Press before paper—when media and science collide

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Since the UK Royal Society (London) published the first issue of the *Philosophical Transactions of the Royal Society* in 1665[1], scientific journals have been the traditional means by which researchers publicly release their data. In recent years, however, media coverage of science before publication and the phenomenon of science by press release have become increasingly common mechanisms for the public dissemination of scientific information. I argue here that media coverage of scientific discoveries in the absence of corroboration in a peer-reviewed scientific paper not only compromises scientific discourse, but also acts perniciously on the public perception of science.

In no area of biology is the phenomenon of media release of science more evident and more damaging than in biotechnology. Several examples immediately come to mind where press-before-paper incidents have had deleterious and far-reaching consequences.

In 1998, Arpad Pusztai, a scientist at the Rowett Research Institute (Aberdeen, UK), disclosed in a television interview (aired in the United Kingdom) experiments in which genetically modified (GM) potatoes expressing a lectin gene "caused toxicity to rats" that ingested them in a feeding study. This prompted a stampede of media scare stories concerning the dangers of toxin-laden GM products, despite the fact that no independent corroboration of Pusztai's results was provided (indeed, the story was made even more juicy by the dismissal of Pusztai by the institute). A year after the debacle, the results of Pusztai's research were finally published in a peer-reviewed paper in the *Lancet*[2]. This paper demonstrated that the findings announced on the television, along with all the extrapolations, were flawed. But the damage was already done—doubts had been planted in people's minds. The incident marked a new low for the (already shaky) public image of agricultural biotechnology in Europe.

More recently, the Ohio State University (Columbus, OH) issued a press release concerning a study completed in 2001 that was in review for publication in a peer-reviewed journal. The study focused on the consequences of gene flow from transgenic sunflower to wild sunflower. The press release coincided with a presentation by Allison Snow at the 2002 Ecological Society of America annual conference[3]. With mass starvation in Africa as a backdrop, newspapers and magazines seized on the story, some warning of impending ecological disaster if GM crop plantings continue apace. To say the least, this placed African governmental acceptance of GM food shipments on a precarious footing. After hasty diplomatic efforts by the World Health Organization (Geneva) and the United States, most African countries did finally accept US transgenic food as aid, but it is unknown how many people starved to death while the press chewed on fodder from the Ohio State University press release. The scientific paper is yet to be published.

Both of these examples highlight the problem of media sensationalization and hyperbole resulting from the premature release of scientific findings. But in some cases absolutely no scientific evidence whatsoever is required to launch frenzied media coverage of an area of research. Clonaid, a company associated with the Raelian religious cult, announced the birth of "the first cloned baby" on December 26, and a second on January 3. Although the Clonaid CEO and Raelian bishop Brigitte Boisselier was giving around-the-clock interviews, there was, simultaneously, a total absence of any scientific evidence that any such babies existed and that they were clones. A freelance journalist, Michael Guillen, and a team of independent scientists were to have cooperated with Clonaid and the putative parents of the putative clones in DNA tests that would have proven or disproved the Clonaid clone claims. Yet, these results are still not forthcoming, and Clonaid has stonewalled. Guillen has since suggested that Clonaid is guilty of "an elaborate hoax".

There are at least three reasons why scientific findings should never be covered by the popular media before their publication in a peer-reviewed paper. The first reason is that peer review is an essential first step in testing the rigor of scientific findings before wider publication and dissemination to the community—it is an essential quality control mechanism to ensure that claims are supported by data, that adequate and proper experimental controls have been carried out, and that a satisfactory description of the methods has been presented to allow independent reproduction by other scientists (see "Peer review under the microscope").

It is only after peer-reviewed publication that scientific information can enter the second tier of validation—open scrutiny by the scientific community and ultimately, independent replication. The day a paper has passed peer review and is accepted for publication is the first time its content becomes part of the scientific canon. Of course, scientists often discuss findings and disseminate them locally via the grapevine (e.g., as a result of posters or talks at meetings or informal discussions with colleagues), but these information exchanges

Peer review under the microscope

Peer-reviewed, scientific publication is accepted around the world as the gold standard for releasing scientifically sound information. It may not be a perfect process, but it is currently the best system available. The role of peer review is both to help editors decide which papers to publish and to help authors in honing their experiments and revising papers. Referees alert editors to technical flaws that might affect a paper's conclusions, suggest whether additional experiments are necessary, and provide advice on the novelty, significance, and likely interest of a set of findings to the community. Editors weigh their decisions on whether to publish a paper on the basis of the fairness and objectivity of referee comments, whether criticisms appear excessive, or whether they appear designed to delay publication (perhaps because the referee is a competitor). Peer review does not work on a majority basis—decisions are based on the quality of referee feedback as a whole (not by toting up 'yes' and 'no' votes for publication). This process has been adopted by many scientific journals as the means to validate science that is publishable. All these filters and checks are absent when journalists write newsworthy science stories obtained from other sources. *CNS*

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should not be viewed with the same significance or impact as publication of a formal paper in a peer-reviewed journal. None of these outlets holds a candle to a peer-reviewed publication in a journal for validation. It is the duty of both scientists and the media to recognize this.

The second reason why the media should be wary of findings released outside of traditional journals is that there is no easy route for rebuttal: in many of the cases outlined above, non-peer-reviewed scientific information released by the media heightened fears among the public and hastened knee-jerk political decisions. As the media was the route for publication, there was no route for rebuttal. Building sound information and media credibility on press releases is like building a skyscraper on mud. The peer-reviewed publication is the primary foundation that all secondary information, including the information published in the popular media, should be built upon. Unlike skyscrapers, the foundation can be subsequently altered.

When a paper on gene flow in Mexican corn was published in *Nature*[4], the press covered it extensively. Subsequently, the original paper was severely criticized on the basis of faulty science[5,6]. Science is a self-correcting process, and the press also covered the process, as well as the final retraction by the editor of *Nature*[7]. Although peer review clearly failed initially in this instance, the catastrophic consequences for public perception that would have resulted if the finding had been published the other way around (press before paper) are easy to envisage. There would have been no way for scientists to respond to equivocal data, because there would have been no data for scientists to respond to.

The third reason that peer-reviewed papers should be the primary source of scientific information is that the majority of journalists and editors in the media do not have the necessary expertise or credentials to assess the significance and validity of scientific findings conveyed to them in a release or in an interview. Judgment about the importance and validity of any particular scientific finding is often difficult for scientists and specially trained editors of scientific journals. How then can journalists, editors, and TV producers discern what is important and valid? The fact that trivial findings are often touted as breakthroughs in the popular media is a reflection of the media's ignorance of the practice of science (which generally proceeds not in breakthroughs but in small steps). Moreover, the media and public often see scientific publication as an end point. But as we see above, it is really the beginning of validation and of scientific discourse.

To avoid more head-on collisions between science and the media, clear guidelines of paper before press should be adopted and adhered to by editors of the news media. At a recent Pew Initiative on Food and Biotechnology conference[8], Richard Knox of National Public Radio conceded, "We do overreport science and report it before it is ready to be reported sometimes." It is time for the media to report science after findings enter the canon of scientific knowledge: only after they are published in a peer-reviewed journal.

1. http://www.royalsoc.ac.uk/royalsoc/
2. Ewen, S.W.B., & Pusztai, A. *Lancet* **354,** 1353–1355 (1999).
3. Annual Conference of the Ecological Society of America, August 4–9, 2002, Tucson, AZ.
4. Quist, D., & Chapela, I.H. *Nature* **414,** 541–543 (2001).
5. Metz, M., & Fütterer, J. *Nature* **416,** 600–601 (2002).
6. Kaplinsky, N., Braun, D., Lisch, D., Hay, A., Hake, S. & Freeling, M. *Nature* **416,** 601 (2002).
7. Editor. *Nature* **416,** 600 (2002).
8. Pew Initiative on Food and Biotechnology. Biotechnology, The Media, and Society, November 21, 2002, Harvard University, Cambridge, MA.