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# **Surveying the Landscape: Public Relations, Advertising, and Marketing Scholarship for Public Engagement with Basic Science**

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# Executive Summary

## Introduction

A number of scholars have recently reviewed the science communication literature to identify scholarship relevant to basic science. This complementary report summarizes the evidence base for applications of public relations, advertising, and marketing to basic science contexts. Two queries were developed to search the Web of Science database for research articles focused on strategic applications of public relations, advertising, and marketing to public engagement with basic science. Top science communication, public relations, advertising, and marketing journals were searched for relevant articles from each journal's inception through April 1, 2023. The final sample resulted in 92 relevant articles.

## *Key Insights and Implications*

1. The review revealed that scholarship in this domain has existed for at least 27 years, and although the volume of research is small, it has increased over time.
2. Articles focused on macro-level reflections and observations about disciplines and avenues to move research and practice forward, and observations about organizations, professionals, audiences, and communication strategies.
3. While there has been some scholarly interest in strategic approaches to public engagement with basic science, the findings demonstrate that the literature is unable to provide generalizable explanations, predictions, or recommendations at this point.

There has been some scholarly interest in such topics, and perhaps some of this literature exists in spaces that are not explicitly defined as “strategic,” “public relations,” “advertising,” or “marketing.” Nonetheless, there are opportunities for practitioners to apply core theories and findings related to strategic communication management (which may not have been developed for federal or basic science contexts), and other scholarly domains in communication (e.g., organizational communication, institutional communication, internal communication, and media psychology) can provide practical guidance and should inform future research agendas.

## *Next Steps*

Although the evidence base is limited in its ability to generalize how federal science agencies might incorporate the principles of integrated marketing communication to engage the public with basic science, practitioners can look to contemporary theories of public relations, advertising, and marketing to understand principles of public opinion, persuasion, and relationship management; practitioners can look to professional associations' ethical codes of conduct to guide decision-making and strategies related to public engagement. Future research should inquire how integrated marketing communication principles and practices may be ethically and legally integrated into federal science contexts and how such approaches may effectively engage the public with basic science.

# Introduction

There is substantial scholarship available to inform science communication and public engagement with science practices and scientific advances. However, this literature typically focuses on applied science and technology, medicine and health, and controversial or contested science-related issues. What evidence is available to inform public engagement in the context of basic science? Here, “basic science” (also called discovery, curiosity-driven, or fundamental science) refers to research studies without intention or immediate expectation to yield a specific application, such as the development of more energy-efficient batteries or a new vaccine.

In 2021, The Kavli Foundation, as part of the Science Public Engagement Partnership with the U.S. Department of Energy Office of Science, commissioned two landscape studies to assess what scholarly literature reveals about public engagement with basic science. Newman et al., 2021 examined the evidence base for public engagement scholarship in basic science journals. Of the 1.5 million science communication publications they found, fewer than 50 focus on communicating basic science. Besley et al., 2021 examined the evidence base for public engagement scholarship in key science communication journals. They found that less than 5% of the public engagement publications focus on how or why to communicate about basic science.

The landscape study findings are the first to show the paucity of evidence to inform public communication or engagement in the context of basic science. However, basic science journals and science communication journals do not represent the totality of available communication evidence. Advertising, public relations, and marketing scholarship are additional bodies of knowledge and research effort that could provide insight on science communication and public engagement.

Advertising is the organizational function tasked with communicating with target audiences in order to promote brands, products, and services. Marketing is concerned with consumers, suppliers, and retailers (among other audiences) to increase sales and profits. Public relations is the organizational function concerned with establishing and maintaining mutually beneficial relationships with all publics for the benefit of the entire organization (Kelleher, 2021). These disciplines—often referred to collectively as “corporate communication” or “integrated marketing communication” (IMC)—conceive of communication as a strategic, ethical process through which communicators may influence and develop authentic relationships with audiences. For conciseness, IMC is used in this report to refer to the combination of advertising, public relations, and marketing.

Although terms like public relations, advertising, and marketing can carry negative connotations (and oftentimes for good reason), modern IMC disciplines are informed by scientific bodies of literature, are guided by theories and ethical codes of conduct, and are committed to ethical and strategic communication for the mutual benefit of communicators and audiences. Moreover, IMC approaches can be used ethically and effectively, and perhaps can produce favorable outcomes such as increased interest in and support for basic science, more favorable attitudes toward science, interest in pursuing science careers, and even public behavior change.

Although IMC approaches *can* be helpful for organizations and professionals engaging the public with basic science, it is unclear what evidence exists to inform how to do so. During the past two decades, the public engagement with science literature has grown more substantial, programmatic, and systematic. However, it is unclear whether a specific evidence base exists that informs the use of IMC techniques to public engagement with basic science. This study is a systematic review of IMC evidence on public engagement with basic science, with particular attention to how U.S. federal science agencies engage the public with basic science supported by public funding.

## Approach

To conduct a systematic review of the IMC literature, 2022 SCImago Journal & Country Rankings were used to determine science communication, public relations, advertising, and marketing journals to include in the analysis. Only journals accessible through The University of Alabama's Web of Science database subscription were considered. Web of Science was used because it "is the world's oldest, most widely used and authoritative database of research publications and citations" (Birkle et al., 2020, p. 363).

Individual research articles were used/considered as the unit of analysis. For a journal article to be included in the analysis, the article needed to focus on some direct form of public engagement with science or needed to focus on some explicit implication(s) for public engagement with science (e.g., training science communication practitioners). Articles were excluded from the analysis if they focused solely on applications of basic science to consumer engagement with no explicit implications for engagement with science (e.g., applications of neuroscience and biometrics to study advertising effectiveness); articles also were excluded if they focused solely on management issues related to research and development processes without explicit implications for public engagement with science (e.g., research focused on improving industrial research and development processes). Each article was manually coded for whether or not it met the criteria for inclusion; the researcher read each article abstract to determine whether or not criteria for inclusion had been met.

An initial query was constructed in the Web of Science database to discover articles that may incorporate advertising, public relations, or marketing perspectives in science communication journals. Search terms (i.e., "public relations" OR "advertis\*" OR "marketing" OR "strategic communication") were used to search research article titles, abstracts, and/or key words in four science communication journals from each journal's inception through April 1, 2023. Building from Besley and colleagues' (2021) landscape study, the science communication journals examined in this report were *Public Understanding of Science*, *Science Communication*, *Journal of Science Communication*, and *International Journal of Science Education, Part B: Communication and Public Engagement*. These journals were examined because of their inclusion in the Besley et al. (2021) landscape study. The search among science communication journals resulted in 58 articles.

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A second query was constructed to search for the inclusion of basic and/or federal science in public relations, advertising, and marketing journals from each journal’s inception through April 1, 2023. Research article titles, abstracts, and/or keywords were searched using the following search terms input into the Web of Science database:

"basic science" OR "basic research" OR "discovery research" OR "discovery science" OR "government science" OR "government research" OR "federal science" OR "federal research" OR "chemistry" OR "physics" OR "neuroscience" OR "nano" OR "nanotechnolog\*" OR "astronom\*" OR "astrophysic\*" OR "NASA" OR "National Aeronautics and Space Administration" OR "NSF" OR "National Science Foundation" OR "Department of Agriculture" OR "Dept. of Agriculture" OR "DOD" OR "Dept. of Defense" OR "Department of Defense" OR "Association of the American Medical Colleges" OR "DOE" OR "Dept. of Energy" OR "Department of Energy" OR "DHHS" OR "Dept. of Health and Human Services" OR "Department of Health and Human Services" OR "NIH" OR "National Institutes of Health" OR "Dept. of Commerce" OR "Department of Commerce"

Public relations journals that were accessible through Web of Science included *Journal of Public Relations Research*, *Public Relations Review*, *Public Relations Inquiry*, and *Journal of Communication Management*. Advertising journals included *Journal of Advertising*, *International Journal of Advertising*, *Journal of Advertising Research*, and *Journal of Current Issues and Research in Advertising*. There were a substantial number of marketing journals that could have been included in the systematic review; in addition to the aforementioned criteria, marketing journals also needed to have an impact factor above 1.0 (to access leading marketing journals that presumably have the most impact) to be considered in the current review. Table 1 lists the marketing journals searched for articles to be included in the current review.

**Table 1. Marketing Journals included in the Systematic Review**

<i>Australasian Marketing Journal</i>	<i>Journal of Business Research</i>	<i>Journal of Marketing</i>	<i>Journal of Social Marketing</i>
<i>European Journal of Marketing</i>	<i>Journal of Consumer Culture</i>	<i>Journal of Marketing Analytics</i>	<i>Journal of Strategic Marketing</i>
<i>Industrial Marketing Management</i>	<i>Journal of Consumer Marketing</i>	<i>Journal of Marketing for Higher Education</i>	<i>Journal of the Academy of Marketing Science</i>
<i>International Journal of Consumer Studies</i>	<i>Journal of Consumer Psychology</i>	<i>Journal of Marketing Management</i>	<i>Journal of the Association for Consumer Research</i>
<i>International Journal of Market Research</i>	<i>Journal of Consumer Research</i>	<i>Journal of Marketing Research</i>	<i>Marketing Letters</i>
<i>International Journal of Research in Marketing</i>	<i>Journal of Interactive Marketing</i>	<i>Journal of Marketing Theory and Practice</i>	<i>Marketing Science</i>

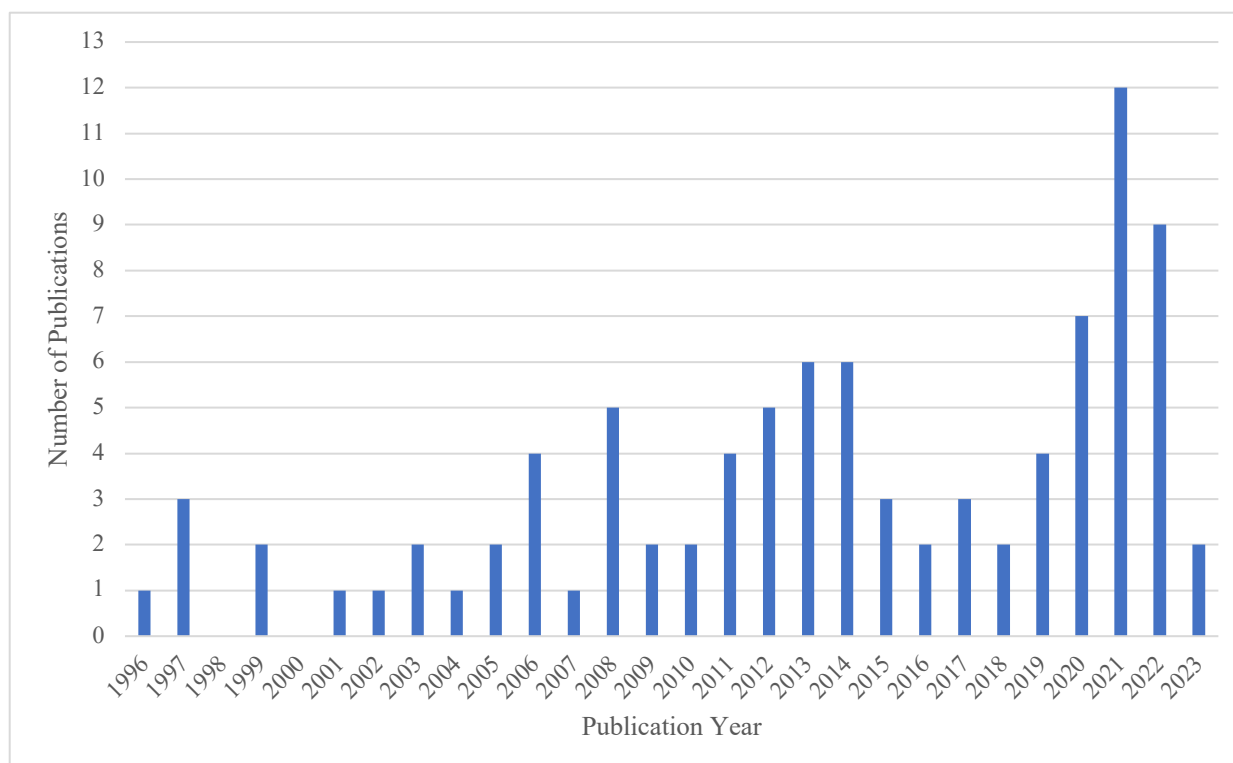
<i>International Marketing Review</i>	<i>Journal of International Consumer Marketing</i>	<i>Journal of Product and Brand Management</i>	<i>Marketing Theory</i>
<i>Journal of Brand Management</i>	<i>Journal of International Marketing</i>	<i>Journal of Research in Interactive Marketing</i>	<i>Social Marketing Quarterly</i>

Top-ranked journals in advertising, public relations, and marketing targeting precise audiences and tailored to precise topics such as information management, supply chain management, retail, and tourism were excluded from consideration due to their presumed lack of focus on (or consideration of) public engagement with science. Overall, the search among advertising, public relations, and marketing journals resulted in 225 articles initially.

The final sample included in this systematic review resulted in 92 articles, including 58 science communication articles (100% of initially downloaded science communication articles; 63.04% of the final sample), 25 marketing articles (13.23% of initially downloaded marketing articles; 27.17% of the final sample), 9 public relations articles (56.25% of initially downloaded public relations articles; 9.78% of the final sample), and 0 advertising articles.

## **FINDINGS**

Figure 1 demonstrates the volume of publications over time. As the figure demonstrates, there has been at least some scholarly attention to IMC approaches to public engagement with basic science for about the past 27 years. Scholarly attention to public engagement with science in these domains has increased consistently over time.



**Figure 1. The Number of Publications Over Time.**

A qualitative thematic analysis was conducted to understand and describe research themes emergent within the sample of articles. Analysis revealed scholarship focused on *macro-level reflections and observations* about systems, disciplines, and avenues to move research and practice forward, and observations about *organizations, professionals, audiences, and communication strategies* including scholarship about messaging, specific campaigns, and interventions. Each of these themes and exemplar studies are described next; particular attention is given to research clearly focused on strategic applications to public engagement with science. Some articles in the sample held clear implications for public engagement with science but focused on less pertinent issues such as journalistic coverage of the scientific community without strategic intervention (e.g., Peters et al., 2008); consequently, less pertinent results are not emphasized in the findings section.

### **Macro-Level Observations**

Articles featuring macro-level observations included discipline-level discussions and reflections in consideration of future avenues for research and practice. For example, one article reflected on the state of public engagement with science scholarship and policies in general (Irwin, 2014). Two articles discussed how integrating a public relations perspective with science communication could advance research and practice related to public engagement with science, issues management with science, and science communication practitioner roles and training (Roberson, 2020; VanDyke & Lee, 2020). Another article considered how the public relations profession could engage challenges associated with climate change to enhance the profession’s reputation (McKie & Galloway, 2007).



## **Audiences**

Much of the audience research identified in this report focused on consumers and individual differences in risk information processing. For example, articles examined how individuals process numeric information to estimate risk (Raghubir, 2008), factors that influence risk and benefit perceptions related to new technologies (Costa-Font & Gil, 2012), and perceived barriers and benefits to motivate clinical trial participation (Hennink-Kaminski, Willoughby, & McMahan, 2014). Consumer-related research focused on consumer perceptions and knowledge about nanotechnologies (Reisch, Scholl, & Bietz, 2011), how consumers' scientific awareness impacts their understanding of scientific claims in advertising (Dodds, Tseïlon, & Weitkamp, 2008), the impact of environmental concern on pro-environmental consumer behavior (Minton & Rose, 1997), and the impacts of genetically modified ingredient labeling and environmental benefit labeling on consumers' willingness to purchase (Kwak, Yoon, & Kim, 2020).

## **Professionals**

Some studies examined communication practices and perceptions of various science and science communication professionals. Many articles focused on scientists and technical professionals. A few examples include: Examinations of how toxic-exposure epidemiologists use hedging language in their articles to manage professional risk (Rier, 1999); U.K.-based medical researchers' perceptions of the impact values associated with public engagement with science and technology (Watermeyer, 2012); and how universities' desire for institutional visibility influences scientists' willingness to engage news media (Marcinkowski et al., 2014). Other research focused on the role of strategy in science communication among scientists, including observations about scientists' perceptions of communication objectives (Besley, Dudo, & Yuan, 2018) and their willingness to use various communication tactics (Besley et al., 2021); and scholars' goals for public engagement (Besley et al., 2020). One article examined how informal risk communicators, such as commercial pesticide applicators, have opportunities to engage the public with risk (Rickard, 2011). Still, many scholars examined the roles of communication and marketing practitioners themselves. This includes research on how science bloggers and science podcasters approach strategy in strategic science communication (Yuan & Besley, 2021; Yuan, Kanthawala, & Ott-Fulmore, 2022), and research demonstrating that science communication trainers are more likely to focus on communication skills rather than communication objectives (Besley et al., 2016). Other research documented higher education communication practitioners' perceptions of their professional roles (Fürst et al., 2022), public information officers' use of crisis communication best practices in public health emergency press releases (Avery & Kim, 2009), and language strategies used by science buyers and sellers in business-to-business nanotechnology sales (Dean, 2021; Dean, Ellis, & Wells, 2017).

## **Organizations**

Many articles focused on organizations and their roles in public engagement with science. Articles examined strategies for successful research and development collaborative organizations (Daniel, Hempel, & Srinivasan, 2002), how Japanese research organizations' public relations efforts seem to balance organizational and journalists' needs (Koso, 2021), and how research

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organizations and universities use websites to promote science (Lederbogen & Trebbe, 2003). Articles examined how science institutions use social media to engage publics during science festivals (Su et al., 2017) and how the Oxford Brookes Science Bazaar converted to a virtual format amid the COVID-19 pandemic, including analyses of which activities were most engaged and how engagement compared to the physical event (Balestri et al., 2022). Related research examined how science communication fellowship programs compare to science communication training programs (Bennett, Dudo, & Besley, 2023); the researchers identified opportunities for programs to better evaluate program effectiveness, incorporate strategy, and collaborate with other programs.

Some articles examined how specific science institutions engaged the public with science. These included a study on the U.S. National Academy of Sciences' efforts to engage the public with earth, atmospheric, and oceanic sciences in preparation for the International Geophysical Year (Korsmo, 2004), a case study of a German science diplomacy program that identified opportunities for academic-politician collaboration (Fährnich, 2017), and an article that identified opportunities for the European Space Agency to enhance public engagement with stakeholders (Pfleger, Gerber, & Struck, 2022). Public relations journals featured multiple case studies examining NASA's public relations efforts around crises related to the Hubble Space Telescope (Kauffman, 1997), Apollo 1 (Kauffman, 1999), Apollo 13 (Kauffman, 2001), and the *Challenger* and *Columbia* tragedies (Kauffman, 2005; Martin & Boynton, 2005). The findings demonstrated opportunities for NASA to follow crisis communication best practices and also highlighted successes when the agency followed best practices in later crises.

Other research focused on industry relations and corporations. For example, one study included an analysis of how a trade association contributed to public discourse around the high fructose corn syrup debate; findings suggested that trade associations may help bridge tensions between commercial interests and health promotion (Heiss, 2013). Some research focused on medical contexts, including an examination of biomedical public relations efforts demonstrating that although stories that appeal to journalists are more likely to be covered, press releases tended to favor interests of internal science audiences (Lynch et al., 2014). Another article analyzed cosmetic surgery providers' consumer-facing qualification and board certification information displayed online (Goodman, 2019). Other research focused on how small nanotechnology firms work to develop brand identity and reputation (Huang-Horowitz, 2015) and how the opportunities and uncertainties of nanotechnology are communicated to investors by marketing professionals through financial media (Ebeling, 2008). Corporate-centric research included critical examinations of corporations' communication strategies in science contexts (e.g., in the context of COVID-19) (Murphy, 2021), marketers' promotion of radioactive products in Sweden from 1910 to 1940 (Eriksson & O'Hagan, 2021), and a corporation's portrayals of the value of science to society, which primarily tied scientific expertise to national security and prosperity (Terzian & Shapiro, 2015).

Less research focused on the science communication activities of nonprofits and activists, but such research included an examination of social media message framing strategies used by global climate nonprofits (Vu et al., 2021) and strategies used by an activist campaign protesting genetically modified food (Bloomfield & Doolin, 2013).

## Communication Strategies

Research findings focused on communication strategies demonstrated the implications of specific message strategies, campaigns and interventions on public engagement with science outcomes. Some articles focused on demonstrating the value of storytelling as a communication strategy, including a rhetorical analysis of a whale watching video to illustrate the power of visual storytelling (Finkler & Leon, 2019) and a research commentary focused on the use of storytelling for co-creation of culturally appropriate, engaging content (Villar, 2021).

Some articles focused on the efficacy of specific campaigns and approaches, including an analysis of how the Substance Abuse and Mental Health Services Administration uses a social marketing approach to engage communities around children's mental health issues (Rubenstein et al., 2018) and an examination of a student-produced campaign to promote fruit and vegetable consumption (Tanner et al., 2008).

## DISCUSSION

As the breakdown of articles included in the final sample indicates, a limited body of evidence exists regarding IMC approaches to public engagement with basic science. This resembles the findings of Newman et al. (2021) who demonstrated that public engagement scholarship rarely appeared in STEM journals, and the findings of Besley et al. (2021) who documented the lack of a robust literature in science communication journals specific to communicating basic science. The bulk of evidence informing IMC approaches to public engagement with basic science exists in science communication journals; however, a small footprint exists in marketing and public relations journals, too. There was no evidence of scholarly attention to public engagement with basic science in advertising journals; although there was substantial interest in both marketing and advertising journals in the application of basic behavioral sciences and neuroscience to better understand human (i.e., often consumers') behavior.

Based on the current review, contributions to macro-level reflections/observations primarily focused on the opportunities afforded by public relations (rather than marketing or advertising) to enhance public engagement with science, and how the public relations profession can lead on issues like climate change. This is unsurprising given modern public relations' focus and orientation toward ethical, authentic relationship-building, engagement, and strategy. Given these findings, future research also might consider opportunities for marketing and advertising to uniquely contribute to the strategic science communication ecosystem.

The literature reviewed here explored the communication strategies of many types of organizations, including research organizations, nonprofits, corporations, government agencies, and activists. However, most of this literature seemed to focus on relatively basic lines of theoretical inquiry (e.g., implications of research organizations' media relations efforts) and theoretically narrow lines of inquiry (e.g., how NASA implements crisis communication) compared to more comprehensive assessments of communication programs or consideration of the full repertoire of IMC approaches, theories, and frameworks that are or could be implemented to realize and analyze strategic engagement with basic science. This aligns with Besley et al.'s (2021) finding that most "basic science" articles in science communication

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journals focus on precise topics rather than building generalizable knowledge. Seemingly, literature examining the role of various professionals and their perceptions and practices related to strategic science communication is the most programmatic and developed research agenda in this area. Moreover, the literature on audiences and communication strategies was comparatively scant, and often focused on consumers' risk perceptions and information processing and case studies of specific interventions and campaigns. Opportunities exist to more fully understand all audiences and stakeholders for basic science and the communication strategies that can successfully and ethically engage them with basic science.

The literature around strategic approaches to public engagement with basic science is unable to provide generalizable explanations, predictions, and recommendations for engaging the public with basic science at this point. This conclusion suggests there has been intermittent scholarly interest in such topics, or perhaps literature exists in spaces that are not explicitly defined as “strategic,” “public relations,” “advertising,” or “marketing”—perhaps due to negative connotations associated with such terms or perceived tensions with “science” being associated with such terms. Regardless, the findings demonstrate a need for a systematic research program in strategic, ethical approaches to public engagement with basic science, and seemingly, there are opportunities for a public engagement with basic science literature to connect with other domains of communication literature. For example, scholarship in organizational communication, institutional communication, internal communication, and public relations may inform research agendas focused on issues such as the role of organizational structures in facilitating public engagement with basic science, and how communication can be used to facilitate internal collaboration around basic science. Similarly, the media psychology and media processes and media effects literatures can inform message design and communication strategies, including the implications for basic science of using specific message content (e.g., fear appeals), structural features (e.g., the use of narrative), and source factors (e.g., implications of a message being delivered by a scientist compared to a public information officer).

Although this report begins to document the meager evidence base for IMC applications for public engagement with basic science, it is not without limitations. The analysis reported here is limited given that research articles related to public engagement with science that did not explicitly use one of the key words required for inclusion in the analysis (e.g., articles cataloged in the broader communication and persuasion literature examining message content and structural features in science contexts, but not explicitly acknowledged as strategic communication) were not accounted for in this report. Moreover, the current review's focus on specific journals (which necessarily excluded others) and reliance on the Web of Science database means that relevant literature presumably exists in other disciplinary journals, including those journals not cataloged by Web of Science, and in those journals that were otherwise not included in the current review. Undoubtedly, literature that is relevant to informing strategic approaches to public engagement with basic science—due to being studied in science contexts or because the research may be generalizable to science contexts—exists outside of this review. Similarly, articles were likely omitted due to the lack of a common lexicon, perhaps among academics who do not use common terms to refer to the same concepts of interest (e.g., “communication”, “engagement”, “outreach”, “education”, and “impact”). Some standardization of a common lexicon around public engagement (e.g., in academic journals) would be helpful in organizing the current evidence base and for informing future research and practice. Nonetheless,

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future research should work toward a more programmatic understanding of how IMC approaches can and should be used to ethically and effectively engage the public with basic science.

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