OPINION

Opinion: Lay summaries needed to enhance science communication

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At first blush, the notion of lay summaries seems a simple idea with admirable aims: Scientists write summaries of journal articles emphasizing the broad significance of research in accessible language. However, viewed from an ivory tower that has been besieged by an increasing amount of paperwork, scientists could easily regard lay summaries as just one more hurdle in peer-reviewed publishing, another administrative task to fit into an already busy agenda.

But rather than an unrewarding burden, scientists (and journal publishers) should consider widespread adoption of lay summaries—accompanying online publications and made publicly available with traditional abstracts—as a way to increase the visibility, impact, and transparency of scientific research. This is a particularly important undertaking given the changing science media landscape.

There are clear professional benefits to increasing visibility of one's own research through broad communication. Disparate studies show consistent connections between public communication, increased visibility of research, and greater numbers of citations (e.g., refs. 1 and 2). Concerns voiced by scientists that public communication is time-consuming, too difficult, and even professionally risky (3) contrast strongly with research documenting that scientists who engage in public communication enjoy an enhanced reputation among peers, and rate contacts with media as generally positive and beneficial to their careers (2, 4). Furthermore, scientists who engage in public communication tend to be more academically productive; few experience negative career impacts from these activities (5). Journalists also value and cultivate connections with scientists who can communicate clearly and accessibly (6). At best, scientists could view lay summaries as opportunities to contextualize their research and communicate with interested nonspecialists. But regardless, they could serve as building blocks for broad and transparent communication of research.

The value of lay summaries increases when considered within the radically changing science media landscape. There is little debate that dissemination of research and scientific news is undergoing a sweeping change (7). Greater reliance on the Internet for scientific information is transforming communication pathways from a traditional top-down transfer of knowledge to one where readers play a much more active role in acquiring information and agenda setting (8). Within the general public, 87% of online users rely on the Internet for research activities like fact-checking or looking up scientific terms (9), and evidence suggests that the public are using increasingly diverse sources of information (e.g., blogs and social media) (7, 10).

Meanwhile, science journalism is fundamentally changing. Along with traditional duties of investigative reporting and agenda setting, a plethora of information and more collaborative relationships with readers is emphasizing new roles, such as curator and convener (8). The number of content producers equates to availability of diverse perspectives on research findings, leading respected scholars in science communication to propose that a "media ecosystem" more accurately depicts the way scientific knowledge is transferred today (8). We have conceptualized the science media ecosystem (Fig. 1) to illustrate both the limitations of current communication pathways and the potential for lay summaries to increase access to and communication of research findings.

The traditional pathway through legacy media (television, radio, and print) effectively reaches wide audiences, but is limited in scope with at most 3 of every 1,000 published articles gaining attention from mass media (11). This pathway is increasingly constrained by reductions in science media staffing, leading to more exclusive reliance on press releases from major scientific journals for story ideas and content (6). Not only is this an unlikely avenue to encourage comprehensive access to research findings, but it is actually trending toward loss of information diversity and homogenization of science news (6, 12). Blogging and social media have transformed the media ecosystem, and many scientists have adopted this route to make material directly available to interested audiences. The primary limitations of this pathway are its uncertain reach, the perceived and actual

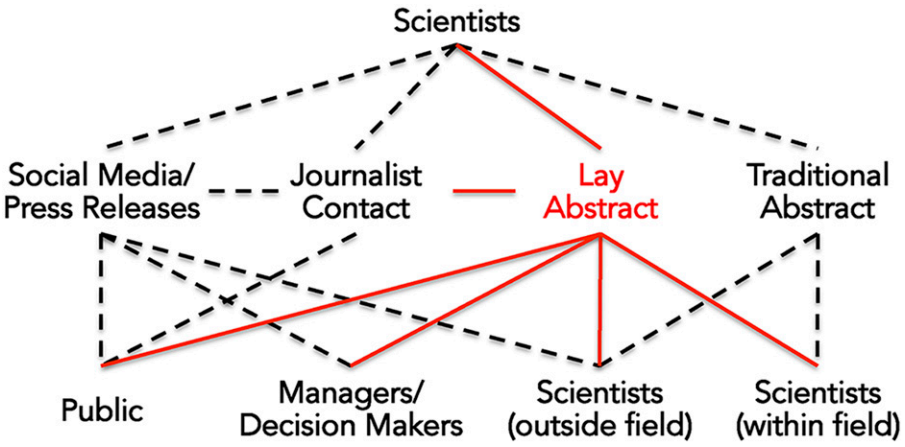

Fig. 1. A conceptual map depicts the pathways available for communicating research results between scientists and end users via different mechanisms (depicted by black dotted lines). Lay summaries of published articles would serve to enhance potential communication pathways (depicted by red solid lines) between scientists and the lay public, increase decision makers' access to information, and improve interdisciplinary communication.

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Box 1. A scientist's brief guide to lay summaries

Although formats vary, some journals—among them *PLOS Biology*, *PLOS Neglected Tropical Diseases*, *PLOS Genetics*, PNAS, *Behavioral Ecology*, *Functional Ecology*, *Frontiers in Ecology and the Environment*—have developed criteria for synopses aimed at a more general audience, thus offering guidance for journal publishers who are considering the requirement of lay summaries. (PNAS requires submission of a 120-word Significance Statement with research articles explaining the relevance to a broad readership.)

However, scientists who have trained for years using highly technical and specific language may find writing meaningful lay summaries a daunting prospect. Achieving a balance between accuracy and accessibility is not an easy task, but (we argue) a worthwhile one. Fortunately, excellent published resources exist to guide scientists in writing for general audiences (e.g., N. Baron's *Escape from the Ivory Tower* and R. Olson's *Don't Be Such a Scientist*) and even specifically in writing lay summaries (14). Based on our review of these resources, scientists faced with crafting their first lay summary might consider these tips:

A lay summary differs in intent and should not be considered a "dumbed-down" version of the standard abstract. The lay summary should focus on the significance of the research with respect to the central or fundamental questions in the field (i.e., the "why and so what?" rather than the "how?").

Make use of available resources, such as university public information offices, published guides and books, including online tools to simplify writing style (e.g., www.readability-score.com).

Make use of lay persons and peers in other disciplines for feedback and review along the way, which will help in avoiding acronyms, jargon, and other forms of inaccessible language.

Embrace the adage "practice makes perfect" and expect improvement in skill over time.

credibility of these sources, and self-selection by scientists as to whether to broaden communication of their research (6, 10).

Lay summaries would significantly increase the number of linkages in the media ecosystem by creating reliable, direct pathways between scientists and the general public, journalists, resource managers, decision makers, and scientists outside of the discipline (Fig. 1). In the changing media landscape, scientists should proactively seek ways to keep their research relevant and in the public eye; lay summaries offer an opportunity to stake a claim in the media ecosystem without necessarily navigating every trend in information-sharing from YouTube to Reddit. We believe journalists (working to cover disparate topics on tight deadlines) would especially benefit from accessible and creditable summaries written from a broad perspective (6, 12), which could help level the playing field for important research currently overlooked by mass media. Furthermore, by relating the significance of the work in the author's own words, lay summaries are a proactive measure against a common fear of scientists that their work will be misinterpreted or misrepresented in the media.

Finally, scientists could embrace lay summaries as a way of taking up the gauntlet of the social contract and science communication in a new way. Although scientists are generally receptive to the need for science communication, Peters (13) documented a striking trend in the hard sciences of strongly differentiating between public versus internal scientific communication. This clear distinction between communication "arenas" sets up a dynamic where the public are consumers (as opposed to creators or cocreators) and scientists hold complex, inaccessible knowledge requiring translation. It has been subsequently suggested that communication that bridges the two arenas may facilitate knowledge transfers between science and civil society (10); lay summaries occur to us as one such mechanism. Writing a lay summary means that a scientist has taken the time to consider and describe their work from perspectives outside of the scientific community (14). It is an invitation for public dialogue, and runs counter to deficit-model thinking, which is still a dominant perspective in the scientific community (15).

Requiring lay summaries does present some practical considerations, the primary one being limited training for scientists in broad communication skills (15). We propose, however, that support for individual scientists exists in the form of published (14) and in-person training opportunities (16), as well as journal guidelines and peer-review networks (Box 1). Public information offices generally support scientists' efforts in communicating their research; we suggest that these departments could offer additional training for scientists in writing lay summaries as a means to increase the reach and impact of institutional products.

The literature is replete with analysis of trends and issues in science communication, but somewhat lacking in concrete proposals that are simple to test and implement. We recommend that journal publishers provide the platform for online publication of lay summaries. We also suggest that scientists working in different disciplines and contexts consider and make use of lay summaries as a concrete way to increase the visibility and accessibility of their research, ensure a voice for research findings in the emerging science media landscape, and forward the goals of the social contract.

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