

UNDER THE INFLUENCE: THE NATIONAL RESEARCH COUNCIL AND GMOS



ISSUE BRIEF • MAY 2016

The National Research Council (NRC) — the research arm of the National Academy of Sciences — enjoys a reputation as one of the elite scientific bodies in the United States, an independent institution that Congress calls on for impartial scientific advice about topics like genetically engineered crops (commonly called GMOs). However, the NRC’s far-reaching ties to biotechnology companies and other agricultural corporations have created conflicts of interests at every level of the organization, which greatly diminish the independence and integrity of the NRC’s scientific work.

Among other conflicts, Food & Water Watch found that the NRC (and its parent organization, the National Academy of Sciences¹):

- takes millions of dollars in funding from biotechnology companies
- invites sponsors like Monsanto to sit on high-level boards overseeing the NRC’s work
- invites industry-aligned, pro-GMO scientists to author NRC reports
- draws scientific conclusions based on industry science
- operates at times as a private contractor for corporate research.

Introduction

The National Academy of Sciences bills itself as “the nation’s premier source of independent, expert advice on scientific, engineering, and medical issues” and provides scientific opinions on important public policy issues, like the use of GMOs in farming or the use of growth-promoting drugs in animal agri-

culture.² Chartered by Congress to provide scientific guidance to the government,³ the Academy and its research arm, the NRC, are required under the Federal Advisory Committee Act to limit conflicts of interest in their scientific work.^a

Yet, for decades, GMO critics have noted that the biotechnology industry exerts enormous influence over the NRC.⁴ The organization has taken millions of dollars from companies like Monsanto and DuPont and allowed corporate representatives from these and other companies to sit on high-level governing boards overseeing NRC projects. The group maintains a revolving door of key staff with industry groups, and demonstrates a clear preference for inviting industry-aligned researchers to produce its reports — while seldom engaging critics at meaningful levels. At times, the NRC’s projects on agricultural topics are even funded in part by corporate donors that have a financial interest in the outcome.⁵

a To avoid confusion, this report consistently refers to the work of the NRC, which can be seen as part and parcel of the work of the National Academy of Sciences, the parent organization of the NRC.

TABLE 1. Notable Biotech Corporate Donations to the National Academy of Sciences¹²

NAS Donor	Amount
Monsanto	\$1-\$5 million
DuPont	\$1-\$5 million
Dow Chemical	\$1-\$5 million

Note: As a private organization, the NRC/NAS is not required to disclose its funding sources, so actual giving from the biotechnology industry may be far greater than is depicted in this table.

TABLE 2. Companies and Industry Associations on the NRC Board Overseeing GMO Projects, 1987-Present*

Monsanto
DuPont
Biotechnology Industry Organization (BIO)
Calgene
Cargill
General Mills
Novus International
Nestlé Purina
Pioneer Hi-Bred

*These companies served at some point on the NRC Board on Agriculture and Natural Resources.¹⁵

These conflicts greatly limit the scientific capacity of the NRC, including, most obviously, its ability to discuss the impact of conflicts of interest on science, a pressing issue in GMO research. A wide body of literature shows that when industry plays a role as an author or funder of scientific research, it tends to produce results favorable to industry.⁶ This issue looms large in the agricultural sciences, as corporations like Monsanto and DuPont have poured millions of dollars in research funding to university professors (including many who serve on NRC committees), authored and funded peer-reviewed studies, sat on editorial boards of scientific journals, and aggressively censored and attacked unfavorable research on GMOs.⁷

In the spring of 2016, the NRC is scheduled to release its newest GMO report that will be published against the backdrop of an aggressive public relations campaign by the biotechnology industry and many of the academic scientists it funds, which falsely asserts that there is a “scientific consensus” on the safety of GMOs.⁸ In reality, there is no consensus, and there remains a very vigorous debate among scientists — and farmers and consumers — about the safety and merits of this technology.⁹

Unfortunately, all sides of this debate are not well represented at the NRC, where industry influence has long played an outsized role, creating not only an appearance of conflicts of interest, but actual bias in the NRC’s work. At a time when Americans desperately need an independent, trustworthy organization to deliver impartial scientific opinions on topics like GMOs, the NRC cannot possibly serve this role.

Recommendations

- Congress should expand and enforce the Federal Advisory Committee Act to ensure that the scientific advice the NRC produces for the government is free of conflicts of interest and bias.
- Congress should immediately halt all taxpayer funding for agricultural projects at the NRC until meaningful conflict-of-interest policies are enforced.
- The NRC should no longer engage funders, directors, authors or reviewers that have a financial interest in the outcome of any of the NRC’s work.
- The NRC should prohibit the citation of science funded or authored by industry, given the obvious potential for bias.

Structural Conflicts of Interest

Monsanto, DuPont and other corporate agribusinesses that produce or support GMOs have poured millions of dollars into the NRC’s parent organization, the National Academy of Sciences.¹⁰ (See Table 1.) These companies, at times, also have provided direct funding for the NRC’s work on GMOs, including sponsoring a 2015 workshop presented in part by industry advocates.¹¹

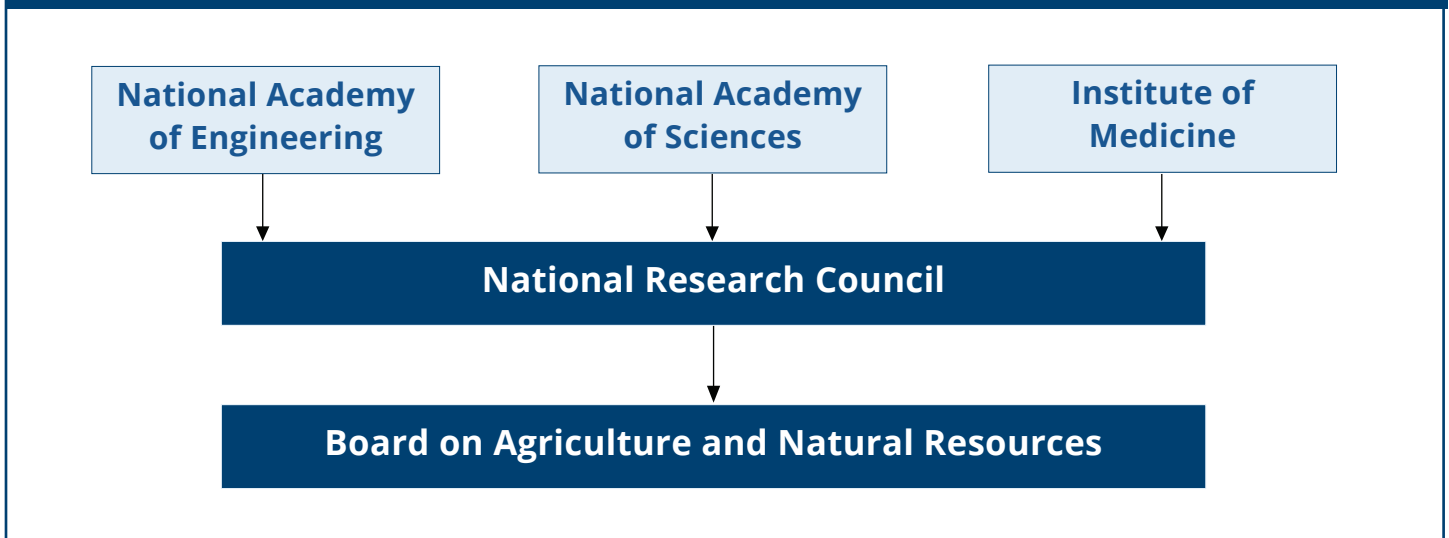
Corporate representatives also participate in high-level decision-making processes at the NRC, including sitting on the board that oversees the NRC’s work on GMOs. Over the last three decades, this has included representatives from Monsanto, DuPont, Pioneer Hi-Bred, Cargill and the trade association BIO. (See Table 2.) Other invited board members include pro-GMO academics with financial stakes in GMO acceptance, like Robert Goldberg, an outspoken GMO advocate who founded a biotech seed company.¹³ Overseeing this board is NRC chair Barbara Schaal, a plant scientist who collaborates on Monsanto research.¹⁴

The project directors of the NRC’s GMO reports are frequently part of a revolving door with the biotechnology industry. (See Table 3.) The NRC’s 2000 report on GMOs was directed by Michael Phillips, who, after establishing a very pro-GMO

TABLE 3. Revolving Door of NRC Directors of GMO Projects

Person	NRC Work Position	Revolving Door
Kara Laney	Staff director of GMO projects (2008-present) ²⁰	Previously worked for the pro-GMO, Monsanto-funded International Food & Agricultural Trade Policy Council ²¹
Michael Phillips	Staff director of GMO projects (1996-1999) ²²	Left the NRC to work for the biotech industry’s main lobby group, BIO ²³

CHART 1. National Academies Organizational Chart



committee of scientists at the NRC, took a job at the leading biotech lobby firm, BIO.¹⁶ Although the NRC publicly acknowledged that this represented an undisclosed conflict of interest,¹⁷ a few years later it hired a new project director, Kara Laney, from the International Food & Agricultural Trade Policy Council, a pro-GMO group funded and directed in part by Monsanto.¹⁸ Laney remains the GMO study director at the NRC as of publication of this issue brief.¹⁹

By contrast, among funders, directors and board members at the NRC, critics of GMOs play no meaningful role — or, often, no role at all. One former director of the NRC’s agricultural work, Charles Benbrook, says that he was dismissed from the NRC for being critical of the pesticide industry.²⁴ His dismissal became part of a controversy that was the subject of a *Frontline* investigation showing how the pesticide industry sought to influence the National Academy of Sciences.²⁵

NRC Recruits Pro-GMO Authors

The NRC recruits outside experts to produce its reports, in theory inviting the best, independent experts it can find. While the NRC routinely invites scientists who are clear GMO proponents or who have financial conflicts of interests with the biotechnology industry, those scientists and experts that are opposed to or highly critical of GMOs do not play a meaningful role in the NRC’s work.

There are long-standing criticisms of conflicts of interest at the NRC. The group’s 2000 report on GMOs was authored by a panel of 12 scientists, 8 of whom had identifiable financial conflicts of interest, according to a letter sent to the National Academy of Sciences by more than a dozen scientists and public interest groups concerned about bias.³⁰

The NRC’s 2010 report on GMOs was produced by a panel of 10 scientists, at least 6 of whom had ties to the biotechnology industry and/or held pro-GMO positions, including collaborating on research, receiving research funding or working for an organization funded by the biotechnology

Pro-GMO Findings From the NRC

NRC reports are hundreds of pages long and frequently offer discussions of both benefits and drawbacks of GMOs. However, criticisms of GMOs often are buried in the text, seldom making their way into a report’s highlighted findings, which tend to frame GMOs in a positive light.

For example, the NRC’s announcement of its 2000 report on GMOs and food safety prominently noted a top-level finding of “no evidence suggesting foods on the market today are unsafe to eat as a result of genetic modification ...”²⁶ This expansive statement, which the international media rightfully reported as favoring biotech companies,²⁷ fails to note that virtually no independent “evidence” existed on the safety of GMO foods at the time of this report.²⁸ Here, the NRC appears to be reaching far beyond what the available science says or, worse, spinning the science to arrive at a scientific opinion that is clearly favorable to the biotechnology industry.

A prudent, measured, science-based determination, it would seem, would need to highlight the fact that no firm food-safety conclusions can be drawn because so little research has been conducted. That was the finding of a group of hundreds of scientists a decade later. After consulting the scientific literature on GMOs, they noted that the available safety research was too scant — and still too heavily influenced by the biotechnology industry — to assert that GMOs are safe to eat.²⁹

industry.³¹ One author noted the strong pro-GMO position he held going into the project — and how his pro-GMO perspective found its way into the NRC’s final report: “When I joined the committee I thought that the main finding will be those of economists, like myself, who realize that GE crops did a lot of good by increasing yields and reducing costs ...

TABLE 4. 2014-2016 NRC Committee Members With Ties to Industry or GMO Advocacy

Name	Affiliation	Industry Ties/GMO Advocacy
David Stelly	Texas A&M	Research collaborator with Monsanto, Bayer, Dow Agrosciences ³⁵
Neal Stewart	University of Tennessee	Consulted for Dow Agrosciences and Syngenta ³⁶ ; patents on GMOs ³⁷
Richard Dixon	University of North Texas	Consulted for Monsanto four times; received more than \$1 million from biotech industry for research ³⁸ ; patents on GMOs ³⁹
Bob Whitaker	Produce Marketing Association	Works for organization sponsored by Monsanto and Bayer ⁴⁰
Karen Hokanson ⁴¹	Donald Danforth Plant Science Center	Consults with Monsanto-sponsored organizations and a pro-GMO group ⁴²
Bruce Hamaker	Purdue University	Director of research center funded by biotech industry ⁴³
Richard Amasino	University of Wisconsin	Patents on GMOs ⁴⁴ ; engages in pro-GMO political advocacy ⁴⁵
Dominique Brossard	University of Wisconsin	Previously worked for a Monsanto-partner organization that helps commercialize GMOs ⁴⁶ ; advocates in media in favor of GMO ⁴⁷
Peter Kareiva	The Nature Conservancy	Works for organization that receives millions of dollars from biotech companies; ⁴⁸ these companies also sit on a Nature Conservancy advisory board ⁴⁹
Robin Buell	Michigan State University	Involved in GMO development ⁵⁰ ; patent related to GMOs ⁵¹
Jose Falck-Zepeda	International Food Policy Research Institute	Works for organization that supports GMOs; collaborates with industry supporters on research advocating use of GMOs in Africa ⁵²
Kevin Pixley	International Maize and Wheat Improvement Center	Research collaborator with Syngenta Foundation ⁵³ ; works for organization that supports and develops GMOs ⁵⁴

Note: Between 2014 and 2016, a total of 22 experts served on the NRC committee at some point. Other members, for whom Food & Water Watch did not identify industry ties, included Mike Gallo, Ken Giller, Leland Glenna, Fred Gould, Timothy Griffin, Daniel Magraw, Carol Mallory-Smith, Elizabeth Ransom, Michael Rodemeyer and Lawrence Busch.

Source: See endnote 33.

As expected, we found that the use of GE varieties reduce the cost of pest control, losses from pests, and enhanced flexibility in farm management ...³²

With the NRC's 2016 report, more than half of the experts selected to participate in the project have apparent conflicts, such as receiving research funding from industry, developing GMOs (or patents), consulting for industry or working for industry-funded organizations. (See Table 4 and note.³³) Some of these scientists also have promoted GMOs in the media or lobbied government regulators in favor of GMOs.³⁴

The NRC's conflict-of-interest policy, although imperfect, clearly affirms that many of these financial ties constitute conflicts of interest, yet the NRC asserts that no such conflicts exist for the scientists working on the 2016 report.⁵⁵ The large presence of GMO advocates and scientists with ties to bio-

technology companies on NRC committees — and the paucity of critics⁵⁶ — does not reflect the scientific mainstream, where there is a very vigorous debate about the safety and merits of this technology. Beginning in 2013 — before the NRC undertook its GMO study — hundreds of expert scientists began coming forward to formally note their concerns about GMOs, issuing a public statement that cited evidence of safety issues with the technology and that made a strong call for more independent research; yet none of these scientists is serving on the most recent NRC committee.⁵⁷

When the NRC announced the authors that it had selected for its 2016 report, numerous scientists and public interest organizations criticized the lack of balance and independence among committee members and offered recommendations of better committee members — recommendations that the NRC did

not take. One letter, signed by more than 45 scientists, called for a “more diverse set of biological, physical and medical/health scientists capable of critically and fairly appraising GE and their associated technologies in comparison to other approaches.”⁵⁸ A separate letter signed by more than 15 scientists questioned the independence of those NRC nominees with backgrounds in GMO development and promotion, and also recommended the names of dozens of highly qualified scientists to be added to the committee.⁵⁹ Likewise, Food & Water Watch sent the NRC a letter detailing financial conflicts of interests among committee members and recommending that new scientists be added to the committee.⁶⁰

The Federal Advisory Committee Act

Given that policy makers sometimes develop rules and regulations based on the scientific advice of groups like the NRC, Congress has developed a law to help ensure that the scientific advice that it receives is independent — presumably to remove bias. The Federal Advisory Committee Act (FACA) requires that government agencies can only use NRC scientific opinions if they come from “fairly balanced” scientific committees free from conflicts of interests — “unless such conflict is promptly and publicly disclosed and the Academy determines that the conflict is unavoidable ...”⁶¹

Yet, as this issue brief shows, the NRC routinely packs its scientific committees with pro-GMO scientists that have far-ranging financial conflicts of interest, which are neither “unavoidable” nor “promptly and publicly disclosed.”⁶² When asked for copies of its conflict-of-interest reviews for its 2016 GMO committee, the NRC refused the request, saying that this information is held “in confidence.”⁶³ If a scientist “makes it onto the final committee list,” an NRC spokesperson added, “that means that under our rules, the NRC/NAS has found no COI [conflict of interest].”⁶⁴

The NRC’s failure to achieve balance and independence, unfortunately, mirrors the state of play with federal advisory bodies to the U.S. government, where industry advocates have long exercised outsized influence that undoubtedly is biasing the work of these advisory bodies — and altering the rules and regulations developed based on their recommendations.⁶⁵

The NRC Draws Scientific Opinions From Industry Research

Biotechnology corporations play a very large role in the production of science on GMOs, authoring and funding much of the scientific literature on key safety topics — including research used in regulatory approval processes.⁶⁶ It is widely documented throughout the sciences that industry studies are far more likely than independent research to be favorable to industry.⁶⁷ Yet the NRC heavily cites industry research in drawing its opinions about GMOs.

While it is beyond the scope of this issue brief to analyze every scientific citation in the NRC’s work on GMOs, examples of this problem abound. The NRC’s 2004 GMO report offered

a very favorable review of the highly controversial recombinant bovine growth hormone (rBGH), at that time produced by Monsanto.⁶⁸ All but one of the peer-reviewed journal articles cited in the relevant section of the 2004 report were co-authored by Dale Bauman, a Monsanto consultant.⁶⁹

What is not mentioned is that many scientific regulatory bodies, including those in Canada and the European Union, have never allowed the use of rBGH in dairy production because of safety concerns.⁷⁰ Even the official drug label for rBGH (now owned by Elanco) notes that it presents an increased risk of an animal health problem, mastitis,⁷¹ which can require the use of antibiotics, the overuse of which raises public health concerns related to antibiotic-resistant bacteria causing hard-to-treat infections in humans.⁷² The NRC report not only does not mention these safety issues, but it actually affirms the very opposite — that cows treated with rBGH are of “normal cow health” — with no qualifications.⁷³

There are similar problems in the NRC’s 2010 report on GMOs and “sustainability,” which includes a discussion of the impacts of GMO feed on livestock production.⁷⁴ After reviewing the available literature, the NRC arrived at the very strong, unqualified determination that “empirical studies have clearly indicated that there is no adverse effect [of GMOs] on quality of livestock feed or on the output or quality of livestock products.”⁷⁵

The NRC cites 11 peer-reviewed studies to arrive at this very strong conclusion — but at least 5 of these studies had industry authors or funders.⁷⁶ (Some of the remaining studies do not list funders, meaning that industry influence may be greater.⁷⁷) One Monsanto-authored study was even published with a disclaimer that it is actually an “advertisement.”⁷⁸ Two of the cited studies were co-authored by Monsanto scientist Gary Hartnell, who was serving on the NRC board overseeing this report.⁷⁹

The NRC’s scientific determination is not only heavily girded by industry science, but also out of step with the wider scientific discourse, where hundreds of scientists have noted in a public statement the safety concerns associated with GMO food and feed. They cite a number of independent animal-feeding studies showing toxic effects, and they make the prudent, measured call for more research in light of the evident concerns.⁸⁰

The NRC’s 2010 report also heavily cites research from the online journal *AgBioForum*, referencing studies from this journal on more than 20 occasions.⁸¹ *AgBioForum* is run by a pro-biotech organization with ties to Monsanto⁸² and is edited by GMO advocates,⁸³ several of whom Monsanto has solicited for help in promoting GMOs in other forums.⁸⁴

Interestingly, seven of the *AgBioForum* citations were co-authored by NRC committee member Michele Marra, an academic who has received hundreds of thousands of dollars in research funding from the biotech industry.⁸⁵ Marra’s *AgBioForum* articles were cited as evidence of GMO benefits, including reducing the risks of crop failure,⁸⁶ increasing farm

The NRC Recruits Pro-GMO Farmers

The NRC's 2016 report on GMOs was criticized from the very beginning for failing to engage with farmers.⁹⁰ Possibly in response, the NRC invited two growers to speak to the NRC committee.⁹¹ The NRC did not disclose that both of these farmers also had served as paid advocates of industry, having previously received funding from Monsanto or a Monsanto-funded advocacy group.⁹²

The NRC did not invite any of the thousands of U.S. farmers and countless international farmers who are critical of or opposed to GMOs — some of whom have suffered economic losses because of the technology.⁹³

income⁸⁷ and decreasing pesticide use.⁸⁸ In total, Marra's research is cited more than 20 times in the NRC report, demonstrating how much influence NRC committee members can have over the final report's findings.⁸⁹

Conflicted Findings: Environmental Benefits of GMOs

The NRC's 2010 GMO report about "sustainability" all but endorsed genetically engineered crops, with a key finding that GMOs "offer substantial net environmental and economic benefits compared to conventional crops." The NRC added the weak qualification that "these benefits have not been universal, some may decline over time, ..."⁹⁴

The NRC arrived at this conclusion in 2010 based in part on its determination that insect-resistant GMOs have reduced insecticide use in agriculture.^{95b} Yet, according to a widely cited analysis published by the non-profit Organic Center the year before, the story is far more complicated.⁹⁶ That study found that while insecticide use has decreased, the use of herbicides has skyrocketed — and the total amount of all pesticides used (herbicides plus insecticides) has increased substantially with GMOs, a point that the NRC barely addresses and buries in the text.⁹⁷ In fact, the NRC's review of the available evidence on total pesticide use is, in some places, a word-for-word recitation of a previously published peer-reviewed study by one of the NRC authors, Michele Marra, who has received hundreds of thousands of dollars in research funding from the biotechnology industry.⁹⁸

The NRC does offer the weak caveat that the sustainability "benefits" of GMOs could decline over time if farmers overuse glyphosate, an herbicide that most GMO crops are designed to be sprayed with.⁹⁹ But highlighting farmer behavior as the problem seems highly misleading in light of the fact that pesticide companies benefit enormously from the over-

use of glyphosate. Monsanto, which sells both glyphosate and glyphosate-tolerant seeds, charted nearly \$10 billion in glyphosate sales between 2008 and 2010, almost 30 percent of its net sales.¹⁰⁰

As farmers widely adopted Monsanto's GMOs and sprayed them with glyphosate, weeds quickly developed their own tolerance to the herbicide, diminishing the effectiveness of the GMO production model.¹⁰¹ In the media, Monsanto, much like the NRC, puts the onus on farmers to use herbicides more responsibly.¹⁰²

Animal Agriculture

Corporate influence at the NRC is by no means limited to the work that the group does on GMOs. In 2014, the NRC undertook an investigation into how to improve "sustainability" in animal agriculture through research and development. The NRC took corporate funding and recruited industry scientists to produce this report, with Monsanto, Tyson, Smithfield, the National Cattlemen's Beef Association and other industry groups involved.¹⁰³

In this instance, the NRC appeared to function as a private, for-hire research contractor, lending its name to a report that had both industry authors and funders — and that made findings that largely support industry's goals in animal production. Industry advocates can use the report, which bears the prestigious NRC name, to defend controversial industry practices, which has already occurred.¹⁰⁴

This report openly marginalizes organic animal agriculture in the first few pages, saying that it has no realistic role to play in meeting "current or future demands for animal protein."¹⁰⁵ This perspective may reflect the bottom lines of companies like Tyson and Smithfield, but it does not reflect the mainstream scientific discourse. A highly publicized report from the United Nations and the World Bank — approved by 58 countries — determined that organic and low-input approaches play a crucial role in improving the sustainability of food production, especially in the developing world.¹⁰⁶

One frequently cited finding of the NRC report is that modern-day industrial approaches to animal agriculture — steroids, hormones and growth promoters — have actually improved measures of sustainability and reduced environmental impact compared to traditional or organic methods.¹⁰⁷ This repeated assertion is often supported by science from industry advocates like Jude Capper, a former academic and now industry consultant whose publications are cited more than 25 times.¹⁰⁸ Long passages of the report are cited almost entirely with Capper's science — and science from other industry advocates and consultants.¹⁰⁹

One of the biggest controversies in modern animal agriculture concerns the use of antibiotics as growth promoters. Industry groups have long defended the use of antibiotics as growth promoters and tried to minimize the role that they play in increasing the risk to human health from antibiotic-resistant bacteria.¹¹⁰ This position stands in contrast to the interna-

b The NRC's 2010 conclusion about reduced insecticide use was partially challenged by 2012 research showing that insecticide use has expanded in many parts of the country. See Fausti, Scott. "Insecticide use and crop selection in regions with high GM adoption rates. *Renewable Agriculture and Food Systems*. Vol. 27, Iss. 4. December 2012 at 299 and 302 to 303.

tional scientific discourse; the World Health Organization, U.S. Centers for Disease Control and Prevention (CDC), American Public Health Association, American Medical Association, American Academy of Pediatrics and Infectious Disease Society of America all agree that the use of antibiotics as growth promoters in livestock poses a threat to human health.¹¹¹

The NRC cites a 2013 report from the CDC showing that antibiotics are overused in human medicine, but fails to cite a more relevant finding of that report, written on the same page: “The use of antibiotics for promoting growth [in animals] is not necessary, and the practice should be phased out.”¹¹² Ultimately, the NRC made a weak, top-level recommendation to “explore alternatives” that can provide “the same or greater benefits in improved feed efficiency, disease prevention, and overall animal health” as antibiotics.¹¹³

This NRC report also includes largely uncited discussion about the benefits of genetically engineered salmon.¹¹⁴ The only scientific citation that the NRC makes in this section is an editorial written by two prominent pro-GMO salmon activists, one of whom formerly worked for Monsanto.¹¹⁵ Not surprisingly, the NRC does not acknowledge the vigorous scientific debate about the safety and merits of GMO salmon, or that some of the world’s leading experts on biotech fisheries have long expressed concerns.¹¹⁶

Conclusion

The agricultural and food sciences in the United States today are overrun with industry money, which has led to industry bias. Corporations have long used their deep coffers to successfully court public universities and institutions like the NRC, hoping to secure favorable science and high-profile allies in the scientific community. This has been a particularly important problem in the GMO debate.

Despite 20 years of commercial production of GMOs, scientists continue to note that there are major gaps in the scientific literature on key safety issues, with biotech companies continuing to play an outsized role in the scientific discourse. The NRC, which has released multiple in-depth reports on GMOs, has never meaningfully addressed this important issue.¹¹⁷ Quite the opposite, the NRC appears to uncritically

embrace industry science, frequently drawing scientific conclusions based on it.

The NRC may dispute that its extensive ties to industry have influenced its work, but even setting aside the copious evidence to the contrary, the NRC must still contend with the appearance of a conflict of interest — and understand that, from the public’s perspective, such an appearance compromises the integrity of the NRC as a credible, science-based organization.

At best, the NRC’s scientific work on topics like GMOs will be looked upon with suspicion by the public, who will take note of the NRC’s structural ties to biotech companies and the deeply unbalanced panels of pro-GMO scientists that preside over NRC activities. Even if the NRC were to issue scientific conclusions unfavorable to industry, the public may still wonder whether these have been watered down.

The cavalier treatment of conflicts of interests by the NRC telegraphs an unfortunate message to the public that such conflicts do not matter, when clearly they do. This may have a far-reaching chilling effect that goes well beyond the GMO debate. If the public cannot trust the credibility and independence of the NRC’s scientific work on GMOs, it is unclear how the public can trust the science from the NRC on other pressing policy issues.

Recommendations

- Congress should expand and enforce the Federal Advisory Committee Act to ensure that the scientific advice the NRC produces for the government is free of conflicts of interest and bias.
- Congress should immediately halt all taxpayer funding for agricultural projects at the NRC until meaningful conflict-of-interest policies are enforced.
- The NRC should no longer engage funders, directors, authors or reviewers that have a financial interest in the outcome of any of the NRC’s work.
- The NRC should prohibit the citation of science funded or authored by industry, given the obvious potential for bias.

Endnotes

- 1 National Academy of Sciences (NAS). Division on Earth & Life Studies at the National Academies Flowchart. Available at http://dels.nas.edu/resources/static-assets/exec-office-other/dels_org_chart.pdf and on file at Food & Water Watch. Accessed January 29, 2016.
- 2 NAS. Reputation. Available at <http://nationalacademies.org/about/reputation/index.html> and on file at Food & Water Watch. Accessed January 29, 2016.
- 3 Wade, Nicholas. "Academy of Sciences, fighting to keep its panels closed, is rebuffed by Supreme Court." *New York Times*. November 4, 1997.
- 4 Collins, Ronald et al. Center for Science in the Public Interest. Letter to Dr. E. William Colglazier, Executive Officer of the National Academies. May 22, 2000; Petermann, Anne et al. Letter to National Research Council (NRC). March 26, 2015; Hauter, Wenonah. Food & Water Watch. Letter to NRC about "Genetically Engineered Crops: Past Experience and Future Prospects." August 4, 2014.
- 5 NRC. "Critical Role of Animal Science Research in Food Security and Sustainability." 2015 at Front Matter; NRC. Public Interface in Life Sciences Roundtable. "Public engagement on genetically modified organisms: when science and citizens connect: a workshop summary." 2015 at Front Matter.
- 6 Diels, Johan et al. "Association of financial or professional conflict of interest to research outcomes on health risks or nutritional assessment studies of genetically modified products." *Food Policy*. November 22, 2010 at 200 to 201; Lesser, Lenard et al. "Relationship between funding source and conclusion among nutrition-related scientific articles." *PLOS MEDICINE*. January 2007 at Discussion; Friedman, Lee S. et al. "Relationship between conflicts of interest and research results." *Journal of General Internal Medicine*. Vol. 19, Iss. 1. January 2004 at Discussion; Als-Nielsen, B. et al. "Association of funding and conclusions in randomized drug trials." *Journal of the American Medical Association*. Vol. 290, No. 7. August 20, 2003 at 924; Krimsky, Sheldon. "Combating the funding effect in science: what's beyond transparency?" *Standard Law & Policy Review*. Vol. XXI. 2010 at 107 to 109.
- 7 Food & Water Watch. *Public Research, Private Gain*. 2012; Food & Water Watch. *Corporate Control in Animal Science Research*. 2015; Diehls (2010) at Discussion; Waltz, Emily. "Under Wraps." *Nature Biotechnology*. Vol. 27, Iss. 10. October 2009 at 882; Pollack, Andrew. "Crop scientists say biotechnology seed companies are thwarting research." *New York Times*. February 19, 2009; Aviv, Rachel. "A valuable reputation." *New Yorker*. February 10, 2014; Food & Water Watch. "Corporate Control in Animal Science Research." 2015.
- 8 See "The so-called consensus on GMOs." Food & Water Watch. 2014.
- 9 Hilbeck, Angelika. "No scientific consensus on GMO safety." *Environmental Sciences Europe*. Vol. 27, Iss. 4. January 24, 2015 at Introduction and Conclusion; "The so-called consensus on GMOs." Food & Water Watch. 2014.
- 10 NAS. Report of the treasurer of the National Academy of Sciences for the year ended December 31, 2014. 2015 at 15, 20 and 40 to 43. *Note*: As a private organization, the NRC is not required to publicly disclose its corporate donations; the full scope of its financial ties to biotechnology companies remains unknown but is likely much larger than Food & Water Watch could document in this report.
- 11 NRC. Public Interface in Life Sciences Roundtable. "Public engagement on genetically modified organisms: when science and citizens connect: a workshop summary." 2015 at Front Matter, v, vi and 43; Shackford, Stacy. Cornell University. [Press release]. "New Cornell Alliance for Science gets \$5.6 million grant." August 21, 2014; International Service for the Acquisition of Agri-Biotech Applications. Annual Report. 2014 at 3 and 25.
- 12 NAS. Report of the treasurer of the National Academy of Sciences for the year ended December 31, 2014. 2015 at 15, 20 and 40 to 43. *Note*: As a private organization, NRC is not required to publicly disclose all of the details of its donations; the full scope of its financial ties to biotechnology companies remains unknown but is likely much larger than Food & Water Watch could document in this report.
- 13 NAS. Board on Agriculture and Natural Resources. Member biographies. Available at <http://dels.nas.edu/resources/static-assets/banr/miscellaneous/BoardMembersBiographies.pdf> and on file at Food & Water Watch. Accessed March 1, 2016; Freedman, David. "The truth about genetically modified food." *Scientific American*. September 1, 2013; Ceres. U.S. Securities and Exchange Commission. Form 10-K. Fiscal year ending August 31, 2015 at 1, 55, 60 and 67; Goldberg, Robert. C.V. Available at https://www.mcdb.ucla.edu/Research/Goldberg/lab_members/Bob.CV.htm and on file at Food & Water Watch. Accessed January 29, 2016; Fedoroff, Nina et al. Letter to Lisa Jackson, Administrator of U.S. Environmental Protection Agency (EPA). July 5, 2011.
- 14 NAS. Division on Earth & Life Studies at the National Academies Flowchart; American Institute of Biological Sciences. Biography of Barbara Schaal. Available at https://www.aibs.org/events/special-symposia/barbara_schaal.html and on file at Food & Water Watch. Accessed January 29, 2016; Monsanto. [Press release]. "Monsanto funds fellowships for graduated students." December 16, 2011; National Science Foundation. Award Abstract #9256779. "Graduate research training in identification and utilization of plant genetic resources." May 25, 1993. Available at http://www.nsf.gov/awardsearch/showAward?AWD_ID=9256779 and on file at Food & Water Watch. Accessed April 5, 2016.
- 15 NRC. Agricultural Biotechnology: Strategies for National Competitiveness. 1987 at iv; NRC. "Genetically Modified Pest-Protected Plants: Science and Regulation." 2000 at vi; NRC. "Ecological Monitoring of Genetically Modified Crops: A Workshop Summary." 2001 at viii; NRC. "Animal Biotechnology: Science Based Concerns." 2002 at vii; NRC. Biological Confinement of Genetically Engineered Organisms. 2004 at vii; NRC. "Impact of genetically engineered crops on farm sustainability in the United States." 2010 at vi; NAS. Board on Agriculture and Natural Resources. Member biographies. Available at <http://dels.nas.edu/resources/static-assets/banr/miscellaneous/BoardMembersBiographies.pdf> and on file at Food & Water Watch. Accessed March 1, 2016.
- 16 Mikesell, Libby. [Press release]. "BIO strengthens Food & Agriculture Section." BIO. July 20, 1999; Peterson, Melody. "Biotech expert's new job casts a shadow on report." *New York Times*. August 16, 1999.
- 17 Mikesell (1999); Peterson (1999).
- 18 Laney, Kara. International Food & Agricultural Trade Policy Council (IPC). "Biofuels: promises and constraints." IPC Discussion Paper. December 2006; IPC. [News release]. "IPC urges Europe to look at broader implications of biotech stance." January 14, 2008 at Media Contact: Kara Laney; IPC. "Plant biotechnology and global food production: trade implications." IPC Position Paper No. 7. October 1998 at 19; IPC. Annual Report. 2002 at 29 and 34 and 2006 at 6 and 8; Monsanto. [Press release]. "Hugh Grant is elected president and chief executive officer of Monsanto company." May 29, 2003; NAS Board on Agriculture and Natural Resources. Staff Biographies. Available at <http://dels.nas.edu/resources/static-assets/banr/miscellaneous/Staff%20Bios.pdf> and on file at Food & Water Watch. Accessed May 6, 2015.
- 19 NAS Board on Agriculture and Natural Resources. Staff Biographies.
- 20 *Ibid*.
- 21 Laney (2006); IPC (2008); IPC (1998) at 19; IPC (2002 and 2006); Monsanto (2003); NAS Board on Agriculture and Natural Resources. Staff Biographies.
- 22 Mikesell (1999).
- 23 Peterson (1999).
- 24 Moyers, Bill. "In our children's food." [Transcript]. *Frontline*. March 30, 1993.
- 25 *Ibid*.
- 26 Kearny, Bill. NAS. "Regulating biotech crops." *NewsReport Online; Environment & Resources*. Summer 2000.
- 27 "GM food 'safe.'" *BBC News*. April 6, 2000.
- 28 Domingo, Roig and Arnais Gomez. "Health risks of genetically modified foods: a literature review." *Revista Española de Salud Pública*. Vol. 73, Iss. 3. May-June 2000 at Abstract; Domingo, Jose. "Toxicity studies of genetically modified plants: a review of the published literature." *Critical Reviews in Food Science and Nutrition*. Vol. 47. 2007 at Conclusions.
- 29 Hilbeck (2015) at Discussion and 1.
- 30 Collins et al. (2000).

- 31 NRC (2010) at v; Gustafson, David et al. "Climate adaptation imperatives: global sustainability trends and eco-efficiency metrics in four major crops – canola, cotton, maize, and soybeans." *International Journal of Agricultural Sustainability*. 2014. Vol. 12, No. 2, at Author Affiliations and Acknowledgements; Zilberman, David. University of California at Berkeley. "Biotech and the 'greening' of agriculture." *The Berkeley Blog*. June 12, 2010. Available at <http://blogs.berkeley.edu/2010/06/12/biotech-and-the-greening-of-agriculture/> and on file at Food & Water Watch. Accessed March 11, 2016; Gealy, David et al. Council on Agricultural Science and Technology. "Implications of Gene Flow in the Scale-up and Commercial Use of Biotechnology-derived Crops: Economic and Policy Considerations." Issue Paper No. 37. December 2007 at Author Affiliations; Zilberman, David. C.V. At 11. Available at https://www.professorzilberman.com/wp-content/uploads/2015/01/Zilberman_CV.pdf and on file at Food & Water Watch. Accessed January 21, 2016; Gassman, Aaron et al. "Fitness costs of insect resistance to *Bacillus thuringiensis*." *Annual Review of Entomology*. Vol. 54. January 2009 at Disclosure Statement; Tabashnik, Bruce. "Asymmetrical cross-resistance between *Bacillus thuringiensis* toxins Cry1Ac and Cry2Ab in pink bollworm." *Proceedings of the National Academy of Sciences*. Vol. 109, No. 29. July 21, 2009 at Disclosure Statement; Williams, Jennifer. "Fitness cost of resistance to Bt cotton linked with increased gossypol content in pink bollworm larvae." *PLOS ONE*. June 30, 2011 at Author Affiliations; Monsanto. 2015 insect knowledge research awardees. Available at <http://www.monsanto.com/knowledge-research-programs/pages/2015-insect-knowledge-research-awardees.aspx> and on file at Food & Water Watch. Accessed February 26, 2016; Marra, Michelle. North Carolina State University. Curriculum Vitae. 2014 at 35 to 37. Available at https://ag-econ.ncsu.edu/wp-content/uploads/2015/11/Marra_vita_3_2014.pdf and on file at Food & Water Watch; Cornell University. Office of Sponsored Programs. Awards received October 2009 and June 2014; Missouri Botanical Garden. [News release]. "Missouri Botanical Garden receives \$3 million gift from Monsanto company toward development of a world flora online." June 5, 2012; Food & Water Watch review of Iowa State University research grants. Obtained by states records request.
- 32 Zilberman (2010).
- 33 Industry influence may be far greater than Food & Water Watch can document because scientists are not required to publicly disclose their conflicts of interests and sometimes publicly deny having conflicts of interest when they, in fact, do. See Folta, Kevin. "FOIAs Chilling a Scientific Dialogue – Your Call to Communicate." *Plant Science Today*. American Society of Plant Biologists. April 28, 2015; Lipton, Eric. "Food industry enlisted academics in GMO lobbying war, emails show." *New York Times*. September 5, 2015.
- 34 Philipkoski, Kristen. "Souped-up rice goes against grain." *Wired*. June 5, 2003; "Scientists oppose plan to expand biotech regulation." *Southwest Farm Press*. July 28, 2011; Fedoroff et al. (2011); De Aenlle, Conrad. "G.M.O. dilemma: Swaying a wary public." *New York Times*. June 24, 2015.
- 35 Sachs, Eric et al. "Expression and segregation of genes encoding CryIA insecticidal proteins in cotton." *Journal of Crop Sciences*. Vol. 38, No. 1. April 24, 1997; TexasAgrilife. [Press release]. "David Stelly to lead efforts to sequence cotton genome." December 21, 2010; Hulse-Kemp, Amanda et al. "Development of a 63K SNP array for cotton and high-density mapping of intraspecific and interspecific populations of *Gossypium* spp." *G3*. Vol. 5, Iss. 3. April 22, 2015 at Author Affiliations; Patterson, Andrew et al. "Repeated polyploidization of *Gossypium* genomes and the evolution of the spinnable cotton fibres." *Nature*. Vol. 492, Iss. 7429. December 19, 2012 at Author Affiliations and Acknowledgements.
- 36 Stewart, Charles Neal, Jr. University of Tennessee. C.V. Available at http://plantsciences.utk.edu/pdf/stewart%20_cv_%202015_%20midyear_public_long.pdf and on file at Food & Water Watch. Accessed July 29, 2014. At 12.
- 37 Stewart, C. Neal. "Inducible plant promoters and the use thereof." U.S. Patent 9,157,087. October 13, 2015; Stewart, C. Neal. "Antibiotic resistance conferred by a plant ABC transporter gene when expressed in transgenic plants." U.S. Patent 7,973,213. July 5, 2011; Stewart, Neal. "Cabbage protease inhibitor gene confers resistance against plant pests." U.S. Patent 6,927,322. August 9, 2005.
- 38 University of North Texas. "Dr. Richard Dixon." Previously available at faculty.unt.edu/editprofile.php?pid=4677&onlyview=1 and on file at Food & Water Watch.
- 39 Dixon, Richard. "Genetic manipulation of isoflavonoids." U.S. Patent 7,038,113. May 2, 2006; Dixon, Richard. "Plant isoflavone and isoflavanone O-methyltransferase genes." U.S. Patent 8,809,627. August 19, 2014.
- 40 Produce Market Association. 2014 Fresh Summit Convention and Expo. 2014 Directory. 2014 at 14 and 15.
- 41 Left committee for personal reasons. See NRC. "A science-based look at genetically engineered crops." Committee members. Available at <http://nas-sites.org/ge-crops/category/committee/> and on file at Food & Water Watch. Accessed March 1, 2016.
- 42 International Society of Biosafety Research. Board of directors. Available at http://isbr.info/Board_of_Directors and on file at Food & Water Watch. Accessed February 11, 2016; Chambers, Judith et al. "GM Agricultural technologies for Africa." International Food Policy Research Institute (IFPRI). 2014 at 119 to 120; Donald Danforth Plant Science Center. [News release]. "Monsanto fund makes \$15 million gift to Danforth Center." September 5, 2006; Gustin, Georgina. "Former anti-GMO crusader speaks at Donald Danforth Plant Science Center." *St. Louis Post-Dispatch*. June 13, 2013; International Society of Biosafety Research. International Symposium on the Biosafety of Genetically Modified Organisms (ISBGM). Sponsor List. Available at <http://isbr.info/ISBGM13/Sponsors> and on file at Food & Water Watch. Accessed February 11, 2016; "Judith A. Chambers." Available at <http://pbs.ifpri.info/pbs-staff/judith-a-chambers/>. Accessed July 28, 2014 and on file at Food & Water Watch; Program for Biosafety Systems. "About Us." Available at <http://pbs.ifpri.info/about/>. Accessed August 4, 2014; IFPRI. Program for Biosafety Systems. "Kenya: PBS helps set the stage for biosafety legislation." September 2009; U.S. Department of State. "Cautious Kenya finally enacts long awaited biosafety act of 2009." Cable No. 09Nairobi1496. March 11, 2009; U.S. Department of Agriculture. Foreign Agricultural Service. [Press release]. "USAID Announces International Biotech Collaboration: Says program will help poor countries reduce hunger," FASonline. June 12, 2002.
- 43 Whistler Center. Purdue University. 2008 Annual Report at Front Matter and 5; Whistler Center. Purdue University. 2014 Annual Report at Front Matter and 7; Whistler Center. Purdue University. 2009 Annual Report at Front Matter and 7; Whistler Center. Industrial Membership. Available at <https://www.whistlercenter.purdue.edu/membership/> and on file at Food & Water Watch. Accessed February 25, 2016.
- 44 Amasino, Richard et al. "Transgenic plants with altered senescence characteristics." U.S. Patent 6,359,197. March 19, 2002; Amasino, Richard et al. "Transgenic plants with altered senescence characteristics." U.S. Patent 5,689,042. March 19, 2002.
- 45 "Scientists oppose plan to expand biotech regulation." *Southwest Farm Press*. July 28, 2011; Fedoroff et al. (2011).
- 46 NRC. "A science-based look at genetically engineered crops." Committee members: Dominique Brossard. Available at <http://nas-sites.org/ge-crops/category/committee/> and on file at Food & Water Watch. Accessed March 1, 2016; Agricultural Biotechnology Support Project II. Consortium partners. Available at <http://absp2.cornell.edu/consortiumpartners/> and on file at Food & Water Watch. Accessed March 14, 2016; Shotkoski, Frank. Agricultural Biotechnology Support Project II. "Agricultural Biotechnology as a tool for international development." PowerPoint Presentation at Central New York Biotechnology Symposium 2011. June 3, 2011; Agricultural Biotechnology Support Project II. Newsletter. Vol. 2, No. 3. July 2007 at 2.
- 47 De Aenlle (2015).
- 48 Monsanto. [Press release]. "Monsanto company receives Gulf Guardian Award for Mississippi Rover watershed partnership." June 27, 2013; Flint, Josh. "Mississippi to see cleanup." *Farm Progress*. January 2009; DuPont. [Press release]. "DuPont pledges \$250,000 to Nature Conservancy for water quality initiatives." October 10, 2007.
- 49 The Nature Conservancy. "Working with companies: Business Council." Available at <http://www.nature.org/about-us/working-with-companies/businesscouncil/ilc-main-content.xml>. Accessed July 29, 2014 and on file at Food & Water Watch; The Nature Conservancy. "Working with companies: Companies we work with." Available at <http://www.nature.org/about-us/working-with-companies/companies-we-work-with/index.htm>. Accessed July 29, 2014 and on file at Food & Water Watch.

- 50 Philipkoski (2003); Song, Junqi. "Gene RB cloned from *Solanum bulbocastanum* confers broad spectrum resistance to potato late blight." *Proceedings of the National Academy of Sciences*. Vol. 100, No. 16. August 5, 2003 at Discussion.
- 51 Collmer, Alan et al. U.S. Patent 7,138,569. "Nucleic acids encoding pseudomonas hop proteins and use thereof." November 21, 2006.
- 52 IFPRI. Program for Biosafety Systems. [Fact sheet]. "Kenya: PBS helps set the stage for biosafety legislation." September 2009; U.S. Department of State. "Cautious Kenya finally enacts long awaited biosafety act of 2009." Cable No. 09Nairobi1496. March 11, 2009; Program for Biosafety Systems. "About Us." Available at <http://pbs.ifpri.info/about/>. Accessed August 4, 2014; Chambers, Judith et al. "GM Agricultural technologies for Africa." IFPRI. 2014 at xiv to xv and 119.
- 53 NRC. "A science-based look at genetically engineered crops." Committee members. Kevin Pixley. Available at <http://nas-sites.org/ge-crops/category/committee/> and on file at Food & Water Watch. Accessed March 1, 2016; HarvestPlus. [Flyer]. "Provitamin A: Maize." 2009. Available at http://www.harvestplus.org/sites/default/files/HarvestPlus_Maize_Strategy.pdf and on file at Food & Water Watch. Accessed February 11, 2016.
- 54 NRC. "A science-based look at genetically engineered crops." Committee members. Available at <http://nas-sites.org/ge-crops/category/committee/> and on file at Food & Water Watch. Accessed March 1, 2016; International Maize and Wheat Improvement Center (CIMMYT). "Improved maize for African soils: a public-private partnership in support of African smallholders." Undated at 4; Lutz, Katie. [Blog]. "International Maize and Wheat Improvement Center. CIMMYT and CIBIOGEM hold symposium on transgenics and society." August 19, 2014.
- 55 NAS. Policy on committee composition and balance and conflicts of interests for committees used in the development of reports. May 12, 2003 at Financial Interests; Personal communication with NRC. February 2016.
- 56 *Note*: No members of the committee have public records of opposing GMOs, and few have a clear track record of strong criticism of the technology. For example, Fred Gould has spoken out about insect resistance spurred by the use of *Bt* (GMO) crops, but he advocates for better management of the technology, not an end to the use of *Bt* crops. Gould also advocates for the development of GMO insects in agriculture, noting his "belief that genetic engineering of insects can be used as a tool for reducing the impacts from pests of medical and agricultural importance." As such, Gould can hardly be called a critic of GMOs. See Tabashnik, Bruce and Fred Gould. "Delaying corn rootworm resistance to *Bt* corn." *Journal of Economic Entomology*. Vol. 105, No. 3. June 1, 2012; Gould, Fred. North Carolina State University home page. Available at <https://www.cals.ncsu.edu/entomology/> Gould and on file at Food & Water Watch. Accessed March 21, 2016.
- 57 Hilbeck (2015) at Introduction and Conclusion; European Network of Scientists for Social and Environmental Responsibility. "Signatories: No scientific consensus on GMO safety as of 30 October 2013." October 30, 2013. Available at www.ensser.org/fileadmin/user_upload/signatories_as_of_131210_lv.pdf and on file at Food & Water Watch. Accessed May 19, 2014.
- 58 Iles, Astair et al. Letter to Kara Laney, Study Director, NRC. August 4. 67 signers. 2014 at 3. On file at Food & Water Watch.
- 59 Iles, Astair et al. Letter to Kara Laney, Study Director, NRC. August 4. 23 signers. 2014 at 1. On file at Food & Water Watch.
- 60 Hauter (2014).
- 61 Federal Advisory Committee Act. 5 U.S.C. app. §15 (b).
- 62 Collins, Ronald et al. (2000); See Table 4.
- 63 Personal correspondence with NRC. January and February 2016.
- 64 Personal correspondence with William J. Skane, Executive Director of the NAS Office of News and Public Information. February 2016.
- 65 Harris, Gardiner and Alex Berenson. "10 voters on panel backing pain pills had industry ties." *New York Times*. February 25, 2005; Harris, Gardiner. "F.D.A. limits role of advisers tied to industry." *New York Times*. March 22, 2007; Willman, David. "2 new FDA panelists have ties to Rezulin Maker." *Los Angeles Times*. March 25, 1999.
- 66 Domingo, Jose and Jordi Gine Bordonaba. "A literature review on the safety assessment of genetically modified plants." *Environment International*. February 5, 2011 at Final Remarks; Diehls (2010); Hilbeck (2015) at Introduction and Conclusion.
- 67 Diehls (2010); Lesser (2007) at Discussion; Friedman (2004) at Discussion; Als-Nielsen et al. (2003) at 924; Krinsky (2010) at 107 to 109.
- 68 NRC. "Safety of Genetically Engineered Foods: Approaches to Assessing Unintended Health Effects." 2004 at 52 to 53; Lilly. [Press release]. "Elanco announces acquisition of Posilac dairy business." August 20, 2008.
- 69 NRC (2004) at 52 to 53; Biello, David. "Can bovine growth hormone help slow global warming." *Scientific American*. July 2, 2008.
- 70 Dohoo, Ian et al. Health Canada Drug and Health Products. "Report of the Canadian Veterinary Medical Association expert panel on rBST." November 1998 at section 7; Groves, Martha. "Canada rejects hormone that boosts cows' milk output." *Los Angeles Times*. January 15, 1999; European Commission, Directorate General for Health and Consumer Protection. "Report on Public Health Aspects of the Use of Bovine Somatotropin." March 1999. Available at http://ec.europa.eu/food/fs/sc/scv/out19_en.html.
- 71 Elanco. Posilac drug label. Available at <https://www.elanco.us/labels/Dairy/Posilac.pdf> and on file at Food & Water Watch. Accessed July 23, 2014.
- 72 Government Accountability Office. "Recombinant bovine growth hormone: FDA approval should be withheld until mastitis issue is resolved." August 1992 at Results in Brief; See Food & Water Watch. "Antibiotic Resistance 101." 2015.
- 73 NRC (2004) at 52.
- 74 NRC (2010) at 164 to 166.
- 75 *Ibid.* at 165 to 166.
- 76 *Ibid.* at 165 to 166; Calsamiglia, S. et al. "Effects of corn silage derived from a genetically modified variety containing two transgenes on feed intake, milk production, and composition, and the absence of detectable transgenic deoxyribonucleic acid in milk in Holstein dairy cows." *Journal of Dairy Science*. Vol. 90, Iss. 10. May 2007 at Author Affiliations; Hammond, B. et al. "The feeding value of soybeans fed to rats, chickens, catfish and dairy cattle is not altered by genetic incorporation of glyphosate tolerance." *Journal of Nutrition*. Vol. 126, Iss. 3. March 1996 at Author Affiliations and Endnotes; Phipps, R. "Effect of corn silage from an herbicide-tolerant genetically modified variety on milk production and absence of transgenic DNA in milk." *Journal of Dairy Science*. Vol. 88, Iss. 8. November 2005 at Acknowledgments; He, X et al. "Comparison of grain from corn rootworm resistant transgenic DAS-59122-7 maize with non-transgenic maize grain in a 90-day feeding study in Sprague-Dawley rats." *Food and Chemical Toxicology*. Vol. 46, Iss. 6. June 2008 at Author Affiliations; McNaughton, James et al. "Feeding performance in broiler chickens fed diets containing DAS-59122-7 maize grain compared to diets containing non-transgenic maize grain; Giesy, J.P. et al. "Ecotoxicological risk assessment for Roundup® herbicide." *Reviews of Environmental Contamination and Toxicology*. 2000; Giesy, John. Michigan State University. C.V. Available at <https://www.msu.edu/user/giesy/complete-cv.pdf> and on file at Food & Water Watch. Accessed March 12, 2016.
- 77 Duke, S.O. et al. "Isoflavone, glyphosate, and aminomethylphosphonic acid levels in seeds of glyphosate-treated, glyphosate-resistant soybean." *Journal of Agricultural and Food Chemistry*. Vol. 51, Iss. 1. December 2002; Magaña-Gómez, J.A., and A.M. Calderón de la Barca. "Risk assessment of genetically modified crops for nutrition and health." *Nutrition Reviews*. Vol. 67, Iss. 1. 2008
- 78 Hammond (1996) at Author Affiliations and Endnotes 1 to 2.
- 79 NRC (2010) at vi; Calsamiglia (2007) at Author Affiliations; Hammond (1996) at Author Affiliations and Endnotes.
- 80 Hilbeck (2015) at Discussion, 1 and Conclusion.
- 81 NRC (2010) at 26, 35, 51, 141, 150, 152, 157, 162 to 163, 193 to 194, 196, 200, 215 and 226.
- 82 AgBioForum. Welcome. Available at <http://www.agbioforum.org/welcome>.

- htm and on file at Food & Water Watch. Accessed February 22, 2016; Maris, Emma. "Almost in bloom." *Nature Biotechnology*. Vol. 26. 2008; Illinois-Missouri Biotechnology Alliance. History. Previously available at <http://www.imba.missouri.edu/index.php?region=3> and on file at Food & Water Watch; Kalaitzandonakes, Nicholas. IMBA Project 2005-7. Final Report. Submitted to Illinois-Missouri Biotechnology Alliance.
- 83 AgBioForum. Editorial Board. Available at <http://www.agbioforum.org/editors.htm> and on file at Food & Water Watch. Accessed February 22, 2016; Philippidis, Alex. "Weighing the costs of GMO labeling." *Genetic Engineering & Biotechnology News*. October 11, 2012; Phillips, Peter. Genetic Literacy Project. "Economic Consequences of Regulations of GM crops." December 11, 2014. Pray, Carl. Rutgers University. C.V. Available at <http://www.dafre.rutgers.edu/documents/cv/carl.pdf> and on file at Food & Water Watch. Accessed February 22, 2016; Pray, Carl et al. "Five years of Bt cotton in China – the benefits continue." *The Plant Journal*. Vol. 31, Iss. 4. 2002 at Summary.
- 84 Lipton, Eric. "Document: A Florida professor works with the biotech industry." *New York Times*. September 5, 2015 at 36 to 45; Phillips, Peter. Genetic Literacy Project. "Economic Consequences of Regulations of GM crops." December 11, 2014.
- 85 NRC (2010) at v, 26, 141, 149, 150, 152 and 157. See citations: Alston, J. al. "An ex ante analysis of the benefits from the adoption of corn rootworm resistant transgenic corn technology." *AgBioForum*. Vol. 5, Iss. 3. 2002; Piggott, N.E., and M.C. Marra. "The net gain to cotton farmers of a natural refuge plan for Bollgard II® cotton." *AgBioForum*. Vol. 10, Iss. 1. 2007; Marra, M.C. et al. "The payoffs to transgenic field crops: An assessment of the evidence." *AgBioForum*. Vol. 5, Iss. 2. 2002. Marra, Michelle. North Carolina State University. Curriculum Vitae. 2014 at 35 to 37. Available at https://ag-econ.ncsu.edu/wp-content/uploads/2015/11/Marra_vita_3_2014.pdf and on file at Food & Water Watch.
- 86 NRC (2010) at 26, 53 and 57. See citations: Alston et al. (2002); Piggott and Marra (2007).
- 87 *Ibid.* at 150 and 183. See citation: Piggott and Marra (2007).
- 88 *Ibid.* at 149 and 183. See citation: Marra et al. (2002).
- 89 *Ibid.* at 24 to 26, 43, 46 to 47, 141, 143 149, 150, 152 and 155 to 157.
- 90 Iles, Astair et al. Letter to Kara Laney, Study Director, NRC. August 4. 67 signers. 2014 at 3. On file at Food & Water Watch; Hauter (2014).
- 91 NRC. Agenda. "Workshop on comparing the environmental effects of pest management practices across cropping systems." NAS, Keck Center, 500 5th St., NW, Washington, DC. March 4, 2015; Scott, Norman. Introduction of Jay Hill and Jennifer Schmidt at "Workshop on comparing the environmental effects of pest management practices across cropping systems." NAS, Keck Center, 500 5th St., NW, Washington, DC. March 4, 2015. (Videos available at <https://vimeo.com/album/3305839/video/122367298> and <https://vimeo.com/album/3305839/video/122426524>); NRC. "Workshop on comparing the environmental effects of pest management practices across cropping systems." See "Bios" of Jay Hill and Jennifer Schmidt. NAS, Keck Center, 500 5th St., NW, Washington, DC. March 4, 2015. Available at <http://nas-sites.org/ge-crops/2015/01/23/workshop-march-4/> and on file at Food & Water Watch. Accessed March 1, 2015.
- 92 Strom, Stephanie. "Food politics creates rift in panel on labeling." *New York Times*. April 10, 2013; Goetz, Katie. New Mexico Department of Agriculture. [Press release]. "New Mexico farmer wins a spot in national 'Faces of Farming & Ranching' program." November 12, 2014; Moskin, Kate. "In debate about food, a monied new player." *New York Times*. September 27, 2011.
- 93 Barker, Tim. "Why some farmers are deciding to go GMO-free." *St. Louis Post-Dispatch*. September 20, 2015; Food & Water Watch. "Organic farmers pay the price for GMO contamination." March 2014.
- 94 NRC. Report in Brief. "The impact of genetically engineered crops on farm sustainability in the United States." 2010 at 1.
- 95 *Ibid.* at 2.
- 96 Fausti, Scott. "Insecticide use and crop selection in regions with high GM adoption rates." *Renewable Agriculture and Food Systems*. Vol. 27, Iss. 4. December 2012.
- 97 NRC (2010) at 149; Note: The NRC actually did not cite the 2009 report from The Organic Center, instead citing research from 2004. See Benbrook, Charles. The Organic Center. "Impact of genetically engineered crops on pesticide use in the United States: The first thirteen years." 2009 at 3.
- 98 Sydorovych, Olha and Michele Marra. "A genetically engineered crop's impact on pesticide use: a revealed-preference index approach." *Journal of Agricultural and Resource Economics*. Vol. 32, Iss. 3; NRC (2010) at 149 to 150; Marra, Michelle. North Carolina State University. Curriculum Vitae. 2014 at 35 to 37. Available at http://ag-econ.ncsu.edu/sites/ag-econ.ncsu.edu/files/person/vitae/Marra_vita_3_2014.pdf and on file at Food & Water Watch.
- 99 NRC. Report in Brief. "The impact of genetically engineered crops on farm sustainability in the United States." 2010 at 2; Walsh, Jennifer. NRC. [Press release]. "Genetically engineered crops benefit many farmers, but the technology needs proper management to remain effective." April 13, 2010; Neuman, William and Andrew Pollack. "Farmers cope with Roundup-resistant weeds." *New York Times*. May 3, 2010.
- 100 Monsanto. Securities and Exchange Commission. 10-K filing. 2010 at 20 and 30.
- 101 Neuman and Pollack (2010).
- 102 Koba, Mike. "'Superweeds' sprout farmland controversy over GMOs." *NBC News*. September 20, 2014.
- 103 NRC. "Critical Role of Animal Science Research in Food Security and Sustainability." 2015 at Front Matter and v.
- 104 Van Eenennaam, Alison. "Why the NYT article on MARC is wrong & what it might mean for animal ag research." *Beef Magazine*. June 3, 2014.
- 105 NRC. "Critical Role of Animal Science Research in Food Security and Sustainability." 2015 at x.
- 106 International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD). "Executive Summary of Synthesis Report." April 2008 at 33.
- 107 NRC. "Critical Role of Animal Science Research in Food Security and Sustainability." 2015 at 187 and 251; Capper, J.L. and D.J. Hayes. "The environmental and economic impact of removing growth-enhancing technologies from U.S. beef production." *Journal of Animal Science*. January 20, 2015.
- 108 Benson, Margaret E. "Animal science: a proud tradition." *The Inside Scoop*. Washington State University Department of Animal Sciences. Spring 2012; NRC. "Critical Role of Animal Science Research in Food Security and Sustainability." 2015 at 34, 52, 53, 58, 107 to 108, 136, 187 to 188, 251 and 274.
- 109 NRC. "Critical Role of Animal Science Research in Food Security and Sustainability." 2015 at 107 to 108, 159 to 160 and 187 to 188; Pelletier, Nathan. "Comparison of the environmental footprint of the egg industry in the United States in 1960 and 2010." *Poultry Science*. Vol. 93, Iss. 2. 2014 at Author Affiliations; Biello, David. "Can bovine growth hormone help slow global warming?" *Scientific American*. July 2, 2008.
- 110 Animal Health Institute. [Press release] "AHI comment on PCAST report on antibiotic resistance." September 18, 2014; Animal Health Institute. [Press release] "AHI statement on CDC report." September 16, 2013; National Pork Producers Council and American Meat Institute. "Groups Respond to White House Executive Order on Antibiotic Resistance." *National Hog Farmer*. September 18, 2014.
- 111 American Medical Association House of Delegates. "Report of Reference Committee E." 2008 at 21; Maves, Michael. Chief Executive Officer, American Medical Association. Letter to Congresswoman Louise Slaughter. April 9, 2009; Bradley, John. American Academy of Pediatrics. Testimony on "Antibiotic Resistance and the Impact on the Health of Children: The Need for More Safe and Effective Antibiotics and Better Antimicrobial Stewardship." Subcommittee on Health. Committee on Energy and Commerce. U.S. House of Representatives. June 9, 2010; American Public Health Association. "Policy Statement: Helping Preserve Antibiotic Effectiveness by Stimulating Demand for Meats Produced Without Excessive Antibiotics."

- Policy Number 2004-13. November 9, 2004. Available at <http://www.apha.org/advocacy/policy/policysearch/default.htm?id=1299>. Accessed March 5, 2012; Infectious Disease Society of America. "Summary of Existing Policy on the Use of Antimicrobial Drugs in Food Animals." November 1, 2009; World Health Organization. "WHO Global Strategy for Containment of Antimicrobial Resistance." 2001 at 37. Available at http://www.who.int/csr/resources/publications/drugresist/en/EGlobal_Strat.pdf. Accessed March 5, 2012; Centers for Disease Control and Prevention (CDC). "Antibiotic Resistance in the United States, 2013." 2013 at 6.
- 112 NRC. "Critical Role of Animal Science Research in Food Security and Sustainability." 2015 at 63; CDC (2013) at 11.
- 113 NRC. "Critical Role of Animal Science Research in Food Security and Sustainability." 2015 at 14.
- 114 *Ibid.* at 69.
- 115 *Ibid.* at 43; Van Eenennaam, Alison. C.V. Submitted to U.S. Food and Drug Administration. Available at <http://www.fda.gov/downloads/AdvisoryCommittees/CommitteesMeetingMaterials/VeterinaryMedicineAdvisoryCommittee/UCM225072.pdf> and on file at Food & Water Watch. Accessed February 25, 2016; Mestel, Rosie. "Scientists fret over slowness on genetically engineered animals." *Los Angeles Times*. October 1, 2012; Prakash, C.S. et al. Letter to U.S. President Barack Obama. September 15, 2012. On file at Food & Water Watch.
- 116 Flatow, Ira. "Debating genetically modified salmon." NPR. December 9, 2011; Kapuscinski, Anne and Fredrik Sundstrom. Comments on Docket No. FDA-2011-N-0899. April 19, 2013.
- 117 In any reports published as of March 2016.

Food & Water Watch works to ensure the food, water and fish we consume is safe, accessible and sustainable. So we can all enjoy and trust in what we eat and drink, we help people take charge of where their food comes from, keep clean, affordable, public tap water flowing freely to our homes, protect the environmental quality of oceans, force government to do its job protecting citizens, and educate about the importance of keeping shared resources under public control.

