

Science Communication & Science Journalism

Meta-Review

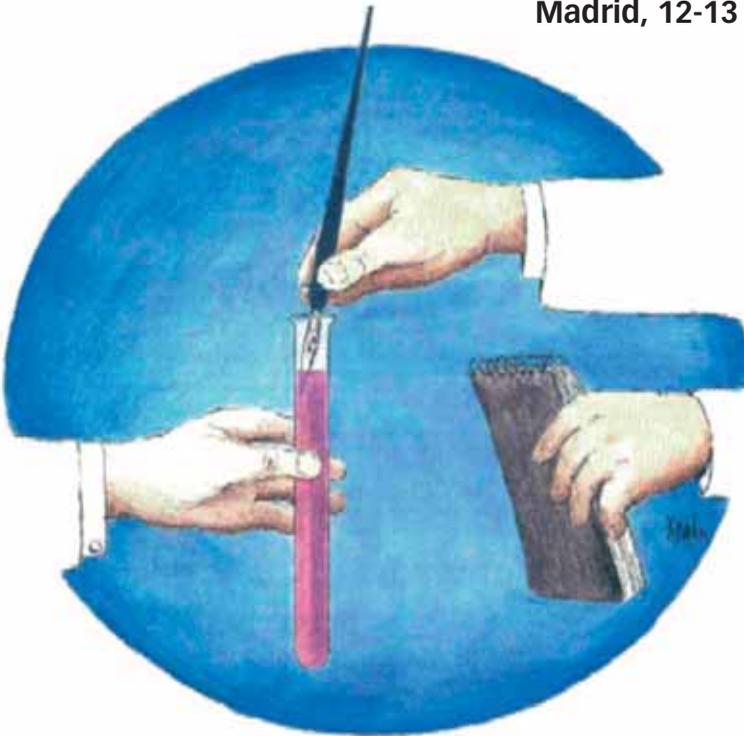
The crisis of media, the relocation of the journalists' world and the decline of science sections in the context of the Internet communicative and social revolution

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www.mediaforscience.com

Madrid, 12-13 May 2010

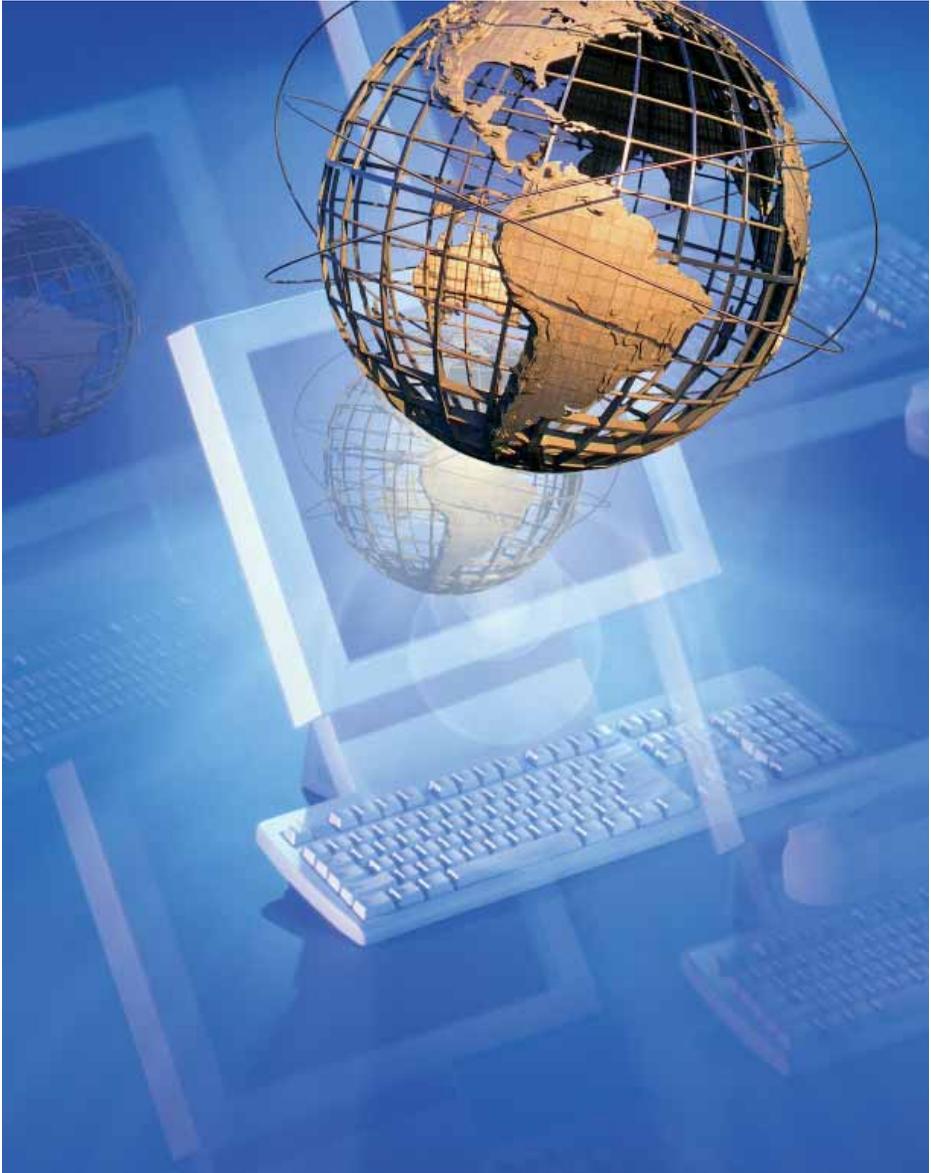


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Index

Introduction	3
Bypassing journalistic intermediation	5
Reasons for communicating	9
Science Communicator or Scientist Communicator?	11
Scientists see bright side of working with media	15
Challenging futures of science communication	19
The Impact of Press Releases & Embargoed Science	23
Challenging the Future of Science and Society	27
The Internet Age	29
“Serious marketing problem”	35
The State of the News Media	37
How News Happens	43
A marriage of convenience	45
Building Public Engagement in Science	49
New directions in public science communication	51
Changes in Science and Media Demand & Evolution in Science Communication	57
The Gap	
Between What Scientists Say and What the Public Hears	61
REFERENCES, ARTICLES, REPORTS, BOOKS... USED FOR THIS META-REVIEW	63
FURTHER READING	67



Science Communication & Science Journalism

Meta-Review

The crisis of media, the relocation of the journalists' world and the decline of science sections in the context of the Internet communicative and social revolution

The world of news is experiencing a serious earthquake. The normal way in which people access information - basically: press from newsagents, radio, television and more recently free press - is being pushed aside by new channels and media - websites, blogs, podcasts, google/news,... - and by a gradual change in the attitude of the public in terms of how to consume information and, in general, culture. The use of the verb "consume" in this context is completely deliberate because it reflects a profound change of habits in our society, in which traditional journalism of intermediation between those who know and those who don't is giving way to simple content providers.

The epicentre of the earthquake is very far from the surface (so it is not so) and as a result is not very apparent to the general public, who are generally passive and lack a critical attitude in relation to the world of information and culture. It is also important to highlight that the traditional large businesses of the world of communication have for some time been trying to minimize what is happening as much as they can, mainly because they didn't see the technological, economic, social and cultural change that was descending on them coming, and for the most part reacted late and badly to the revolution taking place. While the cash cow called publicity was working, why change and adapt?; if fewer daily newspapers are sold, the figures can be disguised with bulk sales, with the advertising exchange and above all by turning to the daily newspaper as a growing support for the sale of other products in the form of promotions. A trend which has brought temporary financial benefits, but some distance from the most

important objective in the search for media loyalty from the buyers (they can no longer be called readers), as happened before with a good news service in both the daily edition and in the supplements, a service which is now weakening day by day. We have thereby moved from the high quality daily model with plenty of information options to a daily model that we could call “daily-bazaar”.

Although the tremor may not be visible in the day to day for the general public, if we look carefully we see that it keeps producing a constant drip of problems and crisis which are gradually coming to the surface. At the start of May 2007, Hearst Co. the editorial company of the influential *San Francisco Chronicle* announced that a quarter of their editors would be laid off to overcome the newspaper’s financial problems and this happened despite the fact that this daily newspaper is one of the best examples of adaptation to the new internet era. In fact, their website (SFGate.com) is one of the 10 news sites with the highest traffic in the United States. However it doesn’t generate enough advertising revenue to offset the process of change that is occurring in the way the public accesses news. Many other written and also audiovisual media have been reducing their services in recent times, closing sections – in particular many related to science and the environment.¹

Neil Henry, Professor of Journalism at the University of Berkeley (California), later wrote, on 29 May, in the *San Francisco Chronicle* itself, an article entitled “The decline of news² in which, amongst other things, he said:

“When journalists’ jobs are eliminated, especially as many as The Chronicle intends, the product is inevitably less than it was. The fact is there will be nothing on YouTube, or in the blogosphere, or anywhere else on the Web to effectively replace the valuable work of those professionals. I see a world where the craft of reporting the news fairly and independently is very much endangered; and with it a society increasingly fractured, less informed by fact and more susceptible to political and marketing propaganda, cant and bias. I see a world in which the pursuit of truth in service of the public interest is declining as a cultural value in our society amid this technological tumult; a world where professional journalism, practiced according to widely accepted ethical values, is a rapidly diminishing feature in our expanding news and information systems, as we escape to the Web to experience the latest “new” thing. I see a world where corporations such as Google and Yahoo continue to enrich themselves with little returning to journalistic enterprises, all this ultimately at the expense of legions of professional reporters across America, now out of work because their employers in “old” media could not afford to pay them.”

Bypassing journalistic intermediation

In March 2009, “in response to the decline in journalistic coverage of sciences”, a group of prominent universities and research centres in the United States decided to create **Futurity**, a scientific news portal that provides information directly from those who produce it (the scientific, medical and environmental community) to the general public.³ **Futurity**, which has now extended to more organisations and also to institutions in Great Britain, is a clear alternative to what used to be the most common way of communicating on science: intermediation of journalists. In other words, a “bypass” has been created today that allows the world of science to skip the unavoidable collaboration or - for some - the obstacle represented by the media in their objective of circulating information to the general public, who also have the option of searching for information directly from the specialised sources.⁴

This portal is a demonstration of the change being experienced by social communication of scientific, medical and environmental information. An approach that is becoming more and more widespread and which is characterised by the fact that producers of knowledge directly contact the public via the many channels now offered by the net, without requiring the media to act as intermediaries. The potential of these types of initiatives is probably very high given the high credibility of the scientific and medical community in the population (at least, in general terms) whilst the world of journalism has gradually seen the level of faith and authority the public instil in it decrease. The portal **Futurity** defends its existence and objectives as follows:

Why Futurity? Why now?

The way people share information is changing quickly and daily. Blogs and social media sites like YouTube, Twitter, and Facebook are just a taste of what's to come. It will be easier than ever to share content instantly with people around the globe, allowing universities to reach new audiences and engage a new generation in discovery.

Equally significant has been the recent decline in science and research coverage by traditional news outlets. For decades, universities have partnered with journalists to communicate their work to the public, but that relationship is evolving. At the same time, research universities are among the most credible and trusted institutions in society and now have the ability to deliver their news and information directly to readers.

In an increasingly complex world, the public needs access to clear, reliable research news. Futurity does the work of gathering that news. Think of it as a snapshot of where the world is today and where it's headed tomorrow. Discover the future.

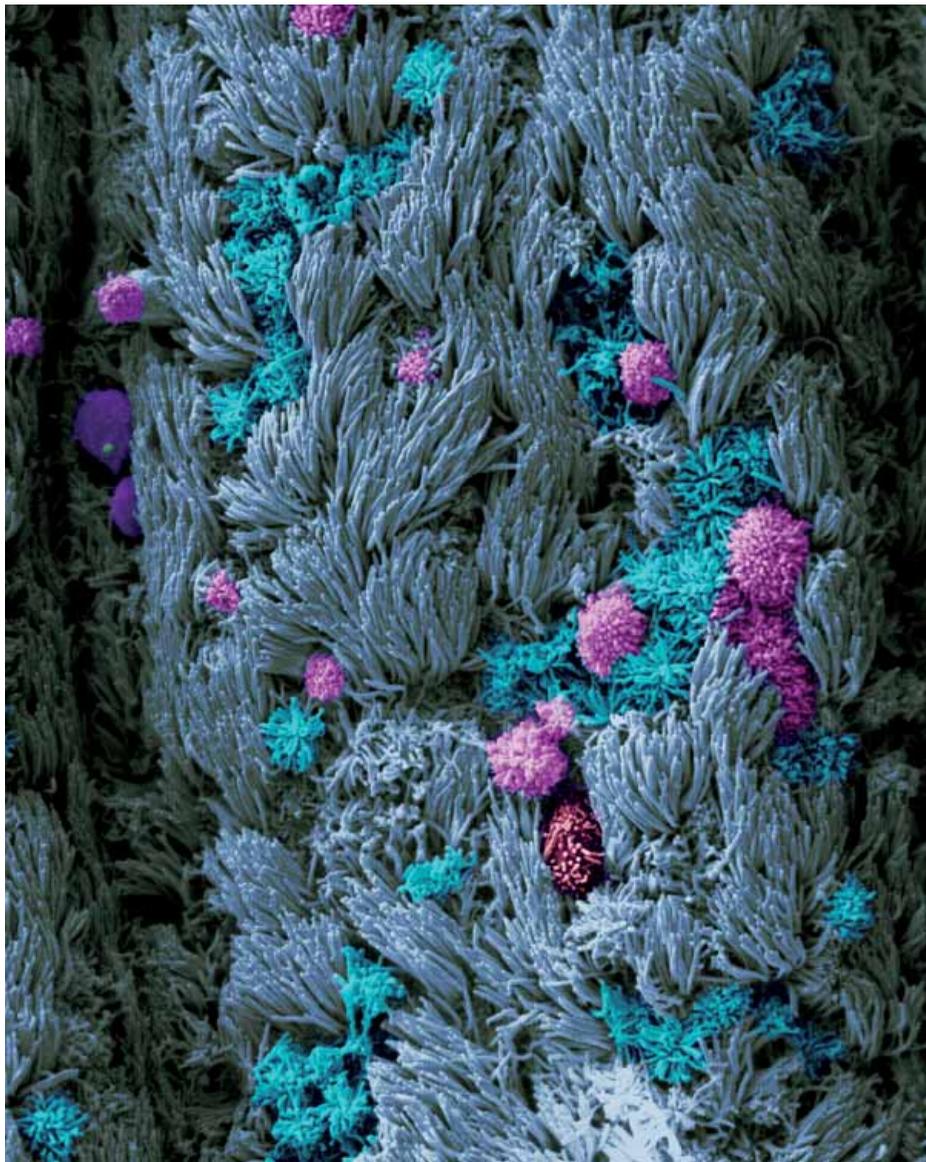
The case of **Futurity** illustrates a trend produced by the spread of the world of internet and serves to pose several questions:

1. If the public can access the information first-hand (and for free), why turn to the media?
2. Do the media have an added value for the user as information providers?
3. What reasons do scientists and doctors have for communicating their information to the public?
4. Is it worth this additional effort for the world of science?
5. Is traditional journalism partly to blame for this bypass spreading?
6. Can the quality of the information be affected in the new form in which it reaches the people?

The public can now access the direct source of the information they are interested in. However, people must also be prepared to learn the new rules of the game. An initiative like the one used as an example can really pursue an increase in society's scientific knowledge and/or pursue other goals aimed more at personal benefit. For example, quite a common objective and, although justifiable, not always transparent, is that behind an initiative like this the aim is also to promote universities and research centres (a new channel of institutional communication). Sometimes, the scientific, medical or environmental organisation that is at the origin of the portal not only seeks to promote itself, but also looks for new clients, to improve their social image, diffuse specific information with a very clear intention (for example seeking additional financing), etc. The user comes face to face with a piece of information and the intentions are not always clear. Absolute objectivity does not exist in journalism, but it does even less so in the world of institutional communication.

The new "disintermediation" of scientific information can, therefore, be very positive, since it allows for more proximity between sources of information and society. But it can also have a negative side and the regulatory role that journalism should have in the search for the truth and as much objectivity as possible is being lost. We could ask ourselves, clearly, if the media have really played this rebalancing role in the recent past or are currently playing it or if, on the contrary, how they have acted and their interests – which they also have – have contributed to a gradual social discredit and distancing of their normal users.





Fragment of "Células acogedoras"- Jesús Yániz Pérez de Albéniz - 7th Edition FOTCIENCIA

Reasons for communicating

Should scientists also be communicators or is it better that they hand this task over completely to communication professionals: journalists, publicists, press office managers...? In the Declaration on Science and the Use of Scientific Knowledge adopted in the World Conference on Science in 1999, sponsored by UNESCO⁵ it was established that: 1) scientific knowledge should be shared; 2) real cooperation needed to exist between governments, civil society, the business sector and scientists; and 3) scientists should be governed by the corresponding ethical standards.

In the same way, in the United Kingdom, the Science and Technology Committee of the House of Lords recommended a direct dialogue with the public in the year 2000⁶. These recommendations occurred after a good part of British (and European) society had lost some of their confidence in the government and in science itself after the scandal of the "mad cows", which reached its media peak there in 1996.

Jane Gregory and Steven Miller reflect in Science in the Public: Communication, Culture, and Credibility⁷ on the importance of openly recognising the motives that lead to a scientist to communicate to the public, and groups them in the following reasons or intentions : a) enthusiasm (the researcher feels passionate about the field they work in and wants to share it with others); b) improve the abilities of the recipients; c) improve the existing democratic processes or help to create new ones if none exist; d) prevent the alienation of specific sectors of society and e) serve the interests of the scientific community and the bodies that finance it.

We can also group the motives that lead to publicly communicating on science according to who will be the resulting beneficiary. These include:

- ▶ every individual that forms part of society, as it increases their knowledge of the world, as well as their ability to make informed decisions and use the new applications derived from science in an effective way.
- ▶ society in general also benefits since the public diffusion of knowledge, especially if it has been generated through public investment, is an essential element of democracy and also because "the knowledge of knowledge" can contribute to the well-being and economic development of countries
- ▶ science and culture in general: knowledge which is not limited to a select few, spreads and generates new research questions, not only in the same field, but also in completely separate areas, even creating new disciplines (bioinformatics is a clear example)
- ▶ the scientific community: scientists are the first to benefit from greater public awareness on science and its processes. Lack of transparency breeds fear, whilst transparency breeds trust within the public. In addition, if one person doesn't communicate, there will always be someone else who will (and not always in the same way, with the same intention or with the same clarity that we could have done it with ourselves)
- ▶ the aesthetic: public communication on science adopts thousands of forms, some of them of extraordinary expressive and artistic beauty. Examples of these are found in books, photographs, drawings and illustrations, videos and documentaries, etc.

It is still more interesting to ask scientists directly about their reasons for communicating to the public. In a study carried out in Spain⁸ - based on the responses to a questionnaire that was answered by 167 professionals (researchers, technicians, support staff and scholars) of the Consejo Superior de Investigaciones Científicas - Superior Council for Scientific Research (CSIC) who had participated in activities related to the circulation of scientific information between 2001 and 2004 - it was observed that high level researchers recognised the strongest feeling of duty (this group assumed that communicating with the public formed part of their obligations), whilst the younger ones more frequently said they felt personal satisfaction and enjoyed carrying out these activities.

Science Communicator or Scientist Communicator?

This is the opinion of a young scientist worried about his job as a researcher and the public communication of it:

“Science Communicator or Scientist Communicator, the distinction is not trivial.ⁱ I have been thinking about this a lot over the last couple years while reflecting on my goals and how I can best communicate the exciting research that I and my colleagues are doing. There are different roles for each category and both persons have important, exclusive responsibilities. Science communication is a personally rewarding endeavor. Miriam, Dr. M, and I gladly (and without pay!) blog on topics we find interesting. Currently we are all scientists who attempt to be communicators as well. I think I can say that neither of us have this in our job description, yet we feel compelled to set an example as young scientists who believe that their research means nothing if it is not appreciated, or at least known, to the public whom we owe our continued support to in many cases.

I view the role of a science communicator as a purveyor of the discoveries, implications, predictions and controversies that scientists, and the scientific process, yields. They are typically concerned with the craft of writing and the art of storytelling. Science communicators have access to major media outlets, make a great attempt to reach the broadest audience possible and, with notable exception, reach a much larger number of interested and potentially interested readers. It is often their sole job to communicate science.

ⁱ Post from Kevin Zelno. He is a Marine Biologist graduate student researcher at Penn State University (USA) and blogs in <http://deepseanews.com/>

On the other hand, scientist communicators often aspire to communicate on par with science communicators but have limited resources (namely time) to devote to such activities except in the rare circumstances where it is part of a scientist's job description. The desire to communicate the discovery, excitement, and implications of research effectively is matched by a plethora of responsibilities such as teaching, securing more funding for research and students, committee duties, mentorship, lab or field work. Oftentimes, communication is done on one's own time with some amount of recourse from supervisory staff (i.e. the old guard who live in an outdated career model).

A scientist communicator offers a unique point of view and personal history that a science communicator cannot offer an audience. The in depth knowledge of their system and details of field observations, experiments, conversations with colleagues and an extraordinary breadth of literature gives the scientist a pool of knowledge to draw from that often is unmatched by most science communicators. This also has a drawback. Scientist's often know so much it is very difficult to winnow information and discoveries into a form that is recognizable by your typical "Joe the Plumber".

Sometimes though, people want to hear about science from the horse's mouth. This is why scientists are asked to interviews by the media, specifically radio and TV. Some scientists are very good at discussing science with an interviewer. They are elegant in their information translation, responsive to the interviewer, well-composed and able to think quickly on their feet. Many are not and appear annoyed or uncomfortable, stumble over their words, interject rehearsed sound bites in lieu of preparedness to be interviewed and fail to personalize research and the field of science as a whole.

So why not substitute the science communicator in place of the scientist during these moments? This is essentially what happens in newspapers, magazines, websites and press offices. The science communicator is often thought of as the translator, someone with a well-practiced grasp of language and grammar, and who is smart enough to not only understand the concepts and write about them for a lay audience, but also to ask the right questions to be able to get the most information out of the scientist. It would seem reasonable that interviewers should talk with science communicators instead scientists. As I discussed above though, people like to hear the information from the originator instead of a middleman. They want their discoveries full proof, straight-laced without any preservatives or additives.

But, there is another, possibly more important role for the scientist communicator that a science communicator cannot provide. It is a calling beyond the role of communicating their life's work to the public. It is as a role to provide a career model for other up-and-coming scientists. To say it is OK to talk about this stuff. Go ahead and blog on some neat paper. Engage the public in scientific discourse; view it as a learning experience for the both of you. Give public lectures about your research. **IT IS ACCEPTABLE TO BE EXCITED BY SCIENCE AND TALK ABOUT IT OPENLY.** Many students and staff do not have this role model. The traditional, outdated model of a career in science stifles enthusiasm. That very enthusiasm that made you interested in science to begin with!

The public feeds off of enthusiasm. If you are studying a neat system and tell everyone you know what cool things you study, important questions you are answering or strange creatures that you found then **YOU ARE DOING OUTREACH.** And its OK. I've done some of my best science outreach at the local pubs or airport bars during layovers just talking to the people around me. But scientists that are excited about their work sometimes suffer from *over-enthusiasm* too. **IT IS NOT ALL ABOUT US!** Do not lose sight of what a discussion is: a two- (or more) way conversation. Scientists need to be better listeners. Our traditional mode of communication is the lecture. We stand on our soap box and command the world's attention. Well "Joe the Plumber" has something to say too and it is just as important as what we have to say.

In fact, what "Joe the Plumber" has to say is more important than our research or enthusiasm. The words coming out of his mouth during a conversation can be more informative than our many years of working on one of the most important problems in basic science. "Joe the Plumber" has the ability to let us know how well we are communicating and how well we can cross ideological boundaries. Not only us as scientists, but the entire field of science. All you have to do is *listen*. Stand down off your soap box, grab a beer, look him in the eyes and listen to what he has to say. Show Joe that you are real person, with compassion and an interest in the very person who indirectly funds your research with his working-wage sweaty, grimy job pulling hairballs out of your shower drain. Ask him questions about his work and life too. **SHOW AN INTEREST IN PEOPLE.** One of the best ways to be a scientist communicator may indeed be by not being "such a scientist" as Randy Olson would pontificate.ⁱⁱ

ii See: <http://www.dontbesuchascientist.com/>

Most other professions realized this long ago, but a member of a group is a representative of that group, whether they want to be or not. We as scientists are all communicators whether we want to be or not. It isn't even a question of merely abstaining from communication. You are still a role model to your colleagues or students. If you don't like it, sorry, do your best to stay away from the camera and journalists because now, more than ever, we need people to talk about science and make discussing it openly in the barroom or with the average "Joe the Plumber" the norm. The science communicator has a very important role in this by popularizing science, but only the scientist communicator can be a role model to other scientists and show the public that we are human and care about what they have to say."



Scientists see bright side of working with media

Once upon a time in the world of science, sharing scientific work with the press was heresy. Journalists, according to the common wisdom, would get it wrong, your research would be distorted, and your colleagues would see you as little more than a shameless grandstander. Scientist popularizers such as the late Carl Sagan, a master of adroit science communication, were excoriated by some of their colleagues for the questionable practice of trying to make science accessible.

But a sea change is under way, it seems. In a report published in the journal *Science*⁹, an international team of researchers in science communication led by Hans Peter Peters from Forschungszentrum Jülich (Germany), reports that relationships between scientists and journalists are now more frequent and far smoother than the anecdotal horror stories scientists routinely share. "Scientists actually see rewards in this process, not just pitfalls," says Sharon Dunwoody, a University of Wisconsin-Madison professor of journalism and a co-author of the report. What's more, a majority of scientists surveyed - 57 percent - found their "latest appearance in the media" to be a mostly positive experience, while only 6 percent were unhappy with the journalistic outcome.

This report is based on a survey of more than 1,300 researchers in five countries: France, Germany, Japan, the United Kingdom and the United States. The poll revealed that, for the most part, scientists felt their work was portrayed accurately, explained well, and that news reports were generally complete and unbiased. Journalists, according to survey respondents, were perceived as responsible and informed in their reporting. The new study sampled

researchers in two broad and well-covered scientific fields, epidemiology and stem cell research.

The results of the survey suggest that scientists' perspectives of the news media have evolved during the past 15 years, says Dominique Brossard, a UW-Madison professor of journalism who is also a co-author of the report. "Clearly, the survey shows that scientists see interactions with journalists as necessary," Brossard explains. "We don't have to convince the scientists anymore. We're beyond that." Although scientists may no longer need to be persuaded to engage journalists, many still view the practice of journalism as incompatible with scientific culture. However, that perception, say the authors of the new report, seems to be more nuanced than in the past. What may be driving the change in scientists' behavior, according to Dunwoody, is the prospect of rewards. Science that is more visible appears more credible to potential funders, and news coverage may enhance individual scientists' career prospects. Another driver, say Dunwoody and Brossard, is that scientists see a benefit of greater public understanding of the scientific enterprise through news coverage of research.

The survey indicated few differences in scientists' perceptions of interacting with journalists from country to country, possibly because the cultural norms of science are universal. The scientists in the survey who interacted most with journalists tended to be more senior, more productive researchers. Suggesting that journalists do a better job than scientists, think of finding the best people to talk to. "Journalists are attending to the highly productive scientists," Dunwoody explains. "That's good news and gives less credibility to the notion that journalists pay too much attention to outliers." The survey also suggests scientists are becoming more knowledgeable about how journalists work and are thus more skilled at working with reporters. "Scientists in this survey are quite savvy in their interactions," says Dunwoody. Although the results of the poll are generally good news for both scientists and journalists, the researchers caution the picture is far from complete. In some fields where social controversy is more acute - climate science and evolutionary biology, for example - surveys might paint a different picture, the researchers' caution.

These are the key findings of the survey:

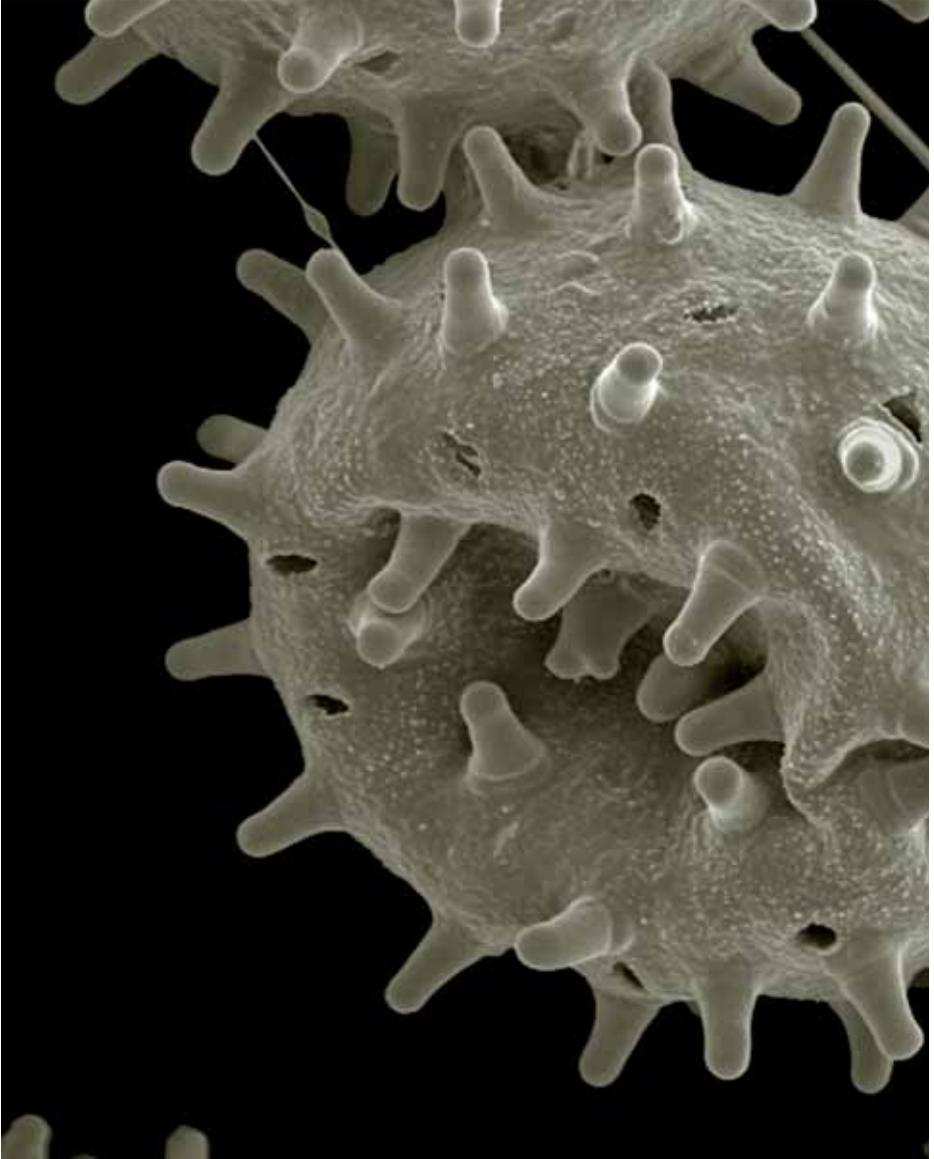
- ▶ Interactions between scientists and journalists occur more frequently and more smoothly than previously thought, according to a new survey.

- ▶ Previous research, as well as anecdotal evidence among researchers and journalists, has often led to the perception that a tension exists between science and journalism.
- ▶ Unexpectedly large percentage of researchers had interacted with the news media in the last three years and that the majority of these researchers were generally pleased with the experience.
- ▶ The most commonly cited motivation for communicating with journalists was to increase the public's appreciation of science.

There has therefore been progress in scientific awareness by communicating and diffusing knowledge and it is very significant that scientific communication is considered a functional requirement in the world context, given the democratic nature of the society of knowledge.

Scientists and journalists have to collaborate closely to ensure contextualised information reaches people that allows for the development of the indispensable critical spirit, both individually and collectively, to be able to understand and participate in the development of ideas and opportunities that will enable us to improve human and organisational abilities to be competent in an environment subjected to constant innovation, learning, creativity and change. The circulation of scientific culture has thereby transformed into the indispensable catalyst of the above-mentioned chain reaction that a cohesive society of knowledge must bring us.

However, we find ourselves at a critical moment: the media and the traditional advertising model that allowed them to exist are immersed in a difficult adaptation to the society of information on the net. The communicative system as a whole has been destabilized. The journal *Nature*¹⁰ has launched reflection on the importance of the scientific world assuming public communication as a strategic line of their work and even for it to use the tools that the world of blogs brings them to directly inform the public to compensate in some way, for the serious decline traditional scientific journalism is subjected to, in clear withdrawal in large-scale media due to the reduction in size of their editorial departments and the cuts in space which they owned up until now. Society as a whole is in a period of mutation.



Fragment of "Polen aliado" - Héctor Perea Saavedra - 7th Edition FOTCIENCIA

Challenging futures of science communication¹¹

Communicating science in ways that are useful and meaningful for both science and society remains a challenge not least because the deficit model underlying the Public Understanding of Science (PUS) remains very strong amongst (some) scientists, policy makers and the media. The solution is not in more information about science but in more effective communication and dialogue.

In spite of many declarations to the contrary, the practice of science communication is still bound to the 'transmission mode'. PUS dominates large parts of science communication, with the objective of informing the public rather than engaging. The more or less hidden goal is mostly to create acceptance and fascination for natural sciences and engineering and thus PUS is a type of marketing in which economic and innovation interests dominate. The ideology behind it can be simply expressed: society needs to accept science and technology and innovation and needs more engineers and natural scientists. In this way, science and society do not communicate (communication is a two-channel process) but science speaks to society. In this last section, we identify five challenges to realising successful engagement between science and society.

First, the myth of a singular public must finally be laid to rest. There is a multiplicity of audiences (scientists, funding organizations, politicians, journalists, NGOs), a multiplicity of reasons for being involved (education, entertainment, deliberation/dialogue) and, thus, a multiplicity of voices (lay and expert, experiential and codified) as well as different types of intermediaries

(journalists, teachers, civil society organizations, etc). The challenge is to require different mechanisms at different times and different training for both providers and users of information, enabling them to choose the most appropriate (set of) means of communication. Scientists experience many demands to communicate, including internal communication with fellow scientists; external communication for purposes of accountability; and much broader communication with the wider public. Complex communication processes are related to all stages of research, such as planning, funding, producing, use, diffusion. Each involves many actors and thus a unidirectional (from science to society) and one-dimensional view of the public is not going to work.

Second, scientists often regard society as a large, unknown, risk averse, irrational 'monster' that sometimes behaves unpredictably. Scientists can be very negative about the role of the media, of primary and secondary education, and of politicians. Ethical inquiry, technology assessment and Ethical, legal and social implications activities are sometimes regarded by scientists as hindering scientific progress or even as dangerous for science because they might awaken the 'monster'. This view has possibly been exacerbated by experiences of severe science and technology conflicts. However, recent developments in the societal debate on nanotechnology suggest there may be positive changes. For some years, nano scientists, policy makers, and funding agencies have been concerned about the public perception of nanotechnology. In the early years of the 21st century, the diagnosis became widespread that nanotechnology – after nuclear power and genetics – would become the next communication disaster at the interface between technology and society. Proposals for a moratorium concerning the use and release of nano particles, brought up by NGOs, fed such expectations and fears.¹²

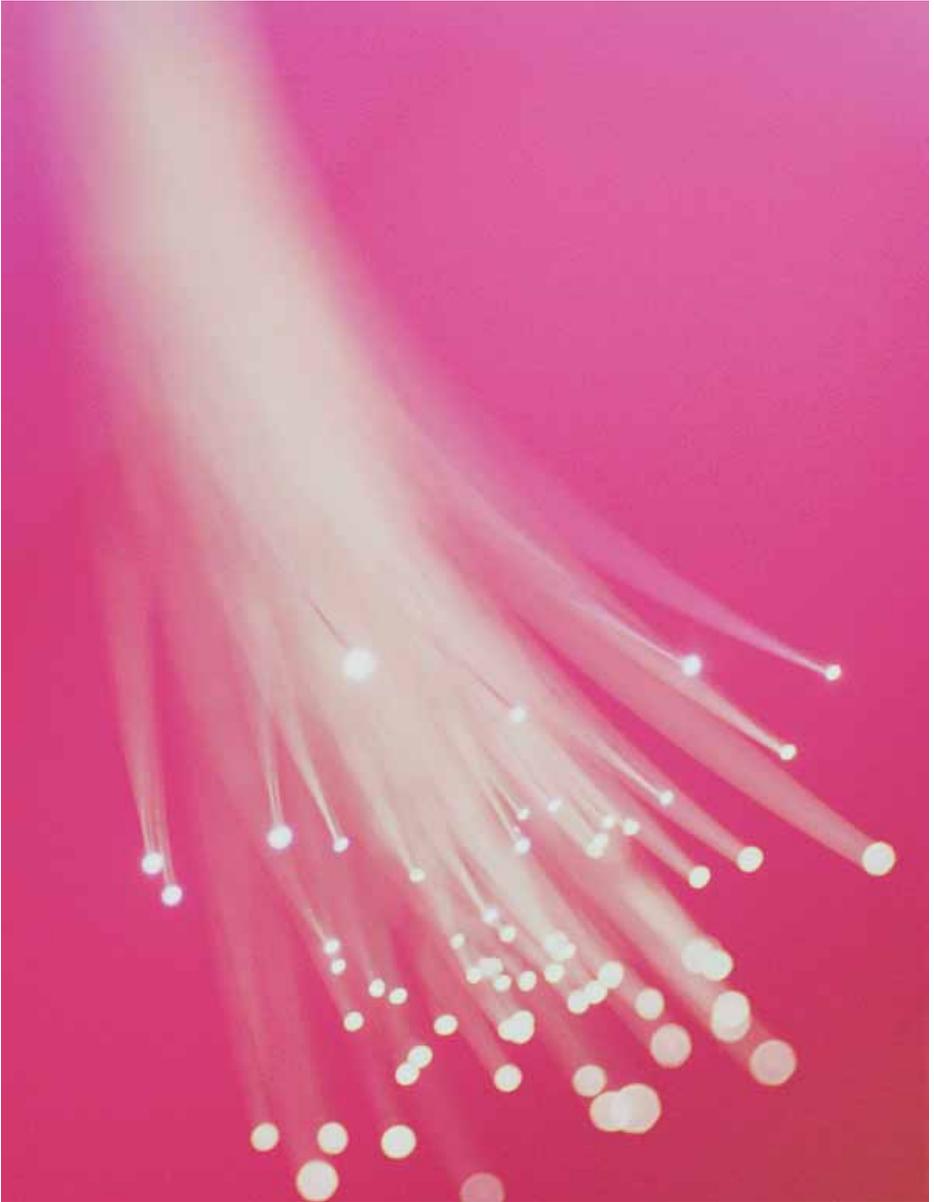
A third obstacle is the strong dependence on scientific journals and the press releases they generate. Scientific reporting in other outlets often consists of little more than drawing information from professional journals, such as *Nature*, *Science*, *The Lancet* and *The New England Journal of Medicine*. The rigorous review system used by these journals gives more generalist reporters the confidence that these are sources of reliable, thoroughly-researched information. However, especially in the case of medical research, the professional journals may no longer be such trustworthy and neutral sources, especially as pharmaceutical companies find ways of using them to publish

their own results. All parties need training, albeit of different types. Journalists need to understand how scientific knowledge is produced, and what the limits of it are. Scientists need to become more skilled in the possibilities and limits of different media for communicating with different publics. The publics need to be both media- and science-literate.

A fourth challenge concerns the rights and responsibilities of both science and society. Science communication has become a 'duty' for scientists' and a 'right' for the public, a right to know and a right to engage. But the duty is not always welcome and the rights are not always enthusiastically exercised. With the proliferation of Public Engagement in Science (PES) and two-way communication, rights and responsibilities have emerged. These have led to a variety of interactions between publics and actors involved in new sciences and technologies. There are growing doubts regarding how meaningful such interactions really are. This is partly a communication issue and partly a governance issue. The expert group Monitoring Activities of Science in Society (MASIS) from the European Commission suggests putting greater emphasis on PES from the communication point of view, with clearly defined responsibilities for actors. For this to be effective there needs to be greater understanding from all parties regarding the nature of science as an on-going activity. There are places to celebrate great scientists and amazing discoveries, but for effective public engagement there needs to be more attention to the choices to be made, the resources to be allocated and to the work done by individual scientists as well as research organizations.

Fifth, while scientific knowledge has shown a remarkable ability to transcend borders of politics and language, there remains a high degree of cultural specificity in relation to science communication. With Europe there are very different traditions and regulations regarding the level of both media and scientific autonomy. These have consequences for how science is communicated within countries and transnationally which should not be ignored or under-estimated.

Finally, scientists should have a more active role in encouraging meaningful reporting of science in the popular media. This is more crucial given that there is nowadays a greater demand for transparency of scientific information whilst science sections are decreasing in the media and scientists must also face fewer experienced science reporters. Scientists can help ensure that reporting about science continues to be both informed and accurate.¹³



The Impact of Press Releases & Embargoed Science

Before scientific news became such a popular feature, well-practiced scientific reporting consisted of drawing information from professional journals, primarily *Nature*, *Science*, *The Lancet* and *The New England Journal of Medicine*. The rigorous peer review system used by these journals assured reporters that these sources provided reliable, thoroughly-researched information.

Due to the heavy reliance of the news media on these sources, journals began to send out weekly press releases to accredited reporters. The purpose of this practice was - and is nowadays - to give reporters time to develop news items on findings that would soon appear in scientific journals, although the lay media cannot report these items until they have appeared in the journal. Press releases not only assist reporters in preparing news items, but they also reflect a certain rivalry between scientific journals that compete for citation in the mass media as well as for the scientific authority and social prestige that follow.

In this sense, another point to reflect on is whether all the issues that appear in scientific reference journals are truly relevant or pursue a certain dose of media impact, a situation that on the long run negatively affects science popularization. In 1995, when Philip Campbell became the director of *Nature* replacing John Maddox he declared in his first editorial: "Nature will continue its quest for independent scientific excellence and journalistic impact".¹⁴ Now, are these really compatible goals? Are all articles published in these journals because they are scientifically relevant or - in some cases - they are published because they will have a clear journalistic impact?

Another problem arises with the embargoed press releases that the main scientific journals such as *Nature*, *Science* and others practice in their relationship with journalists. An embargo means that the content of a journal is sent to journalists on the understanding that they will not write about the work until a prespecified date and time, normally the date when the scientific journal is published. This practice of embargoing research publications stifles competitive journalism and favors uncritical reporting of science and medical news... even promotes "lazy journalism" This is the opinion of Lawrence K. Altman, prestigious medical reporter of *The New York Times*. "I came from a scientific discipline, where peer review was expected but I came to see the flaws in peer review. It's really what I think is called editing-technical, high-quality editing, maybe-but journal editors get tripped up on this." His clashes with those editors have been quite public. "To put embargoes and restrictions and penalties in place, which they're doing, creates an atmosphere in which you can get lazy journalism. People think all journalists should be doing is cheerleading, quoting them, and letting them be heard... That's not what journalism is."¹⁵

In the last times, many other science communication analysts criticize this way of doing. Vincent Kiernan - associate dean in Georgetown's School of Continuing Studies, himself a former senior writer at the *Chronicle of Higher Education* - published *Embargoed Science* in 2006, a compelling critique of the self-aggrandizing embargo system that currently rules scientist-editor-reporter relations.¹⁶ Editors use the journal embargo as a marketing tool to extract the maximum possible publicity for their publications. The control of information through the embargo creates an "impression of immediacy." But it is a misleading impression. The governing idea behind the journal embargo is a bad one: it is a mechanism to restrict, not promote, the communication of science to the press and public. The editors of scientific and medical journals have somehow assumed the power to decide which journalists will and will not have privileged access to information. Kiernan concludes that this system is manifestly against the public interest. Embargoes do create deference among journalists to the scientific and medical establishment. They are artificial, perpetuating the work of less-skilled journalists and giving attention to often weak and dubious science. They turn journalists away from investigating science as they would any other institution in society.

The constant stream of embargoed news releases distracts journalists from what they should be doing--namely, taking a more critical approach to their beat. The existence of this embargo-driven “pack journalism” should be antithetical to a group that usually resists any authority trying to influence what it does. It is strange that journalists acquiesce to the will of such powerful publishing organizations.¹⁷

In the last World Conference of Science Journalists (WCSJ) held in London, June 2009, there was a panel turned to the embargo system. The conclusion for many was that embargoed science turns journalists into agents of propaganda and standardizes science news all over the world. Vincent Krienan advised to journalists: “It’s time to walk away from the embargo. Just walk away.”¹⁸





Challenging the Future of Science and Society¹⁹

Communication between science and society is crucially important: it informs the broader public about issues related to science and technology, it informs science about societal perceptions and expectations, it makes scientific expertise publicly available, it has an impact on policy-making and agenda-setting, it affects the legitimacy of research, and it plays a major role in the governance of science, technology and risk. But communication is also vulnerable to misunderstandings and misuses: over-simplified models and concepts about how science and society communicate, unrealistic expectations on both sides regarding the benefits of communication, and forms of communication that increase the distance between science and its extra-scientific audiences rather than 'engaging' them. Science communication may be able to help to establish a transparent and open form of communication in both directions that contributes to defining the role of science in society, and to enabling society to make the best use of scientific knowledge.

In recent years, there have been many attempts to organize dialogue between the many actors involved in science communication. In this context, for example, science communication is often intended to attract children and young people, potential future scientists. The concern amongst scientists, science educators and policy makers is that science has lost its attraction, as young people choose other subjects and vocations. Part of the problem is that much science communication is initiated and conducted by scientists who cannot imagine that science as such is not interesting and attractive, and therefore present science in terms that are incomprehensible to non-scientists.

Nevertheless, as we can see in different studies about how the general public have access to scientific knowledge, the media are the principal way to disseminate science, with - of course - TV in a leading position till now.²⁰ But at the same time, very few studies, quantitative or qualitative, are available regarding how the media transmit scientific issues to society. Nonetheless, there is an impression that the media trivialise scientific news. The "fast thinking" imposed on audiovisual media, independent of the degree of difficulty involved in presenting complex scientific knowledge, frequently reduces scientific news items to anecdotes and sound bites that may be accompanied by a certain degree of misinformation.²¹ Of course, science communication must simplify and this is not a problem at all if it is done in a sensible way. However the continuous impact of headlines in the news about astounding discoveries can lead to an anecdotal perception of what is really the progress of research and science if all this information is not properly contextualized; above all if we think about the complexity and uncertainty that is consubstantial to the scientific research.

Development of discourse analysis has involved approaches about the use of language and concepts precisely in the way in which scientific knowledge reaches the general public in the age of the information and communication. Scientific-academic use of language and concepts has been recognized as a specific register with his own norms, patterns and style, affecting not only terminology but ways of presentation and reasoning through particular discourse genres and procedures. No wonder, then, that the way of pieces of scientific knowledge is selected and transformed to be presented and explained to non-experts can be a very difficult task since it demands a rigorous recontextualization conveyed through discourse and communication procedures. So discrimination between simplification and trivialization in science popularization is not an easy frontier.



Fragment of "Animal de compañía" - Alejandro del Mazo Vivar - 7th Edition FOTCIENCIA

The Internet Age

The entire media industry is facing unprecedented pressure from the Internet and the ongoing economic crisis, and science journalism is far from immune.²² *Nature* chronicles the ongoing pressures facing the industry as in its survey of 493 science journalists' shows that jobs are being lost in North America, and workloads are on the rise the world over.²³ But as overstretched journalists struggle, new forces are rising. Scientists who blog are becoming increasingly influential, as are the press departments of scientific agencies and organizations. The Internet is allowing both of these groups to reach large public audiences on a daily basis. *Nature's* survey also shows that conventional journalists are increasingly relying on blogs and press releases for story ideas and what it means for the public's understanding of, and access to, scientific information.

Blogs, home pages and open source publishing offer scientists more possibilities for distributing information to each other, and the wider public also has access to enormous amounts of information online. The problem is thus not how to increase an already large stock of information but how to increase people's ability to find useful information, to judge what is reliable and relevant for them at that moment, to make sense of the sometimes conflicting variety of information with which they are faced, and then to engage in communication and discussion when appropriate. Media literacy, across different media forms, demands enormous skills from both producers and users of information.

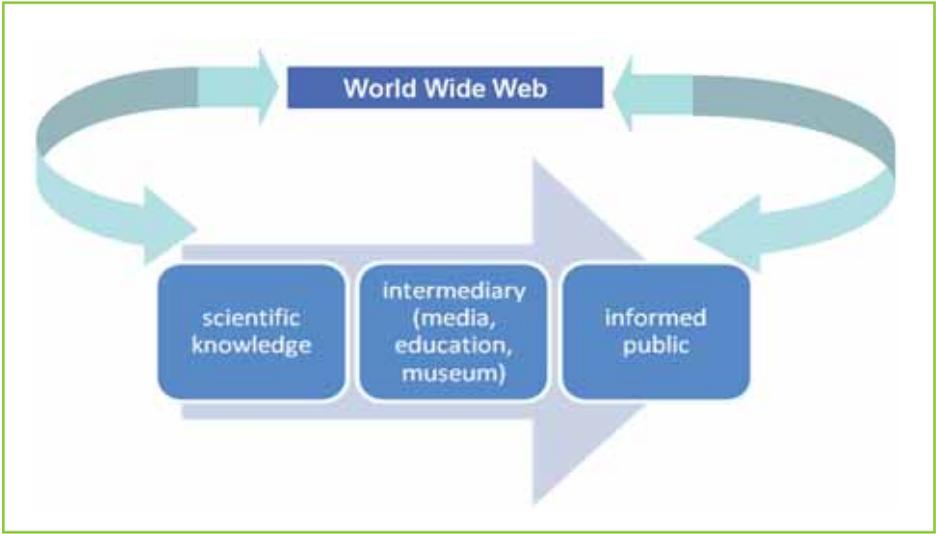
The internet is a pervasive research tool for science news and information. In some parts of the world, the internet is second only to television as a source of scientific information among the general population. A 2006 survey

conducted by the Pew Internet & American Life Projectⁱⁱⁱ in collaboration with the Exploratorium^{iv} of San Francisco benchmarked how the internet fits into people's habits for gathering news and information about science. ²⁴ The survey found that the majority of online users have used the internet as the primary source to look up the meaning of a scientific concept, answer a specific science question, learn more about a scientific breakthrough, and help complete a school assignment, check the accuracy of a scientific fact, downloaded scientific data, or compare different or opposing scientific theories. Such users also reported more positive attitudes about the role science plays in society and higher self-assessments of how well they understand science.

The internet has the potential to change dramatically the relationship between the providers of information and the general public bypassing gatekeepers in traditional media. The internet offers the possibility for scientists and science research centres to be in direct touch with the general public interested in science. Many think of the internet as a gigantic encyclopaedia on all subjects and this certainly applies to scientific information. However, the internet itself is a highly structured medium, and people need training to understand how and why some information is easier to find and how this can change over time and across different platforms.

iii The Pew Internet Project/Exploratorium report, made possible by the National Science Foundation, is based on a survey of 2,000 Americans conducted in January 2006. It has a margin of error of plus or minus three percentage points. The Pew Internet Project is a non-profit, non-partisan initiative of the Pew Research Center that produces reports exploring the impact of the internet on children, families, communities, the work place, schools, health care, and civic/political life. Support for the non-profit Pew Internet Project is provided by The Pew Charitable Trusts.

iv Housed within the walls of San Francisco's landmark Palace of Fine Arts, the Exploratorium is a museum of science, art, and human perception filled with hundreds of interactive, hands-on exhibits. In addition to serving more than half a million people who visit the museum each year, the Exploratorium is also a leader in the movement to promote museums as informal education centers, providing professional development for science teachers and teacher-educators, and operating as a research and development center for the science museum field at large. The Exploratorium's award-winning Web site, online since 1993, currently receives more than 20 million unique visits a year: www.exploratorium.edu



The by-pass of traditional science communication

When Tim Berners-Lee first started developing what we now call the World Wide Web in 1989, he saw it as a collaborative workspace for his fellow scientists at CERN, the European particle physics lab near Geneva. His creation far surpassed his early prediction that “the usefulness of the scheme would in turn encourage its increased use”. Since the commercialisation of the Web in the mid-1990s, its use has grown far beyond its original user group of scientists. For most users, the web in its first decade was like a big online library, where they mainly searched for information. Today it is undergoing a subtle but profound shift, dubbed Web 2.0, to become more of a social web, not unlike Berners-Lee’s original vision. Yet scientists are largely being left behind in this second revolution, as they are proving slow to adopt many of the latest technologies that could help them communicate online more rapidly and collaboratively than they do now.

There are fears, however, that scientists are now lagging behind, as they are proving slow to adopt many of the latest technologies that could help them

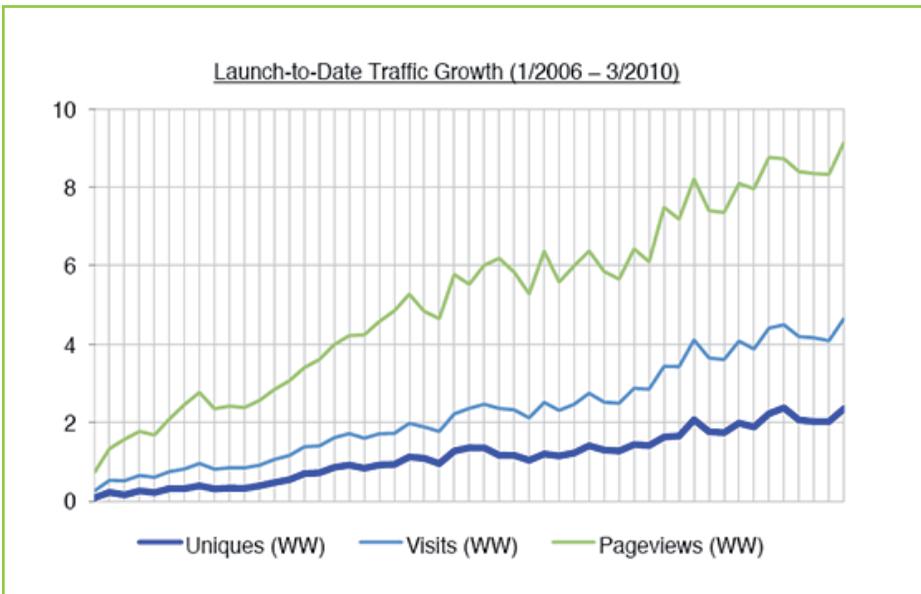
communicate online more rapidly and collaboratively than they do now.²⁵ The emerging web is largely being shaped by dynamic interactions between users in real time. But many researchers still see publications in the formal scientific literature as the primary means of scientific communication, not least because such publications are often the basis of individual career and wider institutional evaluations. Also, they perceive that traditional ways of publishing are ensuring the scientific memory, while the content of Internet is partially volatile. Although the traditional published paper is accepted as the undisputed information of record, younger researchers, in particular, are concerned that scientists are missing out on new ways to communicate with each other and the public.

Supporters say these offer a forum for broader and timelier discussion, to complement the existing system of peer-reviewed journals. This could enhance science communication, both before publication, when generating ideas, and after publication, when discussing results. Blogs are just one example of new social technologies that are allowing more people to publish more easily and in more diverse ways on the web. By allowing reader feedback and syndication feeds, blogs create an instant online community. But for most scientists and academics, blogs and wikis remain unattractive distractions from their real work. Many consider them an online version of coffee-room chatter, background noise that goes against the very ethos of heavily filtered scholarly information.

The latest web tools enable scientists to communicate their ideas in new ways, and maybe to reach new publics. To enhance science communication, scientists could make more extensive use of collaborative technologies such as blogs, wikis and websites that any visitor can add to and edit both before publication, when generating ideas, and after publication, when discussing results. But for most scientists, blogs and wikis remain unattractive distractions from their real work. Many consider them an online version of coffee-room chatter, background noise that goes against the ethos of peer-reviewed scholarly information. Scientists who frequent the 'blogosphere' see it differently. The dynamic hierarchy of links and recommendations generated by blogs creates powerful collaborative filtering, they argue. Blogs may create noise, but they are also useful for keeping up with the most recent developments in the field.

Whatever opinion one may have about the blog world, the fact is that communication via blog is growing rapidly in the world. ScienceBlogs^v data from April 2010 reports double-digit traffic growth:

- ▶ Visits for the quarter ending March 2010 grew by 41% year-over-year to approximately 13 million, and page views topped 25 million. Monthly unique visitors grew to 2.4 million worldwide and in the US surpassed 2 million for the first time this March.
- ▶ Total visits for 2009 grew by 55% year-over-year to 45 million and average monthly unique visitors climbed 49% to 1.9 million.
- ▶ ScienceBlogs.com has achieved high double-digit traffic growth (at least 50%) every year since its launch in 2006.



^v ScienceBlogs (www.scienceblog.com) is the leading social media site in the science category, with more than 130 acclaimed blogs, 11 content channels, a jobs platform, and a fast-growing audience of more than 2 million unique visitors a month. ScienceBlogs recently formed a strategic partnership with National Geographic spanning content and advertising sales.

The network's robust growth is a positive sign when it comes to the transition of science communication from dead tree to the internet. We know that there's been a lot of stress on the part of science journalists as to the sustainability of their enterprise, though that is really just a domain-specific instantiation of the issues in journalism as a whole, but until that works itself out the growth and persistence of science blogging and science-related websites is a good thing. There is calm after the storm of creative-destruction, and the current science blogosphere is laying the seedbed for future renewal. The outcome may be sub-optimal from the viewpoint of labor, but the consumer will benefit.²⁶

So, the World Wide Web offers the possibility of by-passing the traditional way of doing science communication without intermediary actors - and in a two sense interaction - but another problem arises: the need of critical capabilities of the public to know how to reach reliable and useful information, with the ability to identify trustfully sources.



Fragment of "Microsistemas 1" - Francisco Lamata Gordo - 7th Edition FOTCIENCIA

“Serious marketing problem”

In this context, are scientific European institutions – research centers, universities, etc. – prepared to communicate science? Do they have good departments to interact with journalists and general public? Which is the general level of implementation of Internet as an important tool to “open” the research centers and universities to the society? Are scientists aware of the strategic tool of communication? Do they have the skills to do it?

What is very clear in the Internet Age is that scientific community, scientific centers and universities must develop powerful communication skills and teams, using these new tools. Universities and research centers are the main social (even economical) force – in terms of quantity and in quality - in many European cities but their visibility in society is, in general, very poor.

This is the opinion of a relevant voice that has revolutionized the way of access to knowledge - Larry Page, the founding CEO of the Internet giant Google - in reference to the communicative context of science: “Scientists and engineers can change the world, but first they need to get over their serious marketing problem”.^{vi}

Larry Page stressed that they need to become more engaged in politics, business and the media if they are to “basically improve our lot in life by doing really great things. Harnessing the full potential of science and technology will require a better “sell” of science’s possibilities to policymakers, business leaders and the public. Part of the problem lies in the lack of scientists in political leadership. Much of the time, science is watered down and robbed of its critical details by the time it moves through the layers of bureaucracy

vi Speech in the Annual Meeting of the American Association for the Advancement of Science (San Francisco) - February 2007

up to people in leadership positions. "I don't think it's generally a good thing, since it's the part where all the economic growth is coming from, and all the changes in people's lives. I think you really want to have people in power who understand things."

Larry Page also encouraged scientists to make their findings more freely available, saying that "most of the work you guys have done is not represented" in Web searches because of publishing restrictions. Page threw out a few more ideas to raise science's profile, such as tying tenure and grant money to the media impact of research and having universities oversee science education in primary schools, which he admitted was a "radical proposal." He also praised programs such as AAAS's Science and Technology Fellowships and Mass Media Science and Engineering Fellowships as ways to increase scientists' involvement with Congress and the media.



The State of the News Media²⁷

Inside news companies, the most immediate concern is how much revenue lost in recession the industry will regain as the economy improves. Whatever the answers, the future of news ultimately rests on more long-term concerns:

What are the prospects for alternative journalism organizations that are forming around? Will traditional media adapt and innovate amid continuing pressures to thin their ranks? And with growing evidence that conventional advertising online will never sustain the industry, what progress is being made to find new revenue for financing the gathering and reporting of news?

The numbers for 2009 reveal just how urgent these questions are becoming. Newspapers, including online, saw ad revenue fall 26% during the year, which brings the total loss over the last three years to 43%.

Local television ad revenue fell 22% in 2009, triple the decline the year before. Radio also was off 22%. Magazine ad revenue dropped 17%, network TV 8% (and news alone probably more). Online ad revenue over all fell about 5%, and revenue to news sites most likely also fared much worse.

The estimates for what happens after the economy rebounds vary and even then are only guesses. The market research and investment banking firm Veronis Suhler Stevenson projects that by 2013, after the economic recovery, three elements of old media — newspapers, radio and magazines — will take in 41% less in ad revenues than they did in 2006.

For newspapers, which still provide the largest share of reportorial journalism in the United States, the metaphor that comes to mind is sand in an hourglass. The shrinking money left in print, which still provides 90% of the industry's funds, is the amount of time left to invent new revenue models online. The media industry must find a new model before that money runs out.

So what about the new media experiments growing around the country? There are certainly exciting things happening, from former journalists creating specialty news sites and community sites, to citizens covering neighbourhoods, to local blogs and social media.

In 2009 Twitter and other social media emerged as powerful tools for disseminating information and mobilizing citizens such as evading the censors in Iran and communicating from the earthquake disaster zone in Haiti. The majority of Internet users (59%) now use some kind of social media, including Twitter, blogging and networking sites, according to a new Project for Excellence in Journalism/Pew Internet & American Life survey.²⁸

Citizen journalism at the local level is expanding rapidly and brimming with innovation. This year's report includes a new study of 60 of the most highly regarded sites. The prospects for assembling sufficient economies of scale, audience and authority may be most promising at specialized national and international sites. For all the invention and energy, however, the scale of these new efforts still amounts to a small fraction of what has been lost.

Michael Schudson, the sociologist of journalism at Columbia University, sees the promise of "a better array of public informational resources emerging." This new ecosystem will include different "styles" of journalism, a mix of professional and amateur approaches and different economic models — commercial, non-profit, public and "university-fuelled."

There is something important in these notions. As Schudson notes, the news industry became more professional, sceptical and ethical beginning in the 1960s. Many journalists think that sense of public good has been overtaken by a focus on efficiency and profit since the 1990s. In the collapse of those ownership structures, there is some rebirth of community connection and public motive in news.

Yet the energy and promise here cannot escape the question of resources. Unless some system of financing the production of content is developed, it is difficult to see how reportorial journalism will not continue to shrink, regardless of the potential tools offered by technology.

And as we enter 2010 there is little evidence that journalism online has found a sustaining revenue model. A new survey on online economics,²⁹ released in this report for the first time, finds that 79% of online news consumers say they rarely if ever have clicked on an online ad.

There was certainly more talk of alternative approaches to advertising in the last year. Rupert Murdoch announced discussions with Microsoft about higher payments for searching his content and insisted that everything his company produces would go behind pay walls. Columbia University produced a report that explored non-profit and public funding sourcing and assessed the state of start-up new media. *The New York Times* announced it was giving itself a year to figure out a way to charge for content to “get it really right.” And more new media start-ups were planned, a growing sign that as old media continues to shrink, the ecosystem is changing and some things are growing.

But if a new model is to be found it is hardly clear what it will be. The survey, produced with the Pew Internet and American Life Project, finds that only about a third of Americans (35%) have a news destination online they would call a “favourite,” and even among these users only 19% said they would continue to visit if that site put up a pay wall.

In the meantime, perhaps one concept identifies most clearly what is going on in journalism: Most news organizations — new or old — are becoming niche operations, more specific in focus, brand and appeal and narrower, necessarily, in ambition. Old media are trying to imagine the new smaller newsroom of the future in the relic of their old ones. New media are imagining the new newsroom from a blank slate.

Among the critical questions all this will pose: Is there some collaborative model that would allow citizens and journalists to have the best of both worlds and add more capacity here? What ethical values about news will settle in at these sites? Will legacy and new media continue to cooperate more, sharing stories and pooling resources, and if they do, how can one operation vouch for the fairness and accuracy of something they did not produce?

The year ahead will not settle any of these. But the urgency of these questions will become more pronounced. And ultimately the players may be quite different.

Major Trends of News Media

- ▶ As we learn more about both web economics and consumer behaviour, the unbundling of news seems increasingly central to journalism’s future

- ▶ The future of New and Old Media are more tied together than some may think
- ▶ The notion that the news media are shrinking is mistaken
- ▶ Technology is further shifting power to newsmakers, and the newest way is through their ability to control the initial accounts of events
- ▶ The ranks of self-interested information providers are now growing rapidly and news organizations must define their relationship to them
- ▶ When it comes to audience numbers online, traditional media content still prevails, which means the cutbacks in old media heavily impact what the public is learning through the new

But not all the newspaper crisis is due only to the internet revolution... Newspapers are not doing enough to take advantage of the social power of their readers, according to a survey by Gartner Inc.^{vii} Analysts said that newspapers are faced with declining circulations, falling offline and online revenue, and competition from digital sources, but are failing to capitalize on their biggest supporters, their readers. "In the wake of the economic challenges facing the U.S. newspaper industry, publishers are losing focus on the crucial imperative of how to capitalize on those consumers who remain loyal, engaged online and print readers," said Allen Weiner, research vice president at Gartner. "Brand-loyal news consumers need to be turned into brand stewards who can wield their influence to two parts of their social graph — those who know them personally, and those who regard the brand stewards as tastemakers with similar points of view."

In November and December of 2008, Gartner surveyed 989 Internet users in the U.S., U.K., and Italy to understand how consumers discover and share different types of content. The survey looked at the main influences on media consumption, the main factors that prompt people to look for content, the main tools people use to search, what they do when they find interesting content and whether they share this content. Findings from the Gartner survey suggest that newspapers are not providing brand stewards with the necessary tools they need to optimize their role as influencers. This starts with a failure to optimize the search experiences at their Web sites and then carries on to a lack of integration between content and social media functionality.³⁰

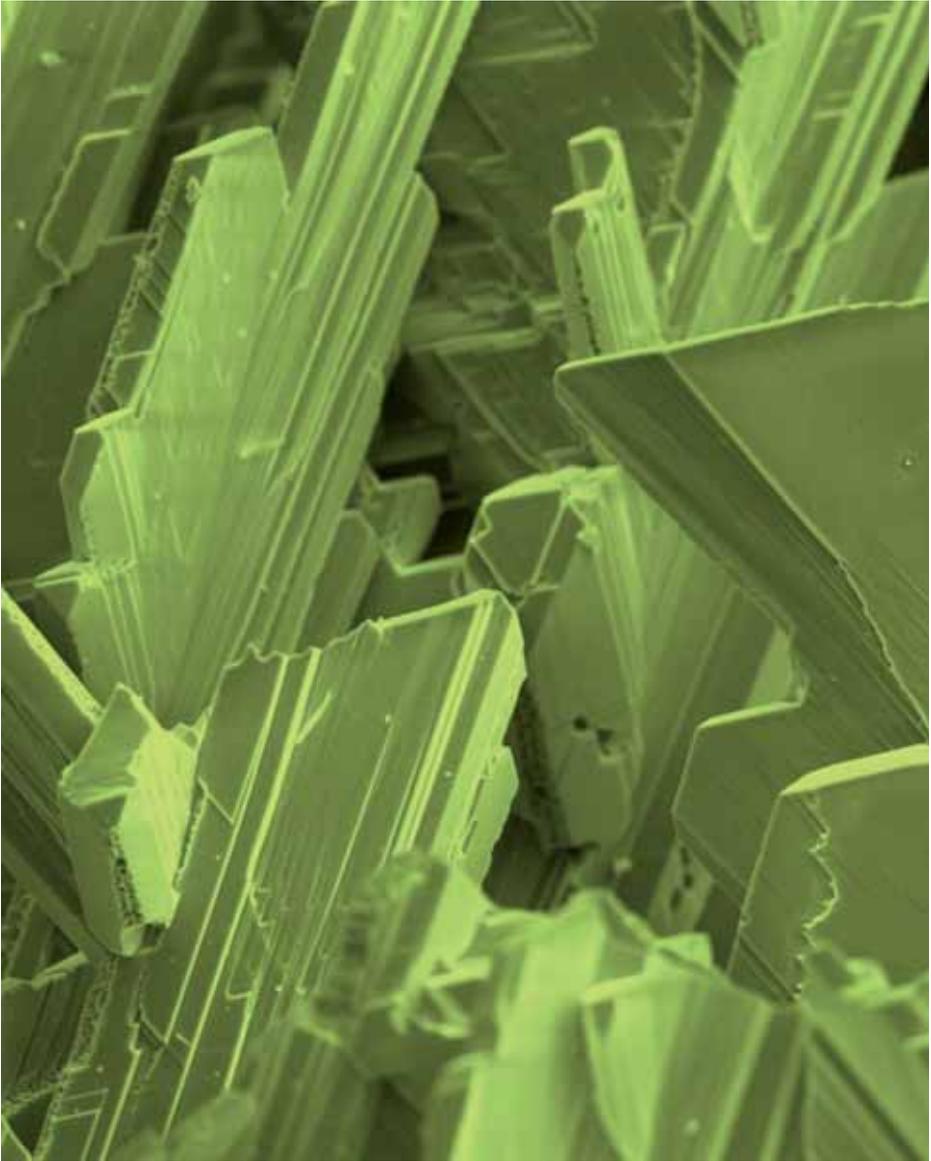
vii Gartner, Inc. is one of the world's leading information technology research and advisory company. Founded in 1979, Gartner is headquartered in Stamford, Connecticut, U.S.A., and has 4,000 associates, including 1,200 research analysts and consultants in 80 countries. See: www.gartner.com

Key findings from the survey include:

- ▶ Approximately 49 percent of respondents use general search engines (such as Google and Yahoo) once a week or more to find content, but only 20 percent use search tools built into a newspaper or magazine site.
- ▶ Only 24 percent of those surveyed share good content “finds” with friends or others via personal communications — such as e-mail and instant messaging (IM), and a mere 7 percent said they usually or often share content via embedding into social network sites.
- ▶ Although many newspapers list their staffers who are on Twitter, an influential micro blogging social network, few offer Twitter users the ability to “tweet” stories from their Web sites.
- ▶ When asked what they do when they find interesting content online, more than half of respondents (52 percent) said that they usually read it immediately. Only 9 percent said that they bookmark it to read later.

Although it’s easy to criticize the newspaper companies for falling behind the digital curve and not thinking innovatively about their future, some of the industry’s current failures fall under the category of looking past the basics. One of those basics is turning those who are fans of your product or service into your best and lowest-cost marketing channel. Even simple social media tools not only allow sharing and recommendations, but also provide a level of identity and reputation management to give others a snapshot of a content curator’s credentials. While the newspapers have incorporated social media content, they just haven’t taken the step of integrating social media tools into their content management “ecosystem” to provide pervasive deployment of important social features. The task at hand is now to prioritize the integration of social media into a current or future content management system.



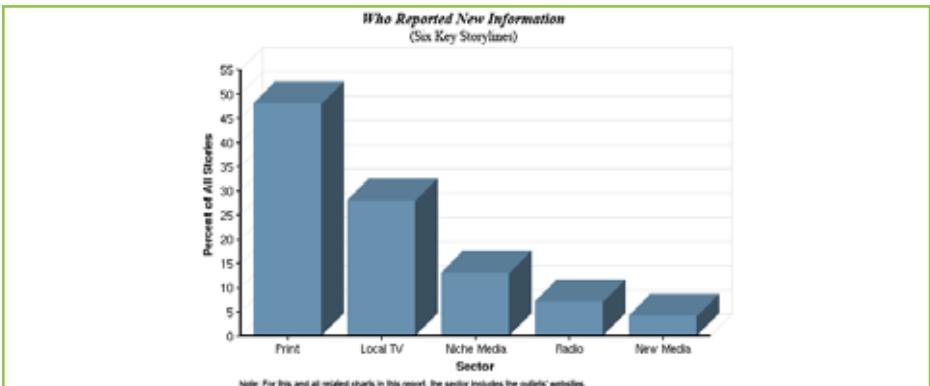


Fragment of "Los mundos de Kriptón"- Ramón Fernández Ruiz - 7th Edition FOTCIENCIA

How News Happens

But there is a big paradox... People are deserting the traditional media to access information via Internet, however: where does the news come from in today's changing media? Who really reports the news that most people get about their communities? What role do new media, blogs and specialty news sites now play? How, in other words, does the modern news "ecosystem" work? And if newspapers were to die—to the extent that we can infer from the current landscape—what would that imply for what citizens would know and not know?

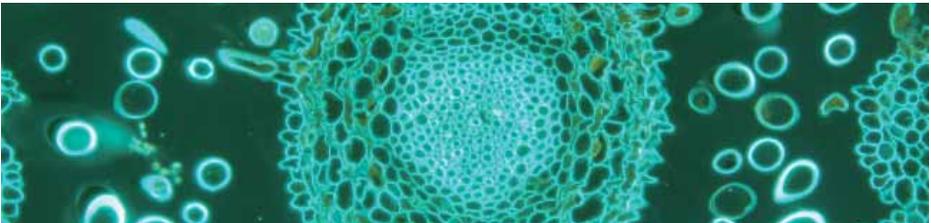
An new study by the Pew Research Center's Project for Excellence in Journalism, which takes a close look at the news ecosystem of one city suggests that while the news landscape has rapidly expanded, most of what the public learns is still overwhelmingly driven by traditional media—particularly newspapers.³¹



The study, which examined all the outlets that produced local news in Baltimore (USA) for one week, surveyed their output and then did a closer examination of six major narratives during the week, finds that much of the “news” people receive contains no original reporting. Fully eight out of ten stories studied simply repeated or repackaged previously published information. The stories that did contain new information nearly all, 95%, came from traditional media—most of them newspapers. These stories then tended to set the narrative agenda for most other media outlets. Indeed the expanding universe of new media, including blogs, Twitter and local websites played only a limited role: mainly an alert system and a way to disseminate stories from other places. New technology was more prevalent as a way for media—both traditional and new—to break news more quickly. The Web is now clearly the first place of publication.

And this faster dissemination of news was tied to three other trends. As news is posted faster, often with little enterprise reporting added, the official version of events is becoming more important. We found official press releases often appear word for word in first accounts of events, though often not noted as such. In the growing echo chamber online, formal procedures for citing and crediting can get lost. We found numerous examples of websites carrying sections of other people’s work without attribution and often suggesting original reporting was added when none was. We found elements of this in several major stories we traced. And sometimes old stories that were already obsolete were posted or linked to after events had changed and the original news site had updated them.

Naturally, we can not extrapolate this study, done in a context of local news, to the case of scientific information, whose original sources are much stronger, broader and extended, but it’s something to think about...



Fragment of “Un planeta con estilo”- Laura Carrera García - 7th Edition FOTCIENCIA

A marriage of convenience

With their specific constraints and cultures, cooperation between the worlds of science and of the media is often reduced to a compromise. The dynamic of science communication in Europe lacks the ingredients to elevate the relationship above that of a marriage of convenience. It is in order to move more in this direction that the European Commission organized in December 2007 the European Forum on Science Journalism with the collaboration of the Science Communication Observatory^{viii} from the Pompeu Fabra University (Barcelona, Spain).³² But to judge from many of the speakers at this event, it seems that a genuine change in mentality is needed, particularly in the world of science. It is rare, for example, for a European research project to include a component dedicated to communicating with the general public. When research centers do set up a communication service, too often it acts as a kind of filter or barrier rather than a genuine facilitation interface.

To encourage direct contact between the media and researchers, the latter require training that is left still very much wanting. "There has been talk of training young researchers for 30 years now. There have been a lot of trials, some of them very positive. But still we continue to use them as technicians. The culture is not changing and there is no global awareness of the issue within the research system itself." It is an opinion shared by Steve Miller, Professor of Science Communication at University College London and leader of the

viii The Science Communication Observatory (SCO) is a special research centre studying the various stages of the process of conveying scientific and technological knowledge to society and analyzing the relationship between science, media and society. SCO was created in 1994 with the commitment to be at the forefront of research, teaching and knowledge transfer in the study and analysis of the processes involved in the transmission of scientific, medical, environmental and technical knowledge to the society.

See: http://en.wikipedia.org/wiki/Science_Communication_Observatory

European Science Communication Network (ESConet)^{ix}: “Training scientists to science communication is not standard practice. Senior researchers sometimes discourage young people interested in getting involved in the media, which makes no sense.”³³

In general terms, journalism university degrees show a deficiency in science communication courses. On the other hand, science degrees pay little attention – or no attention at all – to the acquisition of popular science communication skills. To increase the amount and quality of science items on the media seems quite an impossible goal unless both journalists’ and scientists’ interest and skills on science popularization do not improve. So it is necessary to increase the number of specific training courses for specialized professionals in scientific communication. In order to develop the awareness of science communication it is necessary to promote the dissemination of science amongst university students by offering specific training courses in natural sciences, engineering and social sciences curricula.

Yet despite this situation, researchers are highly regarded by the general public. The 2007 Eurobarometer survey *Scientific research in the media*,³⁴ carried out by the Directorate- General for Research among approximately 27 000 people in the 27 Member States, found that scientists are the favored interlocutors. The survey also showed that most people are interested in scientific research and half of those interviewed consider that media coverage of research is sufficient and satisfactory. There are nevertheless some reservations: science information in the media is seen as reliable, objective, useful and varied but also difficult to understand, not very entertaining and unrelated to their concerns. The communication channels are therefore open, but the message received remains rather fuzzy.

These are the main conclusions of this survey:

- ▶ The majority of the EU population is interested in scientific research. Of all the research fields, medicine attracts the highest degree of public interest but the environment also enjoys high interest levels.
- ▶ European Union citizens have a positive view overall of the current presentation of scientific research in the media. However, in terms of ease of understanding there is a need for improvement as virtually a half of respondents say scientific news are difficult to understand.

ix ESConet (www.esconet.org) organizes Science Communication Workshops for scientists with the collaboration of the European Commission. See. http://www.upf.edu/pcstacademy/_docs/ESConet2010.pdf

- ▶ Television is the most important medium in all aspects covered by the survey: Europeans encounter information of scientific research most frequently via television. They prefer to receive scientific information via traditional and thematic TV channels and TV is the information source they trust the most.
- ▶ EU citizens consider scientific research to be a serious and important issue, since they would prefer programs on the topic – particularly documentaries – to be broadcasted during prime time on weekdays. In addition, the study reveals that Europeans would prefer scientists rather than journalists to present scientific information in the media as they consider this would be more trustworthy and more precise.





Fragment of "*Physarum albescens*" - Juana Arrabal Vargas - 7th Edition FOTCIENCIA

Building Public Engagement in Science

Over the past few years there have been signs of a major shift in how the scientific community [in the United States] views public engagement. Left behind is the assumption that simply informing an audience of the facts of science will meaningfully alter perceptions or decisions. Instead, one can detect a growing recognition that effective communication involves addressing an intended audience's values, interests, and worldviews.

Yet despite these new directions and initiatives, many communication efforts continue to be based on ad-hoc, intuition-driven approaches, paying little attention to interdisciplinary research on what makes for effective public engagement. Most notably, these initiatives start with the false premise that deficits in public knowledge are the central culprit driving societal conflict over science, when in fact, science literacy has only a limited role in shaping public perceptions and decisions.

Matthew C. Nisbet^x, one of the best current analysts of science communication, points the following:

Building public engagement efforts around these assumptions rather than false premises would be a major leap forward.

1. Research shows that science literacy has very little to do with public support, trust, perceptions, respect, or deference to scientific expertise.

^x Matthew C. Nisbet. Ph.D, is a professor in the School of Communication at American University in Washington DC, where his research focuses on the intersections between science, media, and politics. His blog "Framing Science" <http://scienceblogs.com/framing-science> is one of the most followed in the field of Science Communication

2. In American society, scientific organizations enjoy almost unrivaled respect, authority, and hold great communication capital but need to learn to use this communication capital wisely and effectively.
3. Specifically, when an area of science spills into the wider public eye, science organizations need to provide messages that emphasize shared common values and personal relevance rather than make it easy for people to re-interpret science in terms of false conflict, complexity or uncertainty. When science organizations fail to do this, they cede public communication to rival groups who seek to promote these interpretations.
4. Through public dialogue and consultation initiatives, science organizations need to empower citizens to participate in collective decisions but need to be prepared for citizen decisions to cut against the self-interests of science.

On the one hand, it's clear that scientists and, of course, scientific organizations, must improve science communication of the work they do... The best success in communicating will happen for the work of scientists who can participate personally in the communication effort. On the other hand, the future of science journalism will be online, in film, and/or multi-media, merging reporting with synthesis, analysis, personal narrative, and opinion. The goals will be to inform but also to persuade and to mobilize. And most importantly, it will be non-profit, sponsored by universities, museums, think tanks, foundations, professional societies [such as AAAS in the United States], or government affiliated organizations [such as National Science Foundation or the National Academies in the United States].

However, the new forms, modes, style, and sponsors for science coverage will mean that journalists will have to rethink their standard orientations and definitions of objectivity and balance. *The future is already here, it's time to talk about what it all means.*

New directions in public science communication

About the future of science communication, here are some of Matthew C. Nisbet's suggestions:³⁵

Graduate training and new interdisciplinary degree programs. College and doctoral students majoring in the sciences should be offered courses and training in communication. These courses introduce young scientists to much of the research reviewed in this essay, focusing on the relationships between science, the media, and society, and providing valuable professional know-how and skills. There is also the demand for new inter-disciplinary degree programs that combine course work in communication, the sciences, policy or law, sociology, and other fields. Graduates of these programs are likely to find jobs in the news media, the high-tech industries, the government sector, or at research institutions, public affairs strategy firms, and not-for-profits.

Some critics of our proposals have argued that scientists should stick to research and let media relations officers and science writers worry about translating the implications of that research. They are right: In an ideal world that's exactly what should happen. Yet in reality, scientists will be the key individuals who will be giving the interviews, testifying before Congress or addressing local community forums. Perhaps even more importantly, as senior decision-makers, many scientists are ultimately responsible for setting communication policy at scientific institutions, agencies, and organizations. These leaders need to understand how research can and should inform public communication on all issues.

Public dialogue that matters. As reviewed, public dialogue initiatives have many positive uses but also several limitations. In order to enhance public

participation, significant resources need to be spent on sampling, recruitment, and turn-out. Multiple meetings should also be held across dates and locations. In this case, success is a function of money and careful planning. Another strategy to boost public interest in these types of meetings is to pair expert testimony and deliberation with the viewing of a documentary or series of short films. These “deliberative screenings” can not only increase public turn out, but also help frame discussion and thinking in ways that might bridge polarized views. They also provide an additional outlet and repurposing for many NSF-funded films and media productions.

The scope and impact of public dialogue initiatives can also be expanded by generating local and national news attention to the event. Not only does this news attention reach a larger audience with a message that scientists are open to public input, but coverage is likely to reflect the types of frames that the meetings were organized around. For example, a recent study found that a public consultation exercise on nanotechnology generated discussion that was framed mostly in social progress terms, accenting the benefits to society.

A commitment to early consultation and to a genuine role for participants’ recommendations can only come with the realization that sometimes a competent, informed, and engaged public might reach collective decisions that go against the self-interest of scientists. For example, at a recent public consultation exercise on nanotechnology, though the recommendations were not binding as policy, one of the outcomes was that several recruited participants decided to subsequently form their own local advocacy group to monitor the development of nanotechnology in the area.

Data should trump intuition. Efforts to use the media and communication campaigns to engage the public on science need to adapt to the realities of today’s information environment. Many approaches to science communication and outreach still rely heavily on traditional channels, such as science television or newspapers. Recent survey data, however, suggests that we are seeing significant shifts from television (which is still the primary source of information for three quarters of respondents 65 years or older) to online sources (which are the preferred medium for more than half of the under 24 year olds). The same data also show that interest in science-related issues is highest among respondents who relied mainly on new information technologies for news, as opposed to traditional mass media channels.

Effective public communication is not a guessing game; it is a science--which means it is based on data. Public opinion research allows us to get a very accurate picture over time of exactly what different groups in society want to know about climate change, evolution, biotechnology, or nanotechnology, about potential implications for their daily lives, about what their concerns are, and who they are looking to for answers. Relying on systematic research to understand and communicate effectively with different publics is therefore critical to understanding how the public thinks about new technologies, what they know, and what the informational channels are to reach them most effectively.

Quality research, of course, is expensive. Recent calls for the National Science Foundation to fund more direct research on science communication are welcome developments as is the leadership role played by the National Academies in commissioning audience research on evolution. Similarly, the National Academy of Engineering recently issued recommendations for recruiting women and minorities into careers in science and engineering, relying on empirical audience research and principles of strategic communication (Committee on Public Understanding of Engineering Messages 2008).

Connecting to public values. Effective communication will necessitate connecting a scientific topic to something the public already values, emphasizing shared common ground. And in people's minds, these links are critical for making sense of scientific information. A number of recent studies examine how values shape the interpretation of scientific information. Findings on religiosity, for instance, show that the exact same information can translate into very different attitudinal conclusions for highly religious respondents than for non-religious ones. In other words, we may be wasting valuable time and resources by focusing our efforts on putting more and more information in front of an unaware public, without first developing a better understanding of how different groups will filter or reinterpret this information when it reaches them, given their personal value systems and beliefs. Recent research also suggests that these value-based filters may in fact differ across different cultures or national settings.

Science communication that does not focus on elite audiences. As mentioned earlier, some critics argue that it would be unethical to take advantage of strategic communication tools in order to make scientific issues more relevant to a general public. But recent data on potentially widening knowledge gaps

suggests that it may be unethical if we did not use all communication tools at our disposal in order to connect with hard-to-reach audiences. Many traditional approaches to public communication about science, for instance, have inadvertently favored elite audiences. In fact, some previous attempts to connect across diverse sections of the public have resulted in widening gaps between the already information rich and the information poor. This is partly due to likelihood of exposure. Almost 40% of college-educated respondents, for instance, visited a science or technology museum in 2006, compared to less than 10 percent for respondents with a high school education or less.

As a result, museum exhibits, science Web sites, traditional science documentaries, and similar outreach efforts may inherently favor elite audiences. Widening gaps between the information rich and information poor are also a function of the way issues like nanotechnology and biotechnology play out in public discourse. In their research on "knowledge gaps," Phil Tichenor and his colleagues (1970) found that audiences with high socioeconomic status (SES) showed much stronger learning effects from health related information than low-SES audiences. This effect is in part due to the fact that TV shows like PBS' NOVA or the science section of *The New York Times* tailor their content to highly educated audiences. As a result, learning effects for mass audiences are minimal, even if these audiences happen to tune in to NOVA or read an article in *The New York Times*.

Consider alternatively, that surveys show that local television news is among the dominant sources of public affairs-related information for the American public. Therefore, in order to reach non-traditional audiences, scientists and their organizations need to be on local television news. Major national communication efforts should be closely coordinated across local media markets, with specific scientists, institutions, or organizations serving as the local angle and spokesperson.

A recent National Academies (2008) initiative that pairs scientists as consultants on major motion pictures and television series is also a step in the direction of reaching new audiences. Long used as a strategy for engaging the public on public health issues, active involvement with Hollywood in the construction of messages about science can lead to a range of outcomes including informal learning, enhanced interest and attention to science in news coverage and other media, the modeling of positive behavior related to environmental sustainability or energy use, the favorable framing of controversial issues

such as the teaching of evolution in schools, or even a spike in news or policy attention to a scientific topic such as climate change.

Other important media outlets for expanding audience reach include comedy news programs such as *The Daily Show* and *The Colbert Report*. Studies have documented the ability of these programs to engage younger, harder to reach audiences about political candidates and election campaigns, shaping their political attitudes and levels of political knowledge. On science, a recent Pew Research Center Project for Excellence in Journalism analysis finds that *The Daily Show* includes comparatively more attention to science and technology topics than the mainstream press and significantly more attention to climate change.³⁶ These programs also generate buzz online with heavily-trafficked and forwarded clips on hot-button science topics such as evolution, genetics, climate change, or stem cell research. Additionally, both shows frequently feature scientists and science authors as interview guests.

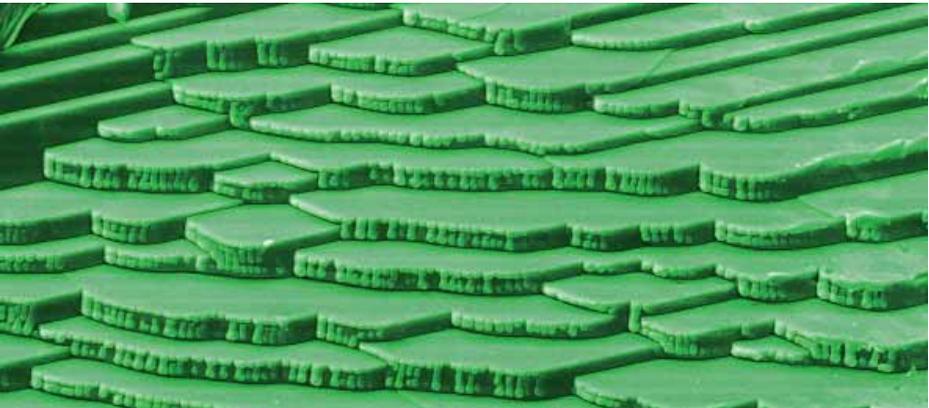
Given that satire and comedic news is an increasingly preferred media format for younger audiences, more research is needed on the potential for using this style of humor as a tool for public engagement on science. Little is known, for example, about the comparative effects of science information communicated in satirical form compared with the same information communicated in traditional science media. Greater understanding in this area would inform not just media strategy but also the incorporation of humor and satire into the production of documentary film, web, and museum content.

Opinion leader campaigns that bridge audience gaps. With so much focus on media strategy, it is important not to forget that perhaps the most effective strategy for connecting with difficult to reach audiences are face-to-face conversations and other interpersonal channels. In this matter, science organizations need to mobilize specially trained opinion-leaders who can bridge the communication gap between news coverage and inattentive audiences, talking up to their friends, family, and co-workers the relevance of science-related issues such as climate change or the teaching of evolution in schools.

We know that these science opinion-leaders exist and can be recruited. For more than sixty years, researchers have traced the influence of news and advertising messages in local communities, identifying a small group of opinion-leading individuals who pay close attention public affairs and

advertising, discuss what they learn from the media with a diversity of others, and appear to be more persuasive in convincing others to adopt an opinion or course of action. In this “two step-flow of information,” opinion-leaders do not necessarily hold formal positions of power or prestige, but rather serve as the connective communication tissue that alerts their peers to what matters among political events, social issues, and consumer choices. Over the past decade, as audiences have become more difficult to reach and less trustful of the media, this research has informed innovative communication campaigns in the areas of public health, politics, and consumer marketing. Yet despite the widespread targeting of opinion-leaders in these other fields, science organizations have traditionally overlooked this important dimension of public engagement.

Several validated measurement techniques exist for identifying individuals with opinion-leader like qualities in surveys and questionnaires. Once recruited and trained, audience-tested messages, such as those developed by the National Academies on evolution, can be matched to an opinion-leader’s social background and network. Moreover, when “surges” in communication and public attention are needed - such as surrounding the release of a future IPCC [Intergovernmental Panel on Climate Change] report or a major state legislative vote on evolution - opinion leaders can be activated with talking points to share in conversations with friends and co-workers, in emails, in blog posts, or letters to the editor.



Fragment of “Terrazas solares de Banaue” - Eberhardt Josue Friedrich Kernahan - 7th Edition FOTCIENCIA

Changes in Science and Media Demand

Evolution in Science Communication

Matthew C. Nisbet says that changes in scientific research and the rapidly changing media landscape demand that eight specific steps be taken by science organizations and journalists in order to better engage the general public and to accurately report scientific research.

“During the past several decades, science has become more bureaucratic, problem-based, and dependent on private funding. Public surveys point to a high trust in scientists, especially those affiliated with universities, but the trust level decreases when it comes to scientists affiliated with corporations or industries,” Nisbet said. “Factor in changes in the media landscape that have created audience fragmentation and ever fewer quality sources of science news, and it is clear changes in science communication are needed to better engage the public on science-related issues.”

The eight steps are outlined in “Science Communication Reconsidered,” an article published in the June 2009 issue of the journal *Nature Biotechnology*.³⁷ It presents the collective recommendations made by Nisbet and 23 other international experts in science, media, and policy at a science communication workshop in Washington, D.C. The workshop was organized by the Health Law Center at the University of Alberta.

The eight steps are as follows:

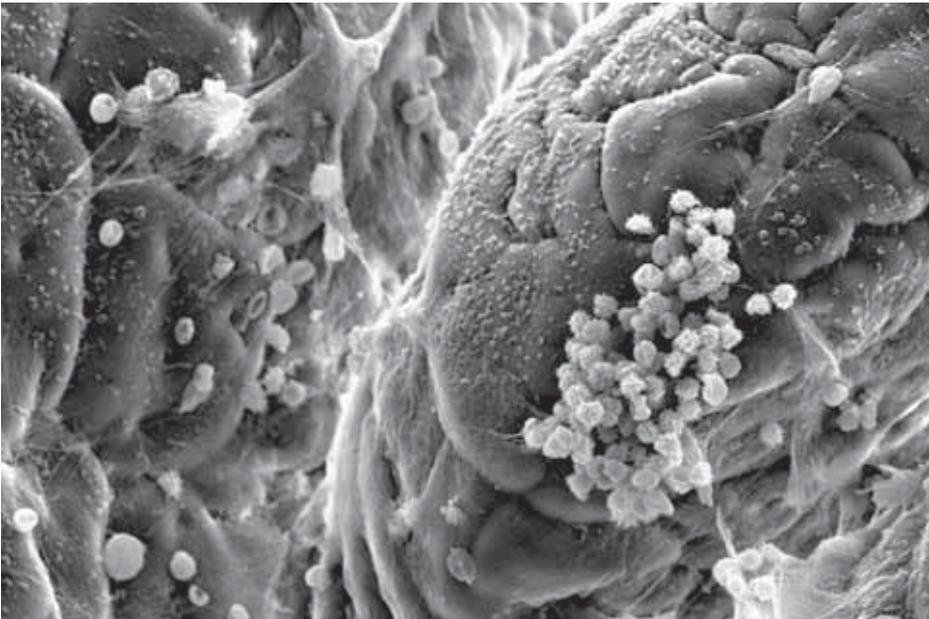
1. **Scientists and science organizations should pursue a trust- and dialogue-based relationship with the public.** More forums, conferences, and other public dialogue initiatives should be held.

The goal is not to persuade or sell the public on the importance of science, but to “democratize” public input about scientific issues so that members of the public can meaningfully participate in science-related decision making.

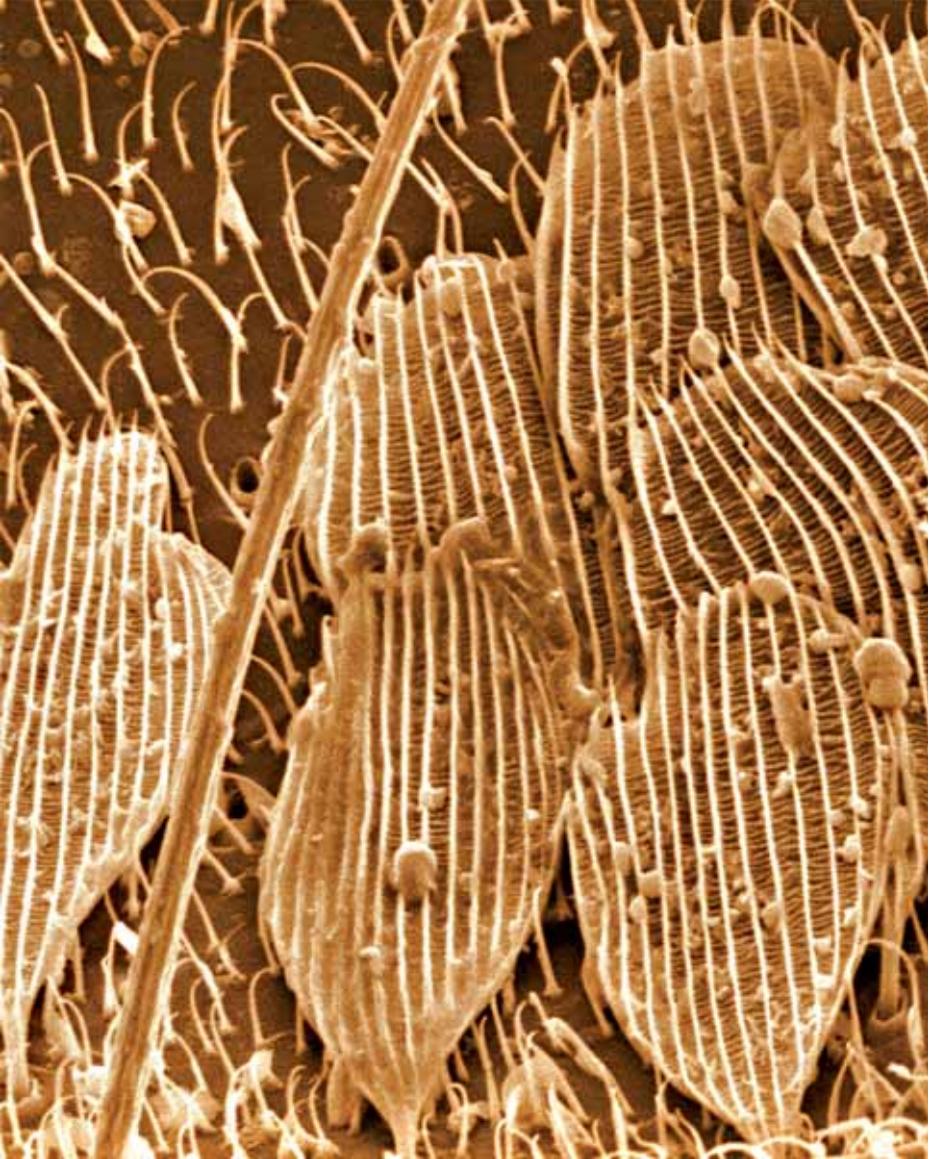
2. **Scientists and science organizations need to recognize the importance of framing science-related issues.** Science communication efforts need to be based on careful audience research. Different frames of reference that better communicate the nature and relevance of scientific issues across a diversity of audiences should be identified and tested. This research on framing can be used to structure dialogue and to move public discussion beyond polarized arguments and entrenched positions.
3. **Graduate students at science institutions should be taught the social and political contexts of science and how to communicate with the media and numerous publics.** Graduate students are future spokespeople and decision makers. They need to understand the significance of research in the field of science communication. These programs should include specialized electives for doctoral students but also new interdisciplinary degree programs that combine scientific training with course work in communication, ethics, and policy.
4. **Factors that facilitate media hype and errors should be recognized and addressed.** Researchers should resist the temptation to describe their studies using inflated metaphors and terminology, such as “groundbreaking,” and remain true to the significance of a study. Research funding and methodological details need to be included in media coverage so that the public may better assess credibility. Short-term gains in media credibility should not be valued above longer-term relationship building with journalists, decision makers, and the public.
5. **Science communication initiatives should investigate new forms of digital media and film to move beyond traditional popular science outlets, such as science newspaper columns, science magazines, and television programs like PBS’s NOVA.** This includes finding ways to create opportunities online for incidental exposure among key audiences not actively seeking news, information, and science-related content
6. **Scientific organizations need to track science-related media coverage (news, entertainment, etc.) to be aware of the numerous**

cultural contexts through which the public interprets science. National newscasts, talk radio, blockbuster films, entertainment TV, and late night comedy provide broader audiences with alternative messages about science topics and can be important outlets for science communication.

7. **Journalism schools and news organizations should develop a science policy beat to address the gap between journalists covering science and those covering politics.** Developing such a beat and training journalists to understand both science and policy would provide important background for science policy debates.
8. **New models of journalism—whether foundation, university, or government supported—are needed.** The for-profit journalism business model is failing and specialty journalists, such as science journalists, are losing their jobs. In addition, new media formats offer another avenue for public participation, as user generated content can enhance professionally produced content.



Fragment of "Sobrevolando el intestino" - María Vicario Pérez - 7th Edition FOTCIENCIA



Fragment of "¿Por qué zumban los mosquitos?" - Ricardo Andrade Pocino - 7th Edition FOTCIENCIA

The Gap

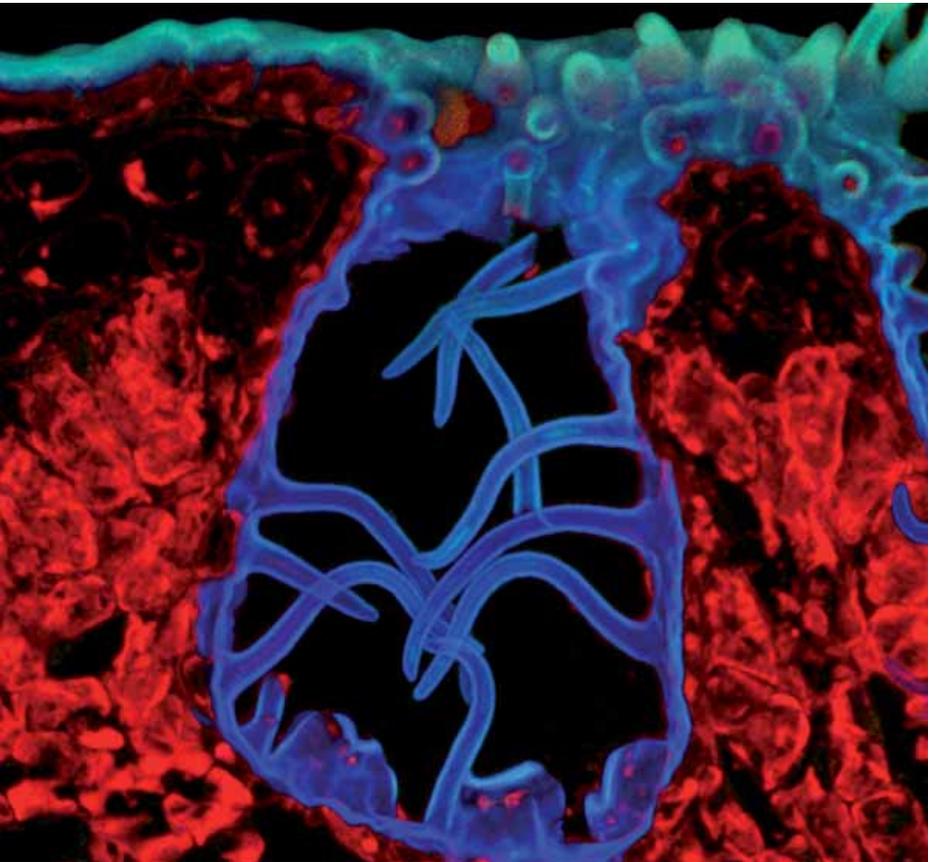
Between What Scientists Say and What the Public Hears³⁸

Research often delivers statistically nuanced findings that the lay public as well as journalists and other science communicators can find hard to understand. And just as political messages can be twisted into snippets of misinformation, scientific findings, too, are vulnerable to distortions and misrepresentations that stick in the public mind, especially if they fit ideological biases.

These distortions are becoming all too common in today's new media environment. Although the World Wide Web offers invaluable access to information, it also gives an audience to anyone with an axe to grind. According to the commentary (see before) in the June 2009 issue of *Nature Biotechnology* authored by 24 experts in communication, law, and journalism, media fragmentation and the rise of ideologically slanted websites are perpetuating gridlocked opinions in science, just as they are in politics. People who aren't inclined to pay close attention to an issue will learn about it from media outlets that reinforce their own social, political, or religious views. This and other types of "mental shortcuts make it possible for individuals to draw quick conclusions about complex topics that fit their own preconceptions.

Given these trends, communication experts are calling for fundamental changes in how scientists interact with the media because debates over climate change, health, energy, and technology are simply too important to lose to misinformation. As always, scientists are encouraged to communicate clearly using language that no specialists can understand. But now they're also being urged to step beyond the confines of the laboratory and to become more engaged in efforts to educate the public.

Sharon Dunwoody^{xi} one of the authors, emphasizes that, as sources in the media, scientists get to decide what they're going to say. But she adds they should also be insightful about how those messages are received, given the need to dispel misinformation in the public arena. "The way you portray something dictates the take-home messages people walk away with," she says. "You've got to be careful."



Fragment of "El pulmón de la adelfa" - Ricardo Andrade Pocino - 7th Edition FOTCIENCIA

^{xi} Sharon Dunwoody is Evjue-Bascom Professor in the School of Journalism and Mass Communication at the University of Wisconsin-Madison, as well as Associate Dean for Social Studies in the Graduate School.

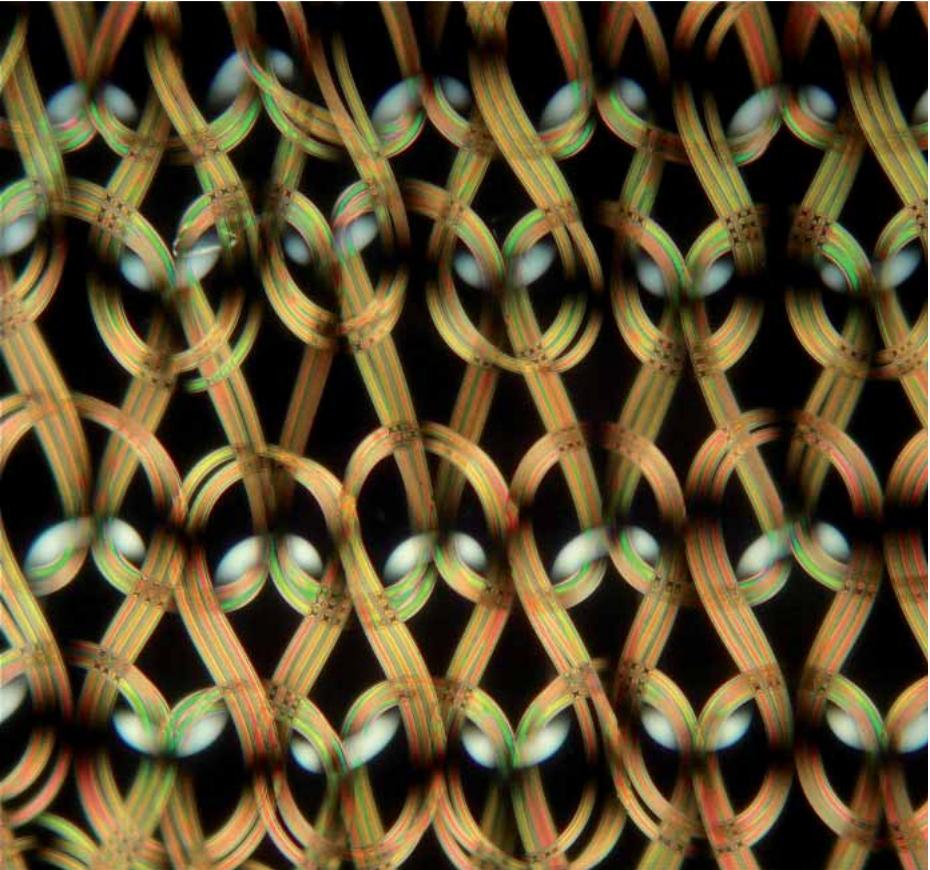
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3. <http://futurity.org> **Who is Futurity?**
Duke University, Stanford University, and the University of Rochester lead a consortium of participating universities that manages and funds the project. All partners are members of the Association of American Universities (AAU) or of the Russell Group. These organizations include the leading research universities in the United States, Canada and the United Kingdom. Futurity aggregates the very best research news. The content is produced by the partner universities, and submitted to Futurity's editor, Jenny Leonard (editor@futurity.org), for consideration. The site, which is hosted at the University of Rochester, covers news in the environment, health, science, society and other areas
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Fragment of "*Lycra multicolor*" - Alejandro del Mazo Vivar - 7th Edition FOTCIENCIA

FURTHER READING

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