**Symposium: *Bridging the Gap Between Scientists and the Public*, PSA 2018**

**How trustworthy and authoritative is scientific input into public policy deliberations?[[1]](#endnote-1)**

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**Abstract**: Appraising public policies about using technoscientific innovations requires attending to the values reflected in the interests expected to be served by them. It also requires addressing questions about the efficacy of using the innovations, and about whether or not using them may occasion harmful effects (risks); moreover, judgments about these matters should be soundly backed by empirical evidence. Clearly, then, scientists have an important role to play in formulating and appraising these public policies.

 However, ethical and social values affect decisions made about the criteria (1) for identifying the range of risks, and of relevant empirical data needed for making judgments about them, that should be considered in public policy deliberations, and (2) for determining how well claims concerning risks should be supported by the available data in order to warrant that they have a decisive role in the deliberations. Consider the case of public policies about using GMOs. Concerning the range of data: is it sufficient for risk assessment only to be informed by data relevant to investigating the risks of using GMOs that may be occasioned by way of physical/chemical/biological mechanisms directly triggered by events within their modified genomes? Or: should data pertaining to the full range of ecological and socioeconomic effects of using them, in the environments in which they are used and under the socioeconomic conditions of their use, also inform this assessment? Those interested in producing and using GMOs, in the light of their adhering to values of capital and the market, are likely to give a positive answer to the first question; those holding competing values, e.g., connected with respect for human rights and environmental sustainability, to the second. And, concerning the degree of support: the former – citing the ethical gravity of losses (both economic and, allegedly, for food security) that would be incurred by failing to use GMOs on a wide scale – are likely to require less stringent standards of evidential appraisal than the latter.

 Scientists, *qua* scientists, however, do not have special authority in the realm of values. Thus, their judgments, about the evidential support that claims about risks (and some other matters) have, may sometimes be reasonably (although not decisively) contested partly on value-laden grounds – as they have been in the GMO case, where the contestation has generated considerable controversy, and continues to do so. It follows that, in the context of deliberations about public policy, unless scientists engage with representatives of all stakeholders in the outcomes of the policies (as, for the most part, has not happened in the GMO case) – taking into account that their competing values may lead to making different decisions about what are the relevant data, as well as about the degree of support required for their claims about risks to gain the required credibility to inform the deliberations; and respecting "tempered equality" of participants in the dialogue (Longino) – their trustworthiness is put into question and their authority diminished.

1.

In a letter, dated June 29th, 2016, 135 Nobel laureates made the following claims, among others,[[2]](#endnote-2) related to using GMOs (genetically modified organisms) in agriculture:

 (i) "Scientific and regulatory agencies around the world have repeatedly and consistently found crops and foods improved through biotechnology to be as safe as, if not safer than those derived from any other method of production."

 (ii) "There has never been a single confirmed case of a negative health outcome for humans or animals from their consumption."

 (iii) "Their environmental impacts have been shown repeatedly to be less damaging to the environment, and a boon to global biodiversity" (Laureates Letter, 2016).

 Reflecting the authority and esteem that tends to be accorded to Nobel laureates, the declaration was widely reported and taken to bolster the allegation that there is a *scientific consensus* that cultivating and harvesting genetically engineered crops, and consuming their products, is safe.[[3]](#endnote-3) The scientists who signed it aimed to assure the public that the three claims are well confirmed, and that public policy and regulatory deliberations should reflect them. The claims do not derive from outcomes of the research conducted by these scientists, for at most one or two of them (so far as I can tell, none) have themselves engaged in biosafety research. They were putting their authority behind the research and judgments of others, whom presumably they trusted. Even so, one might reasonable assume that they had, before signing the declaration, examined the relevant research and concurred with its outcomes, and had found good reason to tell us, as they do, (presumably based on a thorough examination of its writings and actions) that the opposition is "based on emotion and dogma contradicted by data" and that it "must be stopped." At the end of the paper, I will argue that the declaration misuses scientific authority and contributes to doubts about the trustworthiness of leading scientific authorities. My larger purpose, however, is to suggest **some** necessary conditions for re-establishing trust in scientific communities – bridging the gap between scientists and the public, and ( the concern of de Martín-Melo & Intemann, 2018) – so that both the authority and integrity of science, and the conditions for strengthening democratic societies, are enhanced

2.

First, some more general remarks. I maintain that the deliberations out of which arise public polices having to do with introducing, using and regulating technoscientific innovations (I only have time to discuss GEOs) should consider:

 (1) questions about the *efficacy* of the proposed uses are addressed – and about their *safety*, specifically about how well available empirical evidence confirms that the proposed uses do not occasion harmful effects (or risks of causing harmful effects);

 (2) the values reflected in the interests expected to be served by the proposed uses, as well as questions about whether interests expected to be served by competing values may be disadvantaged by them, and priorities among the competing interests;

 (3) identified potential alternatives to using these innovations – including fundamentally different kinds of practices – as well as how using them compares to the proposed uses with respect to efficacy and safety (and other potential benefits).[[4]](#endnote-4)

 Of these conditions only (1) is uncontroversial and generally followed (although there are disagreements about how it ought to be followed) in public policy deliberations.[[5]](#endnote-5) Clearly satisfactory answers to the questions about efficacy and safety depend on trustworthy and reliable scientific input. I will not question that scientific research has reliably established the efficacy of the GEOs that have already been approved by regulatory bodies for agricultural use, for the most part GEOs with herbicide-resistant and insecticidal properties.[[6]](#endnote-6) Efficacy does not imply safety, however, and the research approaches (in molecular biology, biotechnology, etc) within which efficacy is established do not suffice for engaging in research dealing with safety. However, many regulatory practices presuppose that scientific input, pertaining to deliberations about safety – like that about efficacy – is obtained prior to consideration of (2) and (3), and to entanglement with value questions. Hence, the currency of the terms "scientific risk assessments" and "scientific safety studies", areas of research in which scientific/technical "experts" should be granted authority.

 One needs to be wary here, for "safe" and "risk" are 'thick ethical terms'. Scientific safety studies cannot be fully separate from entanglement with values and obligations. Thus, e.g. (simplifying a little), 'using X *is* unsafe' implies (*ceteris paribus*) 'X *should* not be used, unless appropriate precautions are taken.' And, when scientists conclude, on the basis of their investigations, that 'using X is safe', they intend it to follow (and to have impact at step (2)), that *ceteris paribus* 'it is improper to impede using X'.[[7]](#endnote-7) This does not mean that, in the course of empirical research in scientific safety studies, value-laden terms are used in articulating hypotheses and reporting empirical data. The link between the results of the empirical research and the subsequent value judgments depends on a step (call it step (0)), casually made prior to the empirical investigations. At step (0), the set of possible unintended collateral effects of using X is scrutinized, and those that are identified as harmful (as risks)[[8]](#endnote-8) – obviously value judgments are made here – are then investigated for such matters as the probability and magnitude of their possible occurrence, and its being countered by introducing scientifically informed regulations. In the investigation, the possible collateral effects are characterized, not with thick ethical terms, but with theoretical and observational terms deployed in relevant scientific fields, like molecular biology, chemistry, soil sciences and physiology (whose terms have no value connotations). Then, 'using X is safe' may be concluded,[[9]](#endnote-9) – usually qualified by 'provided that it is used in accordance with stipulated regulations' – if the investigations confirm that none of the investigated effects would occur with significant magnitude and probability when X is used in accordance with the regulations. This account is consistent with the picture of scientific safety studies that has step (1) preceding steps (2) and (3); but it clarifies that the move from empirically confirmed results at (1) to the claim the value-implicated 'X is safe' and to value judgments of relevance at (2) rests upon value judgments made at step (0). It follows that the conclusion, 'X is safe', might appropriately be challenged – without thereby challenging the scientists' judgments about each of the particular possible effects investigated – on the basis of the value judgment that not all the harmful possible effects of using X were identified at (0).

 The outcomes of "scientific" safety studies usually constitute the only input to the deliberations of the 'technical' commissions that participate in public policy deliberations about using and regulating technoscientific objects. In these studies (in the GEO case), at step (0), the possible effects identified as harmful are a subset of those that may be occasioned by way of physical/chemical/biological mechanisms directly triggered by events within the modified genomes of plants. One can identify *two ways in which the adequacy of these studies might be challenged*.[[10]](#endnote-10)

 *First*:Conclusions drawn about the safety of using V (a genetically engineered plant variety) could be challenged on the ground that the subset chosen for investigation does not include some possible effects, with similar mechanisms, that are of of special salience for those who uphold a particular value-outlook.[[11]](#endnote-11) For them, even well conducted studies on the the items of the subset chosen will be insufficient to confirm that using V is safe.[[12]](#endnote-12) Challenges of this type can be resolved (in principle) by conducting more scientific studies of the same kind after having identified a larger relevant subset.[[13]](#endnote-13)

 *Second*: Their adequacy could be challenged by those, who object that the set from which the subsets are chosen for "scientific safety studies" is not sufficiently encompassing. For them, deliberations about the safety of using GE-plants should be informed by appropriate empirical investigations, not only of potential effects occasioned by way of physical/chemical/biological mechanisms directly triggered by events within their modified genomes, but also the full range of potential ecological and socioeconomic effects occasioned by using them in the environments (agroecosystems) of their actual or intended use, and under the socioeconomic conditions of their use, taking fully into account that the potential effects vary from variety to variety and species to plant species. Upholding values of respect for human rights, democratic participation and environmental sustainability, which are opposed to those of capital and the market, often motivates challenges of this kind. These potential effects cannot *all* be investigated in "scientific safety studies," for they require utilizing ecological, human and social categories that have no place in research in such areas as physics, chemistry, and molecular biology, and that may include thick ethical terms (e.g., food security, being poisoned).[[14]](#endnote-14) To investigate them empirically, therefore, requires adopting methodological approaches that are not reducible to those used in the indicated scientific areas, and that are generally outside of the expertise of scientists trained in the methodologies appropriate to them. The expertise required to engage in research that leads to the development of GEOs is quite different from that required for studies about the safety of using them.

 At issue here are not only concerns about risks (potential harmful effects). Farmers (and their communities) in many areas of the world have suffered serious health problems because of having been exposed to glyphosate (the principal active ingredient in the widely used herbicide, RoundUp) sprayed on fields planted with glyphosate-resistant GEOs.[[15]](#endnote-15) They are unimpressed when told that the varieties of GEOs planted in these fields had undergone and passed "scientific safety tests." They know from their experience (even if it is not well recorded in peer reviewed studies) that, regardless of what was the case in the conditions of the tests, it is not safe to cultivate these GEOs (which require the accompanying use of glyphosate) in the ways and under the conditions in which they are used in their locales. And, they continue to be unimpressed when the manufactures and regulators of the GEOs insist that the problem was not with cultivating the GEOs, but with using glyphosate without heed to stipulated regulations for safe use,[[16]](#endnote-16) for they have good reason to believe that the sellers of GEOs and glyphosate know that they will in fact not be used in accordance with these regulations.[[17]](#endnote-17)

3.

Summing up, ethical and social values properly affect decisions (at step 0)) made about the criteria to be deployed for identifying the range of risks that should be considered in public policy deliberations, and of the relevant kinds of empirical data needed for making judgments about them. They also – consistent with maintaining that judgments about safety (step (1)) can be settled prior to steps (2) and (3) – also affect the standards deployed for determining how well claims about risks should be supported (by the available empirical data) – in order to ensure that risks are dealt with properly in public policy deliberations.

 Those who uphold values of capital and the market (agribusiness corporations, governments that prioritize economic growth, etc) are likely to cite the ethical gravity of losses (both economic and, allegedly, for food security) that would be incurred by failing to use GEOs on a wide scale; and consequently to require less stringent standards of evidential appraisal than those who uphold values of respect for human rights, democratic participation and environmental sustainability, who are likely to adopt precautionary stances that permit time for research incorporating more stringent standards to be met.[[18]](#endnote-18) Similarly, those who uphold the latter values are likely to emphasize the importance of step (3): investigating alternatives to the food/agricultural system, in which using GEOs and the use of agrotoxics are acquiring ever larger roles, alternatives such as agroecology, a scientifically-informed approach to agriculture that attends simultaneously to production, sustainability, social health, strengthening the values and cultures of local communities, and to furthering the practices needed to implement policies of food sovereignty – and to urge the public support of research, in which are adopted strategies appropriate for dealing with the human, ecological and social dimensions of agroecosystems.[[19]](#endnote-19)

 Scientists, *qua* scientists, however, do not have authority in the realm of ethical and social values. The values they uphold, even when widely shared, do not trump those upheld by other groups in democratic public policy deliberations. Thus, their judgments, about the evidential support that claims about the safety of planting GEO crops and consuming their products have, may sometimes be reasonably contested partly on value-laden grounds (cf. de Melo-Martín & Intemann, 2017, p. 131). That contestation cannot be rebutted by appeal to the alleged "scientific consensus" that GEOs (or, particular varieties of them) are safe. Apart from the fact that actually there is no such consensus, manifestly so among experts in biosafety investigations,[[20]](#endnote-20) if there were, it would likely secrete the scientists’ shared value commitments, a matter on which they have no authority. Appeal to such an alleged consensus covers up the role of upholding the values of capital and the market in affirming it.

 It follows that, in the context of deliberations about public policy, the trustworthiness of scientists is put into question and their authority unmerited,

 - unless they engage with representatives of all stakeholders in the outcomes of the policies (as, for the most part, has not happened in the GEO case);

 - unless, moreover, in doing so – respecting what Longino (2002, p. 129–135) calls "tempered equality" of participants in the deliberations – , they take into account that upholding competing values (e.g., of company-employed scientists and family farmers) may lead to making different judgments concerning relevant data, hypotheses to investigate, and approaches to farming, as well as concerning the degree of support required for claims about safety to merit credibility.

4.

Let us now return to the three claims (introduced at the outset) that the 135 Nobel laureates endorsed:[[21]](#endnote-21)

 These claims are ambiguous, misleading, in some instances false, and apparently made without acquaintance with the relevant studies and arguments of their critics. (i) is false: I am not aware of any agency that has compared the safety of GEO crops and their food products with that of agroecological (or organic farming) methods of production – the agencies have not sought out the results of research dealing with that comparison (and very little of it has been conducted). At most, they have found GEO crops and products to be at least as safe as conventional high- input crops and their products, but that doesn’t respond to the critics who endorse agroecological methods of production. (ii) is probably true – but misleading: it does not mention that epidemiological studies of consumption of GEOs have not been conducted,[[22]](#endnote-22) to a large extent because legal prohibition of labelling GEO products poses probably an insurmountable impediment to conducting them; and that it is well documented that cultivating GEOs has occasioned health problems for numerous farmers who have been exposed to the agrotoxics, whose use is integral to the cultivation of certain varieties of GEOs. (iii) is ambiguous: the environmental impacts may indeed be less damaging than those of conventional high-input agriculture; but they are incomparably more damaging to the environment than agroecological farming that has environmental sustainability built into its fundamental objectives.

 By dismissing criticisms like these "based on emotion and dogma contradicted by data," and not attempting to rebut them in a context where something like Longino’s conditions are in place, the scientists undermine the authority that science should be able to demand to be recognized; and they weaken the contribution that science could make to democratic policy deliberations.

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**Appendix**

The central concern of the letter signed by the Nobel laureates is to support the program of research on Golden Rice [a variety of genetically engineered rice] and to denounce opposition to it, especially that of the NGO, Greenpeace. In a longer work, I would also discuss critically the way in which the letter misleads both about the state of research on Golden Rice and about that character of criticisms that question the importance of this research.

 (a) The letter states that Greenpeace "has spearheaded opposition to Golden Rice, which has the potential to reduce or eliminate much of the death and disease caused by a vitamin A deficiency, which has the greatest impact on the poorest people in Africa and Southeast Asia". It called upon "governments of the world to reject Greenpeace's campaign against Golden Rice specifically, and crops and foods improved through biotechnology in general; and to do everything in their power to oppose Greenpeace's actions and accelerate the access of farmers to all the tools of modern biology, especially seeds improved through biotechnology"; and concluded with the warning: "Opposition based on emotion and dogma contradicted by data must be stopped," accompanied by the rhetorical question: "How many poor people in the world must die before we consider this a 'crime against humanity'?"

 (b) Around the same time, the US National Academies of Science, Engineering and Medicine (2017) pointed out that the International Rice Research Institute (IRRI) had stated reported: "Golden Rice will only be made available broadly to farmers and consumers if it is successfully developed into rice varieties suitable for Asia, approved by national regulators, and shown to improve vitamin A status in community conditions. If Golden Rice is found to be safe and efficacious, a sustainable delivery program will ensure that Golden Rice is acceptable and accessible to those most in need" (p. 228). As of July 2016, IRRI was continuing research on developing varieties of Golden Rice for use in SE Asia, and (according to it) none of the conditions it stated had yet been met - it is for this reason that Golden Rice has not been introduced.

 (c) Two years later, earlier this year (2018), IRRI asked the USFDA for an opinion regarding the safety of a variety of Golden Rice (called GR2E - the only variety yet submitted for regulatory approval - but not yet approved in any Asian country). FDA (May 24, 2018) endorsed the evaluation of IRRI (and the Australian regulatory body) that GR2E is safe for consumption, while pointing out that it is not intended for food or animal uses in USA. However, it added: "the concentration Beta-carotene in GR2E rice is too low to warrant a nutrient content claim." GR2E is safe but not nutritionally relevant.

 (d) The signers of the letter, thus, were remarkably uninformed about the state of research on Golden Rice – and also about the views and stances of Greenpeace (I am not associated with Greenpeace). On its website Greenpeace states that its objective is to "ensure the ability of Earth to nurture life in all its diversity." It fits into the body of critics of using GMOs, who maintain that the dominant food-agricultural system (in which using GEOs has become for the time being a fundamental component) cannot respond adequately to the food and nutrition needs of the world’s impoverished peoples (and the right to food security for everyone), and that these needs can best be ameliorated by the programs of agroecology and food sovereignty (Lacey, 2015a; 2015b) – and that programs for developing GEOs (like Golden Rice) are taking resources away from developing effective and lasting solutions to death and disease caused by vitamin A deficiency. Greenpeace has a respected place among these critics (and its "direct actions" and contributions to legal challenges are often appreciated by them). Of course, it would be legitimate to rebut the critics with argument and evidence. One wonders why the laureates did not attempt to do so.

 (e) The credibility of pronouncements made by scientists of outstanding achievement is weakened when they sign letters like this one, accompanied by inflated, emotionally charged rhetoric, that has has a slender basis in fact. It would be enhanced if they entered into the type of dialogue, advocated by Helen Longino, in which scientists would "listen to" the evidence provided by relevant parties, attempt to understand critics, and not tar them without a hearing. Science has an indispensable contribution to make in policy deliberations; but it is not the determiner of policy. Science will be enhanced, and its role in democratic societies consolidated, if it claims only to have authority where it is actually warranted.

**Notes**

1. **DRAFT** (not for citation outside of the PSA meeting in Seattle) – October 15, 2018. The text is a draft of the presentation I’m planning to make. The notes contain details that will be incorporated into an eventual completed paper. [↑](#endnote-ref-1)
2. See Appendix. [↑](#endnote-ref-2)
3. E.g., Mark Lynas (Cornell Alliance for Science), *A plea to Greenpeace,* <<http://www.marklynas.org/2016/06/a-plea-to-greenpeace/>>.

In this paper I only consider GEOs used in agriculture. I take for granted that claims to the effect that using GEOs is safe refer to GEOs that have passed safety tests, including those currently available on the market. (Obviously an unsafe GEO could be developed. Some varieties of GEOs have been developed that, after failing to pass safety tests, were not released for use.) [↑](#endnote-ref-3)
4. More fully developed and defended in Lacey (2005), Part 2. [↑](#endnote-ref-4)
5. Deliberations concerning (2) and (3) cannot be settled in scientific inquiry (sound empirical inquiry), but there are sound empirically-based inputs that are (or could be) relevant to them. The deliberations will not be satisfactory if they do not draw upon these inputs. (See Lacey, 2005.) [↑](#endnote-ref-5)
6. Claims about efficacy need to be stated in a more qualified and nuanced way. I also will not contest that the claim that scientific research has not provided compelling evidence that consuming GEO products is unsafe health-wise. (The absence of compelling evidence that GEO products are unsafe to consume does not mean that there is compelling evidence that they are safe to consume – it depends on whether or not the necessary research has been conducted.) [↑](#endnote-ref-6)
7. The *ceteris paribus* qualification is needed to take into account that sometimes considerations, not reducible to safety ones, may properly be appealed to. [↑](#endnote-ref-7)
8. I will not discuss here how this set is generated – e.g., from considering past investigations, role of values in it, stakeholders’ concerns, etc) – and who (holding what values?) makes (and should make) the identification of what should be considered harmful? following what kinds of deliberations? and who should be represented in the deliberations?. [↑](#endnote-ref-8)
9. To conclude on the basis of empirical investigation that 'X is safe' requires showing one-by-one that each member of the set of anticipated effect (judged to be harmful) is unlikely to occur at sufficient magnitude under the conditions imposed by proposed regulations. This presupposes: (a) an inductive move to unanticipated effects; and (b) that representative cases of all the effects, that should be labelled potentially harmful, are members of the set. [↑](#endnote-ref-9)
10. I have argued elsewhere that here methodological and value considerations mutually reinforce each other (Lacey, 2017). Proponents of using GEOs often say that these safety studies investigate the risks occasioned by the GEOs themselves, and not those occasioned by the accompaniments of using them in agroecosystems or by socioeconomic mechanisms. [↑](#endnote-ref-10)
11. E.g., effects on soil microorganisms, a matter especially salient for those who regard maintaining soil fertility as indispensable for sustainable agriculture. [↑](#endnote-ref-11)
12. The studies, which have produced many of the results that have actually informed public policy and regulatory decisions, have been criticized for having a number of kinds of shortcomings (e.g., connected with conflicts of interest, and the use of intellectual property rights to maintain studies secret and so unavailable for replication and independent confirmation). Value judgments pervade these criticisms and their rebuttals. I will not attend to the questions that arise here. [↑](#endnote-ref-12)
13. Such challenges might be deemed irrelevant by those who reject the value-outlook for which the possible effects have special salience, and so who reject the need for the further studies. Those adhering to the values of capital and the market sometimes take such a stand. How reasonable that might be depends on the arguments offered against holding the value-outlook in question. [↑](#endnote-ref-13)
14. For elaboration see Lacey (2016; 2017). [↑](#endnote-ref-14)
15. For documentation, see, e.g., Bombardi (2017); Paganelli, et al. (2010); Human Rights Watch (2018). [↑](#endnote-ref-15)
16. After a jury in California recently ruled that Monsanto was responsible for a man’s being afflicted with cancer, and imposed a huge fine on it because it – for it was deemed that Monsanto had “acted with malice” in not providing warning on its label of the risks to health occasioned by using Roundup – the President of Bayer (that has now incorporated Monsanto) responded: "The correct use of Roundup doesn’t present a risk to health" (reference to be added). [Monsanto has appealed the ruling.] [↑](#endnote-ref-16)
17. Three years ago, when representatives of farmers – who had been poisoned in this way – came to present their testimony at a meeting of the "technical" commission in Brazil (CTNBio) that had appraised a particular variety of GEOs as safe, they were not granted a hearing since (most members of the commission maintained) they were bearers only of anecdotal (not scientific) evidence that had no relevance to the conclusions of scientific safety studies. When they then disrupted the meeting (and others of their group prevented the planting of a new variety of GEOs by invading a nursery and pulling up all the seedlings), they were denounced by major scientific organizations as having no respect for science, and acting on the basis of "emotion and dogma." For criticisms of this stance taken by the majority of members of CTNBio, and a response to a rebuttal of the criticism, see Lacey, et al. (2015a; 2015b), articles published in *JC Notícias*, a daily e-newsletter of *Jornal da Ciência*, a publication of SBPC (Brazilian Society for the Advancement of Science).

 The narrow scope of "scientific safety studies" is sometimes justified on the ground that the investigations of the social impact of using GEOs is not "scientific," for the methodologies adopted in them are not reducible to those adopted in the mainstream areas of science mentioned above. Be that as it may: I won’t quibble about how to use the term "scientific" (a thick ethical term); the investigations in question are (when properly conducted) systematic empirical investigations. If they don’t count as "scientific", that would imply that the results of "scientific" investigations cannot provide sufficient input into deliberations concerning public policies about safety, and would need to be supplemented with input from other kinds of empirical investigations. [↑](#endnote-ref-17)
18. See Lacey (2017). [↑](#endnote-ref-18)
19. For details, see Lacey (2005; 2015a; 2015b). [↑](#endnote-ref-19)
20. See, e.g., Hilbeck, et al. (2015); Krimsky (2015); Traavik & Ching (2007). [↑](#endnote-ref-20)
21. See Appendix. [↑](#endnote-ref-21)
22. Unless all the relevant research has been conducted (and it has not been in this case), the absence of compelling evidence that GEO products are unsafe to consume does not imply that there is compelling evidence that they are safe to consume – and it has nothing to do with harms that may be caused by, e.g., contact with an agrotoxic, rather than by consumption. [↑](#endnote-ref-22)