dr. Dennis Weisenburger offered a general causation opinion that was admitted. *Id.* at *27-29.

On a related note, Monsanto complains that the specific causation experts ruled in glyphosate exposure as a risk factor without presenting epidemiological evidence that it has an adjusted odds ratio above 2.0. But the inquiry for this step of the differential diagnosis is whether a risk factor is a *potential* cause, not whether it is in fact the cause. *See Wendell*, 858 F.3d at 1234. Indeed, as discussed further in Section II of this ruling, there is not even a categorical requirement that an expert present a study identifying an adjusted odds ratio above 2.0 to justify a decision not to rule out a risk factor. And in any event, the general causation opinions on which the specific causation experts may build are based significantly on De Roos (2003), which reported an adjusted odds ratio of 2.1 with a 95% confidence interval of 1.1 to 4.0. *See generally In re Roundup Products Liability Litigation*, No. 16-md-02741-VC, 2018 WL 3368534, at *9 (N.D. Cal. July 10, 2018). The specific causation experts cite De Roos as well, but, again, the important point is that these experts will not be repeating the analysis of the general causation experts, but rather relying on them to rule in glyphosate.

B.

The next question is whether the experts adequately assessed all of the potential causes of the plaintiffs' NHL, and properly ruled out factors other than glyphosate, while at the same time declining to rule out glyphosate itself.

The biggest concern, which affects all three plaintiffs, is how the experts account for idiopathy—that is, the possibility that a plaintiff's NHL is attributable to an unknown cause. Imagine 100 people who develop NHL after using Roundup. Imagine further that they had no other significant risk factors for NHL. Assuming for ar-

gument's sake that the plaintiffs' general causation opinions are correct, glyphosate was a substantial factor in causing NHL for *some* of those 100 people. But the experts cannot automatically assume that glyphosate caused all 100 people's NHL. For some, the cause of their NHL may not be determinable with the degree of certainty necessary to prevail in court (perhaps because their exposure to glyphosate was just too low, or perhaps for some other reason). The question for any particular plaintiff, then, is whether there is evidence from which a jury could conclude by a preponderance of the evidence that the plaintiff falls into the category of people whose NHL was caused by glyphosate. To assist the jury in making this assessment, an expert must have a way to differentiate Roundup users who developed NHL because they used the product from Roundup users who would have developed NHL regardless.

One way for an expert to do this is to point to a biomarker or genetic signature associated with a particular risk factor. *See, e.g.*, *Henricksen v. ConocoPhillips Co.*, 605 F. Supp. 2d 1142, 1162 (E.D. Wash. 2009). But as the plaintiffs themselves note, that is not possible here, nor is there any evidence suggesting that NHL presents differently when caused by exposure to glyphosate. Under a strict interpretation of *Daubert*, perhaps that would be the end of the line for the plaintiffs and their experts (at least without much stronger epidemiological evidence). But in the Ninth Circuit, that is clearly not the case. *See Wendell*, 858 F.3d at 1233-37; *see also Messick v. Novartis Pharm. Corp.*, 747 F.3d 1193, 1198-99 (9th Cir. 2014). Recognizing that "[m]edicine partakes of art as well as science," the Ninth Circuit's recent decisions reflect a view that district courts should typically admit specific causation opinions that lean strongly toward the "art" side of the

spectrum. *Messick*, 747 F.3d at 1198; *see also Wendell*, 858 F.3d at 1237 ("The first several victims of a new toxic tort should not be barred from having their day in court simply because the medical literature, which will eventually show the connection between the victims' condition and the toxic substance, has not yet been completed." (quoting *Clausen*, 339 F.3d at 1060)). While the specific holdings of *Wendell* and *Messick* are in some ways distinguishable, particularly with respect to the rarity and specificity of the involved conditions, the opinions are impossible to read without concluding that district courts in the Ninth Circuit must be more tolerant of borderline expert opinions than in other circuits. *Compare In re Lipitor Mktg., Sales Practices and Prods. Liab. Litig.*, 892 F.3d 624, 644-45 (4th Cir. 2018); *Tamraz*, 620 F.3d at 677-78. Of course, district judges still must exercise their discretion, but in doing so they must account for the fact that a wider range of expert opinions (arguably much wider) will be admissible in this circuit.

Under Ninth Circuit caselaw, doctors enjoy wide latitude in how they practice their art when offering causation opinions. *See Wendell*, 858 F.3d at 1237 ("Where, as here, two doctors who stand at or near the top of their field and have extensive clinical experience with the rare disease or class of disease at issue, are prepared to give expert opinions supporting causation, we conclude that *Daubert* poses no bar based on their principles and methodology."). It is sufficient for a qualified expert, in reliance on his clinical experience, review of a plaintiffs' medical records, and evaluation of the general causation evidence, to conclude that an "obvious and known risk factor[]" is the cause of that plaintiff's disease. *See Wendell*, 858 F.3d at 1235. Here, the specific causation experts did that. Relying on the

plaintiffs' admissible general causation opinions—which assert a robust connection between glyphosate and NHL—the experts concluded that glyphosate was a substantial factor in causing the plaintiffs' NHL.

Moreover, the experts relied heavily on the plaintiffs' exposure levels in drawing their conclusions. All three experts noted the plaintiffs' extensive Roundup usage, and further explained—as did the plaintiffs' general causation opinions—that both the McDuffie (2001) and Eriksson (2008) studies showed a dose-response relationship between glyphosate and NHL. *See generally In re Roundup Products Liability Litigation*, 2018 WL 3368534, at *9-10. Thus, consistent with Ninth Circuit caselaw, the experts provided a basis for their conclusion that these plaintiffs fall into the category of Roundup users who developed NHL. The Court may be skeptical of their conclusions, and in particular of the assumption built into their opinions from the general causation phase about the strength of the epidemiological evidence. But their core opinions—that the plaintiffs had no other significant risk factors and were exposed to enough glyphosate to conclude that it was a substantial factor in causing their NHL—are admissible.[4]

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[4] There is another significant risk factor for Mr. Hardeman: hepatitis C. The experts explained that while active hepatitis C is a known risk factor for NHL, it was highly unlikely that Mr. Hardeman's development of NHL was attributable to his past hepatitis C infection almost a decade after he had a sustained virologic response—meaning the hepatitis C virus was no longer detected in his blood. While the experts could certainly have explored the hepatitis C issue with more rigor, including by providing a more comprehensive discussion of the possible mechanisms by which hepatitis C causes cancer and how it differs from pesticides in that respect, they had significant support in the scientific literature for their conclusion. Monsanto can certainly challenge their interpretation of the literature, but their underlying methodology was sound.

II.

During cross-examination at the *Daubert* hearings, Monsanto asked the plaintiffs' specific causation experts several hypothetical questions. These questions typically did not go directly to whether there was a sound basis for concluding that one of the plaintiffs' NHL was caused by glyphosate, but rather to whether the expert would maintain his conclusion if the plaintiffs' exposure was far less severe. In other words, returning to the previously-mentioned scenario of 100 NHL patients with glyphosate exposure but no other risk factors, how, precisely, would they draw the line between those whose NHL was caused by glyphosate and those whose NHL is idiopathic? The primary response of the plaintiffs' experts—which, as discussed above, falls within the range of admissible expert testimony—was that, however they draw the line, the exposure for these three plaintiffs was so significant that their NHL should not be considered idiopathic. When further pressed, however, these experts sometimes crossed into the realm of junk science. These aspects of their opinions will be excluded, unless of course Monsanto chooses to use them as impeachment material. *See Happel v. Walmart Stores, Inc.*, 602 F.3d 820, 825-26 (7th Cir. 2010) (holding that it was not an abuse of discretion for the district court to exclude a portion of expert testimony that it deemed unreliable); *Smith v. Ford Motor Co.*, 215 F.3d 713, 721 n.3 (7th Cir. 2000); *cf. Fortune Dynamic, Inc. v. Victoria's Secret Stores Brand Mgmt., Inc.*, 618 F.3d 1025, 1040-41 (9th Cir. 2010). To the extent the other witnesses intend to offer the same opinions, they are precluded from doing so as well.

First, Dr. Nabhan may not testify that the McDuffie and Eriksson studies stand for the proposition that if someone uses Roundup more than two days

per year or more than ten days in their lifetime, their risk of developing NHL doubles. *See* Feb. 4, 2018 Tr. [Nabhan] 251:06-20 [Dkt. No. 2672]. Because those studies did not adjust for the use of other pesticides, that statement is inaccurate, misleading, and untethered to any sound scientific method. *See In re Roundup Products Liability Litigation*, 2018 WL 3368534, at *26.[5] Relatedly, Drs. Nabhan and Shustov may not tes-

[5] A doubling of the risk is significant under California law because it shows a 50% chance that a specific factor was the cause of an individual's disease. *See Cooper v. Takeda Pharm. Am., Inc.*, 239 Cal. App. 4th 555, 593-94 (2015); *see also Daubert v. Merrell Dow Pharm., Inc.* ("*Daubert II*"), 43 F.3d 1311, 1321-22 (9th Cir. 1995). Accordingly, when a study shows a relative risk greater than 2.0, it can be used, on its own, "to prove that the product at issue was more likely than not responsible for causing a particular person's disease." *Cooper*, 239 Cal. App. 4th at 593. But California law does not categorically require a study showing a doubling of the risk before an expert can opine, based on the totality of the evidence, that a risk factor caused a plaintiff's disease. *Cf. Daubert II*, 43 F.3d at 1322 (noting that an expert can testify "*either* that [a product] actually caused plaintiffs' injuries" *or* that the product "more than doubled the likelihood of" those injuries) (emphasis added).

Although the parties speak of this issue in terms of *Daubert*, it is perhaps better understood as a question of the sufficiency of the evidence. As in any case, a plaintiff might be able to prove their case using one strong piece of evidence. Or they might be able to prove their case using multiple pieces of evidence, none of which could, on its own, satisfy the burden of proof. While a study showing a risk factor greater than 2.0 might itself be enough to submit a case to the jury (assuming the study is scientifically sound), there is no bright-line rule in California law requiring such evidence for a case involving medical causation to survive summary judgment. *Cf.* Restatement (Third) of Torts: Liability for Physical and Emotional Harm § 28 cmt. c(4) (2010) ("[A]ny judicial requirement that plaintiffs must show a threshold increase in risk or a doubling in incidence in a group study in order to satisfy the burden of proof of specific causation is usually inappropriate. So

tify that glyphosate is a substantial causative factor for anyone who exceeds two days per year or ten lifetime days of Roundup use, because that conclusion is again based on unadjusted data. *See* Feb. 4, 2018 Tr. [Nabhan] 253:13-254:05; 260:03-261:10 [Dkt. No. 2672]; Jan. 28, 2018 Tr. [Shustov] 213:21-214:02 [Dkt. No. 2635]. While they may rely on the general causation opinions to testify that the risk of NHL increases as exposure increases, it is not scientifically sound to quantify that risk and assign it to a particular plaintiff using the unadjusted numbers from McDuffie and Eriksson.

Nor may Dr. Weisenburger testify that Mr. Hardeman's risk of developing NHL more than doubled because he used Roundup far more than the threshold of ten lifetime days set by the Eriksson and McDuffie studies. Even putting aside the problems with unadjusted data, those studies simply do not support Dr. Weisenburger's assertion. Eriksson found an unadjusted odds ratio of 2.36 for those exposed to glyphosate for *more than* 10 lifetime days; McDuffie found an unadjusted odds ratio of 2.12 for those exposed to glyphosate for *more than* 2 days per year. Because neither study further delineated the subjects' level of exposure, those results do not show that someone who well exceeds the exposure threshold would necessarily have a higher odds ratio—as Dr. Weisenburger eventually acknowledged at the *Daubert* hearing in response to questions from the Court.

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long as there is adequate evidence of general causation, courts should permit the parties to attempt to show," using different types of evidence, "whether the plaintiff's disease was more likely than not caused by the agent.").

Finally, Dr. Nabhan may not suggest that the risks posed by glyphosate are similar to those posed by smoking, nor may he invoke the uncertainty from decades ago on the dangers of smoking to argue that it will eventually become obvious that glyphosate causes NHL. *See* Feb. 4, 2018 Tr. [Nabhan] 261:17-262:12 [Dkt. No. 2672]. This comparison is highly speculative, and, given its limited probative value, inadmissible under both Rules 403 and 702. *See Daubert v. Merrell Dow Pharm., Inc.*, 509 U.S. 579, 590 (1993); Pretrial Order No. 81, Ruling on Monsanto's Motion in Limine No. 4.1 [Dkt. No. 2275].

III.

There are several other *Daubert* motions pending before the Court. The plaintiffs' motion to exclude portions of the opinions offered by Monsanto's specific causation experts is largely granted in accordance with the Court's motions in limine order. See Pretrial Order No. 81, Ruling on Plaintiffs' Motion in Limine 2 [Dkt. No. 2275]. At the summary judgment hearing, the parties jointly concluded that neither Dr. Sullivan, Monsanto's exposure expert, nor Dr. Sawyer, Mr. Hardeman's exposure expert, would testify during Phase 1 of Mr. Hardeman's trial. The Court will address challenges to the Phase 2 experts, including any challenges to Drs. Sawyer and Sullivan, prior to the start of Phase 2.

IT IS SO ORDERED.

Date: February 24, 2019 [handwritten signature]
Honorable Vince Chhabria
United States District Court

APPENDIX D

UNITED STATES DISTRICT COURT
NORTHERN DISTRICT OF CALIFORNIA

MDL No. 2741
Case No. 16-md-02741-VC

IN RE: ROUNDUP PRODUCTS LIABILITY LITIGATION

This document relates to: ALL ACTIONS
Re: Dkt. Nos. 545, 647
Filed July 10, 2018

PRETRIAL ORDER NO. 45: SUMMARY JUDGMENT AND *DAUBERT* MOTIONS

The question at this early phase in the proceedings—the "general causation" phase—is whether a reasonable jury could conclude that glyphosate, a commonly used herbicide, can cause Non-Hodgkin's Lymphoma ("NHL") at exposure levels people realistically may have experienced. If the answer is yes, the case moves to the next phase, which addresses whether each particular plaintiff's NHL was caused by glyphosate. If the answer is no, none of the plaintiffs' cases may proceed. And the answer must be no unless the plaintiffs can present at least one reliable expert opinion in support of their position.

There are two significant problems with the plaintiffs' presentation, which combine to make this a very close question. First, the plaintiffs (along with some of their experts) rely heavily on the decision by the International Agency for Research on Cancer ("IARC") to classify glyphosate as "probably carcinogenic to hu-

mans." This classification is not as helpful to the plaintiffs as it might initially seem. To render a verdict for a plaintiff in a civil trial, a jury must conclude, applying the "preponderance of the evidence" standard, that the plaintiff's NHL was more likely than not caused by exposure to glyphosate. And at this general causation phase, the question is whether a reasonable jury could conclude by a preponderance of the evidence that glyphosate can cause NHL at exposure levels people realistically could have experienced. The IARC inquiry is different in kind—it is a public health assessment, not a civil trial. Public health assessments generally involve two steps: (1) an effort to identify *hazards*; and (2) an evaluation of the *risk* that the hazard poses at particular exposure levels. The first step essentially asks whether a substance is cause for concern, while the second step asks how concerned we should be. As IARC takes pains to point out, its decision that a substance is "probably carcinogenic to humans" is a hazard assessment—merely the first step in determining whether the substance currently presents a meaningful risk to human health. IARC leaves the second step—risk assessment—to other public health entities. Moreover, even with its hazard assessment, IARC makes clear that although it uses the word "probably," it does not intend for that word to have any quantitative significance. Therefore, the public health inquiry does not map nicely onto the inquiry required by civil litigation. And the hazard assessment IARC undertakes is too limited and too abstract to fully serve the plaintiffs' purposes here. A substance could be cause for concern, such that it can and should trigger preventive public health measures and further study, even when it is not so clearly dangerous as to allow a verdict in favor of a plaintiff.

The second problem with the plaintiffs' presentation is that the evidence of a causal link between glyphosate exposure and NHL in the human population seems rather weak. Some epidemiological studies suggest that glyphosate exposure is slightly or moderately associated with increased odds of developing NHL. Other studies, including the largest and most recent, suggest there is no link at all. All the studies leave certain questions unanswered, and every study has its flaws. The evidence, viewed in its totality, seems too equivocal to support any firm conclusion that glyphosate causes NHL. This calls into question the credibility of some of the plaintiffs' experts, who have confidently identified a causal link.

However, the question at this phase is not whether the plaintiffs' experts are right. The question is whether they have offered opinions that would be admissible at a jury trial. And the case law—particularly Ninth Circuit case law—emphasizes that a trial judge should not exclude an expert opinion merely because he thinks it's shaky, or because he thinks the jury will have cause to question the expert's credibility. So long as an opinion is premised on reliable scientific principles, it should not be excluded by the trial judge; instead the weaknesses in an unpersuasive expert opinion can be exposed at trial, through cross-examination or testimony by opposing experts.

The three expert opinions most helpful to the plaintiffs at this phase in the proceedings were offered by Dr. Christopher Portier, Dr. Beate Ritz, and Dr. Dennis Weisenburger. A jury may well reject these opinions at trial, finding the opinions too results-driven or concluding that the evidence behind those opinions is too weak. But applying the standard set forth in the case law for admission of expert testimony, the Court

cannot go so far as to say these experts have served up the kind of junk science that requires exclusion from trial. And the testimony of these three experts is directly on topic, because they (in contrast to some other experts) went beyond the inquiry conducted by IARC, offering independent and relatively comprehensive opinions that the epidemiological and other evidence demonstrates glyphosate causes NHL in some people who are exposed to it. Accordingly, their opinions are admissible, which means the plaintiffs have presented enough evidence to defeat Monsanto's summary judgment motion. These proceedings thus move on to the next phase, which will involve an attempt by individual plaintiffs to present enough evidence to warrant a jury trial on whether glyphosate caused the NHL they developed. Given how close the question is at the general causation phase, the plaintiffs appear to face a daunting challenge at the next phase. But it is a challenge they are entitled to undertake.

This ruling is organized as follows: Section I provides background information relevant to these lawsuits. Section II describes the legal standard that applies to the admissibility of expert testimony, and explains why the IARC classification is insufficient to get the plaintiffs over the general causation hurdle. Section III provides an overview of the important epidemiological studies, highlighting the strengths and weaknesses of those studies and explaining why Monsanto's criticisms of the studies more helpful to the plaintiffs are not fatal to the plaintiffs' case. Section IV introduces the evidence addressing the carcinogenic effects of glyphosate on rodents. Section V briefly discusses evidence on the effects of glyphosate at the cellular level. Section VI examines each of the plaintiffs' experts' opinions, and analyzes whether those opinions

synthesize all this evidence reliably enough to be admissible at trial. Finally, Section VII addresses the plaintiffs' motion to exclude some of Monsanto's experts.

I. BACKGROUND

Glyphosate is the active ingredient in Roundup, an herbicide manufactured by Monsanto. Roundup became commercially available in 1974, and glyphosate-based herbicides are now widely used across the United States and much of the world, on large-scale farms and in backyards. The U.S. Environmental Protection Agency does not currently consider glyphosate likely to cause cancer.[1]

In 2015, IARC, which is the specialized cancer agency of the World Health Organization, convened a "working group" to assess whether several pesticides, including glyphosate, can cause cancer. Since 1971, IARC has regularly convened working groups to evaluate whether chemicals or other environmental factors are capable of causing cancer in humans. These working groups compile "Monographs" that examine the available scientific evidence and then come to conclusions about the carcinogenic potential of these different agents. The working group examining glyphosate concluded that the pesticide is "probably carcinogenic to humans," a designation whose meaning will be discussed later in this ruling.[2]

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[1] *See* U.S. Environmental Protection Agency Office of Pesticide Programs, *Revised Glyphosate Issue Paper: Evaluation of Carcinogenic Potential* 12-13, 143-44 (Dec. 12, 2017) [Daubert Ex. 873].

[2] IARC, *Some Organophosphate Insecticides and Herbicides: Volume 112*, at 398 (2015) [Daubert Ex. 1030] ("Monograph").

IARC's designation addressed cancer in general, but the working group's report paid particular attention to human studies concerning a particular cancer, NHL, in reaching its conclusion. NHL is a cancer that affects lymphocytes, a type of white blood cell that is part of the immune system. Farmers have long had an elevated risk of NHL, even before glyphosate went on the market.[3]

After IARC classified glyphosate as a probable carcinogen, a wave of lawsuits followed. These lawsuits, which now number in the hundreds, were dispersed among state and federal courts across the country, but the claims against Monsanto raised similar issues. In particular, a central question in all these cases is whether Monsanto's glyphosate-based herbicides can cause NHL.

The Judicial Panel on Multidistrict Litigation, a panel of judges empowered to coordinate proceedings in federal cases where doing so "will be for the convenience of parties and witnesses and will promote the just and efficient conduct" of the cases, determined that coordination in these cases was warranted. 28 U.S.C. § 1407(a). The Panel therefore created this Multidistrict Litigation to centralize management of all the federal cases, and assigned to this Court all pretrial proceedings in the Multidistrict Litigation. As is common in such proceedings, the Court appointed a group of plaintiffs' counsel to serve as leaders and to represent all the plaintiffs' interests. Dkt. No. 62. Many additional cases have since been transferred to this district as part of the Multidistrict Litigation, and more than 400 cases are now pending.

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[3] *See* Kenneth P. Cantor et al., *Pesticides and Other Agricultural Risk Factors for Non-Hodgkin's Lymphoma Among Men in Iowa and Minnesota*, 52 Cancer Research 2447, 2448 (1992).

The Court decided to bifurcate the pretrial proceedings. Dkt. No. 25. The motions at issue here arise during the first phase, which addresses "general causation." As noted, the question at the general causation phase is whether glyphosate is capable of causing NHL at exposure levels humans might have experienced. The second phase will involve, among other things, the issue of "specific causation." The specific causation inquiry focuses on whether individual plaintiffs' exposure to glyphosate-based herbicides caused the NHL they developed.

II. THE *DAUBERT* STANDARD AND THE GENERAL CAUSATION INQUIRY

To carry their burden during this phase of the litigation, the plaintiffs must put forward admissible evidence supporting their claim that glyphosate is capable of causing NHL at exposure levels humans might have experienced. If the plaintiffs cannot provide admissible evidence supporting this proposition—and enough admissible evidence to allow a reasonable jury to find in favor of the plaintiffs on this question—Monsanto is entitled to summary judgment in all the cases. *See Anderson v. Liberty Lobby, Inc.*, 477 U.S. 242, 249-50 (1986).

The evidence at issue here is expert witness testimony. The plaintiffs have retained six experts they contend will provide opinions that satisfy the plaintiffs' burden at the general causation phase. These experts are: Dr. Beate Ritz, Dr. Christopher Portier, Dr. Alfred Neugut, Dr. Charles Jameson, Dr. Dennis Weisenburger, and Dr. Chadhi Nabhan. Broadly speaking, each of these experts reviewed the available scientific evidence and concluded that glyphosate is capable of causing NHL in humans. Monsanto has moved to ex-

clude the plaintiffs' experts and has put forward seven retained experts of its own, each of whom provides a contrary view of the science. Before ruling on these motions, the Court held seven days of hearings to assess the testimony of many of these experts. Pursuant to the Cameras in the Courtroom pilot project, these hearings were video recorded. The recordings are publicly available on the U.S. Courts website.[4]

A. Legal Standard

Experts may not automatically testify before a jury. First, the district court must act as a "gatekeeper" and screen the experts' testimony under the standards set by the Federal Rules of Evidence and the Supreme Court's decision in *Daubert v. Merrell Dow Pharmaceuticals, Inc. (Daubert I)*, 509 U.S. 579 (1993). Federal Rule of Evidence 702, which governs this inquiry, provides that expert opinion testimony is admissible if: (1) the witness is qualified to testify about the topics she intends to address; (2) the expert's specialized knowledge will help the jury "to understand the evidence or to determine a fact in issue"; (3) "the testimony is based on sufficient facts or data"; (4) "the testimony is the product of reliable principles and methods"; and (5) "the expert has reliably applied the principles and methods to the facts of the case." The burden is on the plaintiffs to establish the admissibility of their experts' testimony. *See Building Industry Association of Washington v. Washington State Building Code Council*, 683 F.3d 1144, 1154 (9th Cir. 2012).

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[4] *In re Roundup Products Liability Litigation*, U.S. Courts, http://www.uscourts.gov/cameras-courts/re-roundup-products-liability-litigation [https://perma.cc/YHJ8-Y7YP].

To be qualified, the expert must have sufficient "knowledge, skill, experience, training, or education" to offer the opinion. Fed. R. Evid. 702. So long as the expert's testimony is "within the reasonable confines of his subject area," a lack of particularized expertise generally goes to the weight of the testimony, not its admissibility. *D.F. ex rel. Amador v. Sikorsky Aircraft Corp.*, No. cv-00331-GPC-KSC, 2017 WL 4922814, at *14 (S.D. Cal. Oct. 30, 2017) (quoting *Avila v. Willits Environmental Remediation Trust*, 633 F.3d 828, 839 (9th Cir. 2011) and citing *United States v. Garcia*, 7 F.3d 885, 889-90 (9th Cir. 1993)); *see also Hopkins v. Dow Corning Corp.*, 33 F.3d 1116, 1124 (9th Cir. 1994).

Aside from the qualification requirement, there are two questions at the heart of the admissibility determination: whether the testimony is relevant and whether it is reliable. *See City of Pomona v. SQM North America Corp.*, 750 F.3d 1036, 1043 (9th Cir. 2014). "Expert opinion testimony is relevant if the knowledge underlying it has a valid connection to the pertinent inquiry." *Id.* at 1044 (citation omitted). In other words, the expert testimony must "fit" the question the jury must answer. *Daubert v. Merrell Dow Pharmaceuticals, Inc. (Daubert II)*, 43 F.3d 1311, 1321 n.17 (9th Cir. 1995). This bar is cleared where the evidence "logically advances a material aspect of the proposing party's case." *Messick v. Novartis Pharmaceuticals Corp.*, 747 F.3d 1193, 1196 (9th Cir. 2014) (citation omitted).

Expert evidence "is reliable if the knowledge underlying it has a reliable basis in the knowledge and experience of the relevant discipline." *City of Pomona*, 750 F.3d at 1044 (citation omitted). In deciding whether to permit an expert to testify, courts face the difficult task of "determin[ing] whether the analysis undergirding the experts' testimony falls within the range of

accepted standards governing how scientists conduct their research and reach their conclusions." *Daubert II*, 43 F.3d at 1317. Among the factors courts consider in making this determination are (1) whether the expert's theory or method is generally accepted in the scientific community; (2) whether the expert's methodology can be or has been tested; (3) the known or potential error rate of the technique; and (4) whether the method has been subjected to peer review and publication. *Id.* at 1316 (citing *Daubert I*, 509 U.S. at 593-94). Courts should also consider whether the expert's testimony springs from research independent of the litigation. *Id.* at 1317. If not, the expert should point to other evidence that the testimony has a reliable basis, like peer-reviewed studies or a reputable source showing that the expert "followed the scientific method, as it is practiced by (at least) a recognized minority of scientists in their field." *Id.* at 1317-19. These factors are not a mandatory or inflexible checklist, and the Court has broad discretion to determine which factors are most informative in assessing reliability in the context of a given case. *See Kumho Tire Co., Ltd. v. Carmichael*, 526 U.S. 137, 141-42 (1999); *United States v. Alatorre*, 222 F.3d 1098, 1102 (9th Cir. 2000).

The focus of the reliability inquiry is on the principles and methodology an expert uses in forming her opinions rather than the expert's conclusions. But in conducting the reliability analysis, the Court must also consider whether, for a given conclusion, "there is simply too great an analytical gap between the data and the opinion proffered." *General Electric Co. v. Joiner*, 522 U.S. 136, 146 (1997). In short, both unsound methods and unjustified extrapolations from existing data can require the Court to exclude an expert.

The Ninth Circuit has placed great emphasis on *Daubert's* admonition that a district court should conduct this analysis "with a 'liberal thrust' favoring admission." *Messick*, 747 F.3d at 1196 (quoting *Daubert I*, 509 U.S. at 588). Accordingly, the Ninth Circuit has emphasized that the gatekeeping function is meant to "screen the jury from unreliable nonsense opinions, but not to exclude opinions merely because they are impeachable." *Alaska Rent-A-Car, Inc. v. Avis Budget Group, Inc.*, 738 F.3d 960, 969 (9th Cir. 2013). That is because "[v]igorous cross-examination, presentation of contrary evidence, and careful instruction on the burden of proof are the traditional and appropriate means of attacking shaky but admissible evidence." *Daubert I*, 509 U.S. at 596; *see, e.g.*, *Murray v. Southern Route Maritime SA*, 870 F.3d 915, 925 (9th Cir. 2017); *Wendell v. GlaxoSmithKline LLC*, 858 F.3d 1227, 1237 (9th Cir. 2017). This emphasis has resulted in slightly more room for deference to experts in close cases than might be appropriate in some other Circuits. *Compare Wendell*, 858 F.3d at 1233-38, *and City of Pomona*, 750 F.3d at 1043-49, *with In re Zoloft (Sertraline Hydrochloride) Products Liability Litigation*, 858 F.3d 787, 800 (3d Cir. 2017), *and McClain v. Metabolife International, Inc.*, 401 F.3d 1233, 1244-45 (11th Cir. 2005). This is a difference that could matter in close cases.

B. The Relevance of the IARC Classification

Although much of this ruling concerns itself with the reliability prong of the *Daubert* analysis, relevance is also important here. It's not sufficient for the plaintiffs to present evidence that glyphosate could cause NHL if humans were exposed to glyphosate at the kinds of massive doses, administered in the kinds of ways, that laboratory animals alone have experienced. A "general causation" phase that focused on this ques-

tion would be a waste of time—it would be too far afield from the ultimate question whether any of the plaintiffs in these cases got NHL from glyphosate. That is why, to defeat Monsanto's summary judgment motion on the issue of general causation, it is not enough for the plaintiffs merely to present evidence that glyphosate is capable of causing cancer in the abstract.

By the same token, however, the inquiry at the general causation phase is not whether glyphosate gave NHL to any of the particular plaintiffs who brought these lawsuits, and the plaintiffs need not establish any particular level of exposure. It's enough in this litigation, at this stage, for the plaintiffs to show that glyphosate can cause NHL when people are exposed to the highest dose people might plausibly experience. *See In re Hanford Nuclear Reservation Litigation*, 292 F.3d 1124, 1133 (9th Cir. 2002). Picture, for instance, a professional gardener who has applied Roundup without using protective equipment several times per week, many hours per day, for decades.

The distinction between glyphosate's capacity to cause NHL at any hypothetical dose and its capacity to cause NHL at a human-relevant dose is important here, in light of the plaintiffs' heavy reliance on IARC's classification of glyphosate. Throughout much of this case, the plaintiffs seem to have operated under the assumption that they can clear the general causation hurdle simply by showing that IARC's decision to designate glyphosate a probable human carcinogen is scientifically sound. Accordingly, they have put forward some expert opinions that largely parrot IARC's analysis and conclusions. But whether glyphosate is "probably carcinogenic to humans" as IARC defines that phrase is not what's directly at issue here.

IARC engages in a standardized inquiry that it describes in detail in the Preamble to the Monograph addressing glyphosate. In short, IARC seeks to identify cancer hazards. The organization explains the "important" distinction between hazard identification and risk assessment, stating that "[a] cancer 'hazard' is an agent that is capable of causing cancer under some circumstances, while a cancer 'risk' is an estimate of the carcinogenic effects expected from exposure to a cancer hazard." Monograph at 10. As a result, the Monograph explains, the IARC classification process is only the "first step in carcinogen risk assessment," because the Monographs "identify cancer hazards even when risks are very low at current exposure levels, because new uses or unforeseen exposures could engender risks that are significantly higher." *Id.* Putting this definition into practice, Dr. Portier (one of the plaintiffs' experts) wrote a letter urging the EPA to "declare glyphosate a probable human carcinogen and go on to do a risk assessment to determine if human exposure is sufficient to warrant concern." Expert Report of Dr. Portier, App. Doc. 2 at 4, Wagstaff Decl. ISO Pls.' Opp'n to Def.'s Mot. for Summ. J. & Daubert Mot. ("Pls.' Opp'n") Ex. 5 [Dkt. No. 648-5 at 151].

To make its hazard assessment, an IARC working group looks first at studies in humans and then at studies in animals and at other available data, including studies on the mechanisms by which a particular agent affects organisms at the cellular level. The working group determines, "using standard terms," the strength of the evidence for carcinogenicity in both humans and animals. Monograph at 27. Here, IARC concluded that there is "limited" evidence in humans that glyphosate causes cancer, meaning that "[a] positive association has been observed between exposure to

the agent and cancer for which a causal interpretation is considered … to be credible, but chance, bias or confounding could not be ruled out with reasonable confidence." *Id.* at 27, 398. IARC further concluded there was "sufficient" evidence of carcinogenicity in experimental animals, that is, that "a causal relationship has been established between [glyphosate] and an increased incidence of malignant neoplasms or of an appropriate combination of benign and malignant neoplasms" in animal studies. *Id.* at 28, 398.[5] The label IARC settled upon for glyphosate, "probably carcinogenic to humans," automatically follows from these evaluations. A substance is deemed a probable carcinogen, also known as a "Group 2A" agent, where IARC concludes the evidence in humans is limited and evidence in animals is sufficient. *Id.* at 30.[6] A Group 2A classification can also be made when the working group concludes there is "inadequate" evidence—that is, not even limited evidence—that the agent causes cancer in humans but sufficient evidence that it does so in animals, where there is also strong evidence that it causes cancer in animals by a mechanism that operates in humans. *Id.* For comparison, a "Group 2B" classification of "possibly carcinogenic to humans" usually follows where the working group concludes there is "limited evidence of carcinogenicity in humans" and "less than sufficient evidence of carcinogenicity in experimental animals," or alternatively, where there is "inadequate

[5] Neoplasms are tumors. *Id.* at 10.

[6] IARC also notes that, "[e]xceptionally, an agent may be classified in this category solely on the basis of limited evidence of carcinogenicity in humans," if the agent clearly belongs, based on mechanistic evidence, to a class of agents some of which already have been classified as carcinogenic or probably carcinogenic to humans. *Id.*

evidence of carcinogenicity in humans" but "sufficient evidence of carcinogenicity in experimental animals." *Id.*[7]

All this is to say that IARC conducts its inquiry at a higher level of generality than what the Court must do here. Although IARC's assessment is not entirely divorced from real-world exposure levels, IARC sorts agents into different categories based on a fairly rigid formula that seeks to identify whether an agent is capable of causing cancer "under some circumstances." *Id.* at 10. Here, although there is no need to specify precisely the circumstances under which each plaintiff was exposed to glyphosate, only evidence supporting the conclusion that glyphosate causes NHL in doses within the realistic realm of actual human exposure can get the plaintiffs past summary judgment. It's worth acknowledging that, even at the end of this ruling, precisely what the range of actual human exposure is will remain vague, a product of bifurcated proceedings where the hundreds of individual plaintiffs' experiences remain on the periphery for now. But it's enough at this point to say that IARC's hazard assessment considers the evidence for a different purpose, and without the attention to the effects of current human exposure the Court must pay here. Moreover, it is not enough for the evidence in this case to go merely to the causal relationship between glyphosate and cancer in general; it must go to the relationship between glyphosate and

[7] Group 2B classification can also in some instances follow where there is "inadequate evidence of carcinogenicity in humans and less than sufficient evidence of carcinogenicity in experimental animals together with supporting evidence from mechanistic and other relevant data." *Id.* "[S]trong evidence from mechanistic and other relevant data" can also support classification in this category. *Id.*

NHL in particular. Perhaps most importantly, the question in a court case at this stage is whether a reasonable jury could conclude by a preponderance of the evidence that glyphosate can cause NHL at human-relevant doses—that is, whether a jury could conclude it is "more likely than not" that glyphosate can cause NHL in the human population. IARC's use of the word "probably" has "no quantitative significance." *Id.* The inquiry in this case therefore fits neatly into neither the hazard identification nor the risk assessment boxes as IARC defines them.

As a result, expert opinions that simply parrot IARC's analysis and conclusions are somewhat off topic and are unduly limited, rendering them insufficient to satisfy the plaintiffs' burden at the general causation phase. A "hazard assessment," as IARC and other public health bodies define that inquiry, is not what the jury needs to conduct when deciding whether glyphosate actually causes NHL in people at past or current exposure levels. An expert who recites IARC's conclusions and analysis therefore may be offering a sound scientific opinion, but not an opinion that speaks squarely to the issue the jury must decide. And in addition to the fact that such opinions are not enough to get the plaintiffs past the general causation hurdle, there is a significant possibility that, if there ever is a jury trial (that is, if any plaintiff can get past summary judgment on the issue of specific causation), expert opinions that go no further than IARC's analysis will be excluded. An expert opinion of this sort may not "fit" the general causation inquiry closely enough to be helpful to the jury in the way Rule 702 requires; it may serve primarily to confuse the jury, causing the trial to devolve into an abstract discussion about the differences between what public health organizations do and what juries do. In

any event, for current purposes, the point is that to the extent the plaintiffs have offered opinions from experts who merely reiterate the IARC analysis, those opinions do not allow the plaintiffs to avoid summary judgment. Beyond that, the relevance and admissibility of these opinions at any eventual trial can be addressed as these cases develop.

III. EPIDEMIOLOGY

Epidemiology is "the field of public health and medicine that studies the incidence, distribution, and etiology of disease in human populations."[8] As the parties acknowledge, epidemiology is central to the general causation inquiry, and where such evidence exists, it must be addressed by the experts. *See Norris v. Baxter Healthcare Corp.*, 397 F.3d 878, 882 (10th Cir. 2005); Def.'s Daubert & Summ. J. Mot. 10 [Dkt. No. 545] ("Def.'s Mot."); Pls.' Opp'n 19-20 [Dkt. No. 647]; *cf. Milward v. Acuity Specialty Products Group, Inc.*, 639 F.3d 11, 24 (1st Cir. 2011). None of the plaintiffs' experts base their opinions exclusively on the epidemiology research, but all discuss it to varying degrees.

A. The Bradford Hill Criteria

Epidemiology studies examine whether an association exists between an agent like glyphosate and an outcome like NHL. Whether that agent *causes* the outcome, however, cannot be proven by epidemiological studies alone; an evaluation of causation requires epidemiologists to exercise judgment about the import of those studies and to consider them in context. Once epidemiologists have concluded from the studies that

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[8] Michael D. Green et al., *Reference Guide on Epidemiology*, *in* Reference Manual on Scientific Evidence 551, 551 (3d ed. 2011) ("Reference Manual").

there is an association between an agent and an outcome, they often assess causation through a framework called the "Bradford Hill criteria." These criteria are named for Sir Austin Bradford Hill, who wrote a 1965 article that articulated nine "viewpoints" now generally accepted to be relevant to assessing causation. Broadly, these factors are: (1) the strength of the association; (2) consistency; (3) specificity; (4) temporality; (5) biological gradient or dose response; (6) biological plausibility; (7) coherence with other scientific knowledge; (8) experimental evidence; and (9) analogy.[9] Both parties' experts considered these criteria, which are introduced here to frame the discussion that follows, and they will be explained in more detail in Section VI.

B. Case-Control Studies and Meta-Analyses

The first step in assessing causation is determining whether an association exists between exposure to glyphosate and NHL. In concluding that studies have shown such an association, the plaintiffs' experts emphasize case-control studies. A case-control study is one of two primary types of observational epidemiological studies. This kind of study starts with a group of people who have the disease of interest (the "cases"), selects a similar population of people without the disease (the "controls"), and then compares the groups on the basis of past exposure to the chemical the investigators are studying. In contrast, a cohort study, the other primary type of observational epidemiological study, selects a study population without the disease of interest, sorts that population into exposed and unex-

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[9] Austin Bradford Hill, *The Environment and Disease: Association or Causation?*, 58 Proceedings of the Royal Society of Medicine 295 (1965), Wagstaff Decl. ISO Pls.' Opp'n Ex. 47 [Dkt. No. 649-17] ("Bradford Hill").

posed groups, and then measures the incidence of disease in the exposed and unexposed groups after observing them for a period of time. Frequently touted benefits of case-control studies are their comparatively low cost and ability to identify associations relevant to rare diseases. *See*, *e.g.*, Reference Manual at 556-60; Expert Report of Dr. Mucci 12, Hollingsworth Decl. ISO Def.'s Mot. Ex. 18 [Dkt. No. 546-18] ("Mucci Report"); Expert Report of Dr. Ritz 13, Wagstaff Decl. ISO Pls.' Opp'n Ex. 3 [Dkt. No. 648-3] ("Ritz Report").

Case-control studies report an odds ratio as the measure of association between the variables the investigators are studying. "In a case-control study, the odds ratio is the ratio of the odds that a case (one with the disease) was exposed to the odds that a control (one without the disease) was exposed." Reference Manual at 568. An odds ratio greater than 1.0 indicates an association, as it suggests those with the disease are more likely to have been exposed to the substance of interest.

Odds ratios are typically reported with confidence intervals that seek to capture the likely effects of random error. A 95% confidence interval, the standard interval, is a range that would capture the actual odds ratio 95% of the time if the study were conducted repeatedly. Generally, larger sample sizes produce narrower confidence intervals. When the lower bound of the 95% confidence interval exceeds 1.0, the results of the study are considered to show an association that is "statistically significant" at the .05 level. *Id.* at 580-81. The purpose of assessing statistical significance is to determine how likely it is that an observed odds ratio is merely due to chance, rather than indicative of a true association. The line delineating what constitutes a statistically significant result is necessarily somewhat arbitrary, and the experts dispute how much weight to

give studies reporting odds ratios above 1.0 that are not statistically significant at the .05 level. Although there may be a causal association even in the absence of statistically significant results, statistical significance remains a useful metric for determining whether the results of a given study likely show a real association. *In re Zoloft*, 858 F.3d at 793.

When assessing whether an epidemiological study can form a reliable basis for an expert's opinion, a court must determine whether the study adequately considered confounding variables and possible sources of bias. *In re Abilify (Aripiprazole) Products Liability Litigation*, 299 F. Supp. 3d 1291, 1322-23 (N.D. Fla. 2018). Confounding arises where a factor not accounted for by the study wholly or partially explains an apparent association between the agent under study and the outcome. A factor is a confounder where it is independently related to both the exposure and the disease of interest. Failure to control for true confounding variables can skew the results of a study, producing an observed association where none exists or an observed association that is stronger or weaker than the actual association.[10] Reliable epidemiological studies should account for confounders where they are identified, although "failure to control for every conceivable potential confounder does not necessarily render the results of an epidemiological study unreliable." *In re Abilify*, 299 F. Supp. 3d at 1322. One way to account for confounders is through study design; for instance, matching controls to cases by age would ameliorate concerns about confounding resulting from the age of study participants. Confounders can also be addressed during data analy-

[10] *See* Kenneth J. Rothman et al., *Modern Epidemiology* 129-34 (3d ed. 2008) ("Rothman").

sis, using methods like stratification or multivariable analysis, so long as information about potential confounders was obtained during the study. *See* Reference Manual at 591-97. One important possible source of confounding in the studies relevant here is exposure to other pesticides.

Bias occurs where the results of a study are subject to systematic—in other words, non-random—error. Study design, data collection, and data analysis can all give rise to bias. *Id.* at 583. Most relevant in this case is the possibility of information bias resulting from inaccurate information about study participants' exposure to glyphosate. One type of information bias, recall bias, occurs where people with a disease (the "cases" in a case-control study) are differently able to recall past exposures than are people who never get sick; generally, the assumption is that the cases will recall greater levels of exposure, as those who become ill are more likely to ruminate about the possible causes of their disease. *See id.* at 585-86.

Concerns about recall bias and about study accuracy more generally may be heightened where studies rely on proxy respondents. Proxy respondents or surrogates, often spouses or next of kin, are used when the study participants themselves are not available, typically because they have died or are too ill to participate. Proxy respondents are generally considered less reliable than the study participants themselves. Mucci Report 20-21.

With this background in mind, the following is an overview of the some of the most important and frequently discussed case-control studies.

One key publication is a pooled analysis of three separate case-control studies conducted by the National Cancer Institute in the Midwestern United States

between 1979 and 1986. In a pooled analysis, the study authors combine the raw, participant-level data from earlier studies and then analyze these data as one combined dataset. *See* Ritz Report 6; Mucci Report 25. Pooling allows for uniform analysis of the data in the underlying studies and increases the statistical power of the earlier, smaller studies. The experts identify this study as "De Roos (2003)," by the lead author's last name and its year of publication.[11]

De Roos (2003) aggregated the data from the three studies and analyzed the effects of 47 different pesticides on the incidence of NHL. *Id.* at 1. The authors sought to isolate the effect of each pesticide by controlling for the use of all 46 other pesticides, in addition to age and study site, in their models assessing association. *Id.* at 2. The authors reported results using both a more conventional logistic regression model and a more conservative hierarchical regression model that took into account values estimating the prior distributions of the other pesticides. *Id.* Using the logistic regression model, the odds ratio for those exposed to glyphosate was 2.1, with a 95% confidence interval of 1.1 to 4.0.[12] Using the hierarchical regression model, the odds ratio was 1.6 (0.9, 2.8), no longer a statistically significant result. *Id.* at 5. Thirty-six of the cases and 61 of the controls in this analysis were exposed to glyphosate. *Id.* The study authors considered proxy responses. *Id.* at 4.

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[11] A.J. De Roos et al., *Integrative Assessment of Multiple Pesticides as Risk Factors for Non-Hodgkin's Lymphoma Among Men*, 60 Occupational & Environmental Medicine 1 (2003), Wagstaff Decl. ISO Pls.' Opp'n Ex. 55 [Dkt. No. 652-9].

[12] Going forward, the 95% confidence interval will be reported in the following format: odds ratio (lower bound, upper bound).

Another study discussed at length by the experts focused on a population-based case-control study in Canada. They refer to this study as "McDuffie (2001)."[13] NHL diagnoses in this study occurred between 1991 and 1994, and 51 cases and 133 controls were exposed to glyphosate. *Id.* at 1158. Proxy respondents were not used. *Id.* at 1156. This study reported an overall odds ratio for glyphosate of 1.2 (0.83, 1.74). This estimate was adjusted for medical variables associated with NHL outcomes (like a positive family history of cancer or past cancer), age, and province of residence, but not for use of other pesticides. *Id.* at 1158. The study also sought to capture an estimate of NHL risk that reflected frequency of exposure to glyphosate. It reported that when glyphosate was used between zero and two days per year, the odds ratio was 1.00 (0.63, 1.57). When glyphosate was used more than two days per year, the odds ratio was 2.12 (1.20, 3.73). These estimates likewise appear not to have been adjusted for use of other pesticides. *Id.* at 1161.

The North American Pooled Project ("NAPP") aggregated the data from the three case-control studies included in De Roos (2003) and the Canadian data from McDuffie (2001). The results of this pooled analysis have not been published in a peer-reviewed journal, but the parties highlighted results presented in an abstract and two slide decks prepared for conferences. The more recent analysis is presented in a slide deck for an August 2015 presentation, although this slide deck, like the other NAPP materials, does not detail the methods

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[13] Helen H. McDuffie et al., *Non-Hodgkin's Lymphoma and Specific Pesticide Exposures in Men: Cross-Canada Study of Pesticides and Health*, 10 Cancer Epidemiology, Biomarkers & Prevention 1155 (2001), Wagstaff Decl. ISO Pls.' Opp'n Ex. 60 [Dkt. No. 652-14].

used by the study authors.[14] These slides presented an overall odds ratio for glyphosate use of 1.13 (0.84, 1.51), when adjusted for use of three other pesticides and several other potential confounders. *Id.* at 10. When proxy respondents were removed from the data, the odds ratio dropped to 0.95 (0.69, 1.32). *Id.* at 26. The odds ratios reported for subjects who reported using glyphosate for seven lifetime days or fewer were lower than those who reported use for more than seven days, but none of these odds ratios were statistically significant. For subjects who reported using glyphosate for less than or equal to two days per year, without proxy respondents, the odds ratio was 0.66 (0.39, 1.12), and with proxy respondents it was 0.74 (0.46, 1.19). The greater-than-two-days-per-year odds ratio without proxy respondents was 1.77 (0.99, 3.17), and when proxy respondents were included, the result was 1.73 (1.02, 2.94). *Id.* Monsanto argues that the NAPP study, although still unpublished, should supersede the earlier De Roos (2003) and McDuffie (2001) studies, as it is a more recent and complete analysis.

A further publication, "Eriksson (2008)," addresses the results of a Swedish population-based case-control study, with NHL cases collected between 1999 and 2002.[15] There were 29 glyphosate-exposed cases and 18 controls included in this study. *Id.* at 1659. Proxy respondents were not used. *Id.* at 1660. The authors ana-

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[14] Manisha Pahwa et al., An Evaluation of Glyphosate Use and the Risk of Non-Hodgkin Lymphoma Major Histological Sub-Types in the North American Pooled Project (Aug. 31, 2015) [Daubert Ex. 1278].

[15] Mikael Eriksson et al., *Pesticide Exposure as Risk Factor for Non-Hodgkin Lymphoma Including Histopathological Subgroup Analysis*, 123 International Journal of Cancer 1657 (2008), Wagstaff Decl. ISO Pls.' Opp'n Ex. 54 [Dkt. No. 652-8].

lyzed the data using a multivariate model controlling for six other pesticides, age, sex, and year of diagnosis or enrollment, and reported a non-statistically significant odds ratio of 1.51 (0.77, 2.94) for glyphosate. *Id.* at 1661. This study also reported a more detailed set of numbers unadjusted for use of other pesticides. The overall odds ratio for glyphosate was 2.02 (1.10, 3.71). Breaking this down, the unadjusted results showed statistically significant associations for glyphosate and NHL for those who were exposed to glyphosate for greater than ten days—2.36 (1.04, 5.37), versus 1.69 (0.70, 4.07) for those exposed for less than ten days. *Id.* at 1659. For those who developed cancer more than ten years after exposure to glyphosate, the odds ratio was 2.26 (1.16, 4.40), compared to 1.11 (0.24, 5.08) for those who developed cancer less than ten years after exposure. *Id.* at 1658-59. One possible cause for concern in this study is the authors' choice of the control group for the univariate analysis, that is, the analysis not adjusted for use of other pesticides. *See* Mar. 5, 2018 Tr. [Ritz] 34-35 [Dkt. No. 1172]; Mucci Report 53. The authors used as the control group for this part of the analysis people who were not exposed to any of the pesticides included in the study. Eriksson (2008) at 1658.[16]

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[16] Dr. Ritz sought to offer an opinion that, had the study authors used a more appropriate comparison group, the results would not have changed materially. *See* Apr. 4, 2018 Tr. [Ritz] 22-27 [Dkt. No. 1352]; *see also* Def.'s Apr. 9, 2018 Supp. Br. 5 [Dkt. No. 1354] (objecting to this opinion). In light of her own tentativeness about her adjustment and the absence of any detailed explanation of her method in her reports or her live testimony, Dr. Ritz's opinion regarding how the Eriksson results would change after altering the control group is not admissible.

The plaintiffs also emphasize meta-analyses of the available epidemiological studies. Meta-analysis combines the results of several studies, giving them different weights that take into account, for instance, the size of the study population. Reference Manual at 607. Unlike a pooled analysis, which uses the underlying raw data, meta-analysis uses the reported summary statistics from the earlier studies. *See* Ritz Report 6; Mucci Report 24. The value of a meta-analysis, like the value of a pooled analysis, depends upon the quality of the underlying studies, and meta-analyses can be uninformative when the studies included in the analysis are very different from one another. Although these meta-analyses take into account one cohort study, which will be discussed shortly, they are introduced here since the bulk of the included studies are case-control studies.

Three meta-analyses of the data on glyphosate and NHL have been discussed during these proceedings. The first was published in 2014 by Schinasi and Leon, but this analysis did not use the odds ratios from some of the underlying studies that were most fully adjusted for confounders.[17] The IARC working group updated Schinasi and Leon's meta-analysis to use the more fully adjusted numbers and reported a meta-risk-ratio of 1.3 (1.03, 1.65). Monograph at 350.[18] A later published me-

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[17] Leah Schinasi & Maria E. Leon, *Non-Hodgkin Lymphoma and Occupational Exposure to Agricultural Pesticide Chemical Groups and Active Ingredients: A Systematic Review and Meta-Analysis*, 11 International Journal of Environmental Research & Public Health 4449 (2014), Wagstaff Decl. ISO Pls.' Opp'n Ex. 67 [Dkt. No. 653-7] ("Schinasi & Leon (2014)").

[18] The risk ratio or relative risk, which is used to assess whether an association exists in cohort studies, is the ratio of the risk of disease among people exposed to those who are unexposed. For relatively rare diseases, the odds ratio approximates the rela-

ta-analysis, by Chang and Delzell in 2016, likewise took into account the most fully adjusted results from the earlier studies, and reported a meta-risk-ratio of 1.3 (1.0, 1.6).[19] Chang & Delzell (2016) also conducted sensitivity analyses that swapped out the hierarchical regression in De Roos (2003) for the logistic regression and replaced McDuffie (2001) with a 2011 analysis of the Canadian data. *See id.* at 416. The results for the four models they tested were very similar, all falling between 1.3 (1.0, 1.6) and 1.4 (1.0, 1.8). *Id.*

Monsanto and its experts raise concerns about basing a causation assessment on the case-control studies and meta-analyses. For instance, Monsanto's epidemiology experts highlighted concerns about recall bias. Mucci Report 36; Expert Report of Dr. Rider 3, Wagstaff Decl. ISO Pls.' Opp'n Ex. 116 [Dkt. No. 656-11] ("Rider Report"). The plaintiffs' experts acknowledged that recall bias is a potential concern in case-control studies, but disputed that it is a major issue here. Ritz Report 7-8; Revised Expert Report of Dr. Portier 7, 18, Hollingsworth Decl. ISO Def.'s Mot. Ex. 8 [Dkt. No. 546-8] ("Portier Report"). The plaintiffs' experts explained that, at the time the cases were assessed, the participants had no reason to suspect that glyphosate exposure could cause cancer, and therefore they were unlikely to have over-reported their exposure. Apr. 4, 2018 Tr. [Ritz] 51-53. To demonstrate that participants

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tive risk and, as with an odds ratio, a number above 1.0 indicates an association between the exposure and the disease. Reference Manual at 625, 627.

[19] Ellen T. Chang & Elizabeth Delzell, *Systematic Review and Meta-Analysis of Glyphosate Exposure and Risk of Lymphohematopoietic Cancers*, 51 Journal of Environmental Science & Health 402 (2016), Wagstaff Decl. ISO Pls.' Opp'n Ex. 68 [Dkt. No. 653-8] ("Chang & Delzell (2016)").

didn't generally over-report glyphosate use when these studies were conducted, they pointed out that epidemiology studies on the whole observed associations only between glyphosate and NHL, and not between glyphosate and the other cancers about which participants were asked. If participants were predisposed to think that glyphosate caused cancer and exhibited recall bias as a result, they explained, one would expect to see associations reported for glyphosate and other cancers. *Id.* at 50-51; *see also* Mar. 5, 2018 Tr. [Weisenburger] 192-93 [Dkt. No. 1172]; March 9, 2018 Tr. [Mucci] 945-46 [Dkt. No. 1186]. The plaintiffs' experts also pointed to studies that sought to validate self-reports of pesticide exposure and that found similar recall accuracy between cases and controls. Ritz Report 19; Portier Report 8, 11; Mar. 5, 2018 Tr. [Weisenburger] 182-83. Ultimately, in response to these points, one of Monsanto's epidemiology experts conceded at the *Daubert* hearing that she was "not quite as worried about recall bias in the context of this body of literature," except in the McDuffie (2001) study. Mar. 9, 2018 Tr. [Mucci] 946. On the whole, concerns about recall bias in these studies do not demand that a reliable expert opinion meaningfully discount the body of case-control studies when assessing causation.

Monsanto's experts also attacked the plaintiffs' experts' reliance on case-control studies they contend reflect inadequate latency periods, that is, periods between exposure and diagnosis. *See* Mucci Report 7, 36-40, 49, 69; Rider Report 32-33, 35, 38-39, 45-46. Specifically, Monsanto pointed to the case-control studies conducted in Kansas and Iowa/Minnesota, which are included in the pooled analyses reported in De Roos (2003) and the NAPP. The Kansas cases were identified between 1979 and 1981 and the Iowa/Minnesota

cases between 1980 and 1983. De Roos (2003) at 1-2. Monsanto and its experts argued that these studies focused on people diagnosed with NHL too soon after glyphosate was put on the market in 1974 to capture cases caused by glyphosate, as cancer typically takes many years to develop. The plaintiffs' experts recognized that inadequate latency periods could be cause for concern, and at least implicitly acknowledge that latency could be an issue with the studies that generated many of the numbers that are most helpful to the plaintiffs. *See* Ritz Report 17 ("Although a short latency period does not completely exclude the possibility of exposure-disease relationships in cancer, a longer latency period increases confidence in results due to increased biological plausibility[,] i.e.[,] typically we would generally expect a 5-10 year minimum latency between exposure and disease onset for blood system related cancers."); *id.* at 18-19 (acknowledging that the Iowa/Minnesota study had what "is considered an inadequate latency period"); Mar. 6, 2018 Tr. [Weisenburger] 267-70 [Dkt. No. 1175]; Portier Report 5 ("Because the latency period for cancers can be long (years), evaluation of studies should consider whether the exposure occurred sufficiently long ago to be associated with cancer development."); Apr. 6, 2018 Tr. [Portier] 142, 148-53 [Dkt. No. 1353].

Although the latency concern is legitimate, three of the plaintiffs' experts, Drs. Ritz, Portier, and Weisenburger, explained that this concern was mitigated to a degree by steps taken by some study authors. One reason a study might show an association between glyphosate and NHL shortly after glyphosate was put on the market is confounding; if one of the pesticides that was frequently used before glyphosate came on the market causes NHL, those who later switched to glyphosate

might simply be manifesting the NHL triggered by those other pesticides. However, in some of the studies, the authors adjusted for other pesticides. The plaintiffs' experts explained that, although it is always possible that an observed association is the result of confounding for which the authors did not account, the adjustment for many other pesticides used by De Roos (2003), in particular, made it significantly less likely that a pesticide other than glyphosate explained the observed association. If the studies accounted for likely confounders, they explained, there is little reason to discount the studies, notwithstanding the relatively short latency periods they captured. *See* Mar. 6, 2018 Tr. [Weisenburger] 282-83; Apr. 4, 2018 Tr. [Ritz] 15-18, 30-31; Apr. 6, 2018 Tr. [Portier] 149-53.

The plaintiffs' experts also sought to downplay the latency concern in other ways. Dr. Ritz asserted that, in a case-control study, an association observed after a short latency period might be something of an alarm bell, as those cases might reflect outcomes in people who experienced heavy exposures or who developed particularly aggressive cancers. Apr. 4, 2018 Tr. [Ritz] 9-11. As a result, Dr. Ritz argued, one might expect to see an even stronger association had the studies allowed for longer latency periods. *Id.*; *see also* Apr. 6, 2018 Tr. [Portier] 154. Dr. Ritz also hypothesized that quicker onset of NHL in case-control studies might reflect the older average age of case-control study participants versus participants enrolled in the cohort study discussed below.[20]

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[20] For the most part, Dr. Ritz introduced her views on latency in her original expert report and discussed them at her deposition. *See* Wagstaff Decl. ISO Pls.' Opp'n Ex. 58 [Dkt. No. 652-12] (discussing latency in the context of the De Roos (2003) study). To the

Overall, the latency concern raised by Monsanto is a legitimate one that makes a causal account of the American case-control studies, in particular, more difficult to swallow. But, at least for the studies that adjust for other pesticide exposures, the relatively short period between glyphosate exposure and cancer development is not a concern so significant as to disqualify an expert who gives significant weight to the case-control studies in rendering a causation opinion.

Monsanto also argues that reliance on some of the case-control studies is inappropriate because they did not adequately account for the important possible confounder of exposure to other pesticides. Some glyphosate users, like farmers and landscapers, are likely exposed to many pesticides, and these other pesticides may also be associated with elevated incidences of NHL. As discussed, the case-control studies adjusted for possible confounders to different degrees, and when study authors provided both unadjusted and adjusted numbers, the odds ratios adjusted for use of other pesticides were closer to 1.0, and often not statistically significant. *See*, *e.g.*, Eriksson (2008) at 1659, 1661. The possibility of confounding arising from exposure to oth-

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extent she strayed into new territory regarding latency in the epidemiological studies during the second round of *Daubert* hearings—as is arguably the case with her opinion that the older average age of participants in case-control studies might have some explanatory power—the Court is persuaded that exclusion is not warranted, as Dr. Ritz's testimony was responsive to the Court's questions, and Monsanto will have an adequate opportunity between now and trial to refine its cross-examination on this point. *But see id.* at 187-89 (discussing the relationship between age and latency generally). The Court reaches the same conclusion regarding Dr. Portier's illustration of the different latency concerns associated with case-control and cohort studies. *See* Apr. 6, 2018 Tr. [Portier] 34-40.

er pesticides is a serious consideration and one that must be accounted for in a reliable expert report assessing the epidemiology evidence.

C. Cohort Study

Instead of the case-control studies, Monsanto's experts focus on the results of the Agricultural Health Study (AHS), a cohort study. Recall that cohort studies, unlike case-control studies, select participants without the disease of interest and follow them for a period of time to see what diseases develop in the exposed and unexposed cohorts. Advantages of such studies include that they can conclusively establish the temporal relationship between exposure to a chemical and a disease, and that they avoid the possibility of recall bias by selecting participants before they develop the disease. *See* Reference Manual at 557-58; Supplemental Expert Report of Dr. Ritz 3, Wagstaff Decl. ISO Pls.' Supp. Br. Ex. 7 [Dkt. No. 1136-7] ("Ritz Supp. Report"). The AHS is a cohort study of more than 57,000 licensed pesticide applicators from Iowa and North Carolina.[21] The study participants were first surveyed between 1993 and 1997, and were at that time asked about their use of 50 pesticides, including glyphosate. *Id.* at 2. Participants were asked not only about years of use and days of use per year, but also about other features of their pesticide application that could affect the intensity of their exposure, including use of personal protective equipment and application method. *Id.* Sixty-three percent of the participants completed a follow-up telephone interview approximately five years

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[21] Gabriella Andreotti et al., *Glyphosate Use and Cancer Incidence in the Agricultural Health Study*, 110 Journal of the National Cancer Institute 1 (2018), Wagstaff Decl. ISO Pls.' Supp. Br. Ex. 1 at 1-2 [Dkt. No. 1136-1] ("Andreotti (2018)").

later. *Id.* That survey asked about the participants' pesticide use during the most recent year in which they farmed. *Id.* Cancer outcomes for members of the cohort were determined through cancer registries. *Id.*

When the initial round of expert reports in this case was prepared, the most recent published study addressing the relationship between glyphosate and NHL as observed in the AHS was a 2005 study, whose lead author was again De Roos.[22] The De Roos (2005) study was published before data from the follow-up surveys were analyzed. It reported no statistically significant association between glyphosate use and NHL, considering 92 total observed cases of NHL—a fully adjusted odds ratio of 1.1 (0.7-1.9) for ever having used glyphosate, with no evidence of higher rates of disease with more days of exposure. *Id.* at 51-52. The meta-analyses mentioned previously—Schinasi & Leon (2014), Chang & Delzell (2016), and IARC's meta-analysis—incorporated this study.[23]

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[22] *See* Anneclaire J. De Roos et al., *Cancer Incidence Among Glyphosate-Exposed Pesticide Applicators in the Agricultural Health Study*, 113 Environmental Health Perspectives 49 (2005), Wagstaff Decl. ISO Pls.' Opp'n Ex. 72 [Dkt. No. 653-12] ("De Roos (2005)").

[23] Several of the experts discussed an unpublished reanalysis of the AHS data during the first round of expert reports, "Alvanja (2013)." Chang and Delzell, authors of the 2016 meta-analysis, prepared an unpublished "technical memorandum" revisiting their meta-analysis, replacing the AHS (2005) data with data from Alvanja (2013) and incorporating the unpublished NAPP data into their sensitivity analyses. Wagstaff Decl. ISO Pls.' Opp'n Ex. 56 [Dkt. No. 652-10]. Data from these unpublished studies were provided by Monsanto. The primary meta-risk ratio reported in this memorandum for ever having used glyphosate was 1.2 (0.91-1.6). *Id.* at 5.

A few months before the *Daubert* hearing, an update of the De Roos (2005) study was published in the *Journal of the National Cancer Institute*. This update, which is known as "Andreotti (2018)," included data gathered using the follow-up telephone interviews and considered 575 individuals who developed NHL. Andreotti (2018) at 5. Like the 2005 study, Andreotti (2018) reported no association between glyphosate use and NHL. *Id.* at 4-5. The study broke the cohort into quartiles based on how intensively the study participants had used glyphosate, using a formula that included number of days of use, lifetime years of use, use of protective equipment, and other factors to determine the "intensity-weighted lifetime days of use" for each participant. The results ranged from rate ratios of 0.83 (0.59, 1.18) for the lowest quartile, to 0.88 (0.65, 1.19) for the third-highest quartile. *Id.* The study also reported results that took into account different possible latency periods, and these results likewise showed no statistically significant association. *Id.* at 6. At the Court's request, the parties submitted supplemental briefs addressing the import of this newly-published study. Dkt. No. 761. All of the plaintiffs' experts submitted supplemental reports addressing the study, and Monsanto's epidemiology experts did the same.

The plaintiffs' experts identified concerns with this study. First among these is the risk of exposure misclassification. Dr. Ritz highlighted potential problems with both the way pesticide exposure was assessed during the initial survey and the way the follow-up survey was conducted. *See* Ritz Supp. Report 2-7. Inaccurate exposure assessments were likely during the initial survey, she argued, because the initial data were obtained from people applying for pesticide applicator licenses who were asked on the spot to recall their use

of many pesticides over the past several decades. They did not have an opportunity to check their records or otherwise verify their answers. *Id.* at 2-3.

Dr. Ritz also highlighted problems with the questionnaire's inquiry about the use of personal protective equipment, noting that the survey asked only about the use of protective equipment generally, not about the use of such equipment when applying glyphosate. Because the intensity-weighted results for each pesticide relied on the same generic response regarding protective gear, participants were likely classified into incorrect exposure groups. Mar. 5, 2018 Tr. [Ritz] 72-76. For example, if a farmer had in mind the protective gear he used for his most toxic pesticides when he answered the question, even if he used no protective gear when applying glyphosate, he would be placed in a lower exposure group for the intensity-weighted analysis of glyphosate. Another consideration noted by Dr. Ritz is that, because study participants were in the process of applying for their pesticide applicator licenses, they may have felt an incentive to portray themselves in their responses as using protective gear properly even if they did not actually do so. *Id.* at 74-75.

The plaintiffs' experts also contend there is a particular risk of misclassification where glyphosate is concerned (compared to other pesticides studied in the AHS), because use patterns changed so dramatically in the mid-1990s. Ritz Supp. Report 5. Glyphosate use greatly increased during that period with the introduction of glyphosate-resistant genetically engineered crops. Dr. Ritz elaborated on this concern at some length, arguing that the change in glyphosate use patterns was not adequately captured by the follow-up study for two main reasons. First, the follow-up survey asked only about pesticide use during the last year of

farming prior to the interview, rather than asking about all the intervening years. *Id.* at 6. Second, the study authors imputed the exposures of the approximately thirty-seven percent of participants who did not respond to the follow-up survey using a mathematical model. That imputation, the plaintiffs' experts argued, is also susceptible to error. *Id.* at 6-7; Supplemental Expert Report of Dr. Portier 2-4, Wagstaff Decl. ISO Pls.' Supp. Br. Ex. 22 [Dkt. No. 1136-22] ("Portier Supp. Report").[24] They highlighted a published paper evaluating the AHS imputation method that reported the model underestimated glyphosate exposure when tested against a sample of those who had responded to the survey.[25] According to Dr. Portier, use of this im-

[24] During his second round of *Daubert* testimony, Dr. Portier presented a series of hypothetical examples seeking to explain the risk of exposure misclassification associated with the imputation method in the most recent AHS study. Apr. 6, 2018 Tr. [Portier] 51-57. These examples were not included in his supplemental expert report. However, Dr. Portier explained in his supplemental report that the imputation method could have resulted in differential exposure misclassification and pointed to the 2012 study from which he obtained the numbers he used in his *Daubert* presentation. Portier Supp. Report 3. Under ordinary pretrial circumstances, it would be a closer question whether to exclude these new hypotheticals; there would be an argument that Monsanto lacked sufficient time to prepare to address them before the jury trial. However, in the context of these MDL proceedings, the Court concludes they need not be excluded. *Cf. In re Seroquel Products Liability Litigation*, No. 6:06-md-1769-Orl-22DAB, 2009 WL 3806435, at *13 (M.D. Fla. June 23, 2009). For one, Monsanto will have adequate time to prepare further cross-examination relevant to these charts between now and the next phase of the proceedings. For another, although the charts themselves reflected additional analysis, that analysis elaborated on Dr. Portier's previously disclosed opinions.

[25] *See* Apr. 6, 2018 Tr. [Portier] 49-50, 56-57; Sonya L. Heltshe et al., *Using Multiple Imputation To Assign Pesticide Use for*

putation method likely resulted in differential exposure misclassification. Apr. 6, 2018 Tr. [Portier] 49-50, 56-57. Moreover, Dr. Portier contended, the differences in the total percentage of people exposed could have masked a misclassification of much larger magnitude, had the imputation model also misclassified some of the exposed people as unexposed. Apr. 6, 2018 Tr. [Portier] 53-56. In addition, the model assumed that non-response to the follow-up survey was random, leaving open the possibility that non-responders were meaningfully different from those who responded to the survey. *See* Heltshe (2012) at 8.

Monsanto's experts mounted a strong defense of this study, pointing out that it considered by far the largest number of NHL cases across a broad range of exposures and for the longest period of time. Supplemental Expert Report of Dr. Mucci 6, Hollingsworth Decl. ISO Def.'s Supp. Br. Ex. 7 [Dkt. No. 1137-8] ("Mucci Supp. Report"); Supplemental Expert Report of Dr. Rider 6, 9, Hollingsworth Decl. ISO Def.'s Supp. Br. Ex. 8 [Dkt. No. 1137-9] ("Rider Supp. Report"). In addition, Monsanto argues, the results are appropriately controlled for confounding by lifestyle factors and other pesticides. Mucci Supp. Report 7. To rebut the critiques of the plaintiffs' experts, Monsanto's experts highlighted the sensitivity analyses used by the study authors, as well as the efforts taken to validate the imputation method used to estimate the missing respons-

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Non-Responders in the Follow-Up Questionnaire in the Agricultural Health Study, 22 Journal of Exposure Science & Environmental Epidemiology 1, 11, 18 (2012), Wagstaff Decl. ISO Pls.' Supp. Br. Ex. 31 [Dkt. No. 1136-31] ("Heltshe (2012)") (showing an observed prevalence of glyphosate exposure of 52.73%, compared to an imputed prevalence of 45.42% in a holdout dataset used to test the accuracy of the model).

es and to demonstrate that selection bias with respect to those who completed the follow-up interview was not a serious concern. *Id.* at 3-7; Rider Supp. Report 4, 10; Mar. 9, 2018 Tr. [Mucci] 905-09. In short, Monsanto's experts reasonably consider the most recent AHS publication to be the most powerful evidence regarding the relationship between glyphosate and NHL. Because this study shows no association, Monsanto argues, there is no basis for finding a causal relationship.

* * *

The upshot of all this is that the epidemiology evidence is open to different interpretations, and the potential flaws in the data from the case-control studies and meta-analyses are not overwhelmingly greater than the potential flaws in the data from the AHS study. An expert operating "within the range of accepted standards governing how scientists conduct their research and reach their conclusions" could thus place less weight on the AHS study, and could conclude that the analyses of the case-control studies support an association between glyphosate exposure and NHL, even if this is not necessarily the best interpretation of the evidence. *Daubert II*, 43 F.3d at 1317. As a result, an expert who places more weight on the case-control studies than the AHS study cannot be excluded as categorically unreliable for doing so.

IV. LABORATORY ANIMAL CANCER STUDIES

In addition to the epidemiological evidence, the plaintiffs seek to support their general causation arguments with opinions addressing studies of cancer in rodents.

Monsanto objects to the plaintiffs' experts' reliance on these studies to support their causation opinions, ar-

guing that any opinions based upon these data fail the relevance or "fit" requirement of the *Daubert* inquiry. In effect, Monsanto argues that for opinions addressing this evidence to be admissible, the plaintiffs must show that it is appropriate to extrapolate directly from increased incidences of particular rodent tumors to an increased incidence of NHL in humans at human-relevant exposure levels. That is not necessary. It's true that, where animal studies provide the best available evidence of causation, the experts seeking to rely upon such evidence must explain why the results in animals are relevant to humans. *See Domingo ex rel. Domingo v. T.K.*, 289 F.3d 600, 606 (9th Cir. 2002); *In re Silicone Gel Breast Implants Products Liability Litigation*, 318 F. Supp. 2d 879, 891 (C.D. Cal. 2004) ("Animal studies are not generally admissible where contrary epidemiological evidence in humans exists."). But the parties don't face that scenario here.

It is sufficient for purposes of the Rule 702 relevance inquiry that the evidence "logically advance[] a material aspect of the proposing party's case." *Daubert II*, 43 F.3d at 1315. Demonstrating that a chemical is carcinogenic in rodents would logically advance the plaintiffs' argument that glyphosate is capable of causing NHL in humans, because it is pertinent to, at least, the biological plausibility criterion that is part of the Bradford Hill analysis. *See*, *e.g.*, Mar. 7, 2018 Tr. [Jameson] 429 ("This is a premise that is generally accepted in the scientific community, that if an agent causes a[] cancer in animals, that it's biologically plausible to be a human carcinogen.") [Dkt. No. 1181]. Rodent cancer studies are routinely conducted to learn information that is useful in assessing whether sub-

stances cause cancer in humans.[26] So, while the rodent studies would not be sufficient on their own to satisfy the plaintiffs' burden (at least in this case), the rodent studies nevertheless "speak[] clearly and directly to an issue in dispute in the case," and they will not mislead the jury when properly contextualized. *Daubert II*, 43 F.3d at 1321 n.17.

For these reasons, although IARC's overall conclusion that glyphosate is a "probable human carcinogen" is not squarely relevant to the general causation question in this case, IARC's narrower conclusion about carcinogenicity in lab animals is quite relevant. If there is sufficient evidence that glyphosate causes cancer in animals, as IARC concluded, that would support the plaintiffs' case. And IARC's analysis itself suggests that such a conclusion is within the mainstream of scientific views regarding how to interpret the available animal cancer studies. *See* Reference Manual at 564 n.46.

As with the epidemiological studies, the parties' experts generally agree about which underlying animal studies are worthy of close consideration. The studies at issue are cancer bioassays that assess the development of tumors (both benign and malignant) in rodent subjects after chronic exposure to different doses of glyphosate over most of their lifetimes. *See*, *e.g.*, *id.* at 640-41, 644-45; Expert Report of Dr. Rosol 3, Wagstaff Decl. ISO Pls.' Opp'n Ex. 97 [Dkt. No. 655-7 at 124] ("Rosol Report"); Expert Report of Dr. Jameson 19, Wagstaff Decl ISO Pls.' Opp'n Ex. 6 [Dkt. No. 648-6]

[26] *See* Bernard D. Goldstein & Mary Sue Henifin, *Reference Guide on Toxicology*, *in* Reference Manual on Scientific Evidence 633, 637 (3d ed. 2011) ("[T]he toxic responses in laboratory animals are useful predictors of toxic responses in humans."); *see also In re Silicone Gel Breast Implants Products Liability Litigation*, 318 F. Supp. 2d at 890.

("Jameson Report"). Included in these studies is a control group subject to the same conditions—regarding food, light exposure, or exercise, for example—as the experimental group in every respect except for exposure to the chemical of interest. *See* Reference Manual at 640. The rodents in these long-term studies are typically exposed to doses that are significantly higher, relative to body mass, than what humans realistically would experience, as the goal is to maximize the studies' ability to detect the chemical's capacity to cause cancer. *Id.* at 644-45.

In contrast to the epidemiology studies, much of the data on experimental animals were not presented in studies published in peer reviewed journals. Instead, the data tend to come from studies submitted by manufacturers to regulatory agencies. To the extent the data underlying these studies are public, the data are generally considered by IARC, and they were considered by the experts in this case. *See* Monograph at 12; Apr. 6, 2018 Tr. [Portier] 186. One source of much of the data for the experts here was a supplement to a review article published in 2015, which included tumor incidence tables from many of the regulatory submissions.[27]

As with the epidemiology, the experts also broadly agreed on the method to be employed in evaluating animal toxicology studies. They conducted literature reviews and assessed study quality, excluding those studies about which inadequate information was available

[27] Helmut Greim et al., *Evaluation of Carcinogenic Potential of the Herbicide Glyphosate, Drawing on Tumor Incidence Data from Fourteen Chronic/Carcinogenicity Rodent Studies*, 45 Critical Reviews in Toxicology 185, 185 (2015) ("Greim (2015)"). Although IARC reviewed Greim (2015), it was unable to evaluate in detail several of the studies considered by the experts here. Mar. 7, 2018 Tr. [Jameson] 455-56; Monograph at 354.

or that had serious methodological problems. Although there is some disagreement at the margins, the experts focused primarily on seven rat studies and five mouse studies. *See* Jameson Report 28-29; Portier Report 50; Rosol Report 9-19; Expert Report of Dr. Foster 13-25, Wagstaff Decl. ISO Pls.' Opp'n Ex. 37 [Dkt. No. 649-7] ("Foster Report"). Then, broadly speaking—although the details differ—the experts assessed the tumors that arose in the studies for statistical and biological significance. Relevant to the first aspect of this analysis is both whether there was a statistically significant increase in tumor development in a particular dose group, as compared to the control group, and whether the numbers of tumors that developed in the treated groups showed a statistically significant trend as the dosage of glyphosate increased.[28] The experts also agreed that data from concurrent controls—the rodents

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[28] *See* U.S. Environmental Protection Agency, *Guidelines for Carcinogen Risk Assessment* 2-19 (2005), https://www.epa.gov/sites/production/files/2013-09/documents/cancer_guidelines_final_3-25-05.pdf [https://perma.cc/G878-YJLC] ("EPA, Guidelines for Carcinogen Risk Assessment"). The EPA Guidelines go on to explain:

> Trend tests and pairwise comparison tests are the recommended tests for determining whether chance, rather than a treatment-related effect, is a plausible explanation for an apparent increase in tumor incidence. A trend test such as the Cochran-Armitage test (Snedecor and Cochran, 1967) asks whether the results in all dose groups together increase as dose increases. A pairwise comparison test such as the Fisher exact test (Fisher, 1950) asks whether an incidence in one dose group is increased over that of the control group. By convention, for both tests a statistically significant comparison is one for which p is less than 0.05 that the increased incidence is due to chance. Significance in either kind of test is sufficient to reject the hypothesis that chance accounts for the result.

Id.

in the control group of the same study—were most important. But they acknowledged that the rate of tumor incidence in historical control groups—control groups used in previous, similar studies—was relevant as an indicator of how many spontaneous tumors could be expected. The experts disagreed, however, about how and to what extent to consider historical control information. A further important consideration in assessing whether a chemical causes cancer in rodents is whether particular tumor findings were replicated across gender, subtype, species, or study. Monsanto does not dispute the reliability of this method on the whole, instead critiquing specific aspects the plaintiffs' experts' application. These critiques will be discussed in Section VI.

V. MECHANISTIC DATA

The final category of evidence the plaintiffs seek to put before the jury addresses possible mechanisms at the cellular level by which glyphosate could cause cancer. The plaintiffs identify two possible mechanisms they contend are supported by the scientific literature: genotoxicity and oxidative stress.

Monsanto again disputes the relevance of this body of literature, arguing that the objectives of studies at the cellular level are far afield from the question of general causation. However, for much the same reason that the experts' opinions on the rodent studies are relevant, the plaintiffs' experts' opinions regarding the mechanistic evidence are also relevant: the mechanistic evidence pertains to biological plausibility. Evidence that glyphosate causes damage to the genetic material in cells (genotoxicity) or an imbalance between the production of reactive oxygen species and antioxidant defenses in a cell (oxidative stress) supports the plaintiffs' argument that it is biologically plausible that glypho-

sate acts as a carcinogen. *See In re Denture Cream Products Liability Litigation*, 795 F. Supp. 2d 1345, 1356 (S.D. Fla. 2011) ("When mechanistic evidence is present it can greatly strengthen a causal inference, but when it is absent it does not necessarily undermine the inference." (citation and alteration omitted)). This is not a scenario where the plaintiffs are relying on mechanistic studies alone to justify their experts' causal inferences; mechanistic evidence "may supplement the more substantial evidence of general causation in this case." *In re Abilify*, 299 F. Supp. 3d at 1399.

Monsanto further argues that any opinion that relies upon two human studies—which the parties refer to as "Paz-y-Miño (2007)" and "Bolognesi (2009)"—must be excluded because the methodologies of those studies are so flawed that any opinion based on them is necessarily unreliable.[29] These studies considered possible genotoxic effects of glyphosate in people following aerial spraying in Colombia and Ecuador. They are "in vivo" studies of cells in whole, living organisms, as opposed to "in vitro" studies of cells outside their normal biological contexts.

Studies are not admissible simply because they are published. *See In re Viagra Products Liability Litigation*, 658 F. Supp. 2d 936, 945 (D. Minn. 2009). The two human in vivo studies Monsanto targets have flaws,

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[29] César Paz-y-Miño et al., *Evaluation of DNA Damage in an Ecuadorian Population Exposed to Glyphosate*, 30 Genetics & Molecular Biology 456 (2007), Wagstaff Decl. ISO Pls.' Opp'n Ex. 109 [Dkt. No. 656-4] ("Paz-y-Miño (2007)"); C. Bolognesi et al., *Biomonitoring of Genotoxic Risk in Agricultural Workers from Five Colombian Regions: Association to Occupational Exposure to Glyphosate*, 72 Journal of Toxicology & Environmental Health 986 (2009), Wagstaff Decl. ISO Pls.' Opp'n Ex. 110 [Dkt. No. 656-5] ("Bolognesi (2009)").

some of which are acknowledged by the study authors themselves. *See* Bolognesi (2009) at 995 (acknowledging the possibility of misclassification of exposures and "the need to use better procedures to estimate the exposure"). For instance, there was a delay between glyphosate exposure and the genotoxicity assessment in Paz-y-Miño (2007), and some of the study participants showed symptoms suggesting acute illness. *See* Paz-y-Miño (2007) at 457. But none of these flaws is so glaring that an expert who relies on the studies in assessing all the evidence going to whether glyphosate has a genotoxic effect, as the plaintiffs' experts and IARC did, is necessarily unreliable.

VI. CONCLUSIONS REGARDING THE PLAINTIFFS' EXPERTS

The parties' experts offer contrasting takes on how to assess the evidence discussed in the three preceding sections. It is a given that there will be disagreement among reasonable scientists about which evidence to emphasize in cases where the evidence does not point unequivocally toward a particular conclusion. *See*, *e.g.*, *Milward*, 639 F.3d at 18. The question here is whether the plaintiffs' experts' analysis of these studies "falls within the range of accepted standards governing how scientists conduct their research and reach their conclusions." *Daubert II*, 43 F.3d at 1317.

Although the plaintiffs' experts specialize in various scientific disciplines, they all engage in some version of a Bradford Hill analysis (perhaps with the exception of Dr. Jameson, as discussed below). Recall that the Bradford Hill approach to assessing whether an association is causal takes into account: strength of association, consistency across studies, specificity of the association, temporality, dose response, biological plau-

sibility, coherence, experimental evidence, and analogous compounds.

As mentioned in Section III, the Bradford Hill criteria are generally associated with epidemiology, and a reliable assessment that an association between glyphosate and NHL exists in the epidemiological literature is a prerequisite to application of the criteria. *See* Reference Manual at 597. As a practical matter, however, application of these criteria requires an expert to consider more than the epidemiology literature. In particular, by inquiring about biological plausibility and coherence with other knowledge, the Bradford Hill framework asks experts to survey all the available evidence that might support or disprove causation. A broad survey of the available evidence is neither unusual in expert testimony nor necessarily inappropriate. *See*, *e.g.*, *Milward*, 639 F.3d at 19-20; *In re Neurontin Marketing, Sales Practices & Products Liability Litigation*, 612 F. Supp. 2d 116, 158-59 (D. Mass. 2009). However, this feature of the Bradford Hill methodology poses some challenges for a reviewing court, as the sweep of an expert's opinion is likely to be quite broad, the inquiry involves the exercise of subjective judgment, and an expert may opine on matters outside of her core area of expertise.

To the extent the *Daubert* question is whether consideration of the Bradford Hill factors is a reliable method for determining causation as a general matter, the answer is yes. *See*, *e.g.*, *Wendell*, 858 F.3d at 1235 n.4; *In re Zoloft*, 858 F.3d at 795-97. Although it is not the sort of scientific process that is amenable to objective testing, or that has a known or potential error rate, none of the experts dispute that this method of evaluating scientific evidence is generally accepted in the field of epidemiology. *See Daubert II*, 43 F.3d at 1316; *Lust*

By & Through Lust v. Merrell Dow Pharmaceuticals, Inc., 89 F.3d 594, 597 (9th Cir. 1996) (noting that "testing and rate of error … do not apply, however, when the expert has not done original research, but rather has surveyed available literature and drawn conclusions that differ from those presented by the scientists who performed the original work"). What matters more in this case is whether the way the experts assessed each of the Bradford Hill factors is reliable in light of the underlying evidence. The experts must also show that the analytical leaps required to reach their ultimate conclusions regarding glyphosate's ability to cause NHL in humans are supportable, in light of the evidence on which they relied. *See Joiner*, 522 U.S. at 146.

A. Dr. Portier

Dr. Portier is a biostatistician whose graduate research focused on the design of rodent studies and who, among other things, worked for much of his career at the Center for Disease Control's National Center for Environmental Health and at the National Institutes of Health's National Institute of Environmental Health Sciences. Mar. 7, 2018 Tr. [Portier] 540-41; Portier Report 1-3. Although Dr. Portier's PhD is in biostatistics and his primary focus is on toxicology and mechanistic studies, he has reviewed epidemiology studies throughout his career and has published in the field. Apr. 6, 2018 Tr. [Portier] 13-14, 16-21. Accordingly, although epidemiology is not his core area, he is qualified to examine the epidemiology literature to see whether an association exists and, if so, to engage in a Bradford Hill analysis.

Dr. Portier conducted a literature review of the epidemiological evidence and, as to the epidemiological

evidence alone, agreed with IARC's conclusion that the evidence supported a credible causal interpretation but could not definitively rule out chance, bias, or confounding. *See* Portier Report 6; Mar. 8, 2018 Tr. [Portier] 618-19; Apr. 6, 2018 Tr. [Portier] 78-79. As an initial matter, Monsanto makes a non-frivolous argument that Dr. Portier's description of what the epidemiology evidence shows—a description that several of the plaintiffs' experts shared—entitles it to summary judgment. However, the better conclusion is that the plaintiffs' experts need not derive their causation conclusion exclusively from that body of evidence. If other bodies of knowledge tend to bolster a causal interpretation of studies that could not alone establish causation, an expert need not be excluded based on an opinion that the epidemiology evidence alone is limited in the way Dr. Portier describes.

Although Dr. Portier agreed with IARC's assessment, his expert report did not simply reiterate IARC's conclusions. In analyzing the epidemiology evidence, Dr. Portier emphasized numbers adjusted for use of other pesticides, particularly those from the Chang & Delzell (2016) and IARC meta-analyses and the De Roos (2003) study. He considered the possible roles that chance, confounding, small sample sizes, and recall bias might have played in explaining the observed results. *See*, *e.g.*, Portier Report 11. He also explained that he discounted the Andreotti (2018) study in light of possible exposure misclassification arising from the study design, the dramatic increase in glyphosate use over the course of the AHS, and the authors' imputation of exposures for the sizable portion of the cohort that did not respond to the follow-up survey. Portier Supp. Report 3-4.

As noted, reliably identifying an association between NHL and glyphosate is a necessary predicate to reliable application of the Bradford Hill criteria. *See* Bradford Hill at 295; *In re Lipitor (Atorvastatin Calcium) Marketing, Sales Practices & Product Liability Litigation (No. II)*, 892 F.3d 624, 640 (4th Cir. 2018). Dr. Portier does not in his report first pause to establish an association. Even though Dr. Portier did not structure his report in this way, however, it is clear that he identified an association between glyphosate and NHL. What primarily persuaded Dr. Portier that an association existed was the consistency of the observed associations across different case-control studies. Portier Report 15. He acknowledged that, using the most highly adjusted numbers, the increases in NHL observed with exposure to glyphosate were "modest"—generally under 2.0—and were not always statistically significant. *Id.* at 15, 19. But he concluded it was unlikely that so many studies would report results above 1.0, whether statistically significant or not, if there was no true association. *Id.* at 14-16. This is thus not a scenario where an expert attempted to deploy the Bradford Hill "guidelines to support the existence of causation in the absence of any epidemiologic studies finding an association," given how Dr. Portier interprets the studies. *In re Lipitor*, 892 F.3d at 640 (citations omitted).

Dr. Portier conducted his Bradford Hill analysis as follows: He concluded that the epidemiology studies addressed exposures occurring prior to disease onset, and therefore that the temporality criterion—the only non-discretionary Bradford Hill factor—was satisfied. Portier Report 75. As to the strength of the observed association, Dr. Portier acknowledged that the observed odds ratios showed a "moderate" association,

and that it was therefore "conceivable they are individually due to either chance or bias." *Id.* at 18.[30] Although the magnitude of the observed association in each individual study was not especially large, another Bradford Hill criterion, consistency, allayed his concerns about chance and bias, leading him ultimately to conclude that the case-control studies "demonstrate a significant strength of association." *Id.* at 19. His opinion that the consistency criterion provided strong support for causation emphasized the Chang & Delzell (2016) meta-analysis, which showed little heterogeneity between studies and remained stable after sensitivity analyses. *Id.* at 15-17. He also considered possible sources of bias or confounding that might explain the consistency but noted, among other things, that several of the studies controlled for other pesticides without erasing the observed association. *Id.* at 17-18. Dr. Portier further concluded, based on two case-control studies and the AHS, that dose response, or biological gradient, was demonstrated to a moderate degree by the epidemiological studies. *Id.* at 74-75. Dose response—which refers to whether there is an increased risk of contracting a disease associated with higher levels of exposure to the agent—is strong but not necessary evidence of a causal relationship. Reference Manual at 603.

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[30] Monsanto argues that the plaintiffs must be able to show a statistically significant odds ratio of greater than 2.0 to survive summary judgment at the general causation stage. Controlling case law does not support that proposition. *See In re Hanford Nuclear Reservation Litigation*, 292 F.3d at 1137; *see also In re Bextra & Celebrex Marketing Sales Practices & Product Liability Litigation*, 524 F. Supp. 2d 1166, 1172-73 (N.D. Cal. 2007) (explaining that a relative risk of greater than 1.0 is relevant to general causation, while a relative risk of 2.0 can be probative of specific causation).

Dr. Portier further concluded that the biological plausibility criterion "very strong[ly]" supported causation. Portier Report 77. He focused much of his report on this point, analyzing both the rodent carcinogenicity studies and the studies addressing possible cellular mechanisms of action in conjunction with this factor. *Id.* at 19-74. He again relied on this evidence, along with studies showing absorption and excretion of glyphosate by exposed humans, in support of Bradford Hill's "coherence" criterion, which asks whether a causal interpretation of the association conflicts with other information known about the disease. *Id.* at 75-76. He concluded this criterion strongly supported a causal assessment. *Id.* at 77.

Because there are causes of NHL aside from glyphosate, Dr. Portier concluded "[t]here is little support for specificity." *Id.* at 75; *see also id.* at 77 (stating that specificity is "[n]ot needed"); Apr. 6, 2018 Tr. [Portier] 75 (stating that specificity "doesn't add to the causation argument"). He did not rely on the criteria considering analogous compounds and evidence from human experimental studies in reaching his causation opinion, citing his lack of information about the former and a lack of data altogether as to the latter. Portier Report 76-78.

With respect to Dr. Portier's epidemiology-related conclusions—both his finding of an association between glyphosate exposure and NHL and his application of the Bradford Hill factors that turn on the epidemiology studies—it is not difficult to conclude that much of his analysis is sufficiently reliable to be admissible. For example, as discussed more fully in Section III, it was reasonable for Dr. Portier to rely more heavily on the case-control studies than the AHS. To briefly recap, there is a legitimate concern about exposure misclassi-

fication in the AHS. With respect to the case-control studies, Dr. Portier addressed the most significant concern—the possibility that pesticides other than glyphosate caused the observed cases of NHL—by focusing on data adjusted for potential confounding by various other pesticides. *See In re Abilify*, 299 F. Supp. 3d at 1322-23. Monsanto's other critiques of the case-control studies, like the possible presence of recall bias or the short period between glyphosate exposure and diagnosis in some of the studies, are not significant enough to require an expert categorically to weight them less heavily than the AHS. And having reasonably decided to rely heavily on the case-control studies, Dr. Portier's conclusion that a true association exists between glyphosate and NHL, as well as his conclusion that the Bradford Hill "consistency" criterion was satisfied, was not an unreasonable logical leap.

On the other hand, some of Dr. Portier's epidemiology-related conclusions follow less clearly from the studies—particularly those relating to strength of association and dose response. Regarding the former, it seems like a stretch to conclude, as Dr. Portier seems to have done, that the association between glyphosate use and NHL is strong. *See* Apr. 6, 2018 Tr. [Portier] 68. Even if one completely discounted the AHS (which Dr. Portier claims not to have done), virtually all the adjusted odds ratios from the case-control studies are below 2.0, and many of them are not statistically significant. As discussed in Section III, data may well be informative even in the absence of statistical significance, but one would expect a more cautious assessment regarding the strength of association in light of these numbers, particularly when one remembers that the case-control studies have vulnerabilities of their own. And when the AHS is given some weight (as Dr. Porti-

er apparently agrees it should), the overall picture from the data becomes fuzzier still.

With respect to dose response, it's true that some of the data from the case-control studies support Dr. Portier's conclusion, but other data do not, as he acknowledged. Eriksson (2008) reported a higher odds ratio—2.36 (1.04, 5.37)—for those who used glyphosate for greater than ten days than for those who used it for ten or fewer days—1.69 (0.70, 4.07). McDuffie (2001) reported odds ratios of 1.0 (0.63, 1.57) for those who used glyphosate between zero and two days per year, and of 2.12 (1.2, 3.73) for those who used it for greater than two days per year. Dr. Portier also concluded that the rodent carcinogenicity studies demonstrated a dose response. Yet neither of the published AHS studies, which used much more detailed exposure metrics, demonstrated a dose response. *See* Portier Report 74-75; Apr. 6, 2018 Tr. [Portier] 140. Although the better conclusion might be that these data are inconclusive, Dr. Portier's assessment that the biological gradient criterion is moderately supportive of a causal association does not constitute an unsupported scientific leap. *See Joiner*, 522 U.S. at 146.

More broadly, Dr. Portier's epidemiology-related conclusions, even tempered as they are by the recognition that the epidemiology evidence alone does not show causation, are far from unassailable. There is one large cohort study (the AHS), with results recently published in a well-regarded scientific journal, suggesting no association between glyphosate use and NHL. There is a series of case-control studies arguably suggesting an association, but a fairly weak one. There are limited data indicating that the association strengthens with greater exposure to glyphosate, but also data to the contrary. And there are legitimate concerns about

the reliability of the data from all the studies. Under these circumstances, all one might expect an expert to conclude is that glyphosate exposure is cause for concern, but not that glyphosate is likely causing NHL at realistic human exposure levels.

But, as noted at the beginning of this ruling, the *Daubert* inquiry does not require (or even allow) a district court to exclude an expert's opinion merely because the court is not persuaded that the expert's read of the evidence is the best one. *See*, *e.g.*, *City of Pomona*, 750 F.3d at 1044 ("The district court is not tasked with deciding whether the expert is right or wrong, just whether his testimony has substance such that it would be helpful to a jury." (citation and alteration omitted)); *Quiet Technology DC-8, Inc. v. Hurel-Dubois UK Ltd.*, 326 F.3d 1333, 1341 (11th Cir. 2003) ("[I]t is not the role of the district court to make ultimate conclusions as to the persuasiveness of the proffered evidence."); *Daubert II*, 43 F.3d at 1318 ("[T]he test under *Daubert* is not the correctness of the expert's conclusions but the soundness of his methodology."); *In re TMI Litigation*, 193 F.3d 613, 665 (3d Cir. 1999), *amended*, 199 F.3d 158 (3d Cir. 2000) (explaining that plaintiffs "do not have to demonstrate to the judge by a preponderance of the evidence that the assessments of their experts are correct, they only have to demonstrate by a preponderance of evidence that their opinions are reliable" (citation omitted)). It bears repeating that applying the Bradford Hill criteria involves a certain amount of subjectivity, and experts often will disagree when doing so. The job of the district court is merely to ensure that the expert's methods are not so far outside the realm of reasonable scientific practice that his testimony would be unhelpful or misleading to a jury. *See Messick*, 747 F.3d at 1199. The Court must

also assure itself that the expert's conclusions are not based upon unreasonable extrapolations from the existing data. *See Joiner*, 522 U.S. at 146. Monsanto can cross-examine Dr. Portier on the apparent weaknesses in his analysis, and there is little reason to think that a jury will not understand those weaknesses. But the aspects of his opinion based upon the epidemiology evidence have a sufficiently reliable basis in the methods of that discipline for the jury to consider his testimony about that evidence, including his assessments of the strength, consistency, and dose-response Bradford Hill criteria. *See Messick*, 747 F.3d at 1197.

Dr. Portier's testimony regarding the contested Bradford Hill factors that do not depend primarily upon epidemiology evidence—namely, biological plausibility and coherence—is also admissible, with one exception.

Dr. Portier first supported his biological plausibility conclusion with a determination that sufficient evidence shows that glyphosate causes cancer in two strains of rats and one strain of mice. Portier Report 52. One of Monsanto's major critiques of this portion of his analysis concerns his decision to use a pooling method to analyze together the results of the various rodent carcinogenicity studies. Dr. Portier's expert report combined the results of similar studies, treating the resulting data as "one big bioassay," then analyzed the results using a Cochran-Armitage trend test. Mar. 7, 2018 Tr. [Portier] 579. In response to critiques from one of Monsanto's experts, he then conducted an additional analysis using logistic regression, which he contended provided similar results. *Id.* at 579-80. He also conducted sensitivity analyses in conjunction with his pooling that sought to isolate the effects of studies that, for instance, had a very high rate of tumor incidence in the control and all dose groups. *Id.* at 577-84.

Although some version of Dr. Portier's pooled approach may well gain traction as a means of evaluating the results of multiple rodent studies, it fares poorly under the traditional *Daubert* criteria. His pooling approach is not subject to objective testing, and it appears to have no identifiable error rate. Although neither of these shortcomings itself requires exclusion, Dr. Portier's method also has not gained general acceptance in the scientific community, nor does it appear to have been subjected to peer review and publication. *See Estate of Barabin v. AstenJohnson, Inc.*, 740 F.3d 457, 463 (9th Cir. 2014).

Dr. Portier seemed to acknowledge that his approach was novel, but argued it was still a reliable way to assess multiple animal studies. Mar. 8, 2018 Tr. [Portier] 638 [Dkt. No. 1183]; Portier Report 21 ("Methods for the combined analysis of multiple animal cancer bioassays are not available in the scientific literature."). Dr. Portier later pointed to two studies by another scientist that he contended used a similar pooling analysis. Mar. 8, 2018 Tr. [Portier] 635. But it appears that the pooling used in these studies combined male and female rodents from the same study, or that the authors displayed results from studies of different lengths in a single figure to model a dose-response curve, rather than combining rodents from multiple separate studies to determine whether given tumor findings were significant in the way that Dr. Portier does.[31] As evidence that Dr. Portier's method has

[31] *See* Michael L. Dourson et al., *Update: Mode of Action (MOA) for Liver Tumors Induced by Oral Exposure to 1,4-dioxane*, 88 Regulatory Toxicology & Pharmacology 45, 46-50 (2017), Wagstaff Decl. ISO Pls.' Opp'n, Ex. 104 [Dkt Nos. 655-14]; Michael Dourson et al., *Mode of Action Analysis for Liver Tumors from Oral 1,4-dioxane Exposures and Evidence-Based Dose Re-*

gained acceptance, the plaintiffs pointed to comments by members of the EPA's Science Advisory Panel indicating that pooling the studies here would be appropriate. However, although some members of the panel evidently found Dr. Portier's proposed approach promising, the report of the panel meeting says only that some "[p]anelists recommend that EPA adopt a pooled analysis approach for combining multiple studies." Wagstaff Decl. ISO Pls.' Opp'n Ex. 10 at 59 [Dkt. No. 648-10]. The report continues, "[a]dopting a pooled analysis approach should include the development of full guidelines for how to conduct and evaluate these analyses," suggesting that the details of what might constitute a reliable way to conduct a pooled analysis remained to be determined. *Id.; see also* Mar. 8, 2018 Tr. [Portier] 638.

That Dr. Portier has staked his reputation on his pooling analysis in regulatory submissions in addition to doing so in this litigation suggests that this litigation isn't the only force behind this portion of his analysis. But Dr. Portier's pooling method has evolved as he has received feedback from his peers, and his regulatory submissions reflected a somewhat different analysis than the one he presents here. Mar. 8, 2018 Tr. [Portier] 626-35. Further, during cross-examination, Dr. Portier acknowledged an error in his expert report, in which he neglected to present one of his pooled sensitivity analyses of thyroid C-cell tumors in male rats, making it appear that he had not consistently applied his method to all the relevant studies. Mar. 8, 2018 Tr. [Portier] 665-66. All this suggests that Dr. Portier's pooling is a good faith work in progress, but does not

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sponse Assessment, 68 Regulatory Toxicology & Pharmacology 387, 391, 394 (2014), Wagstaff Decl. ISO Pls.' Opp'n Ex. 105 [Dkt. No. 655-15]; Mar. 8, 2018 Tr. [Portier] 635-36.

yet constitute "the scientific method, as it is practiced by (at least) a recognized minority of scientists in their field." *Daubert II*, 43 F.3d at 1319. The proper place to refine his pooling approach is not in front the jury.

The question thus becomes whether Dr. Portier's opinion as to the animal studies "nonetheless rests on good grounds." *Karlo v. Pittsburgh Glass Works, LLC*, 849 F.3d 61, 83 (3d Cir. 2017). Although it is a somewhat close call, it appears that Dr. Portier's other analyses and conclusions are separable from his pooling. Dr. Portier acknowledged that the pooling was "part of [his] analysis and evaluation," but he sought to make clear that his conclusions were not dependent upon it. Mar. 8, 2018 Tr. [Portier] 640. He explained, "The pooled analysis is just a tool for me to better understand the strength of the evidence across multiple studies. Like a meta-analysis or the pooled analysis in epidemiology. Not having it doesn't change the core meaning of the data. And so my opinion of the animal carcinogenicity data wouldn't change just because I couldn't use the pooled analysis." Apr. 6, 2018 Tr. [Portier] 181. Indeed, a significant portion of his rebuttal report was dedicated to disputing one of Monsanto's expert's interpretations of the individual studies. *See* Rebuttal Report of Dr. Portier 12-24, Wagstaff Decl. ISO Pls.' Opp'n Ex. 96 [Dkt. No. 655-6].

Without pooling, the remainder of his analysis evinces relatively minor disagreements with the other toxicology experts on how to interpret the studies, and his positions in these debates do not depart from the realm of reasonable science. Monsanto criticized the way Dr. Portier addressed the possibility that random chance could explain the statistically significant tumor findings he identified, given the large number of possible tumor sites analyzed. *See* Mar. 8, 2018 Tr. [Portier]

682-89. In addition to disputing the method he used to account for the role of chance, Monsanto highlighted that the total number of tumor sites included in this portion of his initial report was higher than the number included in his rebuttal report. At the *Daubert* hearing, however, Dr. Portier explained the discrepancy, citing his decision to depart from his original reliance on the tumor site counts in a comment provided by another scientist to the EPA. *Id.* at 683-89. Dr. Portier provided a reasonable explanation, and to the extent Monsanto seeks to argue that this change makes his opinion less credible, it is free to do so. *See Primiano v. Cook*, 598 F.3d 558, 566 (9th Cir. 2010) ("Where the foundation is sufficient, the litigant is entitled to have the jury decide upon the experts' credibility, rather than the judge." (internal quotation marks, citation, and alteration omitted)).

Monsanto also accused Dr. Portier of engaging in "p-hacking," manipulation of data to obtain statistically significant results. Monsanto used Dr. Portier's treatment of renal tumors observed in a 1983 mouse bioassay as an example of this alleged methodological flaw. *See* Def.'s Mot. 25-26. Monsanto cites his prior analyses of these data in regulatory submissions, noting that his approach has evolved over time. Yet, although Monsanto takes issue with his use of a measure that takes into account historical controls, it does not provide any reason why use of his other measures, the Cochran-Armitage trend and Fisher exact tests, is an unreliable way to evaluate these data. *See* EPA, Guidelines for Carcinogen Risk Assessment at 2-19; *see also* Expert Report of Dr. Corcoran 8, Wagstaff Decl. ISO Pls.' Opp'n Ex. 102 [Dkt. No. 655-12] ("Corcoran Report"). As to his incorporation of historical control data for tumors he deemed rare, Monsanto has legitimate cri-

tiques of the way he calculated his statistic. But it is within the realm of reasonable toxicological practice to consider historical control data in some fashion, and Monsanto has not demonstrated that another approach to historical controls is the only reliable one.[32] Indeed, there are reasons one might expect a reliable expert to use caution when dismissing tumor findings simply because they fall within the range of tumors observed in historical controls. *See*, *e.g.*, EPA, Guidelines for Carcinogen Risk Assessment at 2-20 to 2-21. Again, Monsanto may highlight discrepancies between Dr. Portier's past approaches and the analysis he presents in this case, and may emphasize what it perceives to be flaws in Dr. Portier's use of historical controls. But the concerns about the opinion he presents here are not sufficient to render his opinion inadmissible.

Monsanto points out that not even Drs. Jameson and Portier, the two plaintiffs' experts who focused at length on the animal studies, could agree on how to analyze the studies and suggests this is evidence of unreliability. Def.'s Mot. 22 n.31. But, by that score, Monsanto's experts would also be unreliable, as they reached somewhat different conclusions regarding some of the studies, too. *Compare*, *e.g.*, Rosol Report 17 (noting in the Stout and Ruecker study a statistically significant increase by pair-wise comparison for pancreatic islet cell adenomas in low-dose males, but concluding the tumors were not treatment related); *id.* at 17-18 (reporting no compound related or biologically

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[32] *See*, *e.g.*, Foster Report 11, 16 n.2 (evaluating tumor findings in comparison to the range of historical controls rather than the mean); Rosol Report 5-6; Charlotte Keenan et al., *Best Practices for Use of Historical Control Data of Proliferative Rodent Lesions*, 31 Toxicologic Pathology 679, 690 (2009), Wagstaff Decl. ISO Pls.' Opp'n Ex. 108 [Dkt. No. 656-3].

relevant changes in any treatment group in the Wood 2009 study); *with* Foster Report 16 (noting non-statistically significant neoplastic changes in pancreatic islet cells in the Stout and Ruecker study); *id.* at 18 (noting in the Wood 2009 study a statistically significant trend for mammary gland adenocarcinomas, and for adenomas and adenocarcinomas combined for the highest dose group in the same study, but concluding the tumors were not compound-related). The Court may not "t[ake] sides on questions that are currently the focus of extensive scientific research and debate—and on which reasonable scientists can clearly disagree." *Milward*, 639 F.3d at 22.

In sum, with the exception of his pooled analysis, Dr. Portier's assessment of the animal carcinogenicity data is admissible. Some of the statistical tests he applied to the data within the expert reports submitted in conjunction with this case are essentially unchallenged. Monsanto disputes the way he incorporated data on historical controls into his analysis and how he sought to address concerns that his observed statistically significant results could be due to chance. But seeking to account for these factors comports with good scientific practice, and Monsanto has not shown that Dr. Portier has taken a scientifically unacceptable, as opposed to a debatable, approach.

Dr. Portier's second opinion supporting his conclusion that it is biologically plausible that glyphosate causes cancer in humans concerns the mechanistic evidence. As discussed in Section V, his reliance on the human in vivo studies does not disqualify his expert opinion. Dr. Portier acknowledged that some of the results he considered were not statistically significant. *See, e.g.*, Portier Report 56. He also considered a later Paz-y-Miño study, published in 2011, that showed no

effect, which Monsanto cites in disputing the plaintiffs' reliance on the other two human in vivo studies. *Id.* at 55-56.[33] Dr. Portier additionally took into account myriad other mechanistic evidence, effectively unchallenged by Monsanto in its motion, including a published meta-analysis of in vivo assays that found a statistically significant positive mean response. Portier Report 68-69. Dr. Portier explained that he weighted these studies heavily, as they demonstrate DNA damage in living organisms with intact DNA repair mechanisms, making them more probative of potential DNA damage in humans than in vitro studies. *Id.* at 69.

Monsanto also argues that Dr. Portier's chart summarizing the study results is unreliable, contending he inappropriately added up the positive studies. Def.'s Mot. 35. But Dr. Portier expressly cautioned against relying too heavily on the table Monsanto disputes, noting that it was simply a summary tool. Portier Report 65 (explaining that the table "does not address the subtlety needed to interpret any one study," but instead "summarizes these studies in a simple framework that allows all of the experimental data to be seen in one glance"); *cf.* Expert Report of Dr. Jay Goodman 31, Wagstaff Decl. ISO Pls.' Opp'n Ex. 38 [Dkt. No. 649-8] ("Goodman Report") ("While there were occasional positives, some of which might have occurred by chance, among the very numerous tests for genotoxicity, these are far outweighed by the overwhelmingly negative results.").

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[33] *See* César Paz-y-Miño et al., *Baseline Determination in Social, Health, and Genetic Areas in Communities Affected by Glyphosate Aerial Spraying on the Northeastern Ecuadorian Border*, 26 Reviews on Environmental Health 45 (2011), Wagstaff Decl. ISO Pls.' Mot. Ex. 111 [Dkt. No. 656-6]; Def.'s Mot. 33 n.66.

In short, Monsanto's attacks on Dr. Portier's analysis of the mechanistic data probe his application of the scientific method, but do not demonstrate that the principles and methodology he applied in analyzing these data were not grounded in science. *See Wendell*, 858 F.3d at 1232.

Stepping back and applying the *Daubert* factors not already accounted for to Dr. Portier's Bradford Hill analysis: Dr. Portier has not sought to publish his conclusions regarding glyphosate and NHL in a peer-reviewed journal. However, the studies underlying his opinion were in large part published in peer-reviewed journals. *See Daubert II*, 43 F.3d at 1318; *cf. Metabolife International, Inc. v. Wornick*, 264 F.3d 832, 845 (9th Cir. 2001) (concluding that experts who "explain[ed] the methodology of risk assessment and how the data found in peer-reviewed articles and adverse incident reports was used" in their declarations "facially complied with *Daubert II's* verification requirement for evidence prepared in anticipation of litigation"). In addition, Dr. Portier has become, in the wake of his participation in the IARC Monograph process, something of an advocate for increased regulatory attention to glyphosate, suggesting his position is not one he has taken solely for purposes of this litigation, even if much of his public commentary occurred after he was retained by counsel for the plaintiffs. *See, e.g.*, Expert Report of Dr. Portier, App. Docs. 1-2, Wagstaff Decl. ISO Pls.' Opp'n Ex. 5; *Daubert II*, 43 F.3d at 1316-18; Mar. 8, 2018 Tr. [Portier] 626-27. Although these factors do not strongly favor admission, neither do they counsel significantly against it.

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On the whole, Dr. Portier has adequately demonstrated that his opinion regarding general causation is sufficiently "within the range of accepted standards governing how scientists conduct their research and reach their conclusions" to proceed to a jury should any of the plaintiffs get past summary judgment at the next phase. *Daubert II*, 43 F.3d at 1317. He may present his full Bradford Hill analysis, but may not support his biological plausibility conclusion with the application of his pooling method. Turning from methods to conclusions, perhaps Dr. Portier has read too much into the evidence in certain areas—particularly in the important area of epidemiology. This could cause a jury to reject his conclusions, but it does not warrant keeping his opinion from a jury altogether. Thus, although it's a close question, Dr. Portier's opinion does not involve any logical leaps so great and so lacking in support as to render them inadmissible. *Joiner*, 522 U.S. at 146.

B. Dr. Ritz

Dr. Ritz is an epidemiology professor at the University of California, Los Angeles. She has a PhD in epidemiology, as well as an MD, and her primary research interests include the health effects of environmental and occupational exposures. Ritz Report 1. Monsanto does not dispute that she is qualified to offer an opinion addressing the epidemiology evidence at issue here.

Like Dr. Portier, Dr. Ritz first conducted a literature search to identify the relevant epidemiology evidence, assessed the quality of each pertinent study, and used her judgment to determine how the results of these studies fit together. *Id.* at 8-9, 14-23. She concluded that "[t]he epidemiologic studies as a whole sup-

port an increased risk of NHL with exposure to glyphosate or glyphosate based formulations." *Id.* at 25.

She also engaged in a Bradford Hill analysis. Dr. Ritz concluded that the strength criterion was "partially met," in light of the results of the meta-analyses that showed a "weak to moderate size association." *Id.* at 23. She further concluded that the dose-response criterion was met, gesturing toward the same two studies with higher odds ratios for greater exposures as Dr. Portier. *Id.* In assessing consistency, she noted briefly that positive associations were observed in different populations, places, and time periods. *Id.* at 24. She briefly concluded that the temporality criterion was met and, like Dr. Portier, acknowledged there was no supportive human experimental evidence. *Id.* at 24-25.

Dr. Ritz took a somewhat different tack than Dr. Portier with respect to the specificity, biological plausibility, and coherence criteria. Unlike Dr. Portier, who focused on whether NHL was an outcome associated exclusively with glyphosate exposure, Dr. Ritz asked the inverse question, inquiring whether glyphosate exposure resulted in a specific cancer outcome. Approaching the factor this way, she concluded that the criterion was met—increased incidences of NHL were observed, but not of other cancers—although she acknowledged that it was difficult to assess this criterion. *Id.* at 24; Apr. 4, 2018 Tr. [Ritz] 53-54.[34] She found coherence not to be a relevant factor, as she considered

[34] The Bradford Hill article seems to countenance both these experts' interpretations of the criterion, noting that "[o]ne-to-one relationships" between exposures and diseases are rare. Bradford Hill at 297; *see also* Rothman at 27 ("The criterion of specificity has two variants. One is that a cause leads to a single effect, not multiple effects. The other is that an effect has one cause, not multiple causes.").

it to overlap with the question whether there was any experimental evidence in humans to consider, and did not address whether any analogous compounds provided information relevant to the causation inquiry here. Ritz Report 25. Finally, to support her conclusion that a causal relationship between glyphosate and NHL is biologically plausible, Dr. Ritz in her report relied on the mechanistic evidence. As to the mechanistic evidence, she provided a cursory summary of studies on human absorption of glyphosate and studies she concludes demonstrate oxidative stress and genotoxicity. *Id.* at 24-25; Mar. 5, 2018 Tr. [Ritz] 86-88. Ultimately, she concluded "to a reasonable degree of scientific certainty," that glyphosate and glyphosate-based formulations like Roundup cause NHL. Ritz Report 25.

Although Drs. Ritz and Portier generally offered similar opinions regarding the epidemiology evidence, one significant difference is Dr. Ritz's greater emphasis on numbers unadjusted for use of other pesticides. Although she acknowledged the importance of considering results that accounted for confounding variables, Dr. Ritz's analysis emphasized some numbers that did not make this adjustment. *See*, *e.g.*, *id.* at 14, 16. Monsanto attacks her opinion on this ground and argues that, once one focuses on the most fully adjusted numbers from the case-control studies, the results of these studies (combined with the AHS cohort study on which Monsanto relies) cannot justify a conclusion that there is a meaningful association between glyphosate and NHL. This critique of Dr. Ritz is a valid one, and exclusive consideration of numbers unadjusted for other pesticides, when adjusted numbers are available, would be disqualifying. Failing to take account of likely confounders by presenting and relying upon only unadjusted (or minimally adjusted) estimates is a serious

methodological concern. *See Nelson v. Tennessee Gas Pipeline Co.*, 243 F.3d 244, 253 (6th Cir. 2001). This is illustrated by the IARC Monograph, which focused on numbers from epidemiological studies that were adjusted for other pesticides, explaining that "there is high potential for confounding by use of multiple pesticides." Monograph at 50; *see also id.* at 331. Accordingly, the misleading "Forest plot" from Dr. Ritz's report—which highlighted numbers unadjusted for other pesticides and, moreover, reported the number of cases in the individual studies without taking into account how many of these individuals were exposed to glyphosate—may not be presented to a jury. *See* Ritz Report 14. And frankly, this portion of her presentation calls her objectivity and credibility into question.

However, although Dr. Ritz did not focus heavily on the adjusted numbers in her reports, she did consider them. Two of the meta-analyses of the case-control studies used the fully adjusted estimates, and both regressions performed in De Roos (2003) adjusted for use of many other pesticides. Ritz Report 16, 19. She cited the numbers from the meta-analyses first and foremost in her causation analysis. *See id.* at 23.[35] Further, during the hearings, Dr. Ritz professed that, even if she were limited to considering only the numbers adjusted for other pesticides, her conclusion would not change. *See* Apr. 4, 2018 Tr. [Ritz] 37-42, 92. By way of explanation, Dr. Ritz, like Dr. Portier, pointed to the consistency of the observed associations in case-control studies, which were primarily above 1.0 even if some were not statistically significant. *See id.* at 39-40. As

[35] Because Dr. Ritz did consider the adjusted numbers, the Court declines Monsanto's invitation to exclude any opinion based on the adjusted numbers. *See* Def.'s Apr. 9, 2018 Supp. Br. 3-5.

discussed in Section III, Dr. Ritz critiqued the methodology of the AHS study, the most significant study that does not support her conclusion, and those critiques raise valid concerns. Further, although Dr. Ritz's conclusions do not predate this litigation, there is some evidence that her critiques of the AHS do. *See* Ritz Supp. Report 8. Although it is again a close question, Dr. Ritz's conclusions regarding the epidemiology evidence are admissible. While her analysis is subject to challenge—something Monsanto's cross-examination during the *Daubert* hearing made plain—her opinion does not rise to the level of an "unreliable nonsense opinion[]." *City of Pomona*, 750 F.3d at 1044 (citation omitted).

Dr. Ritz's assessment of the Bradford Hill "strength" criterion as "partially met" based on the "weak to moderate size association" reported in the meta-analyses requires less of a logical leap than does Dr. Portier's assessment. Ritz Report 23. Her conclusion regarding dose response is based on the "effect estimates for longer or more extensive use" between 2 and 3—presumably, the greater-than-two-days-per-year odds ratio in the McDuffie (2001) study and the greater-than-ten-days odds ratio in Eriksson (2008). *Id.* She does not explain how the contrary results of the AHS impacted her dose-response analysis, but, in light of the two published studies suggesting a biological gradient and the negligible weight she gave to the AHS overall in reaching her epidemiology opinions, her conclusion regarding dose response is admissible, even if it is questionable.

Dr. Ritz's opinion regarding biological plausibility is quite brief, and consists in effect of a series of citations to studies on human absorption of glyphosate and possible genotoxic and cytotoxic effects on humans and in rodents. *See id.* at 24-25. There is little to her analy-

sis of this criterion, and she has not established that she would be qualified to offer an opinion addressing the toxicology evidence in any detail. However, to the extent she simply opines that, as an epidemiologist engaging in a Bradford Hill analysis, a review of the published mechanistic literature suggested it was biologically plausible that glyphosate could cause NHL in humans, that limited conclusion is admissible. *Cf.* Rothman at 28-29.

With her Bradford Hill analysis cabined in this way, Dr. Ritz's opinion that glyphosate causes NHL, and has caused NHL in those who have used it in the manner studied, is admissible. Mar. 5, 2018 Tr. [Ritz] 96; Ritz Supp. Report 10. Dr. Ritz's opinion, like Dr. Portier's, goes to the ultimate general causation question and therefore is sufficient to support a denial of summary judgment; it does not simply rehash IARC's analysis. Also like Dr. Portier—and perhaps to a greater extent—there is ample room to challenge both her methods and her conclusions. But, as discussed, the purpose of Rule 702 and the *Daubert* inquiry is not to "exclude opinions merely because they are impeachable." *City of Pomona*, 750 F.3d at 1044 (citation omitted).

C. Dr. Weisenburger

Dr. Weisenburger, a physician and pathologist who has focused for much of his career on NHL, also engaged in a Bradford Hill analysis in his expert report. He has significant experience in epidemiology and was a co-author of De Roos (2003), one of the key case-control studies for the plaintiffs. *See* Mar. 5, 2018 Tr. [Weisenburger] 169-70; Expert Report of Dr. Weisenburger 1-2, Wagstaff Decl. ISO Pls.' Opp'n Ex. 8 [Dkt. No. 648-8] ("Weisenburger Report"). Monsanto does

not dispute that he is qualified to opine on the epidemiology evidence. *See* Def.'s Mot. 11 n.16.

In his expert report, Dr. Weisenburger offered an epidemiology opinion that was relatively brief. He considered the same core set of studies, reporting both the adjusted and unadjusted odds ratios from these studies. Although he did not include the hierarchical regression in De Roos (2003) in his summary chart, he otherwise considered the full picture presented by the published epidemiology studies and concluded, first, that an association existed between NHL and glyphosate use. He explained that neither methodological critiques of the case-control studies nor the results of the AHS were sufficient to persuade him that the association he detected in the case-control studies was spurious. Weisenburger Report 6. When confronted with the data from the Andreotti (2018) update to the AHS, he discounted the study on the basis of nondifferential exposure misclassification, making many of the same arguments in support of this point as the experts above, as well as what he characterized as an insufficient follow-up period. Supplemental Report of Dr. Weisenburger 1-2, Wagstaff Decl. ISO Pls.' Supp. Br. Ex. 16 [Dkt. No. 1136-16] ("Weisenburger Supp. Report").

Monsanto contends Dr. Weisenburger's opinion is unreliable because it relied upon the univariate analysis in Eriksson (2008). Although Dr. Weisenburger did not provide a particularly nuanced analysis of that study in his report, he did include the results of the multivariate analysis in his report, and he frankly acknowledged the benefits of adjusting for potential confounders in that study during his testimony. Weisenburger Report 5; Mar. 6, 2018 Tr. [Weisenburger] 234-37. However, he disputed the inclusion of one of the variables in the study authors' model (arsenic), and did not say, as Mon-

santo implies, that he found the particular multivariate analysis included in Eriksson (2008), which included that disputed adjustment, to be more reliable. *See* Mar. 6, 2018 Tr. [Weisenburger] 237; Def.'s June 22, 2018 Br. 4. Monsanto also attacks Dr. Weisenburger's failure to mention the NAPP data in his expert report, even though he is an author of that study. Dr. Weisenburger explained that he elected to include published studies in his expert report, a defensible choice. Mar. 6, 2018 Tr. [Weisenburger] 251. And he was willing and able to discuss the NAPP during the *Daubert* hearings, acknowledging the wisdom of certain adjustments made in the NAPP study and that some of the odds ratios became statistically insignificant after these adjustments. He also emphasized that the odds ratio for higher-intensity exposure remained statistically significant. *Id.* at 218-21, 253-55, 257-63. Thus, Dr. Weisenburger's treatment of the Eriksson (2008) and NAPP data is not a reason to deem his epidemiology opinion unreliable.

Dr. Weisenburger's handling of latency gives the Court the most pause. In his initial report, he faulted the first AHS study, De Roos (2005), for its inadequate follow-up period. In doing so, he acknowledged neither that the AHS inquired about exposures occurring prior to the start of the study nor that the case-control studies included in De Roos (2003) could be subject to the same criticism. *See* Weisenburger Report 5. He continued to fault the AHS for inadequate follow-up periods even after publication of the Andreotti (2018) update. Weisenburger Supp. Report 3. And Dr. Weisenburger repeatedly suggested, including in materials prepared outside of this litigation, that glyphosate-induced NHL was likely to have a long average latency period, on the order of 20 or more years. Weisenburger Report 5; Def.'s June 22, 2018 Supp. Br. Ex. 1 [Dkt. No.

1539-1]. Dr. Weisenburger sought to explain why it might be appropriate to discount negative cohort studies on the basis of latency but not positive case-control studies, but his justification was not entirely satisfying. *See* Mar. 6, 2018 Tr. [Weisenburger] 278-84.

Although Dr. Weisenburger's discussion of this issue during his *Daubert* testimony did not answer every question it raised, he ultimately persuaded the Court that he could testify reliably about the latency issue. He admitted during the *Daubert* hearing that the case-control studies could also be critiqued for having a short latency period. Mar. 5, 2018 Tr. [Weisenburger] 190; Mar. 6, 2018 Tr. [Weisenburger] 282-83. And he continued to acknowledge evidence suggesting that it likely takes many years, on average, for NHL to develop as a result of glyphosate exposure. *See* Mar. 6, 2018 Tr. [Weisenburger] 245-47, 268-69. While acknowledging these concerns, however, Dr. Weisenburger explained that the adjustments for other pesticides made by De Roos (2003) and the NAPP study would ameliorate the latency concern to a degree; as noted, one possible explanation for elevated odds ratios so soon after glyphosate's introduction would have been use of other pesticides, but these adjustments took account of that possible confounder. *Id.* at 282-83. So, although there is tension between Dr. Weisenburger's view that, on average, it likely takes more than a decade for NHL to develop as a result of glyphosate exposure and the heavy weight he gives the case-control studies that could only account for a few years, he provided a scientifically plausible reason for continuing to credit the studies that adjusted for other pesticides.

Turning to the remainder of Dr. Weisenburger's opinion, the Court likewise finds no basis for excluding it. Dr. Weisenburger provided a brief rundown of the

positive tumor findings identified by IARC, Greim (2015), and the EPA and concluded these findings provide sufficient evidence of carcinogenicity in experimental animals. Weisenburger Report 6-8. He also reviewed the mechanistic evidence and found that these studies supported IARC's conclusion that glyphosate and glyphosate-based herbicides are genotoxic. *Id.* at 8-9. He further opined that certain mechanistic studies indicated that low-dose exposures can have significant biological effects. *Id.* at 10.

Dr. Weisenburger's Bradford Hill analysis is admissible in light of his interpretation of the epidemiology studies. He concluded the temporality requirement was met. As to the strength of the association, he highlighted the odds ratios above 2.0 observed for certain subsets of the case-control study data, taking into account whether these results were statistically significant. *Id.* at 10-11. He focused on the same two case-control studies that sought to capture dose response as the experts above, and found elevated odds ratios to be adequately replicated across case-control studies conducted by different researchers in different regions. Regarding biological plausibility, he emphasized the studies demonstrating genotoxic effects and the occurrence of lymphoma in mice in some of the animal experiments. *Id.* at 11. Like Dr. Ritz, he concluded the specificity criterion supported causation, as the only disease associated with glyphosate exposure was NHL. Unlike the experts previously discussed, he concluded that glyphosate fell within a class of chemicals others of which have been implicated in causing NHL. *Id.* at 12. In addition, Dr. Weisenburger considered other possible explanations for the observed results and, among other things, concluded that "confounding due to the use of other pesticides does not fully explain the in-

creased risk estimates for glyphosate" in light of the results in some studies that controlled for use of other pesticides. *Id.* None of these conclusions offends *Daubert's* requirements.

Of note, one feature of Dr. Weisenburger's opinion is particularly helpful to the plaintiffs. Unlike Dr. Ritz and Dr. Portier, who elaborated on what the evidence showed as to real-world exposure levels almost as an afterthought, Dr. Weisenburger's opinions were presented in these terms from the beginning. In his original report, he addressed whether glyphosate or glyphosate-based formulations like Roundup cause "NHL in humans exposed to these chemicals in the workplace or environment." Weisenburger Report 2, 12. In addressing this question, he considered the epidemiological studies as well as studies he determined showed biological effects at relatively low doses. *See id.* at 10. Thus, Dr. Weisenburger's testimony goes directly to the general causation question, and likewise assists the plaintiffs in surviving Monsanto's summary judgment motion.

D. Dr. Neugut

Another of the plaintiffs' experts who focused on epidemiology, although eminently qualified and refreshingly candid, has not provided admissible testimony.

Dr. Neugut, like the experts discussed above, evaluated each of the key epidemiology studies before engaging in a Bradford Hill analysis that took into account all available data across disciplines. *See* Expert Report of Dr. Neugut 11-17, 20-23, Wagstaff Decl. ISO Pls.' Opp'n Ex. 4 [Dkt. No. 648-4] ("Neugut Report"). His supplemental report offered many of the same critiques of the AHS that Dr. Ritz offered. *See* Supple-

mental Report of Dr. Neugut 6-12, Wagstaff Decl. ISO Pls.' Supp. Br. Ex. 15 [Dkt. No. 1136-15]. The reports themselves are of high quality.

However, Dr. Neugut's testimony at the *Daubert* hearing was of much lower quality. There were several inconsistencies between his deposition testimony and his testimony at the hearing (significant ones—not just the usual molehills of which lawyers often make mountains). He often seemed unfamiliar with key aspects of the material that purportedly formed the basis of his opinion. He sometimes answered questions in a cavalier fashion, apparently without giving much thought to whether he really knew the answer. And he often needed help from the plaintiffs' lawyers in answering questions. Although the written transcript of Dr. Neugut's testimony reflects these problems to some extent, they were far more apparent in the courtroom (and in the video recording of the hearing). To give a few examples:

- Dr. Neugut sought to characterize IARC's assessment of glyphosate as something other than a hazard assessment, even though the Preamble is quite clear about what the Monographs seek to do. Mar. 6, 2018 Tr. [Neugut] 296; Monograph at 10.
- Dr. Neugut opined that an IARC conclusion that an agent is a probable carcinogen means, as a practical matter, that the group reached this conclusion with 70-90% certainty, although IARC disclaims any numeric probability associated with its classifications. Mar. 6, 2018 Tr. [Neugut] 301, 356-57; Monograph at 30 ("The terms probably carcinogenic and possibly carcinogenic have no quantitative significance and

are used simply as descriptors of different levels of evidence of human carcinogenicity, with probably carcinogenic signifying a higher level of evidence than possibly carcinogenic." (emphasis omitted)).

- In his deposition, Dr. Neugut agreed with Monsanto's counsel that no statistically significant, pesticide-adjusted odds ratio in the published literature supported an association between glyphosate and NHL. Hollingsworth Decl. ISO Def.'s Mot. Ex. 3 158-59 [Dkt. No 546-3]. That was an erroneous statement about a critical issue in the case. Neugut later sought to correct that deposition testimony to take account of De Roos (2003), which reported a statistically significant association in the logistic regression model adjusted for other pesticides. Hollingsworth Decl. ISO Def.'s Reply Ex. 4 [Dkt. No. 681-5]; De Roos (2003) at 5.

- In the slide presentation during Dr. Neugut's *Daubert* testimony, ostensibly prepared by Dr. Neugut himself, there was a slide describing McDuffie (2001). Dr. Neugut was not familiar with all the assertions about McDuffie (2001) that were contained in his own slide. *See* Mar. 6, 2018 Tr. [Neugut] 330.

- He relied on a certain odds ratio from a 2002 Swedish case-control study whose lead author was Lennart Hardell but demonstrated during his testimony that he did not know much about it. Among other things, he did not know whether and to what extent Hardell considered proxy respondents, and required help from the

plaintiffs' lawyer to answer this question. *See id.* at 334-40.

- In response to a question by the Court about the logistic regression and the hierarchical regression in DeRoos (2003), Dr. Neugut first stated that logistic regression was more "legitimate" and that hierarchical regression modeling "is a fancy-schmancy, sophisticated thing you do to look cool." *Id.* at 341. The Court responded, "so can you now try and explain the difference between the two, to me?" After a period of fumbling in which it became apparent that Dr. Neugut couldn't explain the difference between the two, counsel for the plaintiff stepped in to point Dr. Neugut to the portion of the study that explained it. Dr. Neugut stated that he didn't know what it meant. *Id.* at 341-42.

- It appeared from his deposition testimony and his testimony at the *Daubert* hearing that Dr. Neugut reached his opinion that glyphosate causes NHL after reading only the IARC Monograph, and before reviewing the individual studies. *Id.* at 353-55. He also seemed to suggest that even IARC's finding of limited evidence of carcinogenicity in humans, without any review of the underlying studies, would have sufficed for him to reach the conclusion he reached in his report. *Id.* at 355-58.

- At his deposition, Dr. Neugut stated that the epidemiology evidence alone was not sufficient to show causation. During the *Daubert* hearing, Dr. Neugut stated he was revisiting that conclusion, even though the only evidence that

could have justified a change in his analysis was the Andreotti (2018) study, which showed no association between glyphosate and NHL. *Id.* at 368-69; *cf. Domingo ex rel. Domingo*, 289 F.3d at 607.

Each problem with Dr. Neugut's testimony is not sufficient, on its own, to justify exclusion. Reliable experts sometimes make mistakes. They sometimes need to refer to the written materials during their testimony, to refresh their recollection about an issue or perhaps to consider a point raised by counsel for the first time on cross-examination. Even a few instances of misstating the details or failing to recall some aspect of a particular study would not be enough to exclude a witness. But in combination, the problems with Dr. Neugut's testimony lead the Court to conclude that his opinion is not sufficiently reliable to be admissible. *See Department of Toxic Substances Control v. Technichem, Inc.*, No. 12-CV-05845-VC, 2016 WL 1029463, at *1 (N.D. Cal. Mar. 15, 2016) (noting that "[k]ey factual errors" undermine the reliability of an expert's testimony).

E. Dr. Jameson

Dr. Jameson, a chemist and environmental toxicologist who specializes in cancer, engaged in an IARC-style hazard assessment of glyphosate as it relates to NHL, with a focus on the rodent carcinogenicity studies. *See* Jameson Report 1, 9-11, 19-29. Dr. Jameson has more than forty years of toxicology experience, and has worked for the National Cancer Institute and National Institute of Environmental Health Sciences. Mar. 7, 2018 Tr. [Jameson] 403. He was for many years responsible for the preparation of the Report on Carcinogens, a congressionally mandated public health report listing agents known or reasonably anticipated to

cause cancer in humans. Jameson Report 2-3. He has also been a member of several IARC working groups, including the working group that assessed glyphosate as the chair of the experimental animal subgroup. Mar. 7, 2018 Tr. [Jameson] 404.

With respect to his opinion regarding the epidemiological evidence and its bearing on the general causation question, Dr. Jameson is hamstrung by his decision to conduct an IARC-style analysis. Dr. Jameson first summarizes the relevant IARC report at length. Jameson Report 4-8. He then engages in a "hazard based assessment of glyphosate and/or glyphosate-based formulations[] that … is the same as defined and characterized by IARC." *Id.* at 9. Dr. Jameson concludes that the human evidence is "limited" in the sense IARC used the term; that there is "sufficient" evidence that glyphosate causes certain tumors in experimental animals; and that there is strong evidence that glyphosate is genotoxic and induces oxidative stress, the two possible cancer-causing mechanisms also identified by IARC. *Id.* at 19, 29, 30-31. Ultimately, he opines "to a reasonable degree of scientific certainty that glyphosate and glyphosate-based formulations are probable human carcinogens," and that "glyphosate and glyphosate-based formulations cause NHL in humans." *Id.* at 31-32. IARC does not explicitly reach Dr. Jameson's second conclusion but, having characterized his inquiry throughout the report as parallel to IARC's, there is no basis for reading Dr. Jameson's statements regarding glyphosate's ability to cause NHL in humans to mean anything more than that glyphosate is an NHL "hazard" in the sense IARC defines that term. *See id.* at 9; Mar. 7, 2018 Tr. [Jameson] at 412, 418-19. That conclusion, reached using the methods IARC used, is one that meets *Daubert*'s reliability requirement, but it does not itself allow the plaintiffs to survive

summary judgment and, as discussed in Section II, may not be admissible in this case at all, because it involves too different an inquiry from the one a jury would be required to undertake.

Apparently realizing their mistake before Dr. Jameson's appearance at the *Daubert* hearing, counsel for the plaintiffs sought to elicit an opinion from Dr. Jameson during the hearing that went beyond the one presented in his report—specifically, an opinion that "exposure to glyphosate not only can cause [NHL], but it is currently doing so, at current exposure levels today." *Id.* at 405. Dr. Jameson's analysis of the human evidence is not sufficient to support his additional conclusion that glyphosate "is currently" causing NHL "at current exposure levels today." Dr. Jameson's primary focus and meaningful independent analysis concerned the animal toxicology studies, and his analysis was not crafted to support a conclusion that glyphosate is causing NHL in humans at current exposure levels. *See id.* at 455-57. As a result, "there is simply too great an analytical gap between" his analysis, which effectively duplicates IARC's as to human studies but goes further as to the animal studies, and his new conclusion regarding glyphosate's effects on humans at current exposure levels. *Joiner*, 522 U.S. at 146; *see also Domingo ex rel. Domingo*, 289 F.3d at 606-07.

Obviously, none of this is the fault of Dr. Jameson—he is a scientist who should not be expected to identify, on his own, the difference between an IARC-style hazard assessment and the evidentiary standard that governs civil lawsuits. But the apparent failure of plaintiffs' counsel to explain this difference to him, and to elicit an opinion from him that goes beyond a hazard assessment, means that his testimony is insufficient to get the plaintiffs over the general causation hurdle.

Although Dr. Jameson's overall hazard-assessment conclusion may end up not being admissible, he will be permitted to offer testimony (if a case makes it to trial) on the narrower topic of the animal cancer studies. As Dr. Jameson stated repeatedly during the *Daubert* hearing, the purpose of conducting studies in laboratory animals like the ones at issue here is to determine whether a substance causes cancer in animals. *See*, *e.g.*, Mar. 7, 2018 Tr. [Jameson] 475. As mentioned in Section IV, whether a substance does so is relevant to the general causation inquiry.

Monsanto attacks Dr. Jameson for not adequately addressing what it deems an absence of replicated tumor findings across different experiments, and for relying too heavily on statistical significance, rather than conducting a fuller assessment of biological significance. *See* Def.'s Mot. 30-31, 31 n.51; Def.'s Reply 29-30. Dr. Jameson did consider replication, agreeing that repeated findings of the same tumors across sexes, studies, or species would strengthen his conclusion that a particular chemical caused tumor development. Mar. 7, 2018 Tr. [Jameson] 449-52, 495. Further, Dr. Jameson concluded that four of the tumors of interest were repeated across studies. *Id.* at 449-52. Monsanto disagrees with his interpretation of those studies, and pointed out that his conclusions differ in many cases from those of the study authors. But Monsanto's disagreements with how Dr. Jameson weighted different considerations in arriving at his conclusions are fodder for cross-examination, not grounds for exclusion. *See Karlo*, 849 F.3d at 83 ("The question of whether a study's results were properly calculated or interpreted ordinarily goes to the weight of the evidence, not to its admissibility." (citation omitted)).

F. Dr. Nabhan

Dr. Nabhan is a hematologist and medical oncologist who specializes "in the diagnosis and management of patients with all types of lymphoma." Expert Report of Dr. Nabhan 1, Wagstaff Decl. ISO Pls.' Opp'n Ex. 7 [Dkt. No. 648-7]. Although he stated that he routinely reviews epidemiology and toxicology studies as part of his clinical practice, he did not dispute that his primary focus is on clinical work. Mar. 9, 2018 Tr. [Nabhan] 805 ("I'm a clinician, I'm not an epidemiologist or a statistician, but we're on the front line with patients."); *id.* at 818 ("Again, I'm not an epidemiologist. ..."). He summarized many relevant studies, but offered little in the way of critical analysis of these studies. *See id.* at 820 ("[F]rom a clinician's view, we don't really sit down and re-analyze and re-perform a peer-review process for every single paper that has been published. … My job as a clinician is not to peer-review the entire literature again."). Instead, he deferred to the opinions of other experts, and to IARC in particular, in arriving at his conclusions. *See id.* at 820-22, 850;. at 822 ("So as a clinician, I will look [at] these epidemiology studies, then I look at bodies such as the IARC, I look at the history, and it's hard to argue, with all of the data that the IARC looked at and with the history, so I tend to obviously believe the data that came out of IARC."); *id.* at 837 ("I didn't review this particular evidence, but if the IARC says this particular aspect of the mechanism of action is weak, then it's weak."); *id.* at 844 (agreeing that he "rel[ied] heavily on IARC for [his] opinion").

"[M]edical doctors do not need to be epidemiologists in order to testify regarding epidemiological studies," so long as the expert is qualified by training or experience to interpret these studies and his opinions

would be helpful to the jury. *In re Mirena IUD Products Liability Litigation*, 169 F. Supp. 3d 396, 426 (S.D.N.Y. 2016); *see also In re Abilify*, 299 F. Supp. 3d at 1349. The primary problem for the plaintiffs, however, is Dr. Nabhan's uncritical reliance on IARC's conclusions. During the *Daubert* hearing, Dr. Nabhan all but admitted that he reached his conclusion regarding glyphosate upon reading the IARC report, and that contrary new evidence was unlikely to shake his faith in IARC's conclusion. *See* Mar. 9, 2018 Tr. [Nabhan] 850 ("Q. At this point, nothing would [] shake your conviction. A. At this point, the IARC report is very convincing."). The deference to IARC that Dr. Nabhan demonstrated during the *Daubert* hearing may well be appropriate clinical practice but, under these circumstances, it is not a reliable way to reach a general causation opinion. Dr. Nabhan's report also did not demonstrate that he engaged in his own objective analysis of the epidemiologic literature. Although he summarized the relevant studies, he said little about how or whether they addressed possible bias or confounding, for instance. *See* Nabhan Report 11-16.

During the *Daubert* hearing, Dr. Nabhan also suggested that his opinion regarding whether glyphosate was causing NHL at present-day exposure levels was informed by his clinical practice. *See* Mar. 9, 2018 Tr. [Nabhan] 805-07. He suggested that a subset of NHL patients developed their NHL as a result of glyphosate exposure, and that he recommends curtailing glyphosate use for patients with NHL, treating it as a "modifiable risk factor." *Id.* at 810-11, 826-27. Dr. Nabhan may well be able to offer an opinion that glyphosate was responsible for causing a particular patient's NHL, based on that patient's clinical presentation and history, during the specific causation phase of this litigation.

And it may well be good medical advice to tell a patient to curtail glyphosate exposure. However, because Dr. Nabhan has not provided a reliable basis for concluding that glyphosate can cause NHL as a general matter, Monsanto's motion to exclude his testimony is granted.

VII. THE PLAINTIFFS' DAUBERT MOTION

In addition to defending their own experts, the plaintiffs seek to exclude certain of Monsanto's experts. These challenges are addressed in the sections that follow.

A. Dr. Rosol

The plaintiffs seek to exclude Dr. Rosol, a veterinary pathologist, because he considered certain documents available only in a "glyphosate reading room" in Brussels that has since been shuttered. *See* Rosol Report 9, 13-18. They do not object to his general methodology or conclusions aside from this critique. *See* Mar. 8, 2018 Tr. [Rosol] 731 ("We're actually not really even challenging your conclusions or your methodology too much.").

Dr. Rosol elaborated on what the reading room entailed during cross-examination at the *Daubert* hearing. He testified that the reading room allowed researchers to sign up for up to four half-day sessions during the weeks it was open, and the researchers could use one of approximately ten old, monochrome computers to review the data from the studies. *Id.* at 732-36. On the one hand, he testified that he took approximately 50 pages of handwritten notes during his time in the reading room, and he references the material he reviewed in the reading room repeatedly in his report. *See id.*; Rosol Report 13-18. On the other hand, he testified that the "Reading Room pathology reports," apparently the

only material not accessible through the publicly available Greim (2015) study supplements, "did not influence [his] interpretation" and were not necessary to support his conclusions. *Id.* at 735.

So long as neither the Court nor the plaintiffs' experts have access to the data available only in the reading room, Dr. Rosol will be precluded from referencing this material in rendering his opinion. However, because he testified that his opinion would stand absent that material, and his opinion is otherwise admissible, his opinion will not otherwise be excluded.

B. Dr. Goodman

Dr. Goodman, a toxicologist, seeks to offer an opinion that glyphosate and glyphosate-based formulations "should be regarded as non-genotoxic materials," and that, although they "might be capable of causing oxidative stress under certain experimental conditions, … it is not appropriate to use this observation to support a contention that these materials are capable of causing cancer." Goodman Report 3-4.

The plaintiffs challenge the admissibility of Dr. Goodman's testimony on two grounds. First, they argue his opinions discounting two human in vivo studies, Bolognesi (2009) and Paz-y-Miño (2007), are inadmissible because his critiques of the studies are too speculative and contain errors. Some of Dr. Goodman's critiques are less than persuasive bases for discounting the studies—for instance, his concern that more than one person might have analyzed the slides in Paz-y-Miño (2007), which might have introduced subjectivity into the data analysis. *See id.* at 13. Others are very reasonable, like his observations that other factors might have explained the DNA damage in light of the period that elapsed between the aerial glyphosate

spraying and the time when the blood samples were taken, and that study participants appeared to exhibit symptoms of acute illness. *See* Paz-y-Miño (2007) at 457 (noting the physical symptoms reported by participants and that blood samples were gathered between two weeks and two months after the aerial spraying of glyphosate). Regarding the Bolognesi (2009) study, Dr. Goodman emphasized that the indicator of genotoxicity was highest in a region where glyphosate was not aerially sprayed (although where people were still exposed to pesticides, including glyphosate). Goodman Report 15-17; Bolognesi (2009) at 995. Although the plaintiffs ascribe a different meaning to this aspect of the Bolognesi study, Dr. Goodman's observation is neither incorrect nor irrelevant, in light of the study's focus on the effects of aerial spraying and its extremely limited conclusions. *See* Bolognesi (2009) at 994-95. The plaintiffs' motion to exclude Dr. Goodman's critiques of the human in vivo studies is therefore denied.

The plaintiffs also mount a broader attack on Dr. Goodman's methodology as results-oriented. Dr. Goodman's methodology emphasized studies conducted on mammals or mammalian cells and those that use the four basic tests used by international agencies for registration or approval of chemicals. Goodman Report 10-11. He dismisses several of the studies as unable to rule out cytotoxicity as the cause of the results observed. *See*, *e.g.*, *id.* at 23, 26-27, 29-30. Although he reaches different conclusions about what the weight of the mechanistic evidence shows, his analysis is not so flawed or one-sided that his opinions need be excluded.

C. Dr. Foster

The plaintiffs further seek to exclude the testimony of Dr. Foster, who is also a toxicologist. They contend

he is not qualified to offer an opinion on the rodent studies, because his focus is on reproductive toxicology. Notwithstanding Dr. Foster's focus on reproductive toxicology, he is qualified to opine on the rodent carcinogenicity data at issue here. *See D.F. ex rel. Amador*, 2017 WL 4922814, at *14. He is a trained in toxicology, served as the one-time acting director of an environmental toxicology program at Health Canada, and has published at least a few peer-reviewed articles on cancer in rodents. Wagstaff Decl. ISO Pls.' Opp'n Ex. 122 at 118-23 [Dkt. No. 656-17 at 32-33].

The plaintiffs additionally argue that Dr. Foster's opinion is unreliable. Among the alleged flaws they identify are his comparisons across studies the plaintiffs consider insufficiently similar. For example, they point to his comparison of the results concerning interstitial testicular tumors in the Lankas (1981) study with those in the Atkinson and Suresh studies, noting that, in the latter two studies, not all the low-dose animals were fully examined. Pls.' Opp'n 67-68. The plaintiffs also argue that he inappropriately dismissed certain tumors because no tumor progression was observed or, in the case of the Knezevich and Hogan study, because of alleged weight loss in the high-dose group of mice. *Id.* at 68-69.

Dr. Foster, like the plaintiffs' experts, conducted a literature review and evaluated the quality of each of the studies. Unlike the plaintiffs' experts, he explained away the statistically significant tumor findings, pointing to a lack of reproducibility between studies, an abnormally low number of tumors in certain control groups, lack of dose response, decreased survival of certain control animals (which would result in older treated animals, and thus likely more spontaneous tumors), and evidence of systemic toxicity in one high-

dose group. *See* Foster Report 27. As discussed above, different interpretations of these studies are not necessarily evidence of unreliability, and Dr. Foster's interpretations of the same core studies evaluated by the plaintiffs are sufficiently grounded in scientific principles to be admissible. The plaintiffs may raise their concerns via cross-examination.

D. Drs. Rider and Mucci

Monsanto proffered two epidemiology experts, Drs. Rider and Mucci. The plaintiffs object to their opinions because they relied heavily and, the plaintiffs argue, uncritically on the various iterations of the AHS study. As discussed above, the AHS study, like the case-control studies, is open to valid critiques. Like the plaintiffs' experts who focused on epidemiology, Drs. Rider and Mucci assessed the strengths and weaknesses of the relevant epidemiology studies, but weighed the studies differently and reached different conclusions. Dr. Rider briefly acknowledged the possibility of exposure misclassification in the AHS study, but concluded that, in light of the observed odds ratios below 1.0, it would not have obscured any positive association. Rider Supp. Report 3-4. She also explained why she was not concerned about the imputation method used by the AHS study authors, citing methodological and sensitivity analyses. *Id.* at 4-5. Dr. Mucci likewise acknowledged the possibility of nondifferential misclassification of glyphosate exposure and explained how the authors of the Andreotti (2018) study assuaged any concerns she might have about the imputation method. Mucci Report 33, 35; Mucci Supp. Report 2-4, 7; Mar. 9, 2018 Tr. [Mucci] 905 ("[W]e should be, as epidemiologists, concerned with the fact that there is 37 percent missing data. We do want to rule out that there are not biases that are systematic as a result of this missing

data."). Both experts offered rebuttals to the plaintiffs' concerns. *See* Mucci Supp. Report 7-10; Rider Supp. Report 8-11; Mar. 9, 2018 Tr. [Mucci] 863-919. As suggested earlier, the disputes between the experts evaluating these epidemiology studies are reasonable disputes. Dr. Mucci and Dr. Rider used sufficiently reliable methods to reach conclusions about the epidemiology evidence that require no unduly great leap from their analyses. The plaintiffs' *Daubert* motion to exclude their testimony is therefore denied.

E. Dr. Corcoran

Dr. Corcoran, a biostatistician, critiques Dr. Portier's statistical analysis of the rodent carcinogenicity studies. The plaintiffs argue only that Dr. Corcoran is not qualified to offer an opinion on the data at issue here, because his research has focused on dementia and other aging-related diseases. As proof, they point to an exchange in which he purportedly did not know the difference between primary and secondary tumors, the latter of which the plaintiffs contend should be excluded from tumor counts in animal bioassays. Pls.' Opp'n 56 n.165; Pls.' Reply 12. That Dr. Corcoran's research has not focused on cancer or animal bioassays does not require his exclusion. *See Avila*, 633 F.3d at 839. As a trained biostatistician, he is qualified to offer a critique of Dr. Portier's statistical analysis, and the plaintiffs are free to dispute his treatment of secondary tumors through Dr. Portier's testimony and during cross-examination. The motion to exclude Dr. Corcoran is denied.

VIII. CONCLUSION

It's a close question whether to admit the expert opinions of Dr. Portier, Dr. Ritz, and Dr. Weisenburger

that glyphosate can cause NHL at human-relevant doses. Therefore, it's a close question whether to grant or deny Monsanto's motion for summary judgment. But the Court concludes that the opinions of these experts, while shaky, are admissible. They have surveyed the significant body of epidemiological literature relevant to this question; identified at least a few statistically significant elevated odds ratios from case-control studies and meta-analyses; identified what they deem to be a pattern of odds ratios above 1.0 from the case-control studies, even if not all are statistically significant; emphasized that studies of glyphosate have focused on many different types of cancer but found a link only between glyphosate and NHL; given legitimate reasons to question the results of the primary study on which Monsanto relies; and concluded, in light of all the available evidence, that a causal interpretation is appropriate. Their opinions may be bolstered by Dr. Jameson's narrower opinions regarding glyphosate's ability to cause cancer in animals. Therefore, the plaintiffs have presented evidence from which a reasonable jury could conclude that glyphosate can cause NHL at human-relevant doses. Monsanto's motion for summary judgment is denied.

IT IS SO ORDERED.

Dated: July 10, 2018

[handwritten signature]
VINCE CHHABRIA
United States District Court

APPENDIX E

UNITED STATES DISTRICT COURT
NORTHERN DISTRICT OF CALIFORNIA

Case No. 16-cv-00525-VC

EDWARD HARDEMAN,

Plaintiff,

v.

MONSANTO COMPANY,

Defendant.

Re: Dkt. Nos. 18, 23
Filed April 8, 2016

ORDER DENYING MOTION TO DISMISS AND MOTION TO STAY

I.

Monsanto argues that Hardeman's failure-to-warn claims are preempted by the Federal Insecticide, Fungicide, and Rodenticide Act, which prohibits states from "impos[ing] ... any requirements for labeling or packaging in addition to or different from" the requirements in FIFRA itself. 7 U.S.C. § 136v(b). But Hardeman's failure-to-warn claims based on Roundup's labeling are not preempted, because "a state-law labeling requirement is not pre-empted by § 136v(b) if it is equivalent to, and fully consistent with, FIFRA's misbranding provisions." *Bates v. Dow Agrosciences LLC*, 544 U.S. 431, 447 (2005).

A.

To the extent Hardeman's failure-to-warn claims attack Roundup's product labeling, they are consistent with FIFRA. FIFRA requires a pesticide label to "contain a warning or caution statement which may be necessary and if complied with ... is adequate to protect health and the environment." 7 U.S.C. § 136(q)(1)(G); *see also* 40 C.F.R. § 156.60. California law, similarly, requires a manufacturer to warn either of any risk that is known or knowable (in strict liability), or at least those risks that "a reasonably prudent manufacturer would have known and warned about" (in negligence). *Conte v. Wyeth, Inc.*, 85 Cal. Rptr. 3d 299, 310 (Ct. App. 2008). If anything, a manufacturer's duty under California law is slightly narrower than its duty under FIFRA: California law sometimes (in negligence) allows a manufacturer to escape liability where a warning would be unreasonable, but FIFRA seems always to require a warning that is "necessary" and "adequate" to protect human health—whether or not such a warning is otherwise reasonable. In this light, it's hard to see how Hardeman's failure-to-warn claims could "be construed more broadly than" FIFRA. *Astiana v. Hain Celestial Grp., Inc.*, 783 F.3d 753, 758 (9th Cir. 2015). Indeed, Hardeman's complaint explicitly bases his California-law failure-to-warn claims on Monsanto's alleged violation of FIFRA. Complaint at ¶¶161-62.

B.

Monsanto contends Hardeman's failure-to-warn claims are nonetheless preempted because the EPA has approved Roundup's product labels. But the EPA's authority to enforce FIFRA does not prohibit private litigants from also enforcing that statute: the Supreme Court, rejecting an argument against "giv[ing] juries in

50 States the authority to give content to FIFRA's misbranding prohibition," *Bates*, 544 U.S. at 448, has instead allowed "[p]rivate remedies that enforce [FIFRA's] misbranding requirements," *id.* at 451. And the mere fact that the EPA has approved a product label does not prevent a jury from finding that that same label violates FIFRA. In *Bates*, the Supreme Court allowed state-law failure-to-warn claims to go forward as long as those claims were consistent with FIFRA, *id.* at 452-53—even though the EPA had approved the insecticide label at issue, *id.* at 434-35. *Bates* thus "established that mere inconsistency between the duty imposed by state law and the content of a manufacturer's labeling approved by the EPA at registration did not necessarily mean that the state law duty was preempted." *Indian Brand Farms, Inc. v. Novartis Crop Prot. Inc.*, 617 F.3d 207, 222 (3d Cir. 2010).

This result is consistent with the text of the FIFRA statute. Monsanto notes that "registration of a pesticide shall be prima facie evidence that the pesticide, its labeling and packaging comply with the registration provisions of" FIFRA. 7 U.S.C. § 136a(f)(2). But "prima facie evidence" is not conclusive proof. And the preceding sentence in this same statutory provision provides that "[i]n no event shall registration of an article be construed as a defense for the commission of any offense under" FIFRA. *Id.* Of course, if the EPA's approval of Roundup's label had the force of law, it would preempt conflicting state-law enforcement of FIFRA. *See Wyeth v. Levine*, 555 U.S. 555, 576 (2009). But there's no indication that the EPA's approval of Roundup's label had the force of law. *See United States v. Mead Corp.*, 533 U.S. 218, 227-34 (2001). Though EPA rulemaking "[would] necessarily affect the scope of pre-emption under § 136v(b)," the EPA has promul-

gated "relatively few regulations that refine or elaborate upon FIFRA's broadly phrased misbranding standards." *Bates*, 544 U.S. at 453 n.28.

This result is also consistent with the district court's holding in *Mirzaie v. Monsanto Co.*, No. 15-cv-04361-DDP, 2016 WL 146421 (C.D. Cal. Jan. 12, 2016). There, the plaintiffs sought (among other things) injunctive relief forcing Monsanto to change the contents of its label. Complaint at 10, Mirzaie v. Monsanto Co., No. 15-cv-04361-DDP (C.D. Cal. June 9, 2015). According to the district court, "[t]he only question" in ruling on Monsanto's motion to dismiss was "whether the injunctive relief Plaintiffs seek would constitute a requirement for labeling or packaging." *Mirzaie*, 2016 WL 146421, at *2. The answer to that question was yes: "an injunction imposed against a manufacturer to change its [EPA-approved] label would represent a state-mandated labeling requirement and would therefore be preempted." *Id.* (alteration in original) (quoting *Nathan Kimmel, Inc. v. DowElanco*, 275 F.3d 1199, 1203 (9th Cir. 2002)). Dictating the contents of Roundup's label would usurp the EPA's exclusive authority, under 7 U.S.C. § 136v(b), to approve all pesticide labeling. But Hardeman, unlike the Mirzaie plaintiffs, doesn't seek an injunction dictating the contents of Roundup's label: he just contends that Roundup's existing label violates FIFRA, implying that the EPA failed to enforce FIFRA correctly when it approved that label. And *Bates* tells us that the EPA's authority to enforce FIFRA—unlike the EPA's authority to approve all pesticide labeling—isn't exclusive.

C.

Similarly, Monsanto contends that Hardeman's failure-to-warn claims are preempted because the

"EPA repeatedly has concluded that glyphosate is not a carcinogen." But almost all of the findings Monsanto cites were made in regulations interpreting the Food, Drug, and Cosmetic Act—not FIFRA. FDCA regulations don't "give content to FIFRA's misbranding standards," *Bates*, 544 U.S. at 453, so they don't affect the extent to which FIFRA preempts state law.

Monsanto does cite one document from the FIFRA context—a fact sheet discussing glyphosate's re-registration as a pesticide, which notes the EPA's 1991 classification of glyphosate as a "Group E oncogen" showing "evidence of non-carcinogenicity for humans." But neither the fact sheet nor the underlying 1991 classification actually conflict with Hardeman's complaint, because the classification "emphasized ... that designation of an agent in Group E is based on the available evidence at the time of evaluation and should not be interpreted as a definitive conclusion that the agent will not be a carcinogen." And even if the fact sheet or classification did conflict with Hardeman's complaint, it's not clear that either has the force of law, *see Mead*, 533 U.S. at 229, so it's not clear that either has preemptive effect, *see Reid v. Johnson & Johnson*, 780 F.3d 952, 964 (9th Cir. 2015).

Monsanto's last piece of evidence—online video of Congressional hearing testimony in which various speakers characterize the EPA's position on glyphosate—probably isn't subject to judicial notice, because it could reasonably be questioned whether the speakers are characterizing the EPA's position accurately. But, even if it is, there's no indication that the positions discussed in the video involve an interpretation of FIFRA that has the force of law.

II.

Monsanto next argues that, because Hardeman "alleges that both glyphosate and Roundup® are inherently and unavoidably dangerous," he can't proceed on his strict-liability design-defect claims. Monsanto bases this argument on comments j and k to section 402A of the Restatement (Second) of Torts.

Comment j doesn't support Monsanto's argument. That comment provides that, "[i]n order to prevent the product from being unreasonably dangerous, the seller may be required to give directions or warning." Restatement (Second) of Torts § 402A cmt. j (1965). This means that a plaintiff can bring failure-to-warn claims, but it doesn't mean that a plaintiff can bring *only* failure-to-warn claims. Comment j also provides that "a product bearing such a warning, which is safe for use if it is followed, is not in defective condition, nor is it unreasonably dangerous." *Id.* But Hardeman alleges that Roundup did *not* bear the warning it should have, so he's free to allege that Roundup was also "in defective condition" or "unreasonably dangerous."

That leaves comment k. Comment k provides that, where a product is "quite incapable of being made safe for their intended and ordinary use ... [t]he seller ... is not to be held to strict liability." *Id.* cmt. k. But there's an important caveat: comment k only applies where products "are properly prepared and marketed, and proper warning is given." *Id.* Once again, Hardeman alleges that Roundup was not properly prepared or marketed, and was not accompanied by proper warning, so—by its own terms—comment k doesn't apply.

Moreover, even if comment k applied by its own terms, it seems unlikely the California courts would apply it here. The California Supreme Court limited its

adoption of comment k to a narrow medical context: "because of the public interest in the development, availability, and reasonable price of drugs, the appropriate test for determining responsibility is the test stated in comment k." *Brown v. Superior Court*, 751 P.2d 470, 477 (Cal. 1988). In this respect, *Brown* was consistent with prior California case law applying comment k, which "overwhelmingly involve[d] products such as prescription drugs, vaccines, blood, and medical devices such as intrauterine devices and breast implants." *Wilkinson v. Bay Shore Lumber Co.*, 227 Cal. Rptr. 327, 331 (Ct. App. 1986). And though California courts have since clarified that *Brown* extends beyond prescription drugs to include other medical products, *see Hufft v. Horowitz*, 5 Cal. Rptr. 2d 377, 382-84 (Ct. App. 1992), Monsanto does not cite—and the Court cannot find—a California case applying comment k outside the medical context, *accord Garrett v. Howmedica Osteonics Corp.*, 153 Cal. Rptr. 3d 693, 700-01 (Ct. App. 2013). On the contrary, California courts appear willing to apply comment k only where a product is "available only through the services of a physician," *id.* at 701.

III.

Monsanto's motion to dismiss is denied. And because the Court has denied Monsanto's motion to dismiss, Monsanto's motion to stay discovery is also denied.

IT IS SO ORDERED.

Dated: April 8, 2016 [handwritten signature]
VINCE CHHABRIA
United States District Court

APPENDIX F

UNITED STATES DISTRICT COURT
NORTHERN DISTRICT OF CALIFORNIA

MDL No. 2741
Case No. 16-md-02741-VC

IN RE: ROUNDUP PRODUCTS LIABILITY LITIGATION

This document relates to:
Hardeman v. Monsanto, 16-cv-00525-VC
Filed July 17, 2019

PRETRIAL ORDER NO. 164:
AMENDED JUDGMENT

In light of the order granting in part Monsanto's motion for judgment as a matter of law, *see* Pretrial Order No. 160, Dkt. No. 4576, as well as the order granting Mr. Hardeman's motion to amend the interest rate, *see* Pretrial Order No. 163, Dkt. No. 4601, Edwin Hardeman shall recover from Monsanto Co. the following sums for compensatory and punitive damages:

Past economic loss	$200,967.10
Past noneconomic loss	$3,066,667.00
Future noneconomic loss	$2,000,000.00
Punitive damages	$20,000,000.00

Monsanto shall pay prejudgment interest for past economic damages awarded ($200,967.10) at the rate of seven percent (7%) from the date of the filing of the Complaint, February 1, 2016, through the entry of the

original judgment on May 3, 2019, resulting in total prejudgment interest of $45,748.92. Thus, the total judgment in this case pending determination of awardable costs is $25,313,383.02.

Monsanto shall pay postjudgment interest upon this judgment at the federal interest rate governed by 28 U.S.C. § 1961, and shall pay for recoverable court costs incurred in this action by Mr. Hardeman as determined by this Court following review of Mr. Hardeman's bill of costs.

Execution may issue for all amended judgment amounts, interests, and costs thirty (30) days after entry of this judgment.

IT IS SO ORDERED.

Date: July 17, 2019 [handwritten signature]
Honorable Vince Chhabria
United States District Court

APPENDIX G

RELEVANT STATUTORY PROVISIONS

U.S. Const. art. VI cl. 2

This Constitution, and the Laws of the United States which shall be made in Pursuance thereof; and all Treaties made, or which shall be made, under the Authority of the United States, shall be the supreme Law of the Land; and the Judges in every State shall be bound thereby, any Thing in the Constitution or Laws of any State to the Contrary notwithstanding.

7 U.S.C. § 136v

§ 136v. Authority of States

(a) In general

A State may regulate the sale or use of any federally registered pesticide or device in the State, but only if and to the extent the regulation does not permit any sale or use prohibited by this subchapter.

(b) Uniformity

Such State shall not impose or continue in effect any requirements for labeling or packaging in addition to or different from those required under this subchapter.

(c) Additional uses

(1) A State may provide registration for additional uses of federally registered pesticides formulated for distribution and use within that State to meet special local needs in accord with the purposes of this subchapter and if registration for such use has not previously been denied, disapproved, or canceled by the Administrator. Such registration shall be deemed registration under section 136a of this title for all purposes of this subchapter, but shall authorize distribution and use only within such State.

(2) A registration issued by a State under this subsection shall not be effective for more than ninety days if disapproved by the Administrator within that period. Prior to disapproval, the Administrator shall, except as provided in paragraph (3) of this subsection, advise the State of the Administrator's intention to disapprove and the reasons therefor, and provide the State time to respond. The Administrator shall not prohibit or disapprove a registration issued by a State under this subsection (A) on the basis of lack of essentiality of a pesti-

cide or (B) except as provided in paragraph (3) of this subsection, if its composition and use patterns are similar to those of a federally registered pesticide.

(3) In no instance may a State issue a registration for a food or feed use unless there exists a tolerance or exemption under the Federal Food, Drug, and Cosmetic Act that permits the residues of the pesticides on the food or feed. If the Administrator determines that a registration issued by a State is inconsistent with the Federal Food, Drug, and Cosmetic Act, or the use of, a pesticide under a registration issued by a State constitutes an imminent hazard, the Administrator may immediately disapprove the registration.

(4) If the Administrator finds, in accordance with standards set forth in regulations issued under section 136w of this title, that a State is not capable of exercising adequate controls to assure that State registration under this section will be in accord with the purposes of this subchapter or has failed to exercise adequate controls, the Administrator may suspend the authority of the State to register pesticides until such time as the Administrator is satisfied that the State can and will exercise adequate controls. Prior to any such suspension, the Administrator shall advise the State of the Administrator's intention to suspend and the reasons therefor and provide the State time to respond.

Fed. R. Evid. 702

Rule 702. Testimony by Expert Witnesses

A witness who is qualified as an expert by knowledge, skill, experience, training, or education may testify in the form of an opinion or otherwise if:

(a) the expert's scientific, technical, or other specialized knowledge will help the trier of fact to understand the evidence or to determine a fact in issue;

(b) the testimony is based on sufficient facts or data;

(c) the testimony is the product of reliable principles and methods; and

(d) the expert has reliably applied the principles and methods to the facts of the case.

APPENDIX H

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
[letterhead]

August 7, 2019

Dear Registrant,

We are writing to you concerning label and labeling requirements for products that contain glyphosate.

On July 7, 2017, California listed glyphosate as a substance under Proposition 65[1], based on the International Agency for Research on Cancer's (IARC's) classification of the pesticide as "probably carcinogenic to humans." EPA disagrees with IARC's assessment of glyphosate. EPA scientists have performed an independent evaluation of available data since the IARC classification to reexamine the carcinogenic potential of glyphosate and concluded that glyphosate is "not likely to be carcinogenic to humans." EPA considered a more extensive dataset than IARC, including studies submitted to support registration of glyphosate and studies identified by EPA in the open literature as part of a systematic review. For more detailed information on this evaluation, please see the 2017 Revised Glyphosate

[1] California's Safe Drinking Water and Toxic Enforcement Act of 1986 (also known as Proposition 65) requires businesses to inform Californians about significant exposures to chemicals that, under the terms of Proposition 65, are believed to cause cancer, birth defects or other reproductive harm. *See* California Office of Environmental Health Hazard Assessment, "Proposition 65," at https://oehha.ca.gov/proposition-65.

Issue Paper: Evaluation of Carcinogenic Potential[2]. Further, EPA's cancer classification is consistent with other international expert panels and regulatory authorities, including the Canadian Pest Management Regulatory Agency, Australian Pesticide and Veterinary Medicines Authority, European Food Safety Authority, European Chemicals Agency, German Federal Institute for Occupational Safety and Health, New Zealand Environmental Protection Authority, and the Food Safety Commission of Japan.

On February 26, 2018, the United States District Court for the Eastern District of California issued a preliminary injunction enjoining California from enforcing the state warning requirements involving the pesticide glyphosate's carcinogenicity, in part on the basis that the required warning statement is false or misleading[3].

Given EPA's determination that glyphosate is "not likely to be carcinogenic to humans," EPA considers the Proposition 65 warning language based on the chemical glyphosate to constitute a false and misleading statement. As such, pesticide products bearing the Proposition 65 warning statement due to the presence of glyphosate are misbranded pursuant to section 2(q)(l)(A) of FIFRA and as such do not meet the requirements of FIFRA. In registering pesticides, EPA must determine that the labeling complies with the requirements of FIFRA including that the product not be misbranded. See FIFRA 3(c)(5)(B). Therefore, EPA will no longer approve labeling that includes the Propo-

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[2] https://www.regulations.gov/document?D=EPA-HQ-OPP-2009-0361-0073

[3] National Association of Wheat Growers, et al. v. Zeise, 309 F.Supp.3d 842 (E.D.Cal.)

sition 65 warning statement for glyphosate-containing products. The warning statement must also be removed from all product labels where the only basis for the warning is glyphosate, and from any materials considered labeling under FIFRA for those products.

For any pesticide product that currently contains Proposition 65 warning language exclusively on the basis that it contains glyphosate, EPA requests the submission of draft amended labeling that removes such language within ninety (90) days of the date of this letter.

Sincerely,

[handwritten signature]

Michael L. Goodis, P.E.
Director, Registration Division
Office of Pesticide Programs