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Disclosure of Open and Transparent Research Practices, Public Trust, and GMOs

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Abstract

Public trust in agricultural biotechnology organizations that produce genetically-modified organisms (GMOs) is affected not only by misinformed attacks on GM technology but also by the worry among some that the drive for profits among GMO producers overrides concern for the public good, a sentiment exacerbated by publicized cases of problematic industry behavior. In an experiment, we found that reporting that the industry engages in open and transparent research practices increased the perceived trust in university and corporate organizations involved with GMOs. Participants also expressed less skepticism about researchers from the organizations that reported transparent practices. Universities were considered more trustworthy than industry organizations overall, supporting prior findings in other technology domains (e.g., stem cell research). The results suggest that communicating the fact that an organization engages in open and transparent research practices should be part of the process of implementing agricultural biotechnologies.

Keywords

Agricultural biotechnology, Center for Open Science, commercialization, GMO, public opinion, responsible innovation, trust, transparency

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1. Introduction

On July 29, 2016, US President Barack Obama signed a bill that mandated the labeling of foods containing genetically modified ingredients. The enactment of the bill marked the latest step in an often contentious debate involving agribusiness, interest groups, scientists, legislators, and the general public since the first GM food products were approved by the Food and Drug Administration in the early 1990s (Lang & Hallman, 2005). The recent legislation received widespread media coverage.

Since at least the 2000s, surveys have shown that Americans do not know much about agricultural biotechnology (e.g., Brossard & Nisbet, 2007) or its most tangible product, genetically modified organisms (or GMOs; e.g., Bellows, Alcaraz, & Hallman, 2010; Cuite, Aquino, & Hallman, 2005; Hallman, Adelaja, Schilling, & Lang, 2002; Hallman, Hebden, Cuite, Aquino, & Lang, 2004). When asked for their opinion, many nonetheless express negative attitudes and elevated perceptions of risk (APPC, 2016).

What might account for such responses? For one, negative attitudes and perceptions of higher risk might stem in part from a lack of trust. Indeed, consumers are influenced both by how much they trust specific organizations as well as the extent to which they trust the broader context in which transactions are taking place (Grayson, Johnson, & Chen, 2008). For instance, there may be mistrust in the regulatory process implemented to determine the safety of GMOs (Gutteling, Hanssen, Van Der Veer, & Seydel, 2006). A recent survey found that a little over half of individuals surveyed expressed skepticism towards federal regulatory agencies' (e.g., USDA, FDA) abilities "to provide impartial and accurate findings on the safety of genetically engineered or modified crops"; only 42% of survey respondents reported "a great deal" or "a fair amount" of trust, whereas 55% reported "just some" or "very little" trust (APPC & Pew, 2015).[1]

In addition to skepticism toward regulators, negative attitudes may stem from a lack of trust in the organizations that are researching, developing, producing, and marketing genetically-modified products in the first place—particularly when they have a financial stake in the success of research outcomes. For instance, when participants were asked about their overall opinion of Monsanto, an agriculture company known for making genetically-modified products, 43.1% offered an unfavorable opinion compared with only 20.6% reporting a favorable one[2] (APPC & Pew, 2015). In comparison, when asked their opinion about the United States Department of Agriculture (USDA), 30.4% of participants reported having an unfavorable opinion and over 70% of participants expressed a favorable one.

Indeed, when it comes to controversial science (e.g., stem cell research), people are less trusting of research from *for*-profit corporations than from *non*-profit organizations, such as universities (Critchley, 2008; Critchley & Nicol, 2011). Moreover, members of the public demonstrate significantly more overall trust[3] in universities than in industry (Lang & Hallman, 2005). But, when industry funding is involved, even universities studying non-controversial science can be suspect. In September of 2016, for instance, a review article published in the internal medicine division of the Journal of the American Medical Association revealed the previously undisclosed fact that the sugar industry had funded decades-old Harvard research that

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[1] Participants were part of the wave 11 Pew American Trends Panel, a probability based online sample of 3,057 U.S. adults, surveyed between June 8, 2015 and July 29, 2015. Note that attrition does occur for each wave of the American Trends Panel, but the sample has remained demographically and ideologically diverse. For more information, see http://www.pewresearch.org/methodology/u-s-survey-research/american-trends-panel/

[2] Of the remaining participants, about 30% reported either not being sure or never having heard of Monsanto and 6.4% refused to answer.

[3] In that survey, overall trust was composed of items regarding an organization's competence, honesty, likelihood of doing what is right for society, and usefulness as a source of information

downplayed sugar's contributing role to coronary heart disease and instead stressed the role of fats (Kearns, Schmidt, & Glantz, 2016). This revelation received extensive media attention (Bailey, 2016; Domonoske, 2016; O'Connor, 2016; Shanker, 2016; Sifferlin, 2016), with articles labeling the situation a scandal and taking the time to highlight other instances of questionable industry-funded research (Rodman, 2016; Schumaker, 2016). A statement from the Sugar Association in response to the findings said that the sugar industry "should have exercised greater transparency in all of its research activities" (O'Connor, 2016).

Such revelations, of course, fuel public skepticism about industry-funded research. Concerns are exacerbated when the research domain is controversial or perceived as high risk, as is the case with agricultural biotechnology. However, to our knowledge, there has been no work on how to address the lack of trust in research from corporations, or on whether making research practices more open and transparent, and disclosing their existence, might promote trust. This study examines these possibilities.

2. Trust, Credibility, and Conflict of Interest

When people are unable to judge the quality of information from highly specific scientific domains, as is the case with various emerging technologies (Hardwig, 1985; Hendriks, Kienhues, & Bromme, 2016; Siegrist, 2000), they end to rely on expert scientists and scientific organizations to communicate accurate and helpful information about the associated risks and benefits. However, even expert communication can vary from accurate and representative to misleading or downright false. In order to determine whom to trust (Landrum, Eaves, & Shafto, 2015), the public relies on cues that indicate the knowledgeability and motivations of communicators (i.e., the communicators' credibility).

Although there may be multiple cues indicating the circumstances under which the public should question scientists' and organizations' credibility, one important cue, as discussed earlier, is the potential for conflicts of interest. For agricultural biotechnology, similar to the pharmaceutical and nanotechnology research sectors, there is a clear role for private corporations—namely, investing. By hastening knowledge production, such investments can hasten product development (Chalmers & Nicol, 2004; Critchley, 2008). However, such investments can create conflicts of interests, and with them worry that such conflicts may cause researchers to overstate the benefits and understate the risks of any particular product or technology. Accordingly, when university researchers engage in collaborative efforts with industry partners, or when corporations hire their own researchers to test and develop products, questions are understandably raised about the reliability and full disclosure of all results (DeAngelis, 2000; Myhr & Traavik, 2003).

Also problematic is the fact that undisclosed conflicts of interest may undermine the ability of scientific organizations to make accurate consensus statements. For example, a recent consensus panel from the National Academy of Sciences determined, among other conclusions, that there have been no negative health effects attributable to consuming GMOs (NASEM, 2016b). At the same time, it found that industry-funded studies are more likely to cast GMOs in a positive light (Diels, Cunha, Manaia, Sabugosa-Madeira, & Silva, 2011).

Such conflicts of interests do not go unnoticed by consumers, which recognizes that financial motivations may eclipse a commitment to contribute to the public good (Chalmers & Nicol, 2004). Although many research institutions have implemented conflict of interest policies to reveal when research is industry-funded (Gurney & Sass, 2001), such measures are not enough to thwart bias. Instead highlighting potential conflicts of interest may reinforce antagonistic attitudes. If the goal is increasing justified trustworthiness, we argue that it would be helpful to implement a set of standards that hold researchers accountable for the full reporting of results. One set of standards is telegraphed by the terms “open and transparent research practices” (Alberts et al., 2015; Nosek et al., 2015).

3. Open and Transparent Science

Although academic research is less often subject to conflicts of interest than corporate work, academic studies are vulnerable to bias that could also be addressed by open and transparent research practices as well. For example, studies that find a significant effect are more likely to be submitted and accepted for publication than are those that do not find an effect. This phenomenon, known as publication bias, leads to overestimation of the strength and robustness of research findings.

Another troubling phenomenon is finding greater statistically-significant evidence for hypotheses than is probable given their sample sizes. This suggests that some process is overstating the evidence. Researchers may change their hypotheses after the fact to find support (i.e., "hypothesizing after the results are known"; Kerr, 1998) or may attempt many analyses but report only the ones finding the desired result ("p-hacking"; Simmons, Nelson, & Simonsohn, 2011). Finally, mistakes do happen in analysis, but when raw data remain the exclusive property of the original laboratory, they are more likely to go undetected and uncorrected.

To address these problems, a number of open and transparent research standards have been developed. To prevent publication bias, some journals have adopted the “registered report” format for academic articles. In a registered report, peer reviewers evaluate and accept an article on the basis of its methods; once accepted, the research is performed and published regardless of the statistical significance of its results. Similarly, to prevent selective analysis, researchers can "preregister" a set of intended primary analyses before conducting a study or experiment. This prevents them from changing the hypotheses, analyses, or outcomes to try to find support for a preferred conclusion. Finally, the open sharing of data facilitates scrutiny across laboratories, enabling additional layers of error and fraud detection as well as correction (see: COS, 2016).

Free online tools for preregistration and data-sharing are provided by the Center for Open Science, a non-profit organization. In addition to building and maintaining such tools as the Open Science Framework (Spies, 2013), the Center for Open Science organizes collaborative projects between researchers in order to conduct research in a transparent way that minimizes opportunities for biases caused by self-interest.

The same principles could, in theory, be applied to the corporate world. If corporations engaged in some variant of open and transparent research practices, checks and balances would be in place to ensure that research does not suffer from the deleterious effects that can be produced by conflicts of interest. Indeed, the presence of such checks and balances seems to have strong effects on reported research. For instance, in the year 2000, the U.S. National Institutes of Health required that all large randomized clinical trials preregister their outcomes and analyses. Since that time, such trials are more likely to report null or negative, rather than positive results. Prior to these regulations, 17 out of 30 randomized clinical trials reported significant benefits; after these regulations, only 2 out of 25 reported significant benefits (Kaplan & Irvin, 2015). Thus, open and transparent research practices appear to reduce the influence of conflicts of interest.

4. Aims of this Experiment

This experiment examines the effects of organizational context (university versus corporation) and open and transparent research practices (versus "business as usual" practices) on public trust in the organizations and researchers examining and developing genetically-modified organisms (i.e., GMOs). Prior survey work has shown that the public has greater confidence in universities than in corporations when issues involving researching and regulation of GMOs are at play (e.g., Lang & Hallman, 2005), and experimental work has shown that participants trust universities more than industry (and industry-funded organizations) when it comes to controversial science such as stem cell research as well (Critchley, 2008; Critchley & Nicol, 2011). Therefore, our first hypothesis states that

H1. Universities will be perceived as more trustworthy than corporations when it comes to researching and developing genetically modified organisms.

Moreover, we expected that the general public would recognize that open and transparent research practices hold organizations more accountable for reporting findings objectively, leading to our second hypothesis that

H2. Organizations described as engaging in open and transparent research practices will be perceived as more trustworthy than organizations not described in this way.

Importantly, however, other heuristics are also likely to be used when evaluating trustworthiness of these organizations and their researchers. For example, research that supports one's views is often seen as more trustworthy than that which challenges them (e.g., motivated reasoning, confirmation bias, myside bias; Baron, 2000; Koehler, 1993; Kunda, 1990; MacCoun, 1998). Accordingly, members of the public who hold strong anti-GMO attitudes are not likely to trust organizations using that technology, regardless of the sponsoring organization or whether that organization engages in open and transparent research practices. Thus, our third hypothesis states that:

H3. Negative attitudes towards GMOs will be negatively associated with trust.

To examine these hypotheses, we conducted an online experiment. Prior to data collection, we preregistered the experiment design and our hypotheses with the Center for Open Science using their Open Science Framework.

5. Method

Sample

Participants for this experiment were part of a consumer panel recruited by *Research Now*, a digital data collection company, and were compensated by *Research Now*, in line with the company's policies. See supplementary material A for information on the recruitment, compensation, and exclusion of panel participants. The final sample consisted of 1097 participants.

This population was demographically and ideologically diverse and comparable to many national surveys in terms of age and gender. Participants ranged from 18 to 98 years old (*median* = 48 years, *mean* = 47.39). About 48.9% identified as male, 51.0% identified as female, and two participants declined to provide gender information. Sixty-five percent (65.6%) identified as white, non-Hispanic, 14.2% identify as black or African-American, 8.7% identify as Latino/Hispanic, and 7.8% identify as Asian. Regarding political affiliation, 47.4% reported being democrats or leaning toward supporting the democratic party, 35.5% said they were republicans or leaned toward supporting the republican party, and 13.3% identified as strictly independent. Regarding ideology, 35.3% saw themselves as very or somewhat liberal, 34.0% identified as moderate, and 30.7% identified as very or somewhat conservative. Importantly, these demographic variables did not vary significantly across experimental condition. See supplementary material B.

Experiment Design

Participants were randomly assigned to one of six conditions. In each, subjects read a press-release from an organization describing its research activities. Organization and research practices varied by condition. Four of the conditions were parsed into a 2 (Organization: university agricultural department vs. novel corporation) X 2 (Research practices: baseline vs. open & transparent) experimental design. A fifth condition described a real corporation engaging in the baseline research practices; in this condition, the organization was Monsanto, a recognizable agricultural corporation known for researching and developing GMOs[4,5]. The sixth condition was a control unrelated to GMOs: in it subjects read a press release about a baseball research society's upcoming conference.

The press releases used in the four main experimental conditions were based on the material from the original press release used in the fifth, real corporation condition; and, as previously stated, there were two manipulations in each press release: the organization type and its research practices. For all of the conditions, except the sixth, baseball condition, the press release described an organization that is developing a new type of soybean that benefits the consumer by offering an improved nutritional profile. In the two novel corporation conditions, the press release was designed to look as if it came from an agricultural corporation called "Virens", a company that we fabricated for the purpose of this study. In the two university agricultural department conditions, the press release was designed to look as if it came from the University of Pennsylvania College of Agriculture and Life Sciences, a department which does not exist. The press release also included a "research practices" section. In the baseline

4 The press release material for Monsanto was constructed from real press release material, but was shortened so that the length matched the other conditions and to increase the likelihood that participants read the press release.

5 A survey from the Pew American Trends Panel shows that close to 70% of participants have heard of Monsanto (Center & Center, 2015).

conditions (including the real corporation condition, condition 5), the research practices section had text from the real corporation's website:

> *[Organization Name] pledges to take responsibility in achieving results. This pledge includes:*
>
> - *Building strong relationships with our external partners;*
> - *Making wise decisions; and*
> - *Taking responsibility for achieving agreed-upon results.*
>
> *"Our research and development team is dedicated to developing seeds that make growing vegetables easier for farmers, while also meeting the needs of everyone in the produce chain –including retailers, food service, and consumers."*

In the open and transparent conditions, the research practices section included text we drafted based on information from the Center for Open Science on open and transparent research practices.

> *[Organization Name] now partners with the Center for Open Science (COS), a non-profit dedicated to fostering the integrity and reproducibility of scientific research. As a part of this partnership, [organization] has adopted COS research guidelines. We now:*
>
> - *Pre-register our research studies (reporting in advance what we plan to do);*
> - *Make our data available to the public; and*
> - *Explain all of our methods for analyzing data.*
>
> *"These guidelines are aimed at making sure our research upholds the values of scientific integrity. We pledge to make information available, accessible, and understandable."*

The sixth condition, the baseball research organization, did not have any information about research practices. Instead, it discussed an upcoming convention, including a list of the scheduled speakers, the dates the convention was to be held, and the location of the convention. The control condition made it possible to determine whether the GMO knowledge and attitudes items (which occurred after the manipulation) were influenced by the manipulations (the press releases) that discussed GMOs. See supplementary material C for comparisons of GMO items across conditions. Table 1 shows the experimental design and the number of participants in each condition. Supplementary material C contains press releases used in the experiment.

Table 1. Conditions and experiment design with the number of participants in each condition reported.

	Organization Type			***Control***
Research Practices	**Novel Corporation**	**University Ag Dept**	**Real Corporation**	**Baseball**
Baseline	Condition 1 n = 199	Condition 3 n = 200	Condition 5 n = 201	Condition 6 n = 210
Open & Transparent	Condition 2 n = 136	Condition 4 n = 151		

Dependent Variables

Our study aimed to examine the influence of our manipulation on how *trustworthy* participants found the organization and its researchers to be. We operationalized trustworthiness in four ways:

1. *Ratings of Organization Credibility*: the perceived credibility of the organization itself;
2. *Ratings of Researcher Credibility*: the perceived credibility of the researchers at that organization;
3. *Ranking of Researcher Knowledge*: the relative knowledgeability of the researchers at the organization compared to researchers at other relevant organizations; and
4. *Ranking of Researcher Ethics*: the relative ethical behavior of researchers at the organization compared to researchers at other relevant organizations.

Organization Credibility. Our first measure of trustworthiness, organization credibility, was created by combining two ratings of organization credibility on scales from 0 to 100 into an averaged index. The first item asked how credible the research is that comes from the organization (*M* = 60.28, *SD* = 24.14) and the second asked how credible the organization itself is (*M* = 59.79, *SD* = 25.76). The two items were highly correlated ($r = .866$, $p < .001$) and showed similar relationships as one another to education, familiarity with GMOs, and perception of GMO safety.

Researcher Credibility. Our second measure of trustworthiness was created using a researcher credibility scale that we adapted from Critchley (2008). Each item was rated on a scale from 1 to 6, where 6 indicates higher agreement. See supplementary material D. A factor analysis revealed three primary factors: one reflected participants' trust that researchers are competent (e.g., researchers are very knowledgeable about their areas of expertise), one reflected participants trust that researchers are benevolent (e.g., researchers consider how their research influences the health and well-being of the American public), and the third reflected participants' skepticism towards researchers (e.g., researchers are primarily motivated by financial interests). We used the items that loaded onto each factor to create an averaged index of each factor: Trust: Competent (*M* = 4.68, *SD* = 0.85); Trust: Benevolent (*M* = 4.25, *SD* = 1.06); and Skeptical (*M* = 3.39, *SD* = 0.96). For the two trust scales, higher scores indicated more trustworthiness, and for the skeptical scale, higher scores indicate less trustworthiness (more skepticism).

Researcher Rankings. Our third and fourth measures of trustworthiness were obtained by asking subjects to rank a set of 7 organizations (one of which was the test organization) on how knowledgeable the researchers are when it comes to research about GMOs (knowledge ranking) and how ethical the researchers are when it comes to research about GMOs (ethics ranking). The other organizations listed were scientific organizations (e.g., the National Academies of Science), non-profit organizations, university agricultural departments and research centers, anti-GMO advocacy groups (e.g., Non-GMO project, Organic Consumers Association), regulating agencies (e.g., the Food and Drug Administration), and agricultural corporations (e.g., DuPont, Syngenta). Note that the lower the score, the higher the ranking, such that 1 = top-ranked and 7 = bottom-ranked. See Table 2 for the mean and median rankings collapsed across condition. These two rankings served as our dependent variables for further analyses.

Table 2. Rankings for each of the organization types collapsed across condition. Note that participants in the control condition (Baseball) did not see this item. The mean ranking is shown in parentheses.

Median Ranking	Knowledge	Ethics
1st		
2nd		
3rd	Scientific Organizations (*M* = 3.14) University Ag Departments (*M* = 3.44) Regulating Agencies (*M* = 3.49)	Scientific Organizations (*M* = 3.27) University Ag Departments (*M* = 3.42) Non-Profit Organizations (*M* = 3.47)
4th	Non-Profit Organizations (*M* = 4.19)	Regulating Agencies (*M* = 3.62)
5th	Agricultural Corporations (*M* = 4.43)	Anti-GMO Advocacy Groups (*M* = 4.67)
6th	Anti-GMO Advocacy Groups (*M* = 5.00)	Agricultural Corporations (*M* = 5.05)
7th		

Our third hypothesis involved examining how attitudes toward GMOs influenced trust. Thus, we included a series of attitudes towards GMO items, participant policy positions regarding GMOs, and knowledge about GMO items. See supplementary material C. For the attitude items, we asked participants whether they perceived GMOs to be safe where 4 was "GMOs are as safe as conventional crops" and 0 was "GMOs are NOT as safe as conventional crops" (*M* = 1.94, *Med* = 2.0, *SD* = 1.19). We also asked participants a series of risk and benefit items. These items were combined into an averaged index of GMO risk perceptions (*M* = 1.32, *Median* = 1.25, *SD* = 0.55) and an averaged index of GMO benefit perceptions (*M* = 1.31, *Median* = 1.25, *SD* = 0.56), both of which were on a scale from 0.25 to 2.25. We also asked participants whether they purposefully avoid eating GMOs (34% agreed).

Regarding participant's GMO policy positions, we asked participants' whether GMO technology should be (a) banned in all circumstances, (b) banned for making food items, but allowed for making non-food items, or (c) should not be banned. We recoded this into two variables: one representing whether the participant believes in banning all GM technology (10.8% of the sample) and one representing whether the participant believes in banning GM food only (40.8% of the sample). We also asked participants' whether GMOs should be labeled (about 90% agreed) and whether GM technology should be regulated (85% agreed).

Regarding participants' knowledge about GMOs, we asked how much they would say that they have heard or read about GMOs on a scale from 1 (not very much at all) to 5 (a great deal; *M* = 3.11, *SD* = 1.11). We also asked participants which best describes the process used to create GMOs. About 10% thought the description of mutagenesis best described genetic-modification process, about 45% thought that gene-editing best described the genetic-modification process, and the remaining either chose cross-pollination (16%) or said that they did not know (27.4%). We dummy coded the variable so that we had a variable for those who thought it was mutagenesis and one for those who correctly chose gene-editing.

Importantly, although we asked these items after the experimental manipulation (so we would not influence participants' responses to the trust items by priming them to think about their views toward GMOs), we did not expect that knowledge about and attitudes toward GMOs would vary based on our experimental manipulation. To test this, we compared the each of the knowledge and attitudes items across the six conditions, which included the baseball control condition. No condition varied significantly from the baseball condition, for which participants were not primed to think about GMOs prior to answering the knowledge and attitudes questions. These analyses are reported in supplementary material C with the description of each of the items.

6. Results

We used hierarchical ordinary least squares (OLS) regression models to separately test each of the dependent variables[6]. In hierarchical OLS, the independent variables are entered in blocks in order to examine their relative explanatory power. We entered our independent variables in the following blocks:

Block 1. Organization type (university = 1; corporation = 0);

Block 2. Research practices (open & transparent = 1; baseline = 0);

Block 3. Attitudes towards GMOs (views about the safety, risks, benefits, and avoidance of GMOs);

Block 4. GMO policy positions (banning GM technology, banning GM food, labeling GMOs, regulating GMOs); and

Block 5. Knowledge about GMOs (familiarity, process knowledge: genetic engineering, process misconception: mutagenesis, and correct identification of consensus).

See Table 3 for the results from the regression analyses.

[6] We excluded the sixth baseball control condition from this analysis.

Table 3. Results from regressions. Final betas (standardized) displayed. Note that Knowledge Ranking and Ethics Ranking are coded such that top rankings (1st) are lower numbers than bottom rankings (7th), so negative relationships indicate higher trustworthiness.

	Rating of Org	**Rating of Researchers**			**Ranking of Researchers**	
	Organization Trustworthiness (Final β)	Trust: Competence (Final β)	Trust: Benevolence (Final β)	Skepticism (Final β)	Knowledge Ranking (Final β)	Ethics Ranking (Final β)
Block 1: Organization Type						
University	0.15***	0.07*	0.17***	-0.10**	-0.16***	-0.23***
Incremental R^2 (%)	*3.40****	*0.88***	*4.03****	*1.96****	*3.56****	*6.98****
Block 2: Research Practices						
Open & Transparent	0.09**	0.03	0.04	-0.10**	-0.08*	-0.06*
Incremental R^2 (%)	*0.84***	*0.17*	*0.21*	*1.02***	*0.50**	*0.28*
Block 3: GMO Attitudes						
safety	0.15**	0.12**	0.18***	-0.01	-0.09†	-0.08†
risks	-0.13***	0.01	-0.11**	0.20***	0.16***	0.21***
benefits	0.34***	0.32***	0.40***	-0.25***	-0.14***	-0.11**
avoid GM food	-0.06	-0.01	-0.05	0.02	-0.02	-0.01
Incremental R^2 (%)	*26.63****	*20.81****	*34.94****	*19.76****	*9.05****	*11.44****
Block 4: GMO Policy Positions						
Ban all GM technology	0.05	-0.11**	-0.04	0.09*	0.00	-0.05
Ban just GM food	-0.00	-0.06	-0.03	0.10*	0.01	0.04
Label GMOs	0.01	0.05	0.02	-0.02	-0.01	0.02
Regulate GMOs	-0.02	0.02	0.03	0.01	0.05	0.06†
Incremental R^2 (%)	*0.25*	*1.36 ***	*0.19*	*1.30***	*0.26*	*0.98**
Block 5:Knowledge about GMOs						
Familiarity	-0.01	0.06†	-0.07*	0.13***	0.08*	0.08*
Process: Genetic Engineering	-0.01	0.03	-0.05†	-0.04	0.02	0.03
Process: Mutagenesis	0.03	-0.01	0.04	0.06†	0.00	-0.01
Consensus	0.04	0.06†	0.01	-0.05	-0.00	-0.03
Incremental R^2 (%)	*0.22*	*0.92**	*1.11***	*2.23****	*0.61*	*0.83†*
Total R^2 (%)	**31.34**	**24.15**	**40.47**	**26.26**	**13.97**	**20.51**

†p < .10, *p < .05, **p< .01, ***p < .001

Effects of experimental manipulations. As hypothesized (H1), we found a significant effect of organization type for each of the dependent variables, such that participants who read about the university agricultural department found the organization to be more trustworthy than participants who read about a corporation. We also found partial support for our second hypothesis (H2). Overall rating of organization trustworthiness (see Figure 1), rating of skepticism towards researchers, and the relative rankings of knowledge and ethics varied such that organizations that were described as engaging in more open and transparent research practices were seen as more trustworthy. However, the use of such research practices had no significant effect on ratings of researchers' competence and benevolence.

Effects of GMO attitudes. Attitudes toward GMOs also influenced perceptions of trust in the organizations researching and developing GMOs (H3). Perceptions of risks and benefits influenced perceptions of trustworthiness in the anticipated direction: higher perception of risk lead to less trustworthiness and higher perceptions of benefits lead to more trustworthiness[7]. Beliefs about the safety of GMOs only partially predicted trustworthiness: it was positively associated with ratings of organization trustworthiness and trust in researchers to be competent and benevolent, marginally positively associated with the ranking of researchers on knowledge and ethics, and not significantly related to skepticism toward researchers.

Effects of GMO policy positions and knowledge. Results regarding GMO policy positions were mixed. Participants who would like to ban all GM technology or ban just GM foods were more critical (i.e., higher skepticism scores) of researchers developing GMOs. Policy positions on labeling and regulating GMOs, however, were not related to trustworthiness. Similarly, knowledge about GMOs was also mostly unrelated to perceptions of trustworthiness.

[7] Perceptions of risk did not predict ratings of researchers' competence, but did significantly predict all other dependent variables.

The exception is self-assessed familiarity: people who reported more familiarity with GMOs were also more skeptical of the researchers working on GMOs, less likely to rate those researchers as benevolent, and more likely to give the organization that they read about lower rankings (higher numbers such as 6th and 7th versus lower numbers like 1st and 2nd) in both knowledge and ethics.

Exploratory Analyses

Although we found some support for the hypothesis that disclosing open and transparent research practices would increase trustworthiness, these findings were not very robust nor did they hold across all dependent variables. One reason that the effects of disclosing open and transparent research practices were not stronger may be due to a lack of public understanding about what the benefits are of open and transparent research practices. Although we described such practices in the press releases in a way that we hoped would make sense to the general public, our sample may not have been sure what to make of this information. To gain a sense of what the sample knew about the ubiquity of such practices, we asked participants the following two questions regarding open and transparent research practices near the end of the experiment:

1. True or False: Scientists are **usually** required to post their data publicly, so that it may be analyzed and checked by other scientists (ans: false); and
2. True or False: Scientists are **NOT** required to specify what types of analyses they are going to do before collecting their data, which allows them to try several different options before reporting their results (ans: True).

Examining participants' responses suggests that people are not really sure what typical practices are. Regarding the first item about posting data, only 19.8% of the sample correctly answered that scientists are *not* usually required to post data, whereas close to half of the sample

(48.1%) thought that scientists are required to do this (32% were uncertain). Regarding the second item about specifying analyses in advance, only 31.6% of the sample correctly stated that scientists are not required to specify the types of analyses they are going to do in advance, whereas 28.3% stated that scientists do have to do this and 40% were uncertain. Importantly, the experimental manipulations did not seem to affect participants' responses to these items: chi-square tests demonstrate that participants' responses do not vary based on the experimental condition to which they were randomly assigned (question 1: χ^2 (8) = 11.11, p = .196; question 2: χ^2 (8) = 8.21, p = .414). See Figure 1.

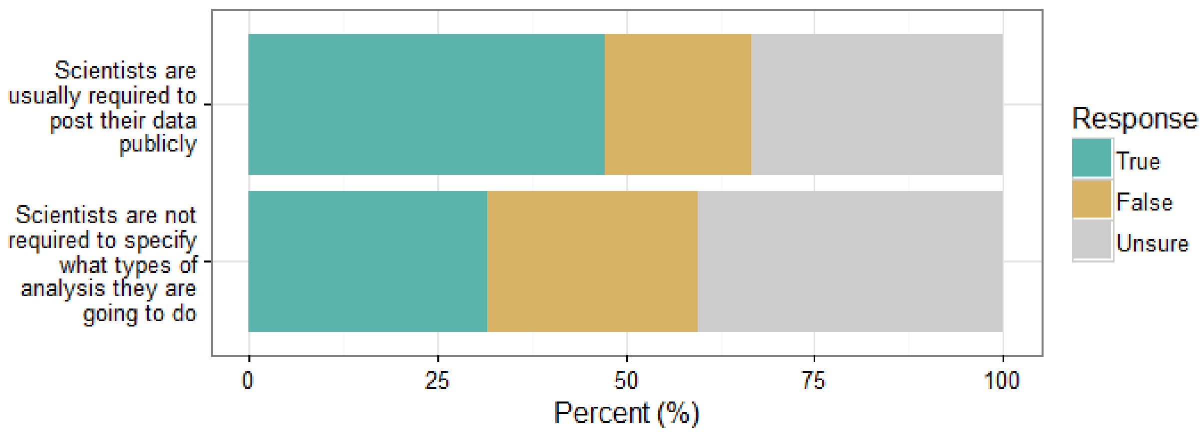

Figure 1. Percent of participants (N = 1097) responding "True", "False", or "Unsure" to the two questions about O&T research practices. The answer to the top question (about open data) is false, despite nearly 47% thinking it was true. The answer to the bottom question (about analysis transparency) is true, with the largest proportion of participants reporting that they were unsure.

These results suggest that, at least among this sample and using these questions, people are not familiar enough with what open and transparent research practices are for them to increase trust drastically. People's knowledge about the process of science and about open and transparent research practices should be further explored.

7. Discussion

The current study finds that the general public places greater trust in the ability of universities, as opposed to corporations, to provide credible, knowledgeable, and ethical research and development of GMOs. Additionally, open-science disclaimers in press releases may have a positive, albeit small and somewhat inconsistent, influence on perceived credibility. In contrast, pre-existing attitudes toward the safety, risks, and benefits of GMOs were strongly associated with the perceived credibility (knowledge and ethical behaviors) of researchers.

Although open-science disclaimers did have some positive effects on credibility, we were surprised that the effects were not larger. Two factors may have limited the influence of the current study's open-science disclaimer. First, the open-science disclaimer is small and resembles boilerplate press release material. Thus it may not have sufficiently captured participants' attention. Future research might examine the influence of more visually salient cues for open and transparent research, such as the badges designed by the Center for Open Science for attaching to research articles (COS, 2016). Second, our exploratory analyses suggest that participants may not be familiar with the distinction between open-practices and typical practices. A plurality of participants thought that data-sharing was already standard practice in research. Thus, the open-science disclaimer may have been interpreted as indicating business- as-usual. Additionally, the benefits of preregistration may still be unclear to respondents. The hazards of adjusting analysis plans after data has been collected and explored are likely too technical to be a primary cause of public distrust in corporations developing GMOs. Nevertheless, this research highlights a potential benefit of engaging in open and transparent research practices: an increase in public trust. In industries on which public opinion exerts considerable pressure on policymakers (e.g., agricultural biotechnology), an organization's ability to innovate partly rests on its ability to first elicit public trust (Hicks, 1995; Marcus, 2014).

The normative desirability of these practices is well established. As stated by Marcia McNutt, former editor-in-chief of *Science* and current president of the National Academies of Science, Engineering, and Medicine, “Nothing matters more than a good reputation in science. Always take the high road and strive for openness and transparency” (Stanford Medicine News Center, 2016). Likewise, a recent report from the National Academies of Science, Engineering, and Medicine (NASEM) recommends that gene drive research embrace transparency as a crucial component of public engagement (NASEM, 2016a), and a forthcoming report on gene-editing will likely make similar recommendations. Innovators in these biotechnology areas understand the societal implications of their research; developing and implementing these technologies will depend on productive dialogue with a wary public. Reporting the incorporation of openness and transparency into research practices can lend credibility and increase the likelihood that future research is perceived as responsible innovation rather than as industry advocacy.

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Supplementary Material A

Participants for this experiment were recruited by *Research Now*, an online data collection company, from their US Consumer panel. Data was collected between June 20 and June 27, 2016.

To compensate panel participants, *Research Now* uses an incentive-scale based on the length of the survey and the panelists profile. Panel participants that are considered “time-poor/money-rich” are paid significantly higher incentives per completed survey than the average panelist so that participating is attractive enough to be perceived as worth the time investment. The incentive options allow panel participants to redeem from a range of options such as gift cards, point programs, and partner products and services.

We requested a sample of 1200 participants. To obtain this sample, *Research Now* emailed 18,230 panelists; 1,761 opened the email, 1,659 started the survey, and 1,199 participants were coded as “completes”. In order to be considered “complete”, participants had to meet two requirements. First, we excluded participants who did not click through to the end of the survey (participants could skip questions they preferred not to answer) and submit their responses (n = 346; remaining participants = 1,313). Second, we excluded participants who were suspected of “speeding” through the survey (i.e., clicking random options to quickly get through the survey and receive their incentive payment). As the survey was designed to take 20 to 25 minutes, and the median response time was 20 minutes, participants who took less than 7 minutes (n = 58) were excluded and participants who took less than 10 minutes (but more than 7) and missed two or more of the reading check questions (n = 56) were also excluded from being coded as complete (remaining sample = 1,199).

When coding participants as complete, we did not take into account participants who took too long on the survey. Thus, 8 participants were excluded who were 2 standard deviations above the average number of minutes spent taking the survey (Original Sample: *Mean* = 33.57 minutes, *Median* = 20.05 minutes, *SD* = 134.30). In addition, 94 participants in the two open & transparent conditions who missed the manipulation check item (i.e., recognizing that the organization engaged in open and transparent research practices) were also excluded. The final sample used for analysis consisted of 1097 participants.

Supplementary Material B

Because random assignment does not guarantee that people of varying demographics will be evenly distributed amongst the conditions, we tested to ensure that each demographic variable did not vary amongst the six conditions. To do this, we used one-way ANOVAs to test the continuous variables (education, age, religion, ideology, and income) and chi-square analyses to test the binary variables (gender, Hispanic/Latino, black). No differences were found.

Table A1. Descriptive Statistics for the continuous demographic variables

	Cond 1	Cond 2	Cond 3	Cond 4	Cond 5	Cond 6	Overall
Age (in years)							
Mean	45.54	50.26	46.76	47.75	47.12	46.93	47.39
SD	16.39	17.06	16.24	15.69	16.53	16.89	16.48
Education (in years)							
Mean	13.21	13.31	13.06	13.24	13.03	13.15	13.16
SD	1.80	1.80	1.90	1.80	1.76	1.94	1.83
Income (in thousands)							
Mean	62.20	61.04	57.53	53.98	59.40	55.45	58.32
SD	43.23	43.16	38.44	40.27	38.02	37.31	39.95
Religiosity (on a scale from 0 to 5)							
Mean	2.81	2.83	3.03	2.95	3.12	3.03	2.97
SD	1.67	1.71	1.64	1.72	1.69	1.70	1.69
Ideology (on a scale from 1 to 5)							
Mean	2.90	2.95	2.96	2.81	2.98	2.88	2.92
SD	1.16	1.20	1.14	1.09	1.29	1.15	1.17

Table A2. Results from the one-way ANOVAs.

		Sum of Squares	df	F	*p*
Age	Between	1,426.03	5	1.051	0.386
	Within	296,066.99	1091		
	Total	297,493.01	1096		
Education	Between	10.12	5	0.602	0.698
	Within	3,667.53	1091		
	Total	3,677.66	1096		
Income	Between	7,535.54	5	0.944	0.452
	Within	1,477,066.42	925		
	Total	1,484,601.958	930		
Religiosity	Between	13.65	5	0.962	0.440
	Within	3,097.42	1091		
	Total	3,111.07	1096		
Ideology	Between	3.42	5	0.495	0.780
	Within	1,446.06	1047		
	Total	1,449.48	1052		

Table A3. Percentages for the binary demographic variables.

	Cond 1	**Cond 2**	**Cond 3**	**Cond 4**	**Cond 5**	**Cond 6**	**Overall**
Gender							
Female	50.3	50.7	50.3	55.6	52.2	47.6	51.0
Hispanic or Latino							
Yes	6.0	8.8	11.5	9.3	7.5	9.0	8.7
Black or African American							
Yes	15.6	15.4	16.0	16.6	16.9	14.3	15.8

Table A4. Results from Chi-Square analysis

	χ^2 Value	**df**	***p***	**Phi**
Gender	2.446	5	.785	.047
Hispanic/ Latino	4.259	5	.513	.062
Black or African American	0.642	5	.986	.024

Supplementary Material C

Attitudes toward GMOs

To measure attitudes toward GMOs, we asked participants what they thought about the safety of GMOs, about several potential risks and benefits of GMOs, about banning GM technology, about labeling GMOs, about regulating GMOs, and whether the participant avoids eating GMOs.

Safety. Participants were asked to state whether they believed that GMOs were safe where 4 was “GMOs are as safe as conventional crops” and 0 was “GMOs are NOT as safe as conventional crops” (M = 1.94, Med = 2.0, SD = 1.19). A one-way ANOVA shows no significant differences between perceptions of GMO safety across the six conditions, $F(5, 1091) = 0.490$, $p = .784$.

Risks and Benefits. Participants to rate a set of four specific potential risks and four specific potential benefits of GMOs. Participants first had to say “how likely this is to be a real risk/benefit from GMO technology”. The responses for this item were coded to be a proxy for the participant’s perception of base rate, where we coded not at all likely as .25, somewhat likely as .50, and very likely as .75. Then, participants were asked to rate “how dangerous/helpful is this risk/benefit, if it is a true risk/benefit”. These responses were coded to be degree of dangerousness or helpfulness, where we coded a little dangerous/helpful as 1, moderately dangerous/helpful as 2, and extremely dangerous/helpful as 3. We then multiplied these two values together, allowing us to weight each of the perceptions of how helpful a benefit or dangerous a risk is with the perceived base rate.

The four risk items were: increased herbicide use, increased allergens, antibiotic resistance, and unpredictability. These items were internally consistent (alpha = .82) and loaded onto one factor in a principal axis factor analysis. Moreover, the items generally show similar relationships as one another with age, education, and safety[8].

The four benefit items were: improving nutrition, saving crops from viruses, combatting disease, and protecting the environment. These items also loaded onto one factor and had high internal consistency (alpha = .85). Moreover, like the risk items, the benefit items show similar relationships as one another with age, education, and perceptions of safety.

Therefore, we combined these items into an averaged index of GMO risk perceptions (M = 1.32, *Median* = 1.25, SD = 0.55) and an averaged index of GMO benefit perceptions (M = 1.31, *Median* = 1.25, SD = 0.56), both of which were on a scale from 0.25 to 2.25. One-way ANOVAs show no significant differences of GMO risk perceptions or GMO benefit perceptions across the six conditions: GMO risks: $F(5, 1091) = 1.18$, $p = .319$; GMO benefits: $F(5, 1091) = 1.35$, $p = .239$.

Banning GMO Technology. Participants were also asked whether GMO technology should be (a) banned in all circumstances, (b) banned for making food items, but allowed for making non-food items, or (c) should not be banned. We recoded this into two variables: one representing whether the participant believes in banning all GM technology (10.8% of the sample) and one representing whether the participant believes in banning GM food only (40.8% of the sample). A chi-square test showed no significant differences in proportion of participants supporting the banning of all GM technology across the six conditions, $\chi^2(5) = 1.43$, $p = .921$. In addition, a chi-square test showed no significant differences in proportion of participants supporting the banning of GM foods across the six conditions, $\chi^2(5) = 6.68$, $p = .246$.

8 Relationships with age and education are all non-significant except for the risks of antibiotic resistance item, which was significantly, positively related to education (r = .06, p = .03) and age (r = .09, p = .005).

Labeling GMOs. Participants were told that some people believe GMOs should be labeled because it gives consumers a choice in what they purchase and eat, whereas other people believe products containing GMOs should NOT be labeled because it intensifies the misperception that GMOs on the market are toxic or allergenic (the order of these two beliefs was randomized between participants). Then, participants were asked whether products containing GMOs should or should not be labeled. About 90% of participants said that GMO products should be labeled. A chi-square test showed no significant differences in proportion of participants supporting the labeling of GMOs across the six conditions, χ^2 (5) = 4.21, p = .519.

Regulating GM Technology. Participants were told that some people believe that the Environmental Protection Agency (EPA) and the Food and Drug Administration (FDA) should strictly regulate GMOs to make sure that there are no environmental or health risks, whereas other people believe that GMOs should NOT be regulated because they have been shown to be as safe as conventional crops and conventional crops are not regulated (the order of these two was randomized between subjects[9]). Then, participants were asked whether GMOs should be regulated or not. About 85% of participants in the study said that GMOs should be regulated. A chi-square test showed no significant differences in proportion of participants supporting the regulation of GMOs across the six conditions, χ^2 (5) = 2.77, p = .736.

Avoid eating GMOs. Participants were asked if they purposefully avoid eating GMOs or not (regardless of whether or not they have ever eaten GMOs). About 34% of participants in the study said that they purposefully avoid eating GMOs. A chi-square test showed no significant differences in proportion of participants avoiding GMOs across the six conditions, χ^2 (5) = 4.47, p = .484.

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[9] The order of the presented beliefs about labeling that were described prior to asking participants what their own beliefs about labeling did not influence participants' responses, χ^2 (1) = .457, p = .499.

GMO Knowledge

To measure knowledge about GMOs, we asked participants how much they have heard about GMOs (i.e., familiarity), what they believe is the scientific consensus of GMO safety, and what process is used to make GMOs.

Familiarity. Participants were asked how much they would say that they have heard or read about GMOs on a scale from 1 (not very much at all) to 5 (a great deal). Participants across all conditions had a *mean* familiarity of 3.11 ("some") and a *SD* = 1.11. A one-way ANOVA showed no significant differences in familiarity with GMOs across the six conditions, $F(5, 1185) = 0.712$, $p = .615$.

Process. Participants were asked, to the best of their knowledge, which best describes the process used to create genetically-modified organisms[10]:

- Plants are mated or cross-pollinated with other plants in order to create more desirable traits [*cross-pollination*].
- Plant genomes are subjected to radiation treatments to induce changes to genes in order to create more desirable traits [*mutagenesis*].
- A specific gene or sequence of genes is targeted and either "turned-off", "turned-on", or exchanged to create more desirable traits [*gene-editing*].

We dummy coded the variable so that we had a variable for those who thought it was mutagenesis (10.4%) and one for those who correctly chose gene-editing (45.3%). A chi-square analysis showed no significant differences in proportion of participants choosing mutagenesis across the six conditions, $X^2(5) = 3.33$, $p = .650$; nor was there significant differences in the

[10] The labels shown here in brackets were not shown to participants.

proportion of participants choosing genetic-engineering across the six conditions, $X^2(5) = 8.40$, $p = .136$.

***Consensus*.** Participants were also asked what most scientists view of the safety of GMOs is on a scale from -2 (GMO's are not as safe to eat as conventional crops) to 2 (GMOs are as safe to eat as conventional crops), with "uncertain about the safety of GMOs" (0) in the middle. We recoded this variable into one called "consensus", such that the two responses that indicated that GMOs are as safe to eat as conventional crops (2 and 1) were given a 1 and the other responses were given 0s. A little over half of the subjects recognized that scientific consensus currently is that GMOs are as safe to eat as conventional crops (51%). A chi-square analysis showed no significant differences in proportion of participants correctly recognizing what the scientific consensus is across the six conditions, $\chi^2(5) = 6.71$, $p = .243$.

Supplementary Material D

Example press releases used in the experiment.

VIRENS

FOR IMMEDIATE RELEASE

Virens Develops Vistive Gold® Soybeans
Thursday, May 26, 2016
Carlisle, PA

CARLISLE, PA – Virens, a sustainable agriculture corporation, announced the development of Visitive Gold® Soybeans.

The new soybeans benefit the consumer by offering an improved nutritional profile with zero trans fats and reduced saturated fats.

Research Practices

Virens now partners with the Center for Open Science (COS), a non-profit dedicated to fostering the integrity and reproducibility of scientific research. As part of this partnership, Virens has adopted COS research guidelines. We now:

- pre-register our research studies (reporting in advance what we plan to do);
- make our data available to the public; and
- explain all of our methods for analyzing our data.

> ***"These guidelines are aimed at making sure our research upholds the values of scientific integrity. We pledge to make information available, accessible, and understandable."***
>
> *J. Smith*
> *Virens CEO*

For more information about the Center for Open Science visit http://cos.io.

○ Please check this box when you have read the press release and are ready to continue.

Figure B1. Experimental Stimuli for the Open and Transparent Corporation Condition (Condition 2).

Penn
University of Pennsylvania
College of Agriculture and Life Sciences

FOR IMMEDIATE RELEASE

Penn College of Agriculture and Life Sciences Develops Vistive Gold® Soybeans
Thursday, May 26, 2016
Philadelphia

PHILADELPHIA – The University of Pennsylvania College of Agriculture and Life Sciences (CALS) announced the development of Visitive Gold® Soybeans.

The new soybeans benefit the consumer by offering an improved nutritional profile with zero trans fats and reduced saturated fats.

Research Practices

CALS pledges to take responsibility in achieving results. This pledge includes

- Building strong relationships with our external partners;
- Making wise decisions; and
- Taking responsibility for achieving agreed-upon results.

> ***"Our research and development team is dedicated to developing seeds that make growing vegetables easier for farmers while also meeting the needs of everyone in the produce chain —including retailers, food service, and consumers."***
> *J. Smith, Dean of CALS*

For more information about Vistive Gold soybeans, visit Visitvegold.com or your local Asgrow® or Channel® seed dealers.

Please check this box when you have read the press release and are ready to continue.

Figure B2. Experimental Stimuli for the Baseline University Agricultural Department Condition (Condition 3).

MONSANTO

FOR IMMEDIATE RELEASE

Ag Processing Inc and Monsanto partnering to bring Iowa farmers Vistive® Gold High Oleic Soybeans
Monday, August 24, 2015
St. Louis

ST. LOUIS – Monsanto announced today that Ag Processing Inc (AGP) will participate in the 2016 pilot introduction of Monsanto's Vistive® Gold high oleic soybeans.

The new soybeans benefit the consumer by offering an improved nutritional profile with zero trans fats and reduced saturated fats.

Research Practices

Monsanto pledges to take responsibility in achieving results. This pledge includes

- Building strong relationships with our external partners;
- Making wise decisions; and
- Taking responsiblity for achieving agreed-upon results.

> ***"Our research and development team is dedicated to developing seeds that make growing vegetables easier for farmers while also meeting the needs of everyone in the produce chain–including retailers, food service, and consumers."***

To learn more about Monsanto, our committments, and our more than 20,000 dedicated employees, please visit discover.monsanto.com and monsanto.com.

○ Please check this box when you have read the press release and are ready to continue.

Figure B3. Experimental stimuli for the real corporation condition using material from the corporation's website.

The Society for American Baseball Research 46: Tony Perez, Jeff Conine, Juane Pierre added as featured speakers
Friday, June 3, 2016
Miami

Miami. The Society for American Baseball Research has just confirmed that Hall of Famer Tony Perez will be joining his son, ESPN analyst Eduardo Perez, on the SABR 46 pregame ballpark session, scheduled for Friday, July 29 at Marlins Park, along with Barry Bonds, Don Mattingly, and Hall of Famer Andrew Dawson.

The special block of Marlins games tickets will only be available for purchase until June 13.

For the 2003 Marlines Championship panel, scheduled for Thursday, July 28 at the Hyatt Regency Miami, former outfielders Juan Pierre and Jeff Conine will join manager Jack McKeon and broadcaster Dave Van Horne for the look back at the Marlin's World Series-winning season.

The 2016 national convention willl be held July 27-31 at the Hyatt Regency Miami in downtown Miama, Florida. Early registration is only available through Monday, June 13 at SABR.org/convention.

Please check this box when you have read the press release and are ready to continue.

Figure B4. Experimental stimuli from control condition using material taken from the organization's website.

Supplementary Material E

Table C1. Items from Critchley (2008) and our changes. Our changes are in red. Items that were not changed have an asterisk at the beginning. Items that were not used are crossed out. All items began with the stem: *"How likely do you think it is that most of the researchers from [organization]…"* Respondents answered on a six-point scale from highly unlikely to highly likely. Higher scores indicate higher agreement with the statement.

variable	Item	Mean (SD)
money	are primarily motivated by money/ financial interests?	4.11 (1.30)
	~~Motivated to win prizes and awards~~	
	~~Study things primarily because it will benefit their careers~~	
	~~Enjoy being treated as important people~~	
media	~~Like having~~ seek media attention	3.81 (1.33)
	~~Want to be famous and well known~~	
	~~want to make life better for ordinary people~~	
society	Want to improve ~~Australian~~ society	4.20 (1.22)
contrib	*Want to contribute towards the understanding of our world	4.17 (1.23)
unethical	Use unethical research methods [Rev coded]	4.11 (1.27)
honest	*Are honest about the results of their research	4.26 (1.14)
health	Consider ~~the well being of those who participate in their research~~ how their research influences the health and well-being of the American public.	4.12 (1.29)
	~~Are truly interested in finding out about the things they study~~	
	~~Are naturally curious about their work~~	
	~~Have a true passion for their area of work~~	
intellect	*Are very intelligent people	4.75 (1.01)
	~~Have a natural talent for their particular area~~	
train	*Are highly trained in what they do	4.67 (1.04)
hack	Are encouraged by higher ranking members of [org] to "bend the rules" when conducting research in order to report results that would be more profitable.	3.48 (1.36)
work	work at [org] because they were not good enough to get jobs somewhere else? [Rev coded]	2.53 (1.25)
expert	are top experts in their field?	4.31 (1.08)
know	know a lot about their areas of study?	4.84 (0.97)