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Uniquely disgusting? Physiological disgust and attitudes toward GM food and other food and health technologies

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Abstract

Despite scientific consensus that genetically modified (GM) food is safe to eat, the American public remains skeptical. This study $(N = 73)$ investigates the proposed role of disgust in driving opposition to GM food, which is debated in extant literature. Using physiological measures of disgust, alongside self-report measures, this study suggests that disgust plays a role in driving skepticism toward GM food, but not other food and health technologies. We further discuss the possible influence of risk sensitivity and perceptions of unnaturalness on attitudes toward novel science.

Keywords

Public perception of science and technology; Public understanding of science and technology

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Introduction

Like many emergent technologies, genetically modified (GM) foods have the potential to help scientists provide solutions to complex global problems, but there can be challenges in gaining the support from the public. In the U.S., people tend to be either unfamiliar with GM foods or have strong negative attitudes toward GM foods, despite the general scientific consensus that GM foods are as safe as conventionally grown foods [Funk and Kennedy, 2016; Funk and Rainie, 2015; National Academies of Sciences, Engineering, and Medicine, 2016]. Unlike most other controversial scientific issues like climate change and stem cell research, attitudes towards GM are not driven by polarized political or religious views [Hasell and Stroud, 2020; Scott, Inbar, Wirz et al., 2018]. Instead, negative attitudes towards GM foods seem to be driven a set of factors relating to disgust [Blancke et al., 2015; Scott, Inbar, Wirz et al., 2018].

This study uses physiological methods to explore relationships between disgust sensitivity and negative attitudes towards GM foods for the first time. Using an observed measure of disgust sensitivity, we can better determine whether disgust plays a role in driving opposition to GM food, while responding to concerns that self-report measures of disgust sensitivity are capturing something apart from experienced disgust. In addition to investigating how disgust sensitivity is associated with attitudes toward GM food, this study also tests associations between disgust and attitudes toward other food and health technologies, including vaccines, stem cell research, pesticides, and livestock hormones. We find that disgust is linked to perceiving risks from GM foods, but not other food and health technologies. We also find that, compared to physiological measures of disgust, self-report measures are additionally associated with skepticism of food technologies. Together, these findings have important implications for how scholars and practitioners understand and speak to public attitudes towards GM foods.

Context

Public opinion on GM foods

Genetically modified (GM) foods present a unique challenge for those who study and practice science communication. The National Academy of Sciences' review of the research on genetically modified or engineered foods concludes that GM foods are as safe for human consumption as conventionally grown foods [National Academies of Sciences, Engineering, and Medicine, 2016], and the majority of scientists agree that GM foods are safe to eat [Funk and Rainie, 2015]. That said, there are still many uncertainties about the long-term risks and benefits of GM foods [Borel, 2018; Dance, 2018; *The Golden Rice Project* n.d.; National Academies of Sciences, Engineering, and Medicine, 2016; Voytas and Gao, 2014].

Despite the general scientific consensus, the public remains very skeptical of GM foods. In the U.S., the majority of the public believes that GM foods are not safe to eat [Funk and Rainie, 2015] and frequently hold misperceptions about GM foods [McFadden and Lusk, 2016]. Knowledge and familiarity of GM foods tend to be very low [Funk and Rainie, 2015], and there is some evidence that misperceptions about GM foods may drive negative attitudes [McFadden and Lusk, 2016]. Though more knowledge of science tends to be correlated with more positive beliefs about science [Allum et al., 2008], research on the knowledge-attitude relationship in the context on GM foods has been inconclusive, demonstrating weak, nonexistent, or inconsistent relationships [Hasell and Stroud, 2020; Rodríguez-Entrena and Salazar-Ordóñez, 2013].

Adding to this complexity is that, unlike many other controversial science issues, public attitudes about GM foods do not fall along distinct or predictable political or religious lines. Public attitudes about science are often shaped by preexisting political, cultural, or religious values, which influence the way people process and evaluate scientific information [Brossard, Scheufele et al., 2009; Flynn, Nyhan and Reifler, 2017; Kahan, 2015; Pasek, 2018; Strickland, Taber and Lodge, 2011]. Attitudes about GM foods, however, are not driven by or polarized along either political or religious differences. With regards to politics, there is no clear elite partisan stance on the issue [Charles, 2016], and conservatives and liberals tend to express similar levels of concern and support for GM foods [Funk and Kennedy, 2016]. Further, political ideology does not influence public perceptions about the safety of eating GM foods [Hasell and Stroud, 2020]. With regards to religion, though it is not unusual for religious leaders to publicly speak on controversial scientific issues like stem cell research or climate change [Brossard and Nisbet, 2007; Landrum et al., 2017], there appear to be no such positions offered by major religious figures on the issue of GM foods [Brossard and Nisbet, 2007; Lull and Scheufele, 2017]. Indeed, religious leanings and preferences do not predict attitudes or beliefs about the safety of GM foods [Hasell and Stroud, 2020; Costa-Font, Gil and Traill, 2008; Hossain et al., 2003]. So, while political and religious views frequently shape public attitudes about scientific issues and research, neither appears to influence public attitudes about GM foods.

Disgust and attitudes toward GM food

Scholars have begun exploring how morality and disgust might influence views on GM food. In media, GM foods are commonly depicted as “Franken-foods”, and the process of genetic modification is described as “messing with nature”. These depictions are intuitively appealing to audiences and play into the naturalistic fallacy that nature is inherently good [Blancke et al., 2015; Scott, Inbar, Wirz et al., 2018]. In other words, people are particularly likely to see GM foods are unnatural, which strongly relates to ascribing moral values to the technology [Rozin, Spranca et al., 2004; Scott, Inbar, Wirz et al., 2018; Siegrist, Hartmann and Sütterlin, 2016]. Indeed, perceiving the process of genetic modification to be immoral is associated with the belief the GM foods are not safe to eat [Hasell and Stroud, 2020].

These perceptions of morality may be driven by feelings of disgust [Scott, Inbar and Rozin, 2016; Scott, Inbar, Wirz et al., 2018]. Indeed, extant work finds a link between people who report high disgust sensitivity and opposition to GM foods. Disgust sensitivity is associated with greater support for food safety regulation across the political spectrum [Kam and Estes, 2016] as well as opposition to GM food specifically. Clifford and Wendell [2016] found that those with high disgust sensitivity were more opposed to GM foods and more supportive of organic foods than those with low disgust sensitivity. Scott, Inbar and Rozin [2016] show that “absolutist” opponents of GM foods were more disgust sensitive than those who either supported or were not absolutely opposed to GM foods. These associations, in conjunction with the disgust-associated rhetoric of anti-GM activists (e.g., “Franken-foods” and “mutant fruit”), draw a link between individuals’ sensitivity to disgust and their attitudes toward genetically modified foods.

Disgust or risk?

However, others question whether disgust is driving opposition to GM foods, arguing that common measures of disgust sensitivity are actually tapping a broader sensitivity to risk or negative affect. Kahan and Hilgard [2016] find that the frequently used pathogen disgust sensitivity scale [Tybur, Lieberman and Griskevicius, 2009] is similarly correlated with perceived risks from threats not related to disgust, like carjacking, as with perceived risk of GM foods. They argue that associations between pathogen disgust sensitivity (PDS) and a multitude of non-disgust related threats suggest this measure is in fact tapping a more generalized sensitivity to risk. Another common measure of disgust sensitivity, the Disgust Scale — Revised (DS-R) [van Overveld et al., 2011], is also associated with heightened risk perceptions across a broad range of risk domains (e.g., social, financial, health) [Karg, Wiener-Blotner and Schnall, 2019]. This work raises the concern that common measures of disgust sensitivity are not reliably measuring disgust, but rather a more generalized perception of risk. If true, this would suggest that sensitivity to risk, rather than disgust, is driving negative attitudes towards GM foods.

In sum, it is known that public attitudes about GM foods tend to be negative, despite scientific consensus regarding their safety. These attitudes are not driven by political or religious views that typically influence perceptions of controversial science, but instead may be driven in part by perceptions of disgust. However, other work casts doubt on the link between disgust sensitivity and GM opposition, arguing that a sensitivity to risk is in fact driving observed associations.

Objectives

Central to the question of whether disgust drives opposition to GM foods is whether self-report measures are indeed capturing respondents' disgust sensitivity [Kahan and Hilgard, 2016]. Compounding this concern are findings that physiological measures of disgust sensitivity are not always correlated with self-report measures. Olatunji et al. [2012] find that galvanic skin response (GSR) during the viewing of disgusting images was significantly associated with the pathogen disgust scale (PDS), but not the sexual or moral disgust scales. Others have found that the Disgust Scale-Reduced [van Overveld et al., 2011] was uncorrelated with physiological disgust sensitivity [Smith et al., 2011]. As this study utilizes the pathogen disgust sensitivity (PDS) scale [Tybur, Lieberman and Griskevicius, 2009; Olatunji et al., 2012], we hypothesize that this self-report measure will be associated with our physiological measure of disgust sensitivity.

H1: Physiologically measured disgust sensitivity and self-reported disgust sensitivity (PDS) will be positively associated.

Previous work using the PDS scale has found that this self-report measure of disgust sensitivity is associated with opposition toward GM foods [Clifford and Wendell, 2016; Scott, Inbar and Rozin, 2016]. As such, we expect that this self-report measure of disgust sensitivity will be positively associated with perceiving risks from GM food and support for policies that regulate GM food.

H2: Self-reported disgust sensitivity (PDS) will be positively associated with perceptions of risks from GM food.

H3: Self-reported disgust sensitivity (PDS) will be positively associated with support for policies that regulate GM food.

Given the links between disgust and GM opposition that these studies find, as well as the nature of GM opposition rhetoric, we further expect that physiological measures of disgust sensitivity will be positively associated with perceiving risks from GM food and support for policies that regulate GM food.

H4: Physiologically measured disgust sensitivity will be positively associated with perceptions of risks from GM food.

H5: Physiologically measured disgust sensitivity will be positively associated with support for policies that regulate GM food.

However, Kahan and Hilgard [2016] find that the PDS scale is associated with perceiving risks from a number of different sources, as well as other policy preferences. For this reason, we expect that self-reported disgust sensitivity will be positively associated with perceiving risks from other food and health technologies, as well as support for policies to regulate them.

H6: Self-reported disgust sensitivity (PDS) will be positively associated with perceptions of risks from other scientific technologies, including vaccines, stem cells, pesticides, and livestock hormones.

H7: Self-reported disgust sensitivity (PDS) will be positively associated with support for policies regulating other scientific technologies, including vaccines, stem cells, pesticides, and livestock hormones.

It remains unclear whether physiological measures of disgust sensitivity would be associated with perceiving risks from or supporting regulation of other food and health technologies. We therefore ask the following research questions:

RQ1: How does physiological disgust sensitivity relate to perceptions of risks from other scientific technologies, including vaccines, stem cells, pesticides, and livestock hormones?

RQ2: How does physiological disgust sensitivity relate to support for policies regulating other scientific technologies, including vaccines, stem cells, pesticides, and livestock hormones?

Methods

Sample

Participants were recruited via university email lists, talking to people on the street near the lab space, and through snowball sampling at a large Midwestern university. Recruitment and data collection took place between April 11, 2019 and April 19, 2019.

After removing seven respondents for poor physiological data quality, our final sample consisted of 73 respondents, 27 men and 45 women.[1] Concerning ethnicity, 53.4% of our sample was White (39 people), 21.9% was Asian and 15% was Hispanic, while only 6.8% was Black or African American. Additionally, one participant reported being Biracial and one participant reported being Jewish. A large proportion, three-quarters of the sample, were students (75.3%). 47.9% of respondents reported having "some college" education, 28.8% held master's or doctoral degrees and 19.2% held bachelor's degrees, while one respondent held

[1] Our measure of gender was open text, allowing respondents to respond as they identify. One respondent was "queer". This participant is excluded from analyses that include gender as a predictor because we lack a sufficient sample of nonbinary participants to make meaningful comparisons.

a 2-year degree and two respondents were high school graduates. As the majority of our sample were students, only 13.7% were employed part time, 6.8% were employed full time, and 4.1% were unemployed and looking for work. Our sample also skewed liberal, though we did have a range of partisans in our sample. The mean partisanship was $M = 2.63$, SD = 1.65, ranging from 1 ("Strong Democrat") to 7 ("Strong Republican").

Procedure

Participants were told that they were participating in a study about public affairs and that in the first part of the study, their physiological responses would be monitored as they viewed an array of photos. Sensors were placed on first, second, and third fingers of the participant's non-dominant hand to capture skin conductance and heart rate. When the sensors were attached, participants were left alone in a small room with a desktop computer.

Participants viewed one minute of black screen to establish baseline skin conductance and heart rate before viewing a photo array. The photo array consisted of 22 photos drawn from the International Affective Picture System (IAPS) [Lang, Bradley and Cuthbert, 1997; Bradley and Lang, 2007] and the Chicago Face Database [Ma, Correll and Wittenbrink, 2015] to capture physiological responses to threatening stimuli (e.g., a gun pointing at you), disgusting stimuli (e.g., a toilet full of vomit), positive stimuli (e.g., a beautiful waterfall), neutral stimuli (e.g., a broom), white males, Hispanic males, and Black males. The photo array included four threatening photos, four disgusting photos, four positive photos, and four neutral photos, as well as two photos each for white, Hispanic, and Black males. Participants viewed each photo in the array, presented in random order, for eight seconds followed by a ten-second inter-stimulus interval of grey screen between photos. For the present study, physiological responses to only the disgusting and neutral stimuli, drawn from the IAPS, were utilized. Physiological responses to other images were utilized by collaborating research groups investigating other research questions about topics such as immigration.

Following the completion of the photo array, lab assistants disconnected the sensors from the respondent and left the participant alone in the same room to complete a survey on the desktop computer. Upon completion of the survey, participants were given the opportunity to debrief the study and were encouraged to share the opportunity to take this study with their friends and family, but to not describe the study to potential participants. All participants were compensated ten dollars.

Measurement

Physiological disgust sensitivity. The use of physiological methods in social sciences, though not new, are becoming more prevalent as technology and computing power has made this data easier to collect and analyze. Though there are differences in the measurement of physiological disgust sensitivity across papers, there are norms of measurement developing in the field, which we follow. For more information about the evolution of physiological measurement of disgust sensitivity and results with alternative measurement, see appendixes A and B.

We used Thought Technology ProComp encoder, equipped with finger band electrodes, to capture participants' galvanic skin response (GSR) at a rate of 256 times per second. Arousal in response to each photo in the array was computed by subtracting the average GSR in the immediately preceding inter-stimulus interval from the participants average GSR between the second and sixth second that the photo was on the screen to account for individual variance in baseline skin conductance [Smith et al., 2011]. This produced a measure of physiological arousal in response to each photo for each of our respondents. We then calculated each participant's average arousal to the four disgusting images. To compute a physiological measure of disgust sensitivity, each participant's average arousal to the four neutral images was subtracted from their average arousal to the disgusting images ($M = 0.03$, SD $= .10$ [MIN $= -.20$, MAX $= .41$]).

Risk perceptions. Risk perceptions were captured measures that have been used in previous work regarding disgust and attitudes toward vaccines and GMOs [Kahan and Hilgard, 2016; Clifford and Wendell, 2016]. Items measuring risk perceptions toward stem cell research, HPV vaccines, and synthetic livestock hormones were adapted from existing scale items and Pew Research Center question wording [Funk and Rainie, 2015]. Respondents were asked, "How much risk do you believe each of the following pose to human health, safety, or prosperity?" Respondents rated the perceived risk of each item on an 8-point scale with labeled scale points from "No risk at all" = 0 to "Very high risk" = 7. The six items were: "Genetically modified food" ($M_{\text{GMO}} = 3.19$, $\text{SD}_{\text{GMO}} = 1.73$); "Vaccination of children against childhood diseases (such as mumps, measles, and rubella)" ($M_{\text{MMR}} = 1.11$, $\text{SD}_{\text{MMR}} = 1.36$); "Vaccination of adolescents against HPV (the human papillomavirus)" ($M_{\text{HPV}} = 1.23$, $\text{SD}_{\text{HPV}} = 1.43$); "Using embryonic stem cells to treat disease" ($M_{\text{STEM}} = 2.23$, $\text{SD}_{\text{STEM}} = 1.69$); "Pesticides" ($M_{\text{PEST}} = 4.73$, $\text{SD}_{\text{PEST}} = 1.37$); and "Use of synthetic hormones in beef cattle" ($M_{\text{HORM}} = 4.45$, $\text{SD}_{\text{HORM}} = 1.51$).

Policy support. The measurement of policy support was drawn from previous work by Kahan and Hilgard [2016], while added items drew on Pew Research Center question wording [Funk and Rainie, 2015]. Previous work on disgust and health issues often includes similar measures of policy support [e.g., Clifford and Wendell, 2016; Scott, Inbar and Rozin, 2016]. Respondents were asked, "Please indicate how much you support or oppose the following policies" on a 6-point labeled scale from "Strongly Oppose" = 0 to "Strongly support" = 5. The eight items were: "Requiring mandatory labeling of products containing genetically modified foods" ($M_{\text{GMO1}} = 4.11$, $\text{SD}_{\text{GMO1}} = 1.12$); "Banning the cultivation of GMO crops" ($M_{\text{GMO2}} = 2.23$, $\text{SD}_{\text{GMO2}} = 1.41$); "Requiring children who are not exempt for medical reasons to be vaccinated against measles, mumps, and rubella" ($M_{\text{MMR}} = 4.48$, $\text{SD}_{\text{MMR}} = .73$); "Requiring adolescents who are not exempt for medical reasons to be vaccinated against HPV (the human papillomavirus)" ($M_{\text{HPV}} = 3.97$, $\text{SD}_{\text{HPV}} = 1.11$); "Allowing parents to opt out of vaccinating their children for non-medical reasons" ($M_{\text{VAC}} = .78$, $\text{SD}_{\text{VAC}} = 1.02$); "Expanding research into the use of embryonic stem cells to treat disease" ($M_{\text{STEM}} = 3.85$, $\text{SD}_{\text{STEM}} = 1.21$); "Banning the use of chemical pesticides" ($M_{\text{PEST}} = 3.10$, $\text{SD}_{\text{PEST}} = 1.26$); and "Banning the use of livestock hormones" ($M_{\text{HORM}} = 3.19$, $\text{SD}_{\text{HORM}} = 1.30$).

Pathogen disgust sensitivity (PDS). To measure self-reported disgust sensitivity, we used the pathogen disgust sensitivity scale, one component of the Three Dimensions of Disgust Sensitivity (TDDS) Scale [Tybur, Lieberman and Griskevicius, 2009; Olatunji et al., 2012] which is widely used in previous correlating disgust with a range of attitudes [e.g., Kahan and Hilgard, 2016; Clifford and Wendell, 2016; Kupfer and Tybur, 2017]. Participants were asked, "Please rate how disgusting you find the concepts described below" and responded on a 7-point labeled scale from "Not disgusting at all" = 0 to "Extremely disgusting" = 6. The items were: "Stepping on dog poop", "Sitting next to someone with red sores on their arm", "Shaking hands with a stranger who has sweaty palms", "Seeing some mold on old leftovers in the refrigerator", "Standing close to a person who has body odor", "Seeing a cockroach run across the floor", and "Accidently touching a person's bloody cut" ($M_{\text{PDS}} = 3.35$, $\text{SD}_{\text{PDS}} = .95$, Cronbach's $\alpha = .77$).

Scientific interest. Scientific interest was captured with a single question, "How interested are you in science?" which was captured on a 5-point labeled scale from "Not at all interested" = 0 to "Extremely interested" = 4 ($M = 3.27$, SD $= 1.13$).

Controls. Education was measured with seven response options from "Less than high school diploma" to "Masters and/or Doctorate degree". All participants had received at least a high school degree, so education was coded on a six-point scale from 0 ("High school degree") to 5 ("Masters and/or Doctorate degree"), where the midpoint was 3 ("4 year degree") ($M = 2.52$, SD $= 1.77$). Partisanship was measured on a seven-point scale from 1 ("Strong Democrat") to 7 ("Strong Republican") ($M = 2.63$, SD $= 1.65$). In addition, dummy measures of sex (Female = 1, $M = .62$, SD $= .49$) and race (Person of color = 1, $M = .47$, SD $= .50$) were used as controls in analyses.

Results

Associations between measures of disgust sensitivity

Disgust sensitivity measured via physiological methods and self-report measures were weakly correlated ($r = .26$, $p = .03$), providing modest support for H1.

Risk perceptions

To examine the association between risk perceptions toward GM food and other issues, we used a series of OLS regressions. The first step included physiologically measured disgust sensitivity as the sole predictor (Table 1), the second step added self-report disgust sensitivity (PDS) as a second predictor (Table 2), and the third OLS regression included the two measures of disgust sensitivity alongside covariates including scientific interest, sex, and partisanship (Table 3). It should be noted in these tables that the F-statistic is only significant for GM risk perceptions in the first two steps, and only for GM and pesticide risk perceptions in the third step. While other F-statistics are included for comparison, the poor model fit for other risk perceptions suggests they are explained by factors unrelated to disgust and our controls.

Table 1. Risk perceptions, physiological measure of disgust sensitivity.

	How much risk do you believe each of the following pose to human health, safety, or prosperity?											
	GM food		MMR vaccination		HPV vaccination		Stem cells		Pesticides		Livestock hormones	
	B	(SE)	B	(SE)	B	(SE)	B	(SE)	B	(SE)	B	(SE)
Physiologically measured disgust sensitivity	5.57^{**}	(1.96)	−0.6	(1.63)	−0.1	(1.71)	−0.6	(2.02)	1.43	(1.63)	1.14	(1.80)
Intercept	3.04^{**}	(.20)	1.12^{**}	(.17)	1.24^{**}	(.17)	2.25^{**}	(.21)	4.69^{**}	(.17)	4.42^{**}	(.18)
Observations	73		73		73		73		73		73	
Adjusted R2	0.09		−0.01		−0.01		−0.01		0		−0.01	
Residual std. error ($df = 71$)	1.65		1.37		1.44		1.7		1.37		1.52	
F statistic ($df = 1; 71$)	8.08^{**}		0.11		0.01		0.08		0.77		0.4	

Note: † $p < 0.1$; * $p < 0.05$; ** $p < 0.01$.

Table 2. Risk perceptions, physiological and self-report measures of disgust sensitivity.

	How much risk do you believe each of the following pose to human health, safety, or prosperity?											
	GM food		MMR vaccination		HPV vaccination		Stem cells		Pesticides		Livestock hormones	
	B	(SE)	B	(SE)	B	(SE)	B	(SE)	B	(SE)	B	(SE)
Physiologically measured disgust sensitivity	4.00^{*}	(1.90)	−1.23	(1.67)	−.65	(1.76)	−1.38	(2.06)	.71	(1.66)	.23	(1.83)
Self-reported disgust sensitivity (PDS)	$.64^{**}$	(.20)	.28	(.17)	.21	(.18)	.34	(.22)	$.29^{\dagger}$	(.17)	$.37^{\dagger}$	(.19)
Intercept	3.94	(.68)	.21	(.59)	.54	(.63)	1.15	(.74)	3.73^{**}	(.59)	3.21^{**}	(.65)
Observations	73		73		73		73		73		73	
Adjusted R2	.20		.01		−.01		.01		.02		.03	
Residual std. error ($df = 70$)	1.55		1.35		1.44		1.68		1.35		1.49	
F statistic ($df = 2; 70$)	9.79^{**}		1.34		.68		1.26		1.84		2.10	

Note: † $p < 0.1$; * $p < 0.05$; ** $p < 0.01$.

The results show that disgust sensitivity, measured via physiologically methods, was associated with perceiving greater risks to human health, safety, or prosperity from GM food, supporting H4 ($B = 5.57$, $p < .001$, Table 1). This association persisted when self-reported disgust sensitivity was added to the model ($B = 4.00$, $p = .039$, Table 2), while self-reported disgust sensitivity (PDS) was additionally associated with perceiving greater risks from GM food ($B = 0.64$, $p < .001$, Table 2). When scientific interest and controls were added to the model, the association between physiological disgust sensitivity and perceiving risks from GM food became non-significant at the $p < .05$ level ($B = 3.45$, $p = .085$, Table 3), suggesting that at least some of these covariates were associated with physiological disgust sensitivity. However, self-reported disgust sensitivity remained significantly associated with perceiving risks from GM food ($B = 0.60$, $p < .001$, Table 3), supporting H2.

Disgust sensitivity captured via physiological methods was not significantly related to any other risk outcome (RQ1). Self-reported disgust sensitivity, on the other hand, was associated with perceiving risks from pesticides ($B = 0.35$, $p = .042$) and livestock hormones ($B = .41$, $p = .046$), though the F-statistic for the regression predicting risk perceptions from livestock hormones was not significant, suggesting poor model fit (Table 3). These findings partially supported H6, but we

Table 3. Risk perceptions, physiological and self-report measures of disgust sensitivity, with controls.

	How much risk do you believe each of the following pose to human health, safety, or prosperity?											
	GM food		MMR vaccination		HPV vaccination		Stem cells		Pesticides		Livestock hormones	
	B	(SE)	B	(SE)	B	(SE)	B	(SE)	B	(SE)	B	(SE)
Physiologically measured disgust sensitivity	$3.45^{\dagger}$	(1.98)	−1.99	(1.73)	−1.22	(1.86)	−1.79	(2.11)	.16	(1.63)	−.59	(1.91)
Self-reported disgust sensitivity (PDS)	$.60^{**}$	(.21)	.29	(.18)	.25	(.20)	.34	(.22)	$.35^{*}$	(.17)	$.41^{*}$	(.20)
Scientific interest	−.17	(.19)	−.18	(.17)	.04	(.18)	−.18	(.20)	.22	(.16)	.03	(.19)
Female (v. Male)	.56	(.39)	.09	(.34)	.34	(.36)	.29	(.41)	.38	(.32)	.38	(.37)
Person of color (v. White)	.37	(.38)	.43	(.33)	.51	(.36)	$.74^{\dagger}$	(.41)	−.25	(.31)	.30	(.37)
Education	.05	(.12)	$.19^{\dagger}$	(.10)	.07	(.11)	.18	(.13)	−.05	(.10)	.06	(.12)
Partisanship	−.16	(.11)	−.02	(.10)	.06	(.11)	.18	(.12)	$-.23^{*}$	(.09)	−.13	(.11)
Intercept	1.41	(1.17)	.10	(1.02)	−.46	(1.10)	.30	(1.25)	3.39^{**}	(.97)	2.79^{*}	(1.14)
Observations	72		72		72		72		72		72	
Adjusted R2	.21		.02		−.03		.05		.11		.02	
Residual std. error ($df = 64$)	1.55		1.35		1.45		1.65		1.27		1.50	
F statistic ($df = 7; 64$)	3.704^{**}		1.21		.69		1.51		2.241^{*}		1.17	

Note: † $p < 0.1$; * $p < 0.05$; ** $p < 0.01$.

note that neither measure of disgust sensitivity was associated with perceiving risks from MMR vaccination, HPV vaccination, or medical applications of stem cell research.

Policy support

To examine the association between policy support for GM food and other issues, we ran the same series of OLS regressions as for risk perceptions. For the sake of brevity, we present the final step that included the two measures of disgust sensitivity alongside covariates including scientific interest, sex, and partisanship (Table 4). As above, some of the F-statistics were not significant, suggesting that for policy attitudes regarding vaccination and stem cell research, disgust and included demographics do not explain policy preferences.

Physiologically measured disgust sensitivity was not associated with policy preferences concerning labeling or banning the cultivation of GM crops; H5 was not supported. On the other hand, those who self-reported being more disgust sensitive reported greater support for GM labeling, ($B = 0.45$, $p = .001$, Table 4), but not banning GM cultivation ($B = 0.32$, $p = .067$, Table 4); H3 was partially supported.

Neither measure of disgust sensitivity was significantly associated with policy preferences toward other scientific issues (H7, RQ2), including requiring MMR vaccination, requiring HPV vaccination, allowing parents to opt-out of childhood vaccinations for non-medical reasons, expanding stem cell research, banning pesticides, or banning the use of artificial livestock hormones.

Table 4. Policy preferences.

Please indicate how much you support or oppose the following policies.	Labeling GM food		Banning GMO crops		Requiring MMR vaccine		Requiring HPV vaccine	
	B	(SE)	B	(SE)	B	(SE)	B	(SE)
Physiologically measured disgust sensitivity	$-.23$	(1.25)	1.89	(1.61)	$-.20$	(0.91)	$-.30$	(1.40)
Self-reported disgust sensitivity (PDS)	$.45^{**}$	(.13)	$.32^{\dagger}$	(.17)	.16	(.10)	.23	(.15)
Scientific interest	$-.06$	(.12)	$-.24$	(.16)	.01	(.09)	.00	(.14)
Female (v. Male)	$.50^{*}$	(.24)	1.02^{**}	(.31)	$-.37^{*}$	(.18)	$-.45$	(.27)
Person of color (v. White)	$.50^{*}$	(.24)	$-.07$	(.31)	$-.23$	(.18)	$-.22$	(.27)
Education	$-.11$	(.08)	.08	(.10)	$-.04$	(.06)	$-.10$	(.08)
Partisanship	$-.08$	(.07)	$-.08$	(.09)	$-.07$	(.05)	$-.04$	(.08)
Intercept	2.73^{**}	(.74)	1.29	(.95)	4.51^{**}	(.54)	3.93^{**}	(.83)
Observations	72		72		72		72	
Adjusted R2	.26		.20		.05		.02	
Residual std. error ($df = 66$)	.98		1.26		.71		1.10	
F statistic ($df = 5; 66$)	4.535^{**}		3.531^{**}		1.49		1.21	
	Allowing non-medical opt-out of vaccination		Expanding stem cell research		Banning pesticides		Banning livestock hormones	
	B	(SE)	B	(SE)	B	(SE)	B	(SE)
Physiologically measured disgust sensitivity	1.06	(1.29)	$-.63$	(1.47)	.36	(1.54)	.04	(1.57)
Self-reported disgust sensitivity (PDS)	$-.09$	(.14)	$-.10$	(.16)	.18	(.16)	.01	(.17)
Scientific interest	$-.22^{\dagger}$	(.13)	.15	(.14)	.20	(.15)	.09	(.15)
Female (v. Male)	.05	(.25)	$-.69^{*}$	(.29)	$.76^{*}$	(.30)	1.09^{**}	(.31)
Person of color (v. White)	.28	(.25)	$-.21$	(.28)	$-.27$	(.29)	.00	(.30)
Education	.01	(.08)	$-.20^{*}$	(.09)	$-.08$	(.09)	.07	(.09)
Partisanship	$.14^{\dagger}$	(.07)	$-.17^{*}$	(.09)	$-.15^{\dagger}$	(.09)	$-.07$	(.09)
Intercept	1.21	(.77)	5.18^{**}	(.87)	2.04^{*}	(.91)	2.18^{*}	(.93)
Observations	72		72		72		72	
Adjusted R2	.03		.11		.10		.10	
Residual std. error ($df = 66$)	1.01		1.15		1.20		1.23	
F statistic ($df = 5; 66$)	1.29		2.223^{*}		$2.110^{\dagger}$		$2.096^{\dagger}$	

Note: † $p < 0.1$; * $p < 0.05$; ** $p < 0.01$.

Discussion

Our study suggests that disgust sensitivity does play a role in perceiving risks from GM food, and that this link likely does not stem from broader risk aversion. Individuals who are more physiologically sensitive to disgust are more likely to see risks from GM food, compared to those who are less disgust sensitive. This association with physiological disgust sensitivity does not extend to perceiving risks from other food and health technologies or any policy preferences, raising questions about which and for what reasons food and health technologies are perceived as disgusting. Notably, the effect of physiological disgust on GM risk perceptions becomes nonsignificant when adding demographic predictors to the model, suggesting that factors like partisanship or gender may be associated with physiological disgust, as suggested in some work on political psychology [e.g., Smith et al., 2011]. Despite this, our results indicate it is worthwhile to continue exploring the influence of physiological disgust on attitudes towards GM foods, as there may be a unique relationship between the two, compared with other food and health technologies.

Self-reported disgust sensitivity is additionally associated with risk perceptions and policy attitudes toward GM food. It is worth noting that self-report measures of disgust explained variance in GM attitudes above and beyond what the physiological measure explained. As previously noted, given the separate processes through which these measures are captured, we do not expect self-report and physiological measures of disgust sensitivity to be identical. While the physiological measure captures observed physiological arousal in response to disgusting stimuli, participants' self-reported disgust is additionally influenced social norms, desirability biases, expressive responding, and survey fatigue [Smith et al., 2011]. These factors may, in part, explain why self-report measures of disgust sensitivity are associated with support for labeling laws while observed physiological measures are not.

However, our results do not immediately corroborate the claims that self-report disgust measures are tapping a general sensitivity to risk [Kahan and Hilgard, 2016; Karg, Wiener-Blotner and Schnall, 2019]. If this were the case, we would expect that the self-report measures would be associated with perceiving greater risks from all the food and health technologies presented. But our results do not follow this pattern. The associations between self-reported disgust sensitivity and risk perceptions were limited to GM foods and pesticides. Participants who reported high disgust on the PDS scale did not perceive vaccines or stem cell research as riskier than those with lower self-reported disgust. In interpreting these results, we must note that we may not see associations with the vaccine measures because our small sample was highly supportive of vaccination. However, there was more variation concerning perceived risks from stem cell research, and thus it remains notable that self-report disgust sensitivity was only associated with perceiving risks from food related outcomes

The association between the physiological and self-report measures of disgust sensitivity was small ($r = .26$, $p = .03$), and self-reported disgust was associated with a broader range of attitudes and policy preferences than physiological disgust. We did not expect these measures to be identical because self-reported disgust, however, it remains an interesting question why the self-report measure was more strongly associated with outcomes. One possibility is that the self-report measure captures both felt disgust and how readily individuals express feeling disgusted. Those who are more likely to express disgust in our survey may also be more likely to express other feelings and attitudes, including risk perceptions and policy support. The biased expression of disgust in self-report measures has long been a concern in the field. While we did not observe any gender differences in self-reported disgust, other studies often find that women tend to report more disgust than men, despite seeing no gender differences in physiological reactions to disgusting stimuli [Kam and Estes, 2016; Smith et al., 2011]. Though individual differences in expression may be a factor driving the associations we see with self-reported disgust sensitivity above and beyond physiologically measured disgust sensitivity, expressiveness alone does not explain why these associations are only observed among food-related outcomes.

Physiological disgust, conversely, was not associated with any policy support outcomes. Support for GM policies may be influenced by a range of emotions, values, and cognitions [e.g. Scott, Inbar, Wirz et al., 2018], and it may be that other factors are influencing policy support. For example, attitudes like trust in government can influence support for GM food policies so that more trust in government is associated with more preference for restrictive government oversight of GM food [Yue et al., 2015]. Such preexisting attitudes and values may moderate the impact that physiological disgust has on policy preferences.

An unnatural way forward

Disgust is hypothesized to be an evolved motivation to avoid potential pathogens [Tybur, Lieberman, Kurzban et al., 2013]. As such, work investigating the role of disgust in opposition to GM foods has focused on concerns about contamination. For example, the self-report measure of disgust used in this study and others [Clifford and Wendell, 2016; Kahan and Hilgard, 2016; Scott, Inbar and Rozin, 2016] aims to capture participants' reactions to possible vectors of disease (e.g., sores, feces). By focusing on this measure of disgust, prior work has prioritized a definition of disgust that is limited to contact with contaminants. Looking at anti-GM rhetoric, allegations that GM food is toxic to humans or the environment fit with this definition of disgust as a reaction to possible contaminants.

However, non-contaminant stimuli may produce a reaction which feels similar to disgust. Two sources may be relevant to research on GM foods: magical thinking and moral disgust. Magical thinking raises the point that there does not need to be a "real" threat of contamination to elicit a disgust response (e.g., participants reporting disgust at the idea of eating a piece of chocolate shaped like dog poop) [Rozin and Fallon, 1987]. In the context of attitudes about GM foods, this kind of magical thinking is evident in the finding that individuals' perceptions of naturalness are more informed by process than by content [Rozin, 2005]. For instance, the public considers selective breeding via gene editing to be far less natural than via domestication, though domestication often has far greater impacts on genetic makeup than the insertion of a single gene [Rozin, 2005]. In other words, people perceive the process of gene editing to be more unnatural than domestication, perhaps because of the level at which humans intervene. That is, disgust may not be aroused because GM food presents a legitimate threat of contamination, but because the process by which it is created violates perceptions of naturalness.

Moral disgust refers to feelings of disgust in response to social violations, such as lying, stealing, or cheating [Olatunji et al., 2012]. The persistence of the idea that GM foods are somehow unnatural may be less about the quality of GM food, but an aversion to the perceived immorality of the process by which it is created [Blancke et al., 2015; Hasell and Stroud, 2020; Scott, Inbar, Wirz et al., 2018]. If natural is viewed as inherently good, safer or better, then "artificial" processes and scientific intervention may be viewed as morally inferior, regardless of actual threat of contamination. Future research should examine how both these aspects of disgust perceptions and experiences are influencing attitudes about GM foods.

Limitations

This study is the first to examine associations between physiological disgust sensitivity and GM attitudes. However, there are limitations worth noting. The first is our small sample size, the majority of whom were students at the university where the research took place. By collaborating with other research group, we collected physiological data from a sample that is large compared to other studies using physiological measures [Aarøe, Petersen and Arceneaux, 2017; Dodd et al., 2012; Hibbing, Smith and Alford, 2014a; Oxley et al., 2008; Smith et al., 2011]. However, the size and characteristics of this sample limits the generalizability of these findings to the broader population as well as the power of statistical inferences. As a result of this collaboration as well, we had constraints on the survey length that precluded us from measuring other factors associated with GM attitudes, including familiarity, knowledge, and exposure to anti-GM rhetoric. It would be interesting to examine the ways in which familiarity with the issue may moderate the effects of disgust sensitivity; it could be that disgust more strongly influences attitudes of participants who have been exposed to anti-GM rhetoric making these links explicit.

We also note limitations of measurement. Though our disgusting stimuli for physiological measurement were drawn from images used in extant work on disgust sensitivity [Smith et al., 2011; Bakker et al., 2020; Dodd et al., 2012], we cannot know that disgust is the only emotion captured in our physiological measure. The galvanic skin responses we recorded simply capture arousal in response to the images in the photo array, but we cannot exclude the possibility that the images we selected to elicit disgust may have also elicited fear, anger, or other emotions in some participants. Further, the self-report measures are cross-sectional and may vary over time or may have been influenced by other external experiences of the participants. As knowledge about and familiarity with GM foods in the U.S. is generally low [Funk and Rainie, 2015], participants' perceptions of risk and policy support may not be reflective of stable opinions and may change in alternate contexts providing different information.

Conclusions

Given the role that GM foods will likely play in the future of our food supply, GM foods present a challenge for science communicators. Designing strategic messages that accurately communicate the risks and benefits of GM technology requires first understanding the drivers of the widespread public skepticism toward GM food. Our study finds evidence that disgust sensitivity does play a role in perceiving risks from GM food, and that the link between disgust and GM foods is relatively unique, instead of stemming from a broader risk aversion. However, the discrepancies between the physiological and self-reported disgust measures, as well as their weak correlation, suggest that the self-report measure is capturing the effects of an influential factor or factors in addition to disgust. Further work is required to investigate the potential role that perceptions of unnaturalness may play in shaping negative attitudes and emotional responses toward GM foods. In addition, future research should also explore how reframing novel innovations in ways that provoke feelings like curiosity may aid in overcoming fears around emergent technologies. This further research is important both to understanding the roots of public opposition to GM foods and has implications for the reception of other food and health technologies, including lab grown meat, artificially grown organs for transplant, and applications of synthetic biology.

Appendix A. Measuring physiological disgust sensitivity

A starting point for measuring disgust sensitivity is to average participants' change in skin conductance across multiple disgusting images compared to a baseline (e.g., the participant's skin conductance during the preceding inter-stimulus interval). Some prior research has used this "raw" average as a measure of disgust sensitivity [Aarøe, Petersen and Arceneaux, 2017; Dodd et al., 2012; Oxley et al., 2008; Smith et al., 2011]. However, there is a problem with simply using these "raw" averages as a measure of disgust sensitivity — the researchers are unable to differentiate between arousal in response to disgust from arousal in response to a visual stimulus. It is therefore important for measuring arousal from disgust that researchers compare participants' physiological response to the disgusting stimuli to participants' physiological response to other images. In this way, researchers can isolate the changes in participants' skin conductance that are attributable to feeling disgust.

However, the question of what visual stimulus to use as a comparison is not settled, and the relevant set of comparison images may differ depending on the research question under investigation. There are two groups of comparison images which may be used to measure disgust sensitivity: neutral images (e.g., a basket, a dustpan) or positive images (e.g., a rainbow, a beautiful waterfall). The argument for using neutral images is that by subtracting participants' mean change in skin conductance while viewing neutral images from their mean change in skin conductance while viewing disgusting images, one isolates the change attributable to disgust. By comparing to neutral images, one removes the effect of viewing any image from the measure of disgust sensitivity [Arceneaux, Dunaway and Soroka, 2018].

However, some work has employed positive images as a comparison when measuring disgust or threat sensitivity [Oxley et al., 2008]. The rationale for comparing to positive images is that some people may be more reactive to affective stimuli than others. A measure of disgust sensitivity that subtracts out participants' reactions to positive stimuli captures whether participants are more or less reactive to disgusting stimuli than they are to positive stimuli. This measure of disgust sensitivity captures a discrete components of negativity bias — indeed, the measure of negativity bias commonly used subtracts participants' physiological responses to positive stimuli from their averaged physiological response to threatening and disgusting stimuli [Hibbing, Smith and Alford, 2014a; Hibbing, Smith and Alford, 2014b].

As stated above, the question of which reference stimuli to use may be in part a consideration of the research question. Research looking at physiological predispositions of political ideology is centrally interested in the different ways in which partisans react to negativity [Oxley et al., 2008], so it is unsurprising that this work has used measures of disgust and threat sensitivity that use positive stimuli as a reference [Hibbing, Smith and Alford, 2014a; Hibbing, Smith and Alford, 2014b]. However, we had no theoretical expectation that individuals' reactivity to affective stimuli generally, or their bias toward negative stimuli, would affect their attitudes toward food and health technologies. We therefore presented results using a measure of disgust sensitivity that compared physiological arousal from disgusting stimuli to neutral stimuli, as we believed it best captured the predisposition we were interested in measuring by isolating participants' reactivity to disgust.

In addition to a priori, theoretical reasons for using the measure of disgust sensitivity v. neutral, we also had data-driven reasons to do so. In our study, we included both physiological measures and self-report measures of disgust sensitivity. We would *not* expect these measures to be identical. Participants' self-reported disgust, like all self-report measures, is filtered through a number of psychological processes including social norms, desirability biases, expressive responding, and survey fatigue [Smith et al., 2011]. For these reasons we may not expect that participants physiological response to disgust and their self-reported disgust to be identical.

However, we should expect *some* association between these measures if they are both somewhat valid measures of disgust sensitivity. This is especially the case in this study, because we use a measure of Pathogen Disgust Sensitivity (PDS) which others have claimed is associated with physiological measures of disgust sensitivity [Olatunji et al., 2012].

In our study, the measure of disgust sensitivity versus neutral was positively and significantly associated with self-reported disgust sensitivity (PDS), though the association was small ($r = .26$, $p = 0.03$). On the other hand, disgust sensitivity v. positive and self-reported measure of disgust sensitivity (PDS) were not correlated ($r = -.04$, $p = .73$). That disgust sensitivity v. neutral is significantly associated with self-reported disgust sensitivity and disgust sensitivity v. positive is not should not be taken as immediate evidence that one measure better captures "real" disgust sensitivity. But it lends additional evidence to our theoretical argument that, in the case of research into peoples' attitudes toward food and health technologies, we are centrally interested a measure that exclusively captures participants' reactivity to disgust, not their differing reactivity to affective stimuli. That said, results using a measure of disgust sensitivity v. positive can be found in appendix B.

We feel it is important to present results using both operationalizations of disgust sensitivity used by the field. Below are presented the results of analyses identical to those in the main text with a measure of disgust sensitivity using positive stimuli as a reference.

Appendix B. Results with alternative measurement

Participants' averaged arousal in response to positive stimuli were subtracted from participants' averaged arousal to disgusting stimuli to create a measure of physiological disgust sensitivity (v. positive) $M_{\text{positive}} = -.005$, $\text{SD}_{\text{positive}} = .13$ ($\text{MIN}_{\text{positive}} = -.35$, $\text{MAX}_{\text{positive}} = .29$).

Physiological disgust sensitivity (v. positive) was not persistently associated with any risk perceptions or policy support concerning any food or health technology (Tables 5–8).

The associations observed between self-reported disgust sensitivity (PDS) and risk perceptions follow an identical pattern to the results presented in the main text.

Table 5. Risk perceptions, physiological measure of disgust sensitivity (v. positive).

	How much risk do you believe each of the following pose to human health, safety, or prosperity?											
	GM food		MMR vaccination		HPV vaccination		Stem cells		Pesticides		Livestock hormones	
Physiologically measured disgust sensitivity (v. positive)	1.43	(1.70)	1.05	(1.34)	2.28	(1.39)	-1.04	(1.67)	1.22	(1.35)	.92	(1.49)
Intercept	3.20^{**}	(.20)	1.12^{**}	(.16)	1.24^{**}	(.17)	2.23^{**}	(.20)	4.73^{**}	(.16)	4.46^{**}	(.18)
Observations	73		73		73		73		73		73	
Adjusted R2	0.00		$-.01$		.02		$-.01$		.00		$-.01$	
Residual std. error ($df = 71$)	1.73		1.36		1.41		1.70		1.37		1.52	
F statistic ($df = 1; 71$)	.70		.61		2.69		.39		.82		.38	

Note: † $p < 0.1$; * $p < 0.05$; ** $p < 0.01$.

Table 6. Risk perceptions, physiological (v. positive) and self-report measures of disgust sensitivity.

	How much risk do you believe each of the following pose to human health, safety, or prosperity?											
	GM food		MMR vaccination		HPV vaccination		Stem cells		Pesticides		Livestock hormones	
Physiologically measured disgust sensitivity (v. positive)	1.67	(1.56)	1.13	(1.33)	$2.34^{\dagger}$	(1.39)	$-.94$	(1.66)	1.32	(1.32)	1.05	(1.46)
Self-reported disgust sensitivity (PDS)	$.75^{**}$	(.20)	.25	(.17)	.21	(.17)	.29	(.21)	$.32^{\dagger}$	(.17)	$.38^{*}$	(.18)
Intercept	.67	(.68)	.28	(.58)	.55	(.61)	$1.24^{\dagger}$	(.72)	3.66^{**}	(.58)	3.18^{**}	(.64)
Observations	73		73		73		73		73		73	
Adjusted R2	.16		.01		.03		.01		.03		.04	
Residual std. error ($df = 70$)	1.59		1.35		1.41		1.68		1.34		1.48	
F statistic ($df = 2; 70$)	7.83^{**}		1.43		2.07		1.19		2.27		2.37	

Note: † $p < 0.1$; * $p < 0.05$; ** $p < 0.01$.

Table 7. Risk perceptions, physiological (v. positive) and self-report measures of disgust sensitivity, with controls.

	How much risk do you believe each of the following pose to human health, safety, or prosperity?											
	GM food		MMR vaccination		HPV vaccination		Stem cells		Pesticides		Livestock hormones	
Physiologically measured disgust sensitivity (v. positive)	1.72	(1.59)	1.31	(1.40)	2.20	(1.46)	-1.01	(1.72)	.87	(1.28)	.80	(1.51)
Self-reported disgust sensitivity (PDS)	$.70^{**}$	(.20)	.22	(.18)	.22	(.19)	.30	(.22)	$.36^{*}$	(.16)	$.39^{*}$	(.19)
Scientific interest	$-.12$	(.18)	$-.08$	(.16)	.05	(.16)	$-.01$	(.19)	.15	(.14)	.06	(.17)
Female (v. Male)	.44	(.39)	$-.05$	(.35)	.19	(.36)	.20	(.42)	.39	(.32)	.30	(.37)
Partisanship	$-.20^{\dagger}$	(.11)	$-.01$	(.10)	.05	(.10)	.18	(.12)	$-.23^{*}$	(.09)	$-.14$	(.11)
Intercept	1.50	(1.18)	.70	(1.04)	.15	(1.09)	.68	(1.28)	3.37^{**}	(.95)	3.09^{**}	(1.12)
Observations	72		72		72		72		72		72	
Adjusted R2	.19		$-.03$		$-.01$		.00		.13		.03	
Residual std. error ($df = 66$)	1.57		1.38		1.44		1.70		1.26		1.48	
F statistic ($df = 5; 66$)	4.28^{**}		.58		.87		.94		3.09^{*}		1.50	

Note: † $p < 0.1$; * $p < 0.05$; ** $p < 0.01$.

Table 8. Policy preferences.

Please indicate how much you support or oppose the following policies.								
	Labeling GM food		Banning GMO crops		Requiring MMR vaccine		Requiring HPV vaccine	
Physiologically measured disgust sensitivity (v. positive)	$-.90$	(1.01)	1.11	(1.27)	-1.35	(0.71)	$-.12$	(1.12)
Self-reported disgust sensitivity (PDS)	$.48^{**}$	(.13)	$.36^{*}$	(.16)	$.15^{\dagger}$	(.09)	.23	(.14)
Scientific interest	$-.09$	(.11)	$-.20$	(.14)	.01	(.08)	$-.08$	(.13)
Female (v. Male)	$.49^{\dagger}$	(.25)	$.98^{**}$	(.31)	.29	(.18)	$-.40$	(.28)
Partisanship	$-.10$	(.07)	$-.09$	(.09)	$-.05$	(.05)	$-.04$	(.08)
Intercept	2.74^{**}	(.75)	1.29	(.94)	4.25^{**}	(.53)	3.81^{**}	(.83)
Observations	72		72		72		72	
Adjusted R2	.22		.21		.09		.02	
Residual std. error ($df = 66$)	1.00		1.25		.70		1.10	
F statistic ($df = 5; 66$)	5.10^{**}		4.69^{**}		2.37^{*}		1.21	
	Allowing non-medical opt-out of vaccination		Expanding stem cell research		Banning pesticides		Banning livestock hormones	
Physiologically measured disgust sensitivity (v. positive)	$-.94$	(1.02)	1.08	(1.20)	.10	(1.22)	$-.97$	(1.22)
Self-reported disgust sensitivity (PDS)	$-.04$	(.13)	$-.11$	(.15)	.19	(.15)	.01	(.16)
Scientific interest	$-.16$	(.12)	$-.03$	(.14)	.14	(.14)	.16	(.14)
Female (v. Male)	.04	(.25)	$-.66^{*}$	(.30)	$.81^{**}$	(.30)	1.11^{**}	(.30)
Partisanship	$.12^{\dagger}$	(.07)	$-.17^{\dagger}$	(.09)	$-.15^{\dagger}$	(.09)	$-.07$	(.09)
Intercept	1.10	(.76)	5.19^{**}	(.89)	1.88^{*}	(.90)	2.09^{*}	(.91)
Observations	72		72		72		72	
Adjusted R2	.03		.06		.10		.13	
Residual std. error ($df = 66$)	1.01		1.18		1.20		1.21	
F statistic ($df = 5; 66$)	1.49		1.87		2.62^{*}		3.04^{*}	

Note: † $p < 0.1$; * $p < 0.05$; ** $p < 0.01$.

PDS is associated with perceiving greater risks from food technologies (GM food, pesticides, hormones) but not health technologies (vaccination, stem cells) (Tables 6, 7). Concerning policy preferences, we see that in these analyses, PDS continues to be associated with support for GM food labeling but is additionally associated with support for a ban on GM food cultivation (Table 8).

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