Journalism, Science and Society

Science Communication between News and Public Relations

Edited by
Martin W. Bauer and
Massimiano Bucchi

Journalism, Science and Society

Routledge Studies in Science, Technology and Society

1. Science and the Media
Alternative Routes in Scientific Communication
Massimiano Bucchi

2. Animals, Disease and Human Society
Human-Animal Relations and the Rise of Veterinary Medicine
Joanna Swabe

3. Transnational Environmental Policy
The Ozone Layer
Reiner Grundmann

4. Biology and Political Science
Robert H. Blank and Samuel M. Hines, Jr.

5. Technoculture and Critical Theory
In the Service of the Machine?
Simon Cooper

6. Biomedicine as Culture
Instrumental Practices, Technoscientific Knowledge, and New Modes of Life
Edited by Regula Valérie Burri and Joseph Dumit

7. Journalism, Science and Society
Science Communication Between News and Public Relations
Edited by Martin W. Bauer and Massimiano Bucchi

Journalism, Science and Society

Science Communication between News and Public Relations

Edited by
Martin W. Bauer and
Massimiano Bucchi

Routledge
Taylor & Francis Group
New York London

Routledge
Taylor & Francis Group
270 Madison Avenue
New York, NY 10016

Routledge
Taylor & Francis Group
2 Park Square
Milton Park, Abingdon
Oxon OX14 4RN

This edition published in the Taylor & Francis e-Library, 2008.

"To purchase your own copy of this or any of Taylor & Francis or Routledge's collection of thousands of eBooks please go to www.eBookstore.tandf.co.uk."

International Standard Book Number-13: 978-0-415-37528-3 (Hardcover)

Library of Congress Cataloging-in-Publication Data

Journalism, science and society : science communication between news and public relations / edited by Martin W. Bauer and Massimiano Bucchi.
p. cm. -- (Routledge studies in science, technology and society ; 7)
Includes bibliographical references and index.
ISBN 978-0-415-37528-3 (hardback : alk. paper)
1. Journalism, Scientific. 2. Science news. I. Bauer, Martin W. II. Bucchi, Massimiano, 1970-

PN4784.T3J68 2007
070.4'495--dc22 2007001215

ISBN 0-203-94231-0 Master e-book ISBN

Visit the Taylor & Francis Web site at
http://www.taylorandfrancis.com

and the Routledge Web site at
http://www.routledge.com

Contents

Figures

Tables

1 Introduction and a guidance for the reader

Martin W. Bauer and Massimiano Bucchi

We started this project some years ago when the British Council and the CRUI—Conference of Italian University Chancellors—offered an opportunity for joint activities on science communication. We called a meeting in May 2003, on some beautiful spring days in the northern Italian Trentino, and invited a group of Italian and British science journalists to discuss issues and trends in their daily practice, asking them to reflect, in particular through case studies, on their own criteria for 'success' and 'failure' in science writing. The positive experience encouraged us to call a second meeting, with the support of the same sponsors. This time we invited voices from the public relations departments of scientific institutions. A handful of Italian and British professionals arrived for the weekend in Trento in May 2005, and some academic colleagues joined for the discussions. Again the proceedings were rich in detail and more questions were raised, so we decided to expand the discussions for the purpose of this book beyond daily newspapers and the geographical scope of Italy and the UK. The basic idea was to juxtapose, in the field of science communication, the worlds of science journalism and public relations, each with its own modus operandi, rules of engagement, and quality criteria, established but changing for science journalism, newly emerging for science PR. How are these two practices interacting? How is this interaction changing the overall framework of science communication? Are there significant discontinuities with regard to the past? The resulting book investigates two main scenarios:

S1: The increasing private patronage of scientific research changes the nature of science communication by displacing the logic of journalistic reportage with the logic of corporate promotion.
S2: Scientific institutions increasingly adopt the strategies and tactics of corporate communication for image, reputation, and product management.

For this purpose, the book has a 'symmetrical' design in four parts. In the first part we trace the changing contexts of science communication in the second half of the twentieth century, complemented by two chapters which extend our horizon into 1930s Britain and late nineteenth century Italy.

Science communication itself has a history of actors and practices in changing contexts. The second part gives voice to professional science writers and invites critical reflections on changing operational rules in their field. Part III brings in the public relation professionals, who again, through case study and critical reflection, demonstrate their emerging rules of engagement. Finally, part IV invites commentaries from around the globe. Experts in science communication from Japan, Korea, Australia, South Africa, and the USA comment on the case studies and ask the question: Are the issues raised global or local?

We will provide a brief overview of the book's contents to guide the reader and end with some comments on the boundaries of the present argument.

THE CHANGING SCENARIOS OF SCIENCE COMMUNICATION

Part I, 'The Changing Scenarios of Science Communication', opens with a chapter by Jeff Hughes (University of Manchester) who explores the emergence of news values for science through an episode in the pre-history of professional science journalism, namely the struggles of young J.G. Crowther with his editor at the *Manchester Guardian*. Hughes comments on newly discovered letters in which Crowther tussles with his editor over what might be newsworthy in the Britain of the 1930s. Crowther's enthusiasm about new atomic and quantum physics finds little editorial support until other papers pick it up. His editor asks for 'clarity' and 'simplicity' and stories about 'insects and dairy farming' rather than electrons.

Paola Govoni (University of Bologna) recovers pioneering attempts to mobilise public attention for science at the end of the nineteenth century and reminds us that popularisation of science has its own protracted history. These Italian attempts to imitate initiatives mainly from Britain did not last. She identifies the critical factor in the general level of education, which proved to be insufficient to sustain a market for popular science publications. General school education—although too often neglected—may also be highly relevant to understanding the contemporary dynamics of science in society.

Bauer and Gregory (London School of Economics and University College, London) look at the fluctuations in intensity and framing of science reportage in post-war Britain, and characterise the transition from an old, journalistic mode of news production to one that is source-driven in the logic of corporate communication and public relations. Key for this transition is the decade of the 1970s, when scientists became alienated by TV technology and a science-critical 'zeitgeist' (environmental and anti-nuclear protest) left the field of communication to the professionals. Furthermore, the increasing private patronage of scientific research makes scientific knowledge to a certain extent similar to a a commodity that requires mar-

ket promotion like toothpaste, cars, or perfumes. The authors point to a number of dilemmas and contradictions that might arise from this trend.

Bucchi and Mazzolini (University of Trento) offer an analysis of the changing press reportage of science in post-war Italy. Trends highlight a growing space devoted to science, but largely 'institutionalised' in special sections; an increasingly dominant coverage of biomedical stories in comparison to other fields; the involvement of scientific and medical experts, not only as sources or as interviewees, but also as the authors of articles. Furthermore, they point to a general trend to represent science as consensual, linear, and uncontroversial, using single, institutional sources like universities and research institutes, which shows the growing impact of PR activities for science.

Massarani and her colleagues (Fundacao Oswaldo Cruz, Rio de Janeiro) present a panorama of science coverage across five Latin America countries in 2005. They document the similarities and differences in science reportage, highlight the efforts that are undertaken to create a presence for science in these public spheres, and point to the dominance of foreign sources for science stories. With few exceptions, Latin American newspapers often tend to ignore home grown scientific achievements. This is in part due to easily available foreign sources and a lack of cooperation on the part of local scientists and research institutions.

Jon Turney (Imperial College, London) characterises the most recent boom in popular science book publishing, which has provided a platform for many authors to become visible scientists. He proposes an explanation for why books continue to be an important medium of popularisation and he reflects on how to tell good from bad popular science books: heroes, big questions, and explanations. He explores their cultural impact as bestsellers, literary genre and blue-prints for TV and cinema productions, and offers some observations on publishers' desperate search for new mass readers.

SCIENCE WRITING

In the opening chapter of Part II 'Science Writing: Practitioners' Perspectives', Tim Radford (former science editor, *The Guardian*) accounts for the uneasy relationship between journalists and scientists in terms of their different time horizons, institutional and professional constraints. He identifies a crucial tension in the focus of the mass media—particularly newspapers—on seeking a good narrative rather than seeking to advance public education as scientists sometimes seem to expect. Science journalists share Scheherazade's predicament: only good story telling keeps them alive.

Luca Carra (*L'Espresso* and Zadig news agency, Italy) shows how the reporting of the cloning of Dolly the sheep (1997) makes use of the news

value 'sex' in its wider meaning of sexuality, reproduction, and kinship, which determined the success of the story well beyond its scientific importance. Before Dolly, biotechnology found little public attention in Italy. After Dolly, biotechnologies gained prominence in the news stimulating public debates on GM food and embryonic stem cells. He also shows, in a case of excitement over 'miracle cures', that readers can read a sceptical story of scientific failure—the therapeutic failures of melatonin—as a story of therapeutic hopes. The key news value seems to be the 'challenge to the natural order of things': either the challenge posed by science to the moral order, or the challenge posed by 'hopes for miracles' to the authority of science.

Sylvie Coyaud (*Il Sole 24 Ore*, Italy) points out that science writers in Italy rely increasingly on press releases by research institutions and write 'second hand' reports. Science journalists are invited to a growing number of science communication events and report the achievements positively. On the other hand, for structural reasons they fail to cover the pressing problems and dysfunctions of current organisation of research and their recruitment practices.

Chiara Palmerini (*Panorama*, Italy) describes science writing as a dual negotiation process: with the journal editor who needs to accept the piece and with the scientists who are the sources for the story. The chapter reports problematic negotiations with scientists who wanted to actually reword her writing, or went so far as to suggest what was or was not appropriate to tell the general public.

Fjaestad (editor *Forskning & Framsteg*, Sweden) explains 'why journalists write the way they do and not how scientists want them to' by the different institutional cultures of mass mediation and of scientific research. Rather than looking for bridging these differences, he stresses their different roles in informing society, and thus advises scientists on how to deal with journalists.

Brian Trench (University College Dublin) invites us to reflect on the challenges posed by the Internet to science journalism. Making information, originally prepared by experts for other experts, available beyond the specialist circle enables patient groups to become significant actors for other patients on medical issues, multiplying and mixing the types of material available to the general public (press releases, scholarly literature, media reports, online discussions). Thus the Internet makes it necessary for science journalists to redefine their role for new science communication scenarios.

Jon Franklin (University of Maryland) offers a frank account of a career as a science journalist in the United States through post-war scientific idolatry and two-culture clashes to the iconoclasm of the 1970s and the turning point of Three-Mile Island. Henceforth science writers refused to be mere translators. Finally and paradoxically, as science has become valuable news and daily routine, science journalism disappears as a speciality; it merges into general public writing and journalism with their ethos of writing good stories for the historical mainstream.

PUBLIC RELATIONS FOR SCIENCE

In Part III, 'Public Relations for Science: Practitioners' Perspectives', Bob Ward (Royal Society of London) shows the strategy and tactics used by the Royal Society of London to engage a media campaign on global climate change. The paper highlights what is possible under the constraints posed by media coverage and in a context of high-profile competing information on climate change, and how it might be evaluated.

Manuela Arata (Italian Institute for the Physics of Matter, Genova) documents successes and failures in a recently established public relation structure, extracting a set of operational rules for how to (and not to) communicate with a broad portfolio of activities targeted to different audiences.

Bonwyn Terrill (Sanger Centre, Cambridge, UK) addresses the issue of the public relations styles of scientific institutions, which have the potential to be equally successful. She offers a short account of events celebrating the 50th anniversary of the discovery of the double helix model of DNA, at Cold Spring Harbour, New York, and Cambridge, UK. She compares these two events in context and practicalities, and evaluates their outcomes against the objectives. In terms of styles, one event focused on stardom and celebrity (US) and the other focussed on a collective effort of reaching out to the public (UK). She wonders whether this difference in style reflects cultural, organisational, or other reasons; for example, to compensate for the lack of a local scientific celebrity.

Pantarotto and Jori (Mario Negri Institute, Milan) present the communication efforts of a major private, non-profit biomedical research institution. In the absence of any centralised public relations function, a series of broad and diversified communication efforts and two major public events are being performed. Communication has two strategic purposes: firstly, to attract donations (30% of its budget is privately donated) through the management and expansion of a donor database; secondly to maintain the image and reputation of the institute as the country's most reliable source of information on drugs and other health issues. These efforts are distributed successfully across three functions without co-ordination: research, external relations, and the press office.

Gregory and her colleagues (University College London and University of Cambridge) explore the meaning of 'public engagement' in the context of private patronage of scientific research. The paper reports a recent initiative of the Royal Society of Art and Industry (RSA) to launch a discussion *Forum for Technology, Citizen and Market* to stimulate social learning. As science is increasingly undertaken in university spin-off companies, what is the potential for dialogue with the public under these new conditions? Since public controversies during the 1990s, over BSE and GM food in the UK, the RSA and other actors are concerned about waning public goodwill towards science and technology. The paper explores what the 'public' means for these newly emerging and privatised scientific actors.

Winfried Goepfert (Free University Berlin) offers a critical analysis of the shifting power balance between public relations and journalism. Professional public relations offers itself as a source of scientific information. The tactics of doing this has become ever more sophisticated and powerful. The working conditions of science journalists, on the other side, are becoming more precarious: less full-time employment, freelance, and shorter deadlines. This renders science writers more dependent on sources. Science public relations has become a lucrative career move for science journalists. Overall the balance of power is shifting from journalism to public relations. The weakness of journalism is the strength of public relations.

Carlos Elias (University Carlos III, Madrid) presents two cases of recent environmental emergencies in Spain. He shows how scientific expertise and information can be instrumentalised and monopolised by government public relations. Spanish scientists have challenged this government strategy, with the help of the international media. The author argues that these attempts to enrol scientific expertise for political purposes can be at least partially explained by relicts of an authoritarian political tradition in Spain.

GLOBAL OR LOCAL ISSUES?

The book closes with a series of commentaries that place these issues and raise them within a broader international context: constancy and changes in news values; dual negotiations; lack of general education; commodification; source-dependency; popular science boom; focus on narrative powers; lacunae of coverage; disappearance of science journalism; challenges of the Internet; the functional organisation, strategies, tactics, operational rules, and styles of public relations; and dialogical engagement. To what extent are these general trends and changes? Sharon Dunwoody (USA) raises the audience focus. Toss Gascoigne (Australia) stresses continued public patronage and the need for co-ordination among communicators. Marina Joubert (South Africa) highlights the need for building capacity for science communication in Africa. Kenji Makino (Japan) reports on the recent 'science news bubble' and the reorientation of science communication. And finally Hak-Soo Kim (South Korea) reflects on the successful watchdog role of science journalism in revealing the 'scientific fraud' of Professor Hwang against the powers of professional PR.

DEFINING THE ARGUMENT

Any book is ultimately selective, and to enumerate all the missing pieces of this book on science communication would be arduous; also the omissions are for our readers to point out. However, some limitations are worth men-

tioning because they define our effort and achievement and widen the range of questions which we have to leave for further discussions.

One clear limitation is our focus on the print media as *pars pro toto*. While radio or TV might operate with similar news values as print journalism, it is hard to neglect significant differences and specificities. For instance the availability of image materials puts enormous pressure on TV, defining the scope of potential news, or accentuating sensationalism. How does TV science adapt to the new context?

Secondly, this book deals largely with routine activities in journalism and PR, barely touching the demands of controversies, crisis, and disasters, however defined. The dealing of journalists and PR professionals with 'crisis management' deserves a range of case studies in its own terms.

Thirdly, our analyses and case studies seem to imply that the main audience of science writing is the broad public of citizens and consumers. But increasingly, particularly in the context of new technologies such as IT, biotechnology, or nanotechnology, the audience is often not the general public, but other non-specialist scientists, policy makers, and investment brokers, who take media attention as cues for potential investment opportunities. We know little to nothing on the use of daily science news among investment brokers and scientists: a key theme for future investigations.

Fourthly, we say nothing about the increasing mobilisation of artistic expression for the purpose of science communication in society: film, photography, painting, sculpture, theatre, music, performances. For example, many public and private cultural bodies have started to combine artistic and scientific events. Funding agencies active in the area of research and public engagement now regularly sponsor artistic creations in diversifying their out-reach activities. Is this just image and reputation management—like T-Mobile's sponsoring of a team at the Tour de France—or the functionalisation of art, a sort, so to say, of 'scientific realism' imitating its socialist precursor? Will this amount to an 'aesthetisation of science' to contain public controversy of science and technologies in excitement and uplifting experiences? Our book is short on this development, clearly a topic that deserves more attention.

Finally, we advise the reader to take with circumspection our two scenarios: the substitution of the logic of journalism with the logic of PR in science news, and the adoption of corporate promotion strategies by research institutions and actors. If science communication is shaped by PR practices, then it would be no less interesting to explore how the theory and practice of PR is 'enriched' by this encounter. The adoption by corporate promoters of guerrilla marketing, forms of environmental and anti-nuclear activism, stunts, and street theatre offers hints that technological controversies are a testing ground and learning opportunity for mainstream PR and for the recruitment of creative competence. Professionalisation brings with it transferable skills and competence across purposes. No surprise then when over the years of environmental campaigning some prominent activists appar-

ently changed 'camp': is this co-optation, conversion, treason, or infiltration? These again are interesting topics for another occasion.

ACKNOWLEDGEMENTS

Last but not least, we would like to thank the British Council and the CRUI for supporting the Trento workshops; our local mentor with the historical perspectives, Renato G. Mazzolini, and all the contributors and discussants who participated; our at the time still students Lorenzo Beltrame and Laura Bona in Trento, and Sue Howard, Gregor Jost, and Dimitris Thomopoulos in London. Sue Howard also contributed her most valuable native English to the editing process.

Part I

The changing scenarios of science communication

2 Insects or neutrons?
Science news values in interwar Britain

Jeff Hughes

INTRODUCTION

The interwar years saw the emergence of the professional science journalist and the institutionalisation of science reporting in Britain. The period also witnessed radical changes in the organisation of newspaper publishing and in the content and composition of newspapers themselves. In this context, the emerging cadre of science journalists often found themselves establishing the practical rules of their profession as well as their professional identities as they mediated between the scientific community on the one hand and the journalistic profession on the other. The 'news values' of science reporting therefore emerged in this period in the course of a process of negotiation between scientists, science journalists, and editors.

'News values' tend, perhaps, to be discussed in general terms on the basis of a limited number of foundational studies, rather than analysed on a case-by-case or subject-by-subject basis. Studies of news values therefore tend to be limited to more or less systematic analyses of news stories as they actually appear in newspapers.[1] While such an approach is useful, however, it can tend to normalise and routinise the processes underlying the creation of news and to neglect the ideological aspects of news production. It also neglects an important part of the real-time process of producing news: the actual process of editorial planning, decision making, and the selection and shaping of 'news' stories as they compete for space in the hour-by-hour and minute-by-minute composition of a newspaper.

This is partly, of course, a problem of sources: it is usually difficult to obtain access to the inside workings of the fast-moving newsroom and the actual decision-making processes of news creation and management. We are fortunate, then, that in the archives of one of Britain's first self-styled science correspondents, James Gerald Crowther, an extensive sequence of correspondence survives detailing his day-to-day working relationship with the editors of the *Manchester Guardian*. The correspondence between the newspaper's editorial team and Crowther offers a highly revealing insight into the science news values of one quality British newspaper in the

interwar years, and furnishes an illuminating contrast with more contemporary news values.

In this chapter, I use some of this material to explore the ways in which Crowther, carefully guided by his editors, fashioned scientific news and features for the *Manchester Guardian*. In particular, I examine Crowther's reporting of the discovery of the neutron, a constituent of the atomic nucleus, in Cambridge in 1932. This episode made his reputation as a scientific journalist, but offers important insights into the working relationship between scientists, journalists, and editors in the reporting of scientific 'news' in this case. Indeed, it leads us to question the very meaning of 'scientific news'.

JAMES GERALD CROWTHER AND THE *MANCHESTER GUARDIAN*

James Gerald Crowther (1899–1983) was born and educated in Bradford, Yorkshire. During the First World War he served with a group of scientists working for the Ministry of Munitions Inventions Department, where he undertook computations on the trajectories of aircraft shells for the Anti-Aircraft Experimental Section. In 1919, he took up a place at Trinity College, Cambridge, to read mathematics and physics. Following a nervous breakdown of some kind, however, he soon left Cambridge. After a series of posts as a school science teacher, in 1924 he obtained a position as a representative of Oxford University Press, specialising in technical (science and engineering) publications. In this capacity, he travelled widely, visiting technical schools, colleges, and universities, and meeting many of the country's leading scientists and engineers (Crowther, 1970).[2]

In the mid-1920s, Crowther became interested in the popularisation of science, a theme much discussed in the scientific press at that time (see, for example, *Nature,* 1926). Having failed in his initial plan to establish a new popular scientific journal, he began submitting occasional paragraphs and short articles to periodicals such as the *New Statesman* and the *Nation*. He also contributed material to a national newspaper, the *Manchester Guardian,* in which he had about sixty articles published in 1927 and 1928, most of them written in his spare time, 'in small bed-rooms, railway waiting-rooms and local libraries all over the country'(Crowther, ibid: 41–42). Among these early forays into journalism were articles on thunderstorms, cosmic rays, ball lightning, colloids, the Raman Effect, the evolution of stars and planets, atomic physics, biophysics, and cryogenics. In keeping with Crowther's belief in spreading good science writing to as large a public as possible, many of these articles were collected and published in book form, including *Science For You* (1928), *Short Stories in Science* (1929), and *Osiris and the Atom* (1932).

In 1928, Crowther wrote to C.P. Scott, editor of the *Manchester Guardian*, asking if he might be taken on as the paper's 'official Scientific Correspondent'. As well as allowing him to approach scientists 'for the kind of information specially suitable for articles', he argued that he would hope to make the paper 'easily pre-eminent among daily papers for its information and attitude to science'. 'The public', he suggested, 'should be helped to realise the greatness of science, and its significance for society and the mind'.[3] Scott evidently agreed. Crowther had done useful work for the paper—an internal memo described him as 'a good authority and a very useful writer'—and Scott readily appointed Crowther 'as our scientific correspondent if that will assist you in your work for us'.[4]

Under the long-standing editorship of Scott, his Manchester news editor William Crozier and his London editor James Bone, the *Manchester Guardian* in the 1920s was a highly respected newspaper, favouring 'free trade, Liberalism, social welfare, progress, and the League of Nations' and occupying a 'dominating position' both in the provincial press and nationally. One foreign journalist in London saw it as 'the only provincial paper to have reached international status', and indeed as 'a paper ranking second only to *The Times* and in commercial matters possibly having precedence over it. The same care as was devoted to this subject was also spent upon politics, criticism, belles-lettres, and the general appearance of the paper'. 'If anywhere', this commentator concluded, 'there is here an instance of quality—for the sake of which the price of twopence has been kept in force—triumphing in the modern English press' (von Stutterheim, 1934: 163, 169–170).

Yet the *Manchester Guardian* in this period was also undergoing significant change. The decline in cotton, the contraction of the Lancashire economy in the 1920s, and the shift of provincial financial interests to London meant a substantial reduction in the newspaper's regional economic and industrial coverage. Editorially, the paper had difficult relations with a Liberal party in decline, and economically it faced competition from the growing popular press and from organised broadcasting which appealed to new audiences and changed the nature of the media in this period. In response, the editorial team of the *Manchester Guardian* sought to diversify its reporting and to find new and interesting avenues for its staff to pursue and its readers to enjoy (Ayerst, 1971).[5] Among the new features to appear in the 1920s were columns on broadcasting, motoring, cinema, and women's issues. Not all the new themes were successful: an attempt to capitalise on popular interest in crime backfired badly when the paper was fined £300 for contempt of court for its reporting of a murder case.[6]

In appointing Crowther as the paper's 'scientific correspondent', Scott was therefore perhaps making a further contribution to the diversification of his paper, as well as to Crowther's professional bona fides. He would find that Crowther's professional entrée into the scientific community via

his work for Oxford University Press gave him a powerful advantage, which would serve both the fledgling science journalist and his newspaper well. But while Crowther began his work for the *Manchester Guardian* with a spirit of optimism and a desire to make emerging scientific knowledge widely accessible, he soon found his aims tempered by the newspaper's own staff, whose views were very different from his own.

SCIENCE NEWS VALUES IN PRACTICE

As 'scientific correspondent' of the *Manchester Guardian*, most of Crowther's dealings were with Scott's lieutenant, Crozier, though he also had contacts with Bone, the London editor. Crozier had joined the paper in 1903, and had been news editor since 1912. He was responsible for planning the content of the paper and for most of its character and tone—'a balanced newspaper in which liveliness might break through'.[7] Crozier himself became editor of the paper in 1932, and held the post until his death in 1945. Throughout, he interacted with his journalists via a series of 'admonitory notes'—memoranda and letters which gave them their assignments, commented on their drafts, and offered praise for or (more often) criticism of their efforts. These notes offer a wonderful insight into the editorial process, and show Crozier's actual sense of news values in operation, both in the commissioning and selection of science stories for coverage and in the shaping of submitted copy.

Foremost among Crozier's concerns was for well-written prose that would be accessible to readers. With Crowther's close links to physicists and his tendency to report them in their own highly technical language (though the issue did not seem to affect the 'popular' writing he pursued in parallel with his journalistic activities), this often proved problematic. In 1929, for example, Crowther suggested to Crozier that 'an article from Dr P.A.M. Dirac of Cambridge on the 'Future of Atomic Physics' might make quite a coup if we could get it. He is a singular genius of Swiss-French extraction, his father being a school-master at Bristol. He is only 27, and quite the most extraordinary figure in English physics at the moment'.[8] But Crozier poured cold water on the idea: an article by Dirac, he replied, 'would be certain to be too stiff for us. I can quite see that it might be something of a catch, but it doesn't do for us to print articles which only the learned can understand'.[9] Similarly, Crozier returned one of Crowther's own articles on the work of the German theoretical physicist Werner Heisenberg as 'too stiff for the ordinary intelligent reader. To mention only one point: you speak of the quantum theory as though it were a thing the meaning of which everyone understood, but, as a matter of fact, scarcely any of our readers would have any idea what it meant'.[10] And in 1933, another of the editorial staff told Crowther: 'If you are going to Lord Rutherford's lecture tomorrow we

should be very glad to have 500/600 words on it if he is breaking any new ground that the public can be made to understand'.[11]

Novelty was naturally important for news—but it was always tempered by this need for accessibility by the readership. In February 1932, Crowther used privileged access he had gained to physicists at the Cavendish Laboratory, Cambridge, to write the first reports of the discovery of the neutron there by James Chadwick. His 'scoop' was important for the *Manchester Guardian*, for Crowther himself (it 'made' his journalistic career), and for the physicists (who received sympathetic coverage of their work). But, tellingly, when Crozier wrote to thank him for his letters and articles, he added:[12]

> I expect you realise that what you send us about the Neutron, although extremely important from the scientific point of view, is also extremely difficult reading for the ordinary person. I doubt whether anyone could make the subject more understandable than you do, and of course I know that it is tremendously exciting to the scientists. I can only urge you, in anything more that you send, to do everything possible to explain what is happening in the simplest terms.

Crozier's plea beautifully captures the tension between the desire for novelty and the news editor's concern for clarity and simplicity. Similarly, in response to a suggestion of Crowther's about a new engineering development, Crozier wrote:[13]

> I don't think we could take the suggested article on the oil engine unless we knew a little more about it. Of course if it is likely to be a big thing as an invention we would be interested in it, but we naturally have to go very slowly in accepting and writing about a new invention of this kind. Perhaps you could let us hear more about it.

By the end of 1932, after a further string of reports on developments in physics and various other rather technical topics, Crozier offered a more brutal appraisal: 'If you find it practicable to furnish a column next time which is more or less of the 'insects and water' standard, I shall be pleased; but if you find it is not possible to do that, then I think we should just drop the feature'.[14]

Crozier's demand for 'insects and water' writing is revealing both of the accessibility he required of Crowther's writing and of the sorts of topics he thought relevant for *Manchester Guardian* readers. Indeed, while many of Crowther's submissions were based on his close association with physicists, Crozier often requested articles on other topics which demonstrate his views of readers' interests. In May 1932 he complained after Crowther had submitted articles that did not meet the requested specifications:[15]

> You have given us too generous measure. We cannot take more than the two articles we asked for, and we should be glad if you would kindly fashion them out of the three you have sent. The sections which we think would be most likely to interest the ordinary reader are those concerned with eels, the physiological effects of manual labour, and dairy farming. [Theoretical physicist Niels] Bohr's eminence could, of course, be indicated but I am afraid we must do without the details of his researches. We should like the articles to be kept within 1,200 words each.

Clearly, in Crozier's mind—and therefore in the paper's policy—only some sciences were relevant to the *Manchester Guardian*'s readers.

Yet there were contradictions in the editorial team's expressed news values and in their editorial policy. If physics was a difficult subject, Crozier remarked to Crowther at one point that chemistry too was 'inclined to be of less general interest'.[16] But one of Crozier's senior editorial staff wrote to Crowther with a request demonstrating when and how physics and chemistry might become relevant and interesting:[17]

> We wonder if you would care to write us an article on the recent report that the Italian physicist Rossi has discovered a new element, No. 93? It may be that there is not much information at present available, but conceivably the report would serve as a 'peg' for discussing recent methods of transmutation. It was stated that he had bombarded the nucleus of uranium with neutrons. Many people, we feel, are interested in the notion that new elements with strange properties might be discovered out beyond the existing range, which the text books say stops at 92!

Thus reports of a discovery by a named individual might act as a vehicle for a story on 'strange properties' beyond known science: a very particular frame for scientific 'news'.

Through the articles he commissioned Crowther to write, we can also identify a second major set of concerns for Crozier. Many of Crozier's commissions were based on topics that had recently been featured in other newspapers. Even before his appointment as science correspondent, for example, Crowther had been asked to submit 900 words on a 'new ray' developed by the physicist J.C. McLennan for the Admiralty, based on a story in the *Daily Telegraph*.[18] Early in 1932, following correspondence on the subject in the *Times*, Crozier asked Crowther to write an article on the causes of tooth decay, and later the same year requested a story on the dangers of medicines containing thorium.[19]

The importance of competition with other newspapers and of the institutional prestige of the *Manchester Guardian* among the rest of the press is seen in another memorandum to Crowther following his scoop on the discovery of the neutron. After his copious initial reports, based on brief-

ings from the Cambridge scientists themselves, James Bone of the London office told him:[20]

> We should much like to have a half column on the stir that has been made by Chadwick's neutron discoveries. There has not been very much in the papers here since the news broke, but I suppose all the scientific weeklies will be on it. You will notice that the 'Times' tried to crab [sic] the story—a very unusual thing for the 'Times' to do with an English scientific triumph. I suppose they were peeved because we and the 'Morning Post' had it and they hadn't. They gave a very minimising account of what Rutherford said about it on the Saturday. Has it made any stir on the Continent, do you know? It has certainly interested America. We should like if possible to have the article for Sunday night's paper.

Bone's concern about the rest of the press and the imperative for the *Manchester Guardian* to retain a lead in reporting a story it had scooped was emphasised a week later, when he wrote again to Crowther:[21]

> I hope very much you will be able to let us have something this weekend. A good many remarks are being made that the 'Guardian' after making a great halloo about a scientific discovery has dropped it like a hot cake and never published a word since. Of course that does not matter at all, but I really think we ought to have something about the world's reaction to the neutron discoveries this weekend. America is surprised by the silence here, especially in the M.G. I hope you can manage something.

In addition to the actual content of particular stories, then, it was clearly at least as important that the *amour propre* of the *Manchester Guardian* in the newspaper world should be maintained.

CONCLUSION

A wide range of motives and values underlay what appeared as science news and features in the interwar *Manchester Guardian*. The tensions between Crowther's views of what should be of interest and his editors' view of what readers might find accessible are particularly illuminating. Based on his own professional links, Crowther tended to favour physics, mostly reporting it as the physicists themselves described it to him, and with little sense of questioning or critique, hence his often rather detailed and technical articles. The editorial team's views of what material might be appropriate for and comprehensible to the readers were straightforward: generally the simpler the article the better and the closer to readers' own lives and expe-

riences the better. Thus nature and health stories were more important to them than physics, and they often overruled Crowther on matters of topic choice and article content.

Yet the editors' values were sometimes in tension with each other. Following Crowther's 'scoop' on the discovery of the neutron, for example, physics became a saleable editorial commodity in the form of a major British scientific achievement. Through Crowther's privileged connections, the *Manchester Guardian* led the field in reporting this development, and its status with respect to other newspapers and its editors' desire to capitalise on and exploit the scoop for maximum benefit now outweighed the desire for simplicity and accessibility.

The material presented here represents only a small part of that available in Crowther's papers, but it sheds interesting light on the negotiation of news values in the first half of the twentieth century. It also demonstrates very clearly that what appeared as science news and science reporting was far from an objective portrayal of 'real' facts and events; rather it was a carefully constructed version of events reflecting the values both of Crowther himself and of the *Manchester Guardian*'s editors. These values were often contradictory with each other, but they do nicely demonstrate the way in which much science reporting involved collusion between the reporter, newspaper, and 'object' of the story. As we have seen, Crowther's extensive connections in the scientific community and the way he positioned himself between the newspaper and the scientists meant that he could sometimes act as a conduit of information back to the newspaper from the scientists. In 1931, he reported to Crozier that scientists at one institution had complained to him about lack of coverage of their field. Crozier's reply was brisk:[22]

> In matters of reporting it is bound to happen every now and then in every newspaper that something gets less than its due importance, just as many things get more than their due amount. Speaking broadly, my impression is that if any of our academic institutions receive less attention than they think they ought to have it is more their fault than ours. There are some of them who help us to help them and seem to be satisfied, and even grateful, for what we do.

Thus scientific 'news values' may turn out to be even more complex even than the conflictual relationship between journalist and editor might imply.

Clearly, further work is needed on the role of the *subjects* of stories in helping shape press coverage. It would also be fascinating to compare Crowther's experiences at the *Manchester Guardian* with those of other science journalists establishing careers and professional identities for themselves in this period—for example Ritchie Calder of the *Daily Herald*, whose articles read very differently from Crowther's and reflected a rather different set of presuppositions about readership and ideology.[23] But it is

clear that the 'news values' underpinning Crowther's work for the *Manchester Guardian* were far from a set of objective criteria: rather they were a set of very subjective opinions and practices often in tension with each other and highly context-dependent. Out of this assortment of factors was 'scientific news' made.

ACKNOWLEDGEMENTS

I am grateful to Special Collections, University of Sussex, for permission to consult and quote the J.G. Crowther papers.

Notes

1. For an overview, see Harcup and O'Neill (2001). On the application of news values to science news, see Gregory and Millar (1998).
2. Crowther's autobiography, this source is heavily selective and should be treated with particular caution.
3. Crowther to Scott, 24 November 1928, Manchester Guardian Archives, John Rylands University Library, University of Manchester.
4. Scott to Crowther, 7 December 1928, Manchester Guardian archives.
5. On the changing nature of the press in this period, see Catterall, Seymour-Ure, and Smith (2000).
6. Ayerst, Manchester Guardian, 450–451.
7. Ayerst, Manchester Guardian, 446.
8. Crowther to Crozier, 9.1.29, Box 5, J.G. Crowther papers, University of Sussex Library (hereafter JGCP).
9. Crozier to Crowther, 15.1.29, Box 5, JGCP.
10. Crozier to Crowther, 12.3.30, Box 127, JGCP.
11. [Phillips?] to Crowther, 25.1.33, Box 128, JGCP.
12. Crozier to Crowther, 21.4.32, Box 127, JGCP.
13. Crozier to Crowther, 19.7.32, Box 127, JGCP.
14. Crozier to Crowther, 22.12.32, Box 127, JGCP.
15. Crozier to Crowther, 23.5.32, Box 127, JGCP.
16. Crozier to Crowther, 16.9.37, Box 128, JGCP.
17. E.J. Phillips to Crowther, 13.6.34, Box 128, JGCP.
18. [Manchester Guardian] to Crowther, 15.8.28, Box 5, JGCP.
19. Crozier to Crowther 23.3.32, 16.12.32, Box 127, JGCP.
20. James Bone to Crowther, 3.3.32, Box 127, JGCP.
21. Bone to Crowther, 10.3.32, Box 127, JGCP.
22. Crozier to Crowther, 26.3.31, Box 127, JGCP.
23. For an initial comparative and contextual survey, see Duncan (1980).

REFERENCES

Ayerst, D (1971) *The Manchester Guardian. Biography of a Newspaper* London: Collins, 439–446.
Crowther, J G (1970) *Fifty Years with Science* London: Barrie and Jenkins.
Crowther, J G (1932) *Osiris and the Atom* London: George Routledge & Sons.
Crowther, J G (1929) *Short Stories in Science* London: George Routledge & Sons.

Crowther, J G (1928) *Science For You* London: George Routledge & Sons.
Duncan, P D (1980) 'Newspaper Science: The Presentation of Science in Four British Newspapers during the Interwar Years, 1919–1939' Unpublished PhD dissertation, University of Sussex.
Gregory, J and Miller, S (1998) *Science in Public: Communication, Culture, and Credibility* New York and London: Plenum, 108–114.
Harcup, T and O'Neill, D (2001) 'What is News? Galtung and Ruge Revisited' *Journalism Studies* 2, 261–280.
Von Stutterheim, K (1934) *The Press in England* (trans. W.H. Johnston) London: George Allen & Unwin Ltd.
'Science and the Press' (1926) *Nature* 118, 757–759.

3 The rise and fall of science communication in late nineteenth century Italy

Paola Govoni

Since the early 1990s, the Italian public, Italy's politicians and entrepreneurs, together with the media and the entertainment market, have been showing a growing interest in science and scientists. There has been a mushrooming of public and private initiatives aimed at communicating and promoting science: an increasing number of magazines are devoted to science, there are many successful TV and radio programmes, and science festivals attract large and attentive audiences. And yet, despite the quantity, and often good quality of the non-specialist information on science in circulation, scientists and several commentators have found an indication in several cases that relations between science, technology and citizens in Italy have reached a critical stage.[1]

In this chapter I would like to suggest that the history of science, especially if comparative and long term, can be a precious resource to understanding the present situation. From this perspective, a comparative study of communicative styles in action in different cultural and national contexts may help us to grasp what is at stake in different reactions to similar science and technology issues. Long term history is needed because the relationship between the public and science has a long history in countries like Italy. Looking back over the period following industrialisation and urbanisation in the late nineteenth century, we are in a better position to understand contemporary social attitudes toward science.

Comparative history of science, on the other hand, tells us that ever since the establishment of the Royal Society, dialogue between experts and non-experts has brought immense benefits to the development of science. Nowadays, scientists cannot (and have no wish to) take responsibility for choices that frequently concern the future of millions of fellow human beings. So it is scientists themselves who increasingly demand that the public participate in making delicate choices, after duly acquiring the necessary awareness. But the big question is: do science journalism and a lively science communication market provide sufficient information for the public to make an adequate contribution?

The approach I will adopt in this chapter is the one suggested in classical works of the field by historians such as Gaetano Salvemini (1873–1957),

who argued the need for the historian to be also a social scientist (Salvemini, 1939), Marc Bloch (1886–1944), who believed it to be fundamental for any historian to be involved in the present in order to understand the past, and vice versa (Bloch, 1984) and Edward H. Carr (1892–1982), who explicitly and pragmatically used history to understand the present, in an attempt to found possible solutions to present social or political crises (Carr, 1961).

Within this historiographical perspective, and in the context of the relationships between science and the public, the historian of science, using examples from the present, may contribute to an understanding of the uses and effects of the communication of science, as sociologists of science themselves have done successfully using examples from the past.[2]

So, in this chapter the recent interest of Italians in science will be compared to what happened in the Peninsula in the decades after the political unification of 1861, the period of the greatest success of the 'science for all' movement in Europe. At that time Italian scientists who were popularising science took their British counterparts as their main model, and contributed to the outstanding success of Italian popular science in the 1870s and 1880s. The history of that success, and above all its decline around the end of the century, seems to indicate that today some of the difficulties in the relations between science and the public in Italy derive, as they did a hundred years ago, from the structural weakness of the institutions, public and private that provide basic education. This was definitely the case, as shown by the high illiteracy rates found at the beginning of the twentieth century in the Peninsula, despite the earlier success of the popularisation of science movement, and is shown today by the data such as those coming from the Program for International Student Assessment (PISA). This is data which may be regarded as disappointing in the face of the above mentioned mushrooming of arenas and opportunities for the communication of science.

ON THE USEFULNESS OF HISTORY

In the first half of the 1980s, collaboration between historians and sociologists of science (mainly writing in English or French) led for the first time to an in-depth exploration of the popularisation of science. It was a genre that until that time had only occasionally attracted the attention of historians of science.[3] The alliance between sociologists and historians of science finally allowed the popularisation of science to be included among the processes pertaining to the production of knowledge, and not just to its diffusion.[4] It thus became possible, in studying different historical periods and national contexts, to make sense of the important role played by popular science in the mechanisms regulating the relationships between scientists themselves, as well as between the latter and politicians, industrialists, and the public.

A decisive factor in this research tradition was the publication of books that reconstructed the ways in which science in action spread beyond its

canonical borders, following changes in scientists' behaviour towards society. This literature verified the reactions and modifications produced and undergone by science in contact with the social context (Latour, 1984/1988).[5] Cases such as the diffusion of Newtonian physics in the eighteenth century, or chemistry around 1800, phrenology in nineteenth-century England, or the 'Pasteurisation' of France, provided models that could be adopted when following scientists and science in other social contexts (Stewart, 1992; Golinski, 1992; Cooter, 1984; Latour, 1984/1988; Burnham, 1987; LaFollette, 1990). The British social history of medicine also made an outstanding methodological impact on an understanding of the relations between experts and non-experts, especially in terms of exploring the viewpoint of patients.[6] In addition, of especial usefulness have been the studies of specific sub-fields, such as the publishing industry or the history of books and readers (Darnton, 1990; 1979; Eisenstein, 1979; Johns, 1998; Frasca Spada and Jardine, 2000; Secord, 2000).

Still lacking is research that compares the phenomena mentioned at an international level, and over a long period. This is a limitation of the history of science generally, rather than of the history of the popularisation of science alone.[7] New horizons are needed in the history of the relations between scientists, popularisers, journalists, and publishers, as with the history of literary genres, including popular ones.[8] The popularisers, whether they were scientists, professional popularisers, or journalists, made use of just about every available literary genre to communicate. From the eighteenth century they adjusted to the requirements proper of genres as diverse as popular science almanacs, novels, dialogue and theatrical texts, the journalist's article, and the popular lecture. Also of great importance will be the inquiry into the social construction of the roles of gender, and of notions such as race, which were crucial when popularising topics like evolutionary and anthropological theories, which played a crucial role in the nineteenth and twentieth centuries throughout Europe and in the United States.

Following the numerous historical traces and historiographical models briefly mentioned above, the history of the popularisation of science has slowly attracted the attention of scholars at an international level, not only for the undoubted interest a certain aspect of its iconography may have (Rider, 1983; Béguet, 1990; Rudwick, 1992).

IN THE 'AGE OF SCIENCE', SOUTH AND NORTH OF THE ALPS

The Italian case of the history of popular science in the eighteenth and nineteenth centuries is useful for grasping new aspects of what appears to be the country's lasting backwardness in social and scientific fields, compared to those European countries that from the Enlightenment on

had been taken by the elites as models of 'modernity': in the first place, of course, England.[9]

During the Victorian age, which on the continent saw a second industrial revolution, colonial expansion, and the birth of modern states, scientists understood the importance of consolidating their dialogue with the diverse audiences of science. Thus politicians, industrialists, and the educated middle classes in general, as well as artisans, workers, and women, became the addressees of an amazing variety and quantity of writings and public events in which science was the protagonist: a 'popular' science 'for all', in many European languages (Brock, 1996; Bensaude-Vincent and Rasmussen, 1997; 'Science Popularisation', 1994; Daum, 1998).

In France there were famous professional popularisers such as Louis Figuier, Camille Flammarion, or Gaston Tissandier; in England there were scientist popularisers such as Michael Faraday, Thomas Huxley, and Norman Lockyer among many others; in the German speaking countries such authors as Ludwig Büchner or Ernst Haeckel. Together, they were for decades the protagonists of a cultural movement who considered popular science as the best tool to use in order to improve development and 'progress', not only at an economic and political level, but indeed as a moral and social mission. A science 'for all' citizens, not only for the elites, was to achieve this miracle, mainly through events such as popular science lectures and national and international expositions, but above all through a huge production of popular science books and periodicals.[10]

After unification in 1861, the 'science for all' movement had its moment of glory even in a scientifically marginal country such as Italy. It was credited in strong ideological colours as the instrument capable of breaking the link between scientific backwardness and religious superstition. On the crest of the wave generated by the political enthusiasm for unification, scientists engaged in popular science and the educated middle classes were protagonists of the success (mainly in the North of the country) of popularisation of science, encouraged by publishers acquainted with international publishing markets.

But if these were the main causes for success, what then were the reasons for the following decline, already visible in the 1890s? What stopped Italy from developing a tradition of popularisation of science comparable to that of England, which was so often indicated as a model?

Our attention should focus on two points: on the one hand, the scientists and their commitment to popularising science, and on the other, the public and its capacity to consume popular science, and thereby maintain a vigorous demand for it.

Unlike France, where the profession of the popular science writer had already emerged, in England many among the more successful authors were scientists, such as Faraday, Lockyer, Huxley, and Tyndall: the 'leaders of science in London' (Barton, 1998) as they liked to style themselves (Sheets-Pyenson, 1985). The same was true of Italy. However, in England

the community of scientists had for many decades understood the importance of making public opinion a participant in the findings of research, and this did not happen in Italy. The involvement of the public in questions connected to science, the policies of education and development, had been an important component in the process of turning the British scientist into a professional figure, increasingly close to positions of power with the advance of industrialisation. From the early Victorian age, English scientists' way of bringing common objectives before public and government had been a means for them to emerge as a new and powerful social category. This obviously did not presuppose a community of opinion, but the clear perception that they belonged to the same professional elite, with growing involvement in society (Cannon, 1978; Morrell and Thackray, 1981; MacLeod, 1996; 2000). These premises, which had led among other things to the birth and success in 1869 of a journal such as *Nature*, were not perceived clearly by Italian scientists, despite the frequency with which they drew attention to the centrality of the British scene.[11]

Rather than identify themselves as a new professional community, with shared objectives, at least in part, Italian scientists preferred to side (at one time or another) with one or other academic or political faction. Given this widespread pattern of behaviour, which obviously had an adverse effect on research, it became impossible for quality popular science publications to survive: the slow decline of popular science in Italy in fact was already beginning at the end of the 1880s (Govoni, 1997).

Of course, Italian scientists perceived the need to have a greater voice in society, but this tended to find expression more with an effort to gain seats in Parliament, where scientists were numerous (seven out of a hundred) (Banti, 1996). However, this did not in itself encourage the coagulation of a professional community, nor its relations with public opinion. Among scientists, as they themselves admitted, there were continuous fratricidal struggles, while towards the public more often than not prevailed the desire to 'manovrare le falangi dei cervelli'[12]; that is, indoctrinate the public on political and moral questions. The label 'popular science' was in actual fact used to help the circulation of political programmes, typically Catholic or anti-Catholic. On the one hand, famous Catholic scientist popularisers, such as the geologist and abbè Antonio Stoppani, used popular science works to vigorously attack the position of scholars of a secular and evolutionist orientation. On the other, the popularisation of science was credited by many scientists, such as the then internationally known Paolo Mantegazza—as was the case for Thomas Huxley in England—as being the instrument able to break the link between scientific backwardness and religious superstition.

In Italy, secularising popular culture seemed the indispensable mission to at last provide freedom for scientific research. The inevitable victory of science would have erased the Church's insult to Galileo and to Italian science forever. Although the secularised approach proved for a while most

successful among readers, this brand of popular science works did not necessarily foster the diffusion of a widespread and strong scientific education tradition in the long term, which was being maintained by desultory investments in public education.

In fact, beside the well-known weaknesses of the Italian scientific community, another feature seems to have been decisive in preventing the consolidation of the popularisation of science in Italy: the lack of a basic scientific education of quality, widespread among all citizens. The commitment of scientists and publishers to the promotion of the popularisation of science could not, on its own, provide the kind of formation that only schools, public libraries, and a network of associations for the dissemination of culture could guarantee.[13]

THE ROLE OF EDUCATION

An analysis of the 'progress of science in Italy' provided in 1909 by one of the key figures of the late nineteenth- and early twentieth-century Italian intellectual scene, Luigi Luzzatti (1841–1927), helps to illuminate the situation at a time when the extraordinary season generated by the 'science for all' movement was coming to an end.

Luzzatti, an economist with in-depth experience of Italian society, who had been a minister several times, and once Prime Minister, thought fit to call attention, above all, to what remained to be done for popular education:

> Our school system is one of the weakest in Europe, whereas just North of the borders with Trento, Istria and Swiss illiteracy has been eliminated [...]. Italian elementary education, poorly supported by subsidiary institutions (such as evening schools, Sunday schools, popular public libraries, associations providing books for the poor and getting poor pupils started through mutual aid etc.), does not leave an effective imprint in the minds of the pupils, which more than in other countries quickly forget how to read, write and do sums. (Luzzatti, 1909)

Luzzatti continued:

> That thirty years of unification has only led to the illiterate diminishing by 7% in the province of Catanzaro [southern Italy]—where in the census of 1872 illiteracy was at 78.3%—is a humiliating result for the Italian state, considering that this should have been one of the most vital goals it ought to have pursued immediately after unification. (Luzzatti, 1909, p.205)

The problems Luzzatti pointed out, for decades the terrain of conflict between Catholics and their secular opponents had not been radically

tackled and solved despite the passing of so many years. The poor results obtained on the education front, whoever was in power, reveal in the Italian elite, even its intellectual and most progressive sectors (with few exceptions), an inability to believe that the basis of a civilised nation had to be the education of all its citizens. Thus while in 1900 illiteracy in France had dropped to 5%, and in England to 3%, in 1901 in Italy only Lombardy and Piedmont had illiteracy rates of less than 25%, while literacy in Liguria, Veneto, Emilia, Tuscany and Lazio did not pass the threshold of 50%, and elsewhere in Italy illiteracy was over 50% (De Mauro, 2001). How could the diffusion of scientific culture beyond the elites be expected from a social context of this kind?

When the generation of enthusiastic popularisers of science who had taken part in the unification of Italy reached the age of retirement, in the years of the 'bankruptcy of science' and the re-emergence of idealism, popularisation of science returned to being a minority genre.

Indeed, in those years the university, too, revealed its limitations in this sphere: it was incapable of forming that intermediate network of professional figures which would have been useful for the development of professional journalism and the publishing sector, as well as the formation of capable state functionaries.

The history of the success of the popularisation of science in Italy from the 1870s to the 1890s, and its later decline, shows characteristics in line with what is happening in the country today.

TODAY: SOME CONCLUDING REMARKS

I recalled earlier the recent renewal of interest in science on the part of the Italian public and Italian public institutions, a phenomenon that has coincided with the spread at the international level of projects linked with the Public Understanding of Science (PUS) movement. Having recognised the connection between investments in research and in scientific communication on the one hand, and social and economic development on the other, in Italy too it was thought that encouraging a renewed rapprochement between scientists and the public would help both, with the consequence of attracting growing numbers of young people to science faculties, and making society in general more sensitive to the subjects of research and technological innovation. It would seem that the recent increase in activities devoted to strengthening those relations, by investing in science communication and in the 'diffusion of scientific culture', has so far led to mixed results: the gap between what the elites and the rest of the Italian population perceive when it comes to science and its role still seems to be a problem, in terms which are reminiscent of the problems faced by the 'science for all' movement in late nineteenth-century Italy.

If data on Italian literacy around 1900 explain the backwardness of the country, and the impossibility of reaching citizens who did not belong to the elites with popular science, today of course things have changed. Since the 1970s, Italy has been one of the most industrialised countries on the planet and, on the whole, illiteracy has been eliminated almost everywhere in the peninsula. And yet data provided by the PISA assessment offer a dramatic picture: general education of Italian young people does not appear adequate to the requirements of one of the world's eight most industrialised countries. In the post-PUS era, the major problem remains the lack of an adequate elementary and secondary education, as was the case in the time of the 'science for all' movement around 1900.

PISA is the well-known survey carried out every three years by the Organization for Economic Co-operation and Development. It tests the competence of 15-year-old students from OECD countries in several areas, including mathematics and science (OECD, 2003). Students from 41 OECD countries were tested. In the final ranking, Italians were ahead of only eight countries, Greece, Serbia and Montenegro, Turkey, Thailand, Mexico, Indonesia, Tunisia, and Brazil, whose GDP was incomparably lower than Italy's.[14]

Today, I suggest, it is precisely the abilities tested by surveys such as PISA that make the difference when it comes to judging success of science communication, or of programs aimed at the diffusion of scientific culture. In young adults, the PISA survey looks for: 'the ability to use their knowledge and skills in order to meet real life challenges, rather than how well they had mastered a specific school curriculum'. These are the same abilities that enable citizens to make use of scientific information (and to defend themselves from poor-quality science journalism). These abilities help citizens maintain a degree of detachment from the occasionally miraculous claims of medicine and technology, and to assess critically the claims of those who see conspiracies set up everywhere by scientists against common people and their health; a critical sense that allows citizens to entertain a degree of scepticism vis-à-vis authoritative, expert sources, while participating somehow in the life of science and technology.

This attitude, combining participation and scepticism, is what from the time of the so-called scientific revolution allowed some groups of individuals to get interesting results in the study of nature and in the invention of new technologies. It is the acquisition of this combination of participation and scepticism, as well as a good quality and quantity of science communication and science news that citizens should be aiming for.

The short-lived success of the popularisation of science in Italy in the 1870s and 1880s, and its subsequent decline at the turn of the twentieth century, suggest that the right combination of participation and scepticism can develop only through a systematic alliance between different levels of communication of science, such as those provided by communicators and journalists, scientists, popularisers, and science writers—and the educational system.

The large quantity and often good quality of popular science in nineteenth-century Italy could not possibly overcome the weaknesses set by the dramatically high illiteracy rates, just as the generous efforts at the communication of science since the early 1990s are unlikely to prevail over the conditions revealed by the 2003 PISA survey.

NOTES

1. Italians' strong opposition to GM food has often been cited in this light. More recently, comments focused on the public protest sparked by the beginning of the construction of the new TGV line connecting Turin and Lyons in December 2005. Many commentators highlighted the fact that the French population and environmentalist groups were in favour of the project, whereas both categories were against it in Italy.
2. In the specific case of the popularisation and communication of science, see the classic Shinn and Whitley (1985) and the more recent Bucchi (1998).
3. I am referring to Shinn and Whitley (op. cit.). Nevertheless, the subject had been explored beforehand. See for example, Roqueplo (1974) and Holton and Blanpied (1976). In this chapter the—basic—bibliography provided will focus mainly on English and Italian national contexts.
4. There have been many interventions on this theme, but see Hilgartner (1990).
5. On the different use of the labels 'popularisation of science' and 'popular science', also in particular relation to the Italian context, see Govoni (2002)
6. I am referring to the scholars linked to the former Wellcome Institute for the History of Medicine, now the Wellcome Trust Centre for the History of Medicine, University College, London, and in particular to Roy Porter (1992).
7. On these themes see 'The Big Picture' (1993), Pickstone (2000), and Pyenson (2002).
8. Useful suggestions come from Roger Chartier's cultural history of reading and readers. See Cavallo and Chartier (2003).
9. Reference to English civilisation, presented as a model Italy should imitate, occurs frequently in the texts of some of the best known Italian popularisers, from Francesco Algarotti (1712–1764) to Carlo Cattaneo (1801–1869), from Paolo Mantegazza (1831–1910) to Adriano Buzzati Traverso (1913–1983). On the history of the popularization of science in Italy from the eighteenth to the beginning of the nineteenth century, see Govoni (ibid.).
10. To have an idea of the huge British popular science periodical production, see the SciePer Project at http://www.sciper.leeds.ac.uk/ and in particular Cantor et al. (2004), Hendson et al. (2004), and Cantor and Shuttleworth (2004).
11. On different aspects of the nineteenth-century Italian scientific context, see Lacaita (1973), Maiocchi (1980), Santucci (1982), Rossi (1986), Pancaldi (1991), and Babini and Lama (2000).
12. The words of the best-known science populariser in Italy (also well-known abroad), the racist and sexist anthropologist Paolo Mantegazza (1884)
13. On popular education in Italy and its history see Catteneo (1963), Bertoni Jovine (1965) and Soldani and Turi (1993).
14. For the Italian data see Istituto Nazionale per la Valutazione del Sistema dell'Istruzione, *Il livello di competenza dei quindicenni italiani in matematica, lettura, scienze e problem solving. Prima sintesi dei risultati di PISA 2003*, available at www.astrid-online.it.

REFERENCES

Babini, V P and Lama, L (2000) *Una 'donna nuova': Il femminismo scientifico di Maria Montessori*, Milano: Angeli.

Banti, A M (1996) *Storia della borghesia italiana. L'età liberale, 1861–1922*, Roma: Donzelli.

Barton, R (1998) 'Just before 'Nature': The purposes of science and the purposes of popularization in some English popular science journals of the 1860s' *Annals of Science*, *55*, 1–33.

Béguet, B (Ed.) (1990) *La science pour tous. Sur la vulgarisation scientifique en France de 1850 à 1914* Paris: Biblioteque du Conservatoire National des Artes et Métiers.

Bensaude-Vincent, B and Rasmussen, A (eds.) (1997) *La science populaire dans la presse et l'édition XIX et XX siècles*, Paris: CNRS Editions.

Bertoni Jovine, D (1965) *Storia dell'educazione popolare in Italia*, Roma-Bari: Laterza.

Bloch, M (1984) *The historian's craft* Translated from the French by Peter Putnam with a foreword by Joseph R. Strayer, Manchester: Manchester University Press (1st orig. ed. 1949; 1st American ed. 1953).

Brock, W H (1996) *Science for all. Studies in the history of Victorian science and education*, Aldershot: Variorum.

Bucchi, M (1998) *Science and the media: Alternative routes in the scientific communication*, London: Routledge.

Burnham, C (1987) *How superstition won and science lost. Popularizing science and health in the United States*, New Brunswick, NJ: Rutgers University Press.

Cannon, S F (1978) *Science in culture: The early Victorian period*, New York: Dawson and Science History Publications.

Cantor, G and Shuttleworth, S (eds.) (2004) *Science serialized: Representations of the sciences in the nineteenth-century periodicals,* Cambridge, MA: MIT Press.

Cantor, G, Dawson, G, Gooday, G, Noakes, R, Shuttleworth, S, and Topham, *J R (2004)* Science in the nineteenth-century periodicals: Reading the magazines of nature, Cambridge: Cambridge University Press.

Carr, E H (1961) *What if history?* London: Macmillan.

Cattaneo, C (1963) *Scritti sull'educazione e sull'istruzione*, ed. by L. Ambrosoli, Firenze: La Nuova Italia.

Cavallo, G and Chartier, R (eds) (2003) *A history of reading in the West*, Amherst: University of Massachusetts Press.

Cooter, R (1984) *The cultural meaning of popular science. Phrenology and the organization of consent in nineteenth-century Britain*, Cambridge: Cambridge University Press.

Darnton, R (1982/1990) 'What is the history of books?' In *The kiss of Lamourette: Reflections in cultural history* New York: Norton, pp. 107–135.

Darnton, R (1979) *The business of Enlightenment: A publishing history of the Encyclopédie, 1775–1800* Cambridge, MA: Belknap Press of Harvard University Press.

Daum, A (1998) *Wissenschaftspopularisierung im 19. Jahrhundert*, München: Oldenbourg Verlag.

Eisenstein, E (1979) *The printing press as an agent of change*, 2 vols, Cambridge: Cambridge University Press.

Frasca Spada, M and Jardine, N (eds.) (2000) *Books and sciences in history*, Cambridge: Cambridge University Press.

Golinski, J (1992) *Science as public culture: Chemistry and Enlightenment in Britain, 1760–1820*, Cambridge: Cambridge University Press.

Govoni, P (1997) 'Nature' à l'italienne. La presse de science populaire en Italie à la fin du XIX siècle' In Bensaude-Vincent, B and Rasmussen, A (eds.) (1997) *La science populaire dans la presse et l'édition XIX et XX siècles*, Paris: CNRS Editions, pp. 175–189.

Govoni, P (2002) *Un pubblico per la scienza. La divulgazione scientifica nell'Italia in formazione*, Roma, Carocci.

Hendson, L, Cantor, G, Dawson, G, Noakes, R, Shuttleworth, S, and Topham, J R (eds.) (2004) *Culture and science in the nineteenth-century media*, Aldershot: Ashgate.

Hilgartner, S (1990) 'The dominant view of popularization: Conceptual problems, political uses' *Social Studies of Science*, 20, 519–39.

Holton, G and Blanpied, W A (eds.) (1976) *Science and its public: The changing relationship* Dordrecht: D. Reidel.

Johns, A (1998) *The nature of the book. Print and knowledge in the making*, Chicago: University of Chicago Press.

Lacaita, C G (1973) *Istruzione e sviluppo industriale in Italia, 1859–1914*, Firenze: Giunti Barbèra.

LaFollette, M C (1990) *Making science our own: Public images of science, 1910–1955* Chicago: University of Chicago Press.

Latour, B (1984/1988) *The Pasteurization of France* Cambridge, MA: Harvard University Press.

Latour, B (1987) *Science in action: How to follow scientists and engineers through society*, Milton Keynes: Open University Press.

Luzzatti, L (1909) 'Progressi della scienza in Italia. Insufficienze della scuola e dei suoi ordinamenti' *Nuova Antologia*, 227, 197.

MacLeod, R (2000) *The 'Creed of Science' in Victorian England*, Aldershot: Variorum.

MacLeod, R (1996) *Public science and public policy in Victorian England*, Aldershot: Variorum.

Maiocchi, R (1980) 'Il ruolo delle scienze nello sviluppo industriale italiano' In *Storia d'Italia*, annali 3, Scienza e tecnica, Torino: Einaudi, pp. 865–999.

Mantegazza, P (1884) 'La scienza nella società moderna' *La Natura*, 1, 1.

Mauro, T De (2001) *Storia linguistica dell'Italia unita*, Roma-Bari: Laterza, p. 96 (1st ed. 1963).

Morrell, J and Thackray, A (1981) *Gentlemen of science: Early years of the British Association for the Advancement of Science*, Oxford: Clarendon Press.

Pancaldi, G (1991) *Darwin in Italy. Science across cultural frontiers*, Bloomington: Indiana University Press.

Pickstone, J V (2000) *Ways of knowing: A new history of science and technology, and medicine*, Manchester: Manchester University Press.

Organization for Economic Co-operation and Development (OECD), PISA (2003) *Technical Report*, p. 9. Available at: http://www.pisa.oecd.org/dataoecd/49/60/35188570.pdf.

Porter, R (Ed.) (1992) *Popularization of medicine, 1650–1850*, London: Routledge.

Pyenson, L (2002) 'Comparative history of science', *History of Science*, 40, 1–33.

Rider, R E (1983) *The show of science* Berkeley: The Friends of the Bancroft Library

Roqueplo, P (1974) *Le partage du savoir, science, culture vulgarisation*, Paris: Le Seuil

Rossi, P (a cura di) (1986) *L'età del positivismo*, Bologna: il Mulino.

Rudwick, M (1992) *Scenes from deep time: Early pictorial representations of the prehistoric world* Chicago: University of Chicago Press.

Salvemini, G (1939) *Historian and scientist: An essay on the nature of history and the social sciences*, Cambridge, MA: Harvard University Press.
Santucci, A (a cura di) (1982) *Scienza e filosofia nella cultura positivistica*, Milano: Feltrinelli.
Secord, J A (2000) *Victorian sensation. The extraordinary publication, reception, and secret authorship of 'Vestiges of the Natural History of Creation'* Chicago: The University of Chicago Press.
Sheets-Pyenson, S (1985) 'Popular science periodicals in Paris and London: The emergence of a low scientific culture, 1820–1875' *Annals of Science*, 42 (6), 549–72.
Shinn, T and Whitley, R (eds.) (1985) *Expository science: Forms and functions of popularization*, *Sociology of the Sciences Yearbook* Dordrecht: Reidel.
Soldani, S and Turi, G (eds.) (1993) *Fare gli italiani. Scuola e cultura nell'Italia contemporanea*, 2 vols. Bologna: il Mulino.
Stewart, L (1992) *The rise of public science. Rhetoric, technology, and natural philosophy in Newtonian Britain, 1660–1750*, Cambridge: Cambridge University Press.
'Science Popularization' (1994) Special issue of *History of Science*, 32 (97).
'The Big Picture' (1993) Special issue of the *British Journal for the History of Science*, 26 (4).

4 From journalism to corporate communication in post-war Britain

Martin W. Bauer and Jane Gregory

The public communication of science is an activity within constraints. It takes place in an evolving cultural, economic, and political environment; and it is in that context that science communication should be understood. By charting some developments in the public communication of science in the evolving context in the UK since World War II, we explore the following thesis:[1]

In the post-World War II period in the UK, there has been a shift in science communication from a logic of journalism towards a logic of corporate communication, or in other words, from media-led activities towards a source-driven reportage of science.

To warrant this claim, we first describe trends in the press coverage of science during the post-war period. We then explore the changing functions of science communication, and evolving contexts of science, and we conclude by ideal-typing the old and new modes of science communication and end with some thoughts on future dilemmas.

TRENDS IN MEDIA COVERAGE

The shifting fortunes of science communication are evident in the salience and the evaluation of science in the press in post-war Britain. Trends in science coverage from 1945 to 1990 have been identified in a large-scale study by Bauer and colleagues (1995). From that study, a single key newspaper, *The Daily Telegraph*, a national broadsheet, serves us here as a salience indicator.[2] Figure 4.1 shows the annual estimates of total science coverage in one newspaper. The data show a remarkable, linear, and three-fold expansion from below 2000 articles per year to around 6000 articles per year with scientific or technological contents. However, considering the expansion in newsprint—newspapers have become thicker—it is likely that much of the trend reflects this increase in news space. The relative attention paid to science and technology may have increased less than the absolute figures suggest.

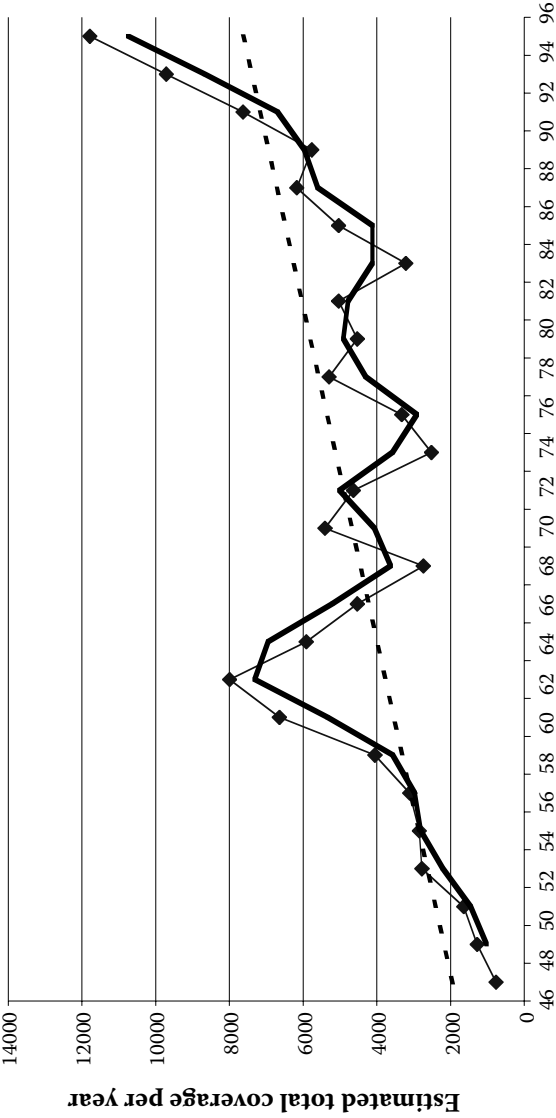

Figure 4.1 Estimates of yearly science reportage in the UK quality press (the broken line shows the linear trend; the dark line shows the 4 year-moving average).

More robust, therefore, is the observation of the fluctuations around the trend. There are clearly two periods where the prominence of science and technology is above the trend: once between 1956 and 1966 with the peak in 1960/62, and then again after 1992. In this longitudinal picture, we identify the second half of the 1970s as the transition years, where the decline of the 1960s reaches its lowest point, and the trend goes into reverse.

In terms of content, we find that the first expansion of the 1950s is dominated by astronomy, the beginning of the space race, and by nuclear power, both civil and military—all of which are government-funded, national programmes. Space and nuclear issues were replaced first by environmental news, then by computers, then in the 1990s by biotechnology as the dominant techno-scientific theme of the mass media. Over this period the public space commanded by the physical sciences declines, while that of the bio-medical and social sciences increases. One can describe this shift as the 'medicalisation' of science news (Bauer, 1998). Note that this denotes a change from the reporting of state and 'public' technologies such as nuclear power and space exploration to the reporting of commercial and 'private' technologies such as biotechnology.

Figure 4.2 gives the changing evaluation tone of science coverage: that is, the degree of positivity or negativity in the representation of science. The graph shows two clear periods, relative to the long-term average: 1954–1967 is a more positive climate, and 1967–1990 is a more negative climate. The increasing negativity in science reporting during the 1960s

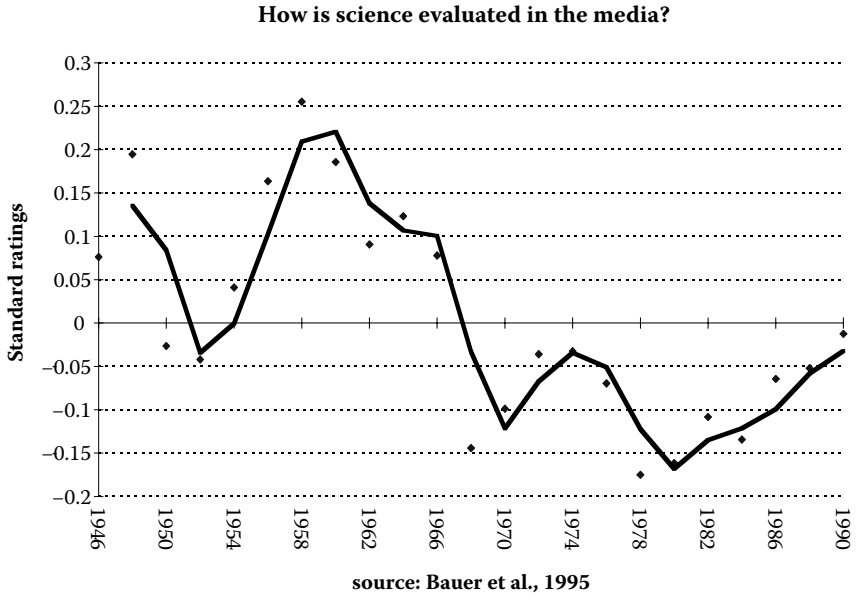

Figure 4.2 The relative positivity or negativity of science coverage in *The Daily Telegraph* as deviation from the long-term average (the zero line).

is clearly documented. Relative negativity continued in science reportage, apart from a brief reverse in the early 1970s, until a trend change in the early 1980s. With Schudson (2003) we see this as part of a general trend of journalism at the time: increased independence from government sources and the mobilisation of alternative news sources; the emergence of 'pack journalism' of mutual monitoring among professionals; and the beginnings of public relations disguised as 'para-journalism'.

Our salience figures also show the transition period in the 1970s, when science coverage reached its lowest levels for over 20 years. This decline predates the economic depression of the 1970s; science coverage started to decline already during the boom years of the 1960s. This reversal of the long-term trend during the 1970s is not a British phenomenon alone: international comparisons point towards the 1970s as years of transition.[3]

THE CHANGING FUNCTIONS OF SCIENCE COMMUNICATION

Science communication has a long history and strong tradition in Britain, where it played a crucial role in the institutionalisation of science in the second half of the nineteenth century (Gregory & Miller, 1998). In the second half of the twentieth century, however, ambivalence among scientists about their role in public came with the colonisation of science communication with new types of professionals and activities, the rise of specialist science journalisms, and later of the para-journalism of professional public relations.

> The mass media serve many of the same purposes for scientists as they serve for other people—the promotion of a personality, idea or cause, fame, money and fun can all be achieved through media activity (Goodell, 1977; Shortland & Gregory, 1991). Popularisation has maintained its association with a liberal agenda (originally Huxley, 1897). However, scientists nevertheless use popular accounts to further their own interests (Hilgartner, 1990), to muster practical support, or to establish conceptual allegiances. It is, according to Lievrouw (1990), 'essentially a communication process that facilitates the gathering of resources for pursuing certain lines of research'.(9)

At different times popularisation has been suppressed in order to maintain the status of science, and has been undertaken to claim that status. According to Jarvie:

> …the scientific community employs various communication processes and structures in a strategic manner that help the community preserve the privileged status of scientific knowledge in…culture. (72)

Scientists use the media as a tool in their power relations with other social actors. As Hansen notes:

> …media reporting is a factor/vehicle in the exercise of power through definitions of reality, both within the scientific community in the fight of different disciplines for supremacy and prestige, and between the scientific community and other powerful institutions in society. (1990: 2)

Thus there are many and varied functions of the public communication of science. There is also a variety of contexts that shape popular science. Some clear periods can be defined as coinciding with the waves of salience in science news noted above. In the aftermath of the war effort of 1939–1945 in which science played an acknowledged, crucial role, science was suddenly very public in a number of different ways. Wartime secrecy rules were abandoned, and, in older media such as books and newspapers and in newer ones such as radio and television, science was popularised in celebration of the achievements of the war years, and in promise of social and economic progress. While the scientific community was to some degree ill at ease with mass culture and media norms, it relied on communicators among its members who could represent science's interests in the public sphere (Gregory, 1998).

The late 1940s saw the first science on television in Britain, as well as the continuing occupation of radio by scientist-popularisers (Jones, 2006). With the growing tendency for science to be reported, science became increasingly part of the general journalistic beat (what Franklin in this volume refers to as the paradoxical end of science journalism). This brought a wider circle of journalists into science reporting. Some chose to specialise, and the growing body of specialists founded the Association of British Science Writers in 1947. To exemplify this period, the 'Great Exhibition' centenary celebration, the Festival of Britain in 1951, manufacturers exhibited new products ranging from industrial machinery to clothes, alongside innovations in scientific thinking in areas such as cosmology and medicine. After the austerity of the war years, this display signified a brighter future and the great promise of scientific progress. In the media, although the tone of coverage tended to be negative, the amount of coverage was growing.

As the 1950s progressed, the implementation of nuclear and space technologies realised the promise of science. But they also made explicit its political character, and provoked partisan approaches and the emergence of special interests. In the media, science journalists embraced this political aspect, bringing science coverage still more strongly into mainstream reporting. In government, expertise was developing among civil servants who became influential players in the increasingly competitive funding process. Overall, the tone of coverage became very positive, and amounts of coverage grew dramatically. To exemplify this period, in February 1961

two well-known astronomers, radio astronomer Martin Ryle and cosmologist Fred Hoyle, argued on the front pages over the merits of their theories, while in private government committees they and their supporters from science and the Civil Service battled over which of their two fields should be awarded the money available for a new astronomical institute. News coverage of the public battle was interwoven with stories of the H-bomb and a Russian space mission (Gregory, 2005).

> By the end of the 1960s, earlier optimism in media coverage had given way to political scepticism over science's ability to contribute to the economy, and to public criticism of science and technology that centred on its military connections and its adverse environmental impact. While many of the new science journalists were primarily enthusiasts for science, the developing climate of social criticism in the 1960s also gave space to journalists who challenged science. This critical tone was echoed in science-based drama: in 1970, one television screenwriter noted that 'the days when you and I marvelled at miracles of science…are over. We've grown up now—and we are frightened.… The honeymoon of science is over. (Davies cited in Gregory & Miller, 1998: 44)[4]

The journalists' traditional deference towards scientists was now coloured by their professional ethos of independence: one science writer noted that 'the spirit of untrammelled inquiry and scepticism required of journalism in other fields must become a standard in science writing' (Shortland & Gregory, 1991: 15; see also Friedman, 1986 and Hansen, 1994). Through the 1960s, the tone of coverage became increasingly negative and—despite the activity of specialist science journalists—the growth in the amount of coverage declined.

So while science in the public sphere in the immediate post-war period belonged in the main to the scientists, and especially to those prepared to engage in the new political sphere for science, the 1960s was the decade of the science journalist, whose participation in the post-war celebration of science turned, in the middle of the decade, into scientifically informed social and political criticism. Television had quickly become an important medium for science communication in the 1960s. Scientists who had felt competent in newspapers or on radio found television technically complex, and felt that they had little control over the broadcast. The few scientists who excelled in this medium carried the flag for whole communities. With the increasingly critical climate and the technical professionalism of TV journalism, scientists themselves were both increasingly excluded from and increasingly reluctant to contribute to the mass media. In any case, pressures on scientists to earn their keep enforced devotion to research activity. The mood of this time is captured in the 'Ingelfinger Rule' of 1969, named

after the then editor of the *New England Journal of Medicine*, which urged scientists to speak to the mass media only after publication in the peer-reviewed literature (Toy, 2002).

By the 1970s, many scientists had withdrawn not just from communicating directly with the public, but also from co-operating with journalists. To exemplify this period, in 1971 the BBC documentary series *Horizon* broadcast a report on whaling that brought environmental protest into the mainstream and galvanised British politicians to treat whaling as an issue of international politics; and in 1973 the retired physicist Jacob Bronowski, who had turned his attention to social problems of science, broadcast his television series *The Ascent of Man*. The deceleration of the space race ended the long-running public dominance of the physical sciences in the media. Where science did earn a place in the mass media, it was through journalists rather than scientists. The tone of coverage was more sceptical, and amounts of coverage generally lower: *these were the transition years of science in the media in the UK* (see also Jon Franklin's US account in this volume). By the mid-1970s many newspapers had a staff reporter who was designated the 'energy correspondent', to cover the problems with oil and nuclear power; and popular book titles in 1974 were Erich von Daeniken's archaeology of alien invasion *Chariots of the Gods*, and Fritz Schumacher's ecological economics *Small is Beautiful* which echoed the limits of growth debate of the Club of Rome of 1972.

But by the early 1980s, some scientists had begun to feel that their isolationism was impacting negatively on their profession. Influential institutions came together in what has been described as a 'movement' for 'public understanding of science' (PUS), heralded by the Royal Society's report on *The Public Understanding of Science* in 1985. The rationale behind this mobilisation was that the neglect of science by society was caused by a failure of the mass media and public ignorance of science, and that if, with more media attention, the public knew more about science this would create a climate of goodwill towards it. The scientific establishment tended to use the phrase 'public understanding of science' to mean 'positive public appreciation of science' (Lewenstein, 1992; Gregory & Miller, 1998). Scientists entered into a new pact with the media in which science could be proactive and media-wise. The turn towards more positive reporting that began in the early 1980s pre-dates this PUS movement, which, as far as these data can indicate, effected little acceleration in the positive nature of coverage. It, however, contributed to the mobilisation of more media attention, increasing the amount of coverage in the years to come.

While some of the players in the PUS movement have prioritised public interests, the scientific establishment in the UK has clearly seen science as a commodity to be promoted for the benefits of the scientific community. In one statement by a leading scientific protagonist, the idea that science could be marketed to the public is explicit:

> …it would help if we knew more about the ways in which various target audiences may be reached most effectively with information about science and technology which research has shown it wants. This would be the standard approach for anyone marketing goods or services and a similarly professional approach should be taken for the public understanding of science. (Bodmer & Wilkins, 1992)

The media have been represented in scientists' discussions as an enemy that ignores real science and peddles anti-science, and as a potentially powerful ally in the dissemination of science to broad publics. One key attitudinal change expressed in the early literature of the public understanding of science movement was that 'scientists should…communicate with the public…indeed, consider it their duty to do so' (Royal Society, 1985). Now, science communication is not just an acceptable activity for scientists, it has become their duty: it explicitly ought to be part of being a scientist in Britain.

This does not mean, however, that scientists have since wholeheartedly embraced media norms and practices. According to some commentators, a war is being fought for control of science in public; and according to one recent policy statement "some…would like to see the scientist turn journalist, and take the war into the enemy's camp" (House of Lords, 2000: 60)—that is, to reverse the process of the early 1960s by which scientists were replaced by journalists in the public sphere. Science students are being encouraged to take part in this infiltration: the institutionalisation of science communication as an accredited component of formal science education in the UK began in the late 1980s. The courses were hosted by scientific institutions rather than journalistic institutions, and admission criteria were scientific qualifications. Science communication remains a growth industry in UK universities. Employment rates among graduates from these programmes are high and their destinations varied: many join the growing ranks of PR agencies devoted to promoting scientific and commercial interests. In contrast to the days of the isolation of the academic 'ivory tower', the biggest growth areas for public relations in the UK have been the universities and the health and biomedical sciences (Davis, 2000).

The result is that a significant proportion of science communication practitioners in the UK are now science graduates whose entire education—academic and professional—has been undertaken within scientific institutions, and whose professional life has been entirely concerned with science. Thus the corporate values of science are gaining ground in a sphere that has previously undertaken critical reflection upon those values.

By the mid-1990s, marketed innovations, especially in food and medical technology, prompted a sceptical public to enter public debate—a debate which was mediated by PR agencies for companies or the new breed of press offices of universities and learned societies. Scientists, perhaps after some media training, engaged in the marketing of their knowledge and world-

view to the public. In 1994 the first government-sponsored National Science Week to celebrate 'science and its importance to our lives' exemplifies this period,[5] One contribution to a subsequent week was a travelling exhibition developed by the Wellcome Trust, the wealthiest non-governmental sponsor of biomedical research, which was called 'Genes 'R'Us' and staffed by Wellcome-funded scientists. In 2000, President Clinton and Prime Minister Blair held a joint press conference in collaboration with the Celera Genomics Corporation, to announce the mapping of the human genome, and hailing the 'public and private efforts leading to this historic achievement'.[5]

THE PRIVATISATION OF SCIENTIFIC RESEARCH

In the 1930s in the UK, popularisation of science and politics were closely intertwined; for example, in the activities of a visible network of Marxist scientists (Werskey, 1978); but science policy, bringing together military, political, economic, and civic interests, is largely a post-war phenomenon and linked to doctrine of the 'special relationship' between Britain and the US (Baylis, 1997). In the early post-war period, scientists dominated the science policy arena, while defending the autonomy of science with the polemic of the 'two cultures' (Gregory & Miller, 1998). Facing a civil service largely uneducated in science, scientists could use their expertise to dramatically reorient government policies (e.g., Balmer, 2001). Although scientists remained powerful throughout the 1950s, the power shifted towards political appointees; and a new breed of scientific civil servants appeared: C.P. Snow called them 'the New Men' in his novel of that title (Snow, 1954). By becoming part of government, science became part of the culture of secrecy that dominated the Cold War military-scientific complex. Scientists were conscious of the need for confidentiality (Hoyle, 1994). While science now had greater means and a stronger rationale for mass media presence, contrary forces were at work, among which were their withdrawal of co-operation with the mass media in response to critical journalism.

The post-war economic miracle reached levelled off after the mid-1960s. A beat culture of non-conformism and anti-authoritarianism brought new forms of activism, and by the end of the decade, also criticism of science and technology, particularly of their role in warfare and environmental pollution. Scientists' lobby groups, largely on the political left, merged science and social concerns. This was echoed by utilitarian economists for whom 'science was too important to leave to scientists' and who addressed the market failure in resource allocation by treating knowledge as a commodity (Dasgupta & David, 1994). Science came under pressure to prove its economic utility like any other societal endeavour.

The oil crisis of the mid-1970s and emerging environmental concerns brought especially the nuclear power issue into sharp political focus. With

the apparent failure of the old industries and new opportunities in computing, biotechnology, and new materials, by the 1980s science policy had turned towards seed-corn funding of innovation. Academics had begun to explore the commercial potential of their work by the early 1980s (Etzkovitz, 1983). Renewed technological optimism fused with social concerns into a new kind of establishment, making policy inputs on health, environment, and development. Also science reportage is rising again.

Scientists whose work had clear and immediate commercial potential flourished in this new environment. The post-war expansion in research funding had come to an end, thus increasing the competition among researchers for stable or decreasing funds. When in 1979 the new Conservative government, poised on reducing public spending, turned its attention to the science budgets, scientists in Britain quickly felt a crisis. In 1985, the Royal Society published its influential report 'Public Understanding of Science', and a new pressure group called itself 'Save British Science'. UK science felt disempowered, and that its cultural authority was fragile. The importance of basic research in industrial and technological innovation has increased the value of universities (OECD, 1984, 1990). Planning was ideologically alien to the New Conservatives, and universities were used as agents of indirect industrial policy. Many universities in the UK now have science parks attached to serve as a means for technology transfer.

Unlike the older, publicly funded techno-sciences, recent R&D has been highly transferable: computing and the biosciences have provided technologies upon which current global industrial sectors rely (Etzkovitz & Webster, 1995). There has also been a breakdown in the distinction between basic and applied research; and shorter distances between idea and application require closer links between research and industrial agencies (Calvert, 2000). There are now market pressures also on public scientific institutions. In the UK, government funding agencies have diverted an increasing proportion of their funds to strategic and applied research (Etzkovitz and Webster, 1995). This contrasts with the previous situation, when public funding was seen as a bar to profit-making activity (Seidel, 1992). Figure 4.3 shows the increasing deployment of the private sector R&D in OECD countries. Both finance and performance become mainly a private affair (OECD, 2004). In the Britain of 2002, two-thirds of R&D was performed privately, and just 26 per cent is under public patronage. Only in very recent years has a slowing or a reversal of this trend been indicated.

In the mid-1980s, universities gained new rights to exploit patents (Reams, 1986). This required entrepreneurial skills and universities established agencies to market intellectual property. For the scientist, it became possible to sell ideas to companies in exchange for a share in corporate equity. The transformation of academia into research teams (as opposed to individuals collaborating) brought it closer to the production structures of industry. These groups now operate as firms: the team leader in a university research group raises funds, manages staff, and engages in public relations

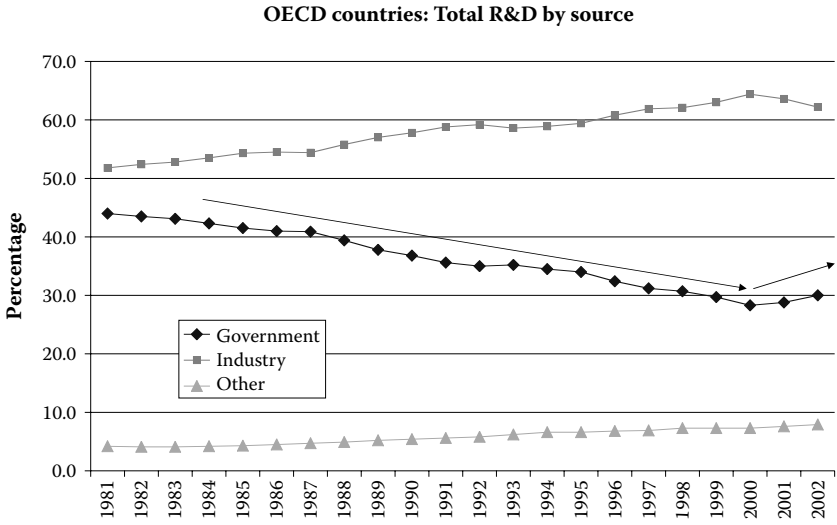

Figure 4.3 R&D expenditure by source in OECD countries, 1981–2002.

(Etzkovitz, 1990). This also encourages the exchange of personnel between academia and industry.

Last but not least, the stock markets enter the new scenario. Investors and their scouts prospect ideas and innovations to bet on future returns. New stock-market indexes such as NASDAQ now cluster corporations specialising in science-based hi-tech innovations. These indexes offer a continuous public display of the potential of science to generate revenue.

Thus we note the privatisation of scientific research, and not only for the UK, but a general trend in the funding and performance of science in industrial countries. This contrasts with the early decades of the last century, when scientific development responded to the nation's particular need for agricultural, medical, and military innovation. Now, the situation reflects the state's need to create conditions that stimulate generic economic growth (Etzkowitz, 1989).

Thus the last decades of the twentieth century have seen increased financial pressures on universities, and scientists have been encouraged to conduct research that generates revenue; and thus they struggle to entertain both the scientific-theoretical focus and the commercial significance of their work (Etzkovitz, 1983). Universities are now sites for industrial development, supported jointly by government and industry, which facilitates links between previously separate institutions. And with the economic success of such links, geographical clusters emerge which tie the industrial, political, and public spheres (Etzkovitz & Webster, 1995). Universities now function within a context where governmental, industrial, and financial milieus become less and less distinguishable. The privatised production of

knowledge inevitably brings with it the logic of professional communication of marketing, advertising, and public relations for science.

FROM THE OLD TO THE NEW REGIME OF COMMUNICATION

We summarise the period under study in Table 4.1. We see a shift from national-public to global-private funding; from communicating scientists with an educational mission, to professional science journalism, to public relations for science; and from the occasional media opportunity for scientists, to the strategic management of media events. We sum up the new mode of science communication as 'PUS Inc.'[6]

The recovery of science reportage after the low period of the 1970s, and particularly the recent boom in science communication which began in the 1980s, have taken science coverage way above the linear trend (see Figure 4.1 below). After the crisis of the mid-1970s, science underwent a total re-construction of its public self-expression in the logic of a corporate activity. The transition from the old to the new regime, from the modus operandi of the 1950s to that of the 1990s and beyond, is marked by the arrival of the logic of public relations and of corporate communication in the practice of science communication. The modes of reporting and attention to issues are now more the outcome of strategic public relations than the older journalistic agendas of investigation, education, and enlightenment. Our old-new distinction is of course ideal-typical—neither period is entirely one or the other regime.

Table 4.1 Summary of shifts in the modes of science communication

Period	*Science content*	*Mode of communication*
1940s 1950s 1960s	Physical sciences Nuclear power Space race (national public projects)	**'Old regime' science journalism** **communicating scientists educational mission;** **science journalism;**
1970s early 1980s	EnvironmentalismAnti-nuclear protest War against cancer Limits to growth (Club of Rome)	'Period of transition' transition years (1970s); critical, sceptical journalism;
late 1980s 1990s	'medicalisation' of science news: bio-medical sciences biotechnology information technology (global private business funds)	**'New regime' of PUS inc.** **promotion of image of science;** **Public relations of corporate science** **Mass media events;** **Para-journalism**

Let us consider the recent history of biotechnology through the postwar period, where we find that the bio-medical sciences became the dominant representation of science in the news media (Bauer, 1998, 2006). A number of factors may account for this increasing prominence. Firstly, since the quiet origins of molecular biology and genetics in the universities in the mid-1950s, these sciences and have produced some high-profile and newsworthy events, from rDNA, to test-tube babies to cloned sheep (Turney, 1998). New understandings and new techniques produced widespread reorganisation of the institutions of biology. Institutional instability is a powerful generator of popularisation as new configurations and new ideas are publicly defined (Lewenstein, 1995; Gregory, 1998). The new field is interdisciplinary where physicists, chemists, engineers, computer scientists, and others collaborate, and interdisciplinary science produces higher levels of popularisation, as differing groups attempt to understand each other. The biosciences raise ethical issues which many different groups—including critical journalists—have addressed in public, demanding in return a response from science. Thus there are many reasons why the new biology and biotechnology should have been communicated so vigorously. However, this new science also offered immediate opportunities for commercial exploitation: University spin-offs, new opportunities for biologists in the new 'life science' sector. During the 1990s, public communication of the biological sciences took on the character of corporate PR only blighted by the stock market crash of 2002.

Journalistic activity, ideally and typically newspaper-based, consists of investigating scientific issues via credible sources and developing subject expertise and a critical response. On the other hand, public relations (PR) or corporate communication is a corporate-based activity, promoting corporate interests and non-critical public relations. These two communication professions can be compared on working conditions, operative rules and constraints, professional ethos, their societal contributions, and their relation to science.

Journalists strive to inform the public, raise attention, entertain, and, co-ordinated by an editor, to sell space and readership to advertisers. In terms of professional ethos, the journalist can claim to be a trustee of public interests, and to function as a Fourth Estate in modern governance. The mass media are the classical locus of public opinion. The PR professional, on the other hand, aims to design a favourable image of the corporation she works for, either as employee or as consultant, and undertakes damage limitation during crises. The ethos of the PR person is the professional cultivation of a favourable corporate image in the public. However, journalism and PR have a common interest in the functioning of a free mass media system (Jenkins, 2006).

The professional situation of the journalist is increasingly precarious. The number of mass media outlets that compete for public attention is getting ever larger, and the production of news ever faster. Newspapers and

other mass-media operators are responding with cost-cutting, outsourcing, short-term contracting of freelancers, and ever quicker production cycles.[8] While UK daily newsprint nearly doubled between 1984 and 1994, the staffing levels of newspapers have barely increased. While the working situation of the journalist deteriorated during the last quarter of the twentieth century, the future of PR is very bright indeed. It is an expanding field of activity, well paid, and a major career opportunity for journalists.

Journalists work under the pressures of daily deadlines and a set of news values and routines (see Hansen, 1994). These pressures make them increasingly reliant on prepared source materials, thereby reducing their own contribution to one of editing, cutting, and personalising. By contrast, PR professionals work the media system, maximising communications to their own design. The work cycle of PR is longer and controlled: the staging of media events requires time and strategic planning. Consider an "Einstein Year", or the going public of a hi-tech spin-off company. The generation of favourable stories is carefully prepared, information is strategically disseminated, and unfavourable stories are diffused by 'flak' and diverting alternatives. PR professionals maintain a network of loyal journalists by offering 'bribes' such as invitations, access to exclusive materials, conference travel and fees. Precarious working conditions render journalists increasingly dependent on fringe benefits. Their main problem is to maintain public credibility; and they keep a watchful eye on each other; the outing of 'aditorials' (as opposed to editorials) of 'bribed' competitors could have news value. PR people, on the other hand, are constrained by a lack of credibility, in particular in times of crisis. PR activity is hidden from public eyes, because readers will assume that 'they would say that wouldn't they'. While a close network with the media is essential, a public profile makes the PR person vulnerable to scapegoating in times of crisis. Thus journalists seek the public eye; PR people tend to avoid it.

Journalists render issues salient and focus public attention: they know how to make a story newsworthy. They are the self-observers for society, the neurotic reflexivity of modern society, at their best in times of crisis, feeding on competing sources. Crises have a perennial attraction for journalists—to such a degree that they are tempted to create them from mere dramas. On the other hand, the contribution of PR is the long-term cultivation of public perceptions. Their craft is in the building of goodwill in anticipation of some possible future crisis; they like to diffuse crises.

FUTURE DILEMMAS

PR and journalism inter-relate by exchanging news space, and therefore public attention (the journalists offers), with privileged information (the PR of science offers). Three modes of this relationship are being observed (Russ-Mohl, 2000). The first model postulates that PR is in control by

feeding selected journalists. PR is able to bypass journalists, and thereby make them potentially redundant or subject to blackmail. The second model assumes that PR and journalism are symbiotic, enabling each other. PR people may actively induce a story, but in order to be successful they have to meet the expectations of the journalists and adopt established news routines and journalistic values. They both rely on and contribute to an open playing field—the media system. Finally, in the third model, journalists provide the necessary infrastructure. PR exploits professional journalists who gain little in return and who are blind to that fact. PR is parasitic upon journalism.

As a secular trend, and we acknowledge Dorothy Nelkin for having pointed to such a trend years ago (Nelkin, 1987: 132ff), it seems that PR takes the upper hand over journalism (see Goepfert in this volume), and this reflects the way science is arranged in the twenty-first century; it is increasingly a private matter. Rather than deploring and moralising about the trends which we discussed here—though there may be many good reasons to do so—we will end by exploring some dilemmas that will arise from this changing context.

The incorporation of science communication—the situation we call PUS Inc.— as shown in Table 4.2, presents a number of dilemmas of communication. Double-binds of this kind are likely to cause situations to proliferate with all the strains of contradiction and dissonance that this might entail.

Both science and journalism are traditionally sceptical professions. They interrogate and assess the results critically. Their work seeks controversy and the debunking of myths. PR professionals, on the other hand are myth-makers: PR promotes a positive image of its paymaster so as to minimise controversy and a critical response. Where the process of debate in science aims to open scientific claims to the scrutiny of others, a media conference to announce those same claims aims to celebrate and affirm them. Traditional

Table 4.2 The dilemmas of the 'PUS Inc.'

Science communication	*PUS Inc.*
Sceptical	Celebratory
News story	News event
Debunking myths	Myth-making
Debate and controversy	Media conference
Visible scientists in the media	Stars staged by PR professionals
The hero scientists	Images of corporations
Knowledge-sharing	Image-making
Public as citizens	Public as consumers and shareholders
Public forum	Trade show

science journalism has as at least part of its mission to critically disseminate knowledge; this is not essential in the process of corporate image-making.

The specialist skills required for managing both media messages and the public responses are the PR person's stock in trade. While scientists may have the skills to speak on the radio or to write a newspaper feature, they do not have the professional skills of media and audience management. Perhaps PR skills will become part of scientists' professional toolkit in the same way as popular writing and public speaking have become part of scientific educations in Britain and elsewhere. However, for the time being, the PR skills required under PUS Inc. mean that science communication is the province of the few, rather than of the many. Furthermore, the logic of PR requires a centralised communication function, which will render increasingly obsolete the 1990s attempt of making every scientist a populariser of his or her own work.

Despite the tenor of recent concerns over a crisis of confidence in science (House of Lords, 2000), over the long term, most scientists and most journalists have been considered relatively trustworthy by the public. However, the public is alert to and weary of the marketing and PR logic encroaching on science communication. In a climate of PUS Inc. the public faces a fundamental dilemma of trust: how to trust the message, if you cannot trust the source?

Independent critical journalism is the life-blood of democracy. However, the current routine reporting of science, supported by specialist PR techniques, aims primarily at informing capital markets and shareholders rather than at enlightening citizens, consumers, and voters. While public events such as the science weeks and science festivals recently place emphasis on encouraging dialogue between science and the public, the proliferation of corporate sponsorship has turned these events into trade shows rather than public forums.

Dilemmas and double-binds can be maddening and paralysing, but science communication may need to face these paradoxes. And indeed, the new climate of PUS Inc. as we have characterised it here may make that a very problematic enterprise.

NOTES

1. An earlier version of this chapter was published in French: Gregory and Bauer (2003)
2. Over the last 50 years the *Daily Telegraph* had a consistent Conservative Party editorial, the highest circulation figures of any broadsheet (between 1 and 2 million a day), and prided itself on quality science reportage. The quality newspaper market in the UK has been stable despite competition from TV news (Seymour-Ure, 1991), decline setting in only in the 1990s. We can assume that in aggregate and over a long period of observation, news content on TV and the radio is more or less the same.

3. Bulgaria and Britain display similar cycles of science coverage over the post-war period across the Iron Curtain (Bauer et al., 2006). Kepplinger (1989) reports a recovery of science news in German newspapers during the 1970s from a lower period in the 1960s; Australia (ADITC, 1991) sees an explosion of science news after 1980. As a reverse indicator, the expansion of membership into the AAAS during the 1960s reached its peak in the early 1970s (Kohlstedt et al., 1999).
4. Gerry Davies, writing here in the BBC's Radio Times, had moved from writing science fiction screenplays to writing realistic science-related dramas reflecting contemporary concerns.
5. From the website of the BAAS, http://www.britassoc.org.uk.
6. White House press briefing, 25 June 2000.
7. None of these trends is clear-cut or novel. For example, after World War I, chemists in Britain mounted a campaign of popularisation that was essentially PR to boost their image after the damage done to it by the gas weapons used in combat. In the late 1920s, the Cavendish Laboratory, a distinguished but flagging Cambridge University physics laboratory, was promoted in the media by the journalist J.G. Crowther, who was acting as what in modern terms would be described as a press agent (Hughes 2000). The American space agency NASA pioneered the science press conference in the early 1960s. Note that institutions to do need to be corporations in order to engage in corporate-style communications strategies.)
8. See Peter Preston on 'all the news that's fast and cheap to print', *Observer*, 10 November 2000, p. 10.

REFERENCES

ADITC (1991) 'Science and technology news in the media' *Australian Science and Technology Brief*, Section 5, 35–43.

Balmer, B (2001) *Britain and Biological Weapons* London: Routledge.

Bauer MW (2006) 'The public career of "genes": long-term trends in the press coverage of genetics, 1946 to 2002' *New Genetics and Society*.

Bauer M (1998) 'The medicalisation of science news: from the "rocket-scalpel" to the "gene-meteorite" complex', *Social Science Information*, 37, 731–751.

Bauer M (2000) '"Science in the media" as cultural indicator: contextualising surveys with media analysis' in: Dierkes M and C von Grote (eds.) *Between Understanding and Trust: the Public, Science and Technology* Reading: Harwood Academics, 157–178.

Bauer, M, Durant, J., Ragnarsdottir, A, and Rudolfdottir, A (1995) 'Science and technology in the British Press, 1946–1990' *London Science Museum, Technical Reports* 1–4.

Bauer M W, Petkova K, Boyadjieva, P, and Gornev, G (2006) 'Long-term trends in the representations of science across the iron curtain: Britain and Bulgaria, 1946–95', *Social Studies of Science*, 36 (1), 97–129.

Baylis J (1997) *Anglo-American Relations Since 1939: The Enduring Alliance* Manchester: Manchester University Press.

Bodmer, W and Wilkins, J (1992) 'Research to improve public understanding programmes' *Public Understanding of Science* 1(1), 7–10.

Calvert, J. (2000) 'What's special about basic research?' Paper presented at the conference 'Demarcation Socialised', University of Cardiff, 25–27 August.

Dasgupta P and P A David (1994) 'Toward a new economics of science' *Research Policy*, 23, 487–521.

Davis, A. (2000) *Public Relations, Political Communication, and National News Production in Britain 1979–1999*, PhD thesis, Goldsmiths College, London.
Elzinga, A and Jamieson, A (1995) 'Changing policy agendas in science and technology' in *Handbook of Science and Technology Studies* Jasanoff, S, Markle, G E, Petersen, J C, and Pinch, T (eds.) Thousand Oaks, CA: Sage, p 574.
Etzkovitz, H (1983) 'Entrepreneurial scientists and entrepreneurial universities in American academic science' *Minerva*, 21, pp 198–233.
Etzkovitz, H (1989) 'Entrepreneurial science in the Academy: the case of the transformation of norms' *Social Problems*, 36 (1), pp 14–29.
Etzkovitz, H (1990) 'The second academic revolution: the role of the research university in economic development' in *The R&D System in Transition* S. Cozzens, S, Healey, P Rip, A, and Ziman, J (eds.) Dordrecht: Kluwer.
Etzkovitz, H and Webster, A (1995) 'Science as intellectual property' in *Handbook of Science and Technology Studies* Jasanoff, S, Markle, G E, Petersen, J C ,and Pinch, T (eds.) Thousand Oaks, CA: Sage.
Friedman, S (1986) 'The journalists' world' in *Scientists and Journalists: Reporting Science as News* Friedman, S, Dunwoody, S, and Rogers, C (eds.) New York: Free Press, pp 17–41.
Goodell, R (1977) *The Visible Scientists* Boston: Little, Brown.
Gregory, J (1998) *Fred Hoyle and the Popularisation of Cosmology* PhD thesis, University of London.
Gregory, J (2005) *Fred Hoyle's Universe* Oxford: Oxford University Press.
Gregory J & Bauer M W (2003) 'PUS Inc.: l'avenir de la communication de la science', in Schiele, B & Jantzen, R (eds.) *Les Territoires de la Culture Scientifique* Montreal & Lyon: Press Universitaire de Lyon, chapter 2, 41–65.
Gregory, J and Miller, S (1998) *Science in Public: Communication, Culture and Credibility* New York: Plenum.
Hansen, A (1990) 'The construction of science in the mass media' Paper presented in the Sociology and Social Psychology Section, The XVIIth Conference of the International Association for Mass Communication Research, Bled, Yugoslavia, 26–31 August, p 2.
Hansen, A (1994) 'Journalistic practices and science reporting in the British press' *Public Understanding of Science*, 3, 111–134.
Hilgartner, S (1990) 'The dominant view of popularisation: conceptual problems, political uses'. *Social Studies of Science*, 20, 519–539.
House of Lords Select Committee on Science and Technology (2000) *Science and Society, 3rd Report of Session 1999–2000* London: HM Stationery Office
Hoyle, F (1994) *Home is Where the Wind Blows: Chapters from a Cosmologist's Life* Mill Valley, CA: University Science Books.
Hughes, J (2000) 'J G Crowther and science journalism: public understanding or propaganda?' London Public Understanding of Science Seminar, UCL and LSE, 27 September 2000.
Huxley, T H (1897) *Man's Place in Nature and Other Anthropological Essays* London: Macmillan, p ix.
Jarvie, I C (1990) 'Media representations and philosophical representations of science' *Critical Studies in Mass Communications*, 7, 72.
Jenkins S (2006) 'PR and the press: two big guns' *British Journalism Review*, 3, 45–49.
Jones, A (2006) 'Science in the air' *Ocean Challenge* 14, (3).
Kepplinger, H M, et al. (1989) *Kuenstliche Horizonte. Folgen, Darstellung und Akzeptanz von Technik in der Bundesrepublik* Frankfurt a Main: Campus Verlag.

Kohlstedt, S G, Sokal, M M , and Lewenstein, B V (1999) *The Establishment of Science in America* Washington, D.C.: AAAS.
Krieghbaum, H. (1967) *Science and the Mass Media* New York: New York University Press.
Lewenstein, B V (1995) 'From fax to facts: communication in the cold fusion saga' *Social Studies of Science*, 25, 408–424.
Lievrouw, L A (1990) 'Communication and the social representation of knowledge' *Critical Studies in Mass Communication*, 7, 9.
Nelkin, D (1987) *Selling Science: How the Press Covers Science and Technology* New York: Freeman.
OECD (1984) *Industry and University: New Forms of Corporation and Communication* Paris: OECD.
OECD (1990) *University Enterprise Relations in OECD Member Countries* (DSPI/SPR/89. 37; first revision) Paris: OECD.
Reams, B (1986) *University Industry Research Partnerships: The Major Legal Issues in Research and Development Agreements* Westport, CT: Quorum.
Royal Society (1985) *The Public Understanding of Science* London: Royal Society.
Russ-Mohl, S (2000) 'Symbiose oder Marktbeziehung?' *NZZ*, November, 257, 51.
Schudson M (2003) *The Sociology of News*, New York: WW Norton.
Seidel, R (1992) 'The origins of the Lawrence Berkeley Laboratory' in *Big Science: The Growth of Large Scale Research*, Galison, P and Hevly, B (eds.) Stanford, CAStanford University Press, p 38.
Seymour-Ure, C (1991) *The British Press And Broadcasting Since 1945* Oxford: Blackwell.
Shortland, M, and Gregory, J (1991) *Communicating Science: A Handbook* London: Longman.
Snow, C P (1954) *The new men* London: Macmillan.
Toy, J (2002) 'The Ingelfinger Rule: Franz Ingelfinger at the *New England Journal of Medicine* 1967–77' *Science Editor*, 25 (6), 195–198.
Turney, J (1998) *Frankenstein's Footsteps: Science, Genetics and Popular Culture* New Haven, CT: Yale University Press.
Werskey, G (1978) *The Visible College* London: Allen Lane.

5 Big science, little news

Science coverage in the Italian daily press, 1946–1997

Massimiano Bucchi and Renato G. Mazzolini

INTRODUCTION

The coverage of science by the non-specialized mass media—the daily press, radio, television, and magazines—has often been criticized by scientists, commentators, and analysts of media communication. The media are blamed for, among other things, allocating inadequate space to scientific topics, inaccuracy in reporting about the issues, and exaggerating the political or non-scientific significance—indulging in dramatization and sensationalism. The media are often overtly accused of a negative, antiscientific attitude in their coverage of science (Friedman et al., 1986; Burnham, 1987; Farrands, 1993; Gunter et al., 1999).[1] This conception of the media as a 'dirty mirror' of science, as an opaque lens unable to present and filter scientific content properly, has often been invoked in debates that have recently developed in the Italian public sphere as well, in the wake of issues such as BSE, the 'Di Bella affair', and GMOs.[2] The frictions that have arisen in the relationship between scientific research and its institutions, on the one hand, and public opinion, on the other have often been attributed to the inadequacy of media coverage, largely responsible for the alleged 'scientific illiteracy' of Italians.

During the last two decades, however, this view of public communication of science, and more particularly of the role played by the media, has been amply challenged both theoretically and empirically. Several studies have been carried out on specific science stories and controversies receiving special attention by the news media, often highlighting the increasing importance of media actors and dynamics in shaping the core scientific debate.[3] It has been shown that the non-specialized media perform an extremely complex role in the communication of science, a role that in certain circumstances may act as a 'filter' and an 'arena' for researchers in specialist and inter-specialist areas (Shinn and Whitley, 1985; Hilgartner, 1990; Phillips et al., 1991; Lewenstein, 1995b; Bucchi, 1998).

Other studies have focused on the coverage of science and technology issues particularly relevant in terms of public debate—such as the environment, AIDS, or biotechnology—and of research areas such as medical sci-

ence (Hansen, 1994; Bauer et al, 2001). In some cases, results from these studies have lead to critical discussions of the causal nexus between the representation of a scientific issue by the media and its perception by the general public, so that it does not appear that the latter's hostility can be explained solely in terms of information gaps or distortions (Wynne, 1995; Bucchi and Neresini, 2002, 2004).

While in some countries it has been possible to project the analysis of 'breaking' science stories, as well as the study of science and technology issues against some background knowledge of the general presence of science in the mass media either from a short- or a long-term perspective, this has not been possible in Italy so far (La Follette, 1990; Hansen and Dickinson, 1992; Einsiedel, 1992; Pellechia, 1997). Trying to remedy this shortcoming has been one of the aims of a broad study on science coverage in the Italian daily press and television news. Regarding the daily press, the project's research design and methods were developed in close analogy with what has thus far been one of the most thorough studies of the presentation of science by the daily press: A survey of 6,000 articles published in seven British daily newspapers from 1946 to 1990 conducted in 1995 by the London Science Museum (Bauer et al., 1995; Bauer 1998).[4]

The research discussed in this paper is limited to the coverage of science and technology by the leading Italian national daily, *Il Corriere della Sera*. Published in Milan since 1876, owned by RCS-Group—one of the largest editorial groups in Italy—*Il Corriere della Sera* is the most widely circulated and prestigious Italian newspaper. The study considers a total of 1,336 articles published in that newspaper in the period between 1 January 1946 and 31 December 1997, using a day-based statistical sampling method.[5]

As in the London Science Museum study, 'science stories' were defined in a broad sense, and included articles explicitly reporting research findings or events related to the natural sciences or to applied sciences such as engineering and medicine, and articles featuring statements by scientific experts or articles including references to science or using science based argumentation. For example, an article about the use of doping in sport was selected only if it contained a substantial account of how dopant substances have an impact on biological functions. However, unlike in the London Science Museum study, stories reporting on or containing references to social science research were not selected. A reliability test among the different researchers responsible for selecting articles was conducted in the early stages of the project to check the consistency of the selection criteria. Once selected, each article was analyzed using a coding sheet both in terms of formal characteristics (e.g., size, position, presence of images, author) and narrative elements (e.g., sources cited, representation of actors, science fields covered, geographic context of the story, presence of dimensions such as controversy or risk, type of consequences envisaged with regard to the research or the event described) for a total of approximately 50 variables.

THE COVERAGE OF SCIENCE ISSUES

General features of science stories

Analysis of the distribution of articles among the newspaper's various sections shows that a large part of them (62 percent) do not appear in pages explicitly devoted to science—a section first introduced in Italy by the newspaper *Il Giorno* in 1958, consisting of a page devoted to 'science and technology' and subsequently in the 1960s by *Il Corriere della Sera* ('science and technology') and *La Stampa*. Stories about science appear on domestic news pages in 7.6 percent of cases; on the foreign news pages in 4.7 percent of cases; and on the front page in 5.8 percent. Less than 1 percent of scientific articles appear on the economics and arts pages. The remaining 38 percent appear in inserts and on pages devoted to science.

In 17.1 percent of cases, the articles are written by scientists or doctors; the rest are by journalists and commentators. This direct involvement of scientific experts in the writing of articles for the non-specialist press—which adds to other forms of involvement like interviews—matches the findings of numerous other international studies, thereby contradicting the image of the media treatment of science as inadequate because it is entirely delegated to non-specialists and vitiated by the ignorance of journalists (DiBella et al., 1991; Dunwoody and Scott, 1982; Jacobi and Schiele, 1988; Hansen, 1994).[6]

Coverage of the different science fields

The results yielded by analysis of the disciplinary areas to which the articles refer are particularly interesting: Biology and medicine on their own, account for more than half of all articles (52.7 percent). A further 14.7 percent of the stories deal with engineering, and just under one in every ten is about physics. Astronomy, environmental sciences, zoology, chemistry, and geology follow at some distance, while interest in mathematics on the part of the newspaper seems to be entirely negligible.

Some fields, such as medicine and biology, are more frequently the subject of specific sections devoted to science or health (the scientific pages, the health supplement now published on Sundays). Physics is the field that most frequently appears in the newspaper's general sections. Articles on the environmental sciences and geology, when they appear, are almost entirely confined to special features on scientific topics.

One finds almost the reverse situation when quantifying the appearances of individual disciplines on the front page. Analysis of the percentage of stories about each discipline promoted to the status of 'news of the day' and therefore printed on the front page shows that mainly engineering and physics receive such treatment. These disciplines, in fact, are less frequently reported in the newspaper as a whole, but when stories about them do

Table 5.1 Authors of articles by science field covered (percentage of articles written by scientists/researchers and by journalists for each science field)

	Specialist	*Journalist*
Medicine	18.3	55.1
Biology	20.7	52.9
Physics	12.8	56
Engineering	5.7	58.5
Astronomy	23.6	61.8
Geology	36.8	55.3

appear, they are put on the front page much more frequently than are ones about medicine. Stories about the latter discipline appear on the front page with the same frequency as do stories on environmental sciences (3.6 percent), although medical stories are six times more numerous than those on ecological topics. Thirty-six percent of all the articles on scientific and technological topics printed on the front-page deal with engineering matters, even though this discipline accounts for only slightly more than 17 percent of all scientific and technological articles in the newspaper.

Researchers and medical doctors most frequently contribute articles in the biological and medical fields and in disciplines like geology, rather than in areas like engineering, where little more than 5 percent of articles are written by specialists.

THE REPRESENTATION OF SCIENCE ISSUES: PLACES, ACTORS, SOURCES, AND CONTROVERSY

Besides researchers—present in 'passive' form in two out of three articles—the categories most frequently featured in the presentation of science by

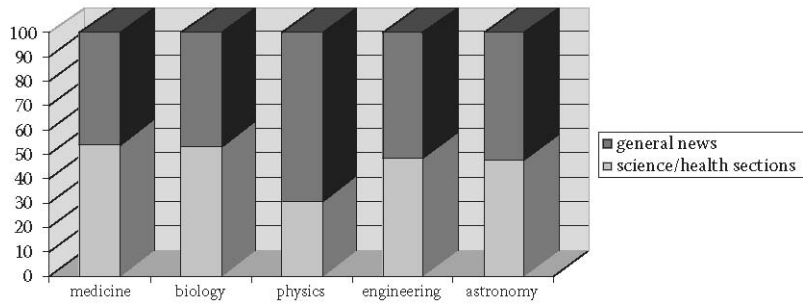

Figure 5.1 Presence of different fields in general news and science sections in *Corriere della Sera*.

the daily press are medical doctors (represented in 35.1 percent of articles), patients and their associations (9.2 percent of articles), which confirm the strong medical emphasis of coverage. Almost negligible is the presence of exponents of the economic sector like entrepreneurs or companies (2.3 percent) and especially politicians (1.8 percent).

What sources do these articles cite? In other words, where do they get their information? It appears the information mainly comes from universities and research bodies, which are cited by almost one-third of articles (31.3 percent). Not infrequently, however, sources such as conferences or symposia are mentioned (9.8 percent and 9.7 percent respectively), followed by health authorities (7.3 percent), and foreign specialist journals (6.0 percent; almost no reference is made to Italian scientific journals). On rare occasions, the non-specialist press (magazines, daily newspapers) is cited as a source of scientific information (3.1 percent).

Four in every 10 articles cite no scientist at all; 30 percent of them mention only one, which delineates a highly consensual and uncontroversial representation of science. In fewer than one-third of cases, in fact, does an article cite more than one scientist, and in half of them no more than two are cited. Even in the case of direct citations of scientific experts, in the great majority of cases only one expert is cited (71.3 percent); citations of several experts increase in the case of indirect citations, where almost half of the articles contain more than one.

There is almost invariable agreement between the author of the article and the sources. Obviously cited with much greater frequency are sources that support the article's arguments; much more rarely ones that disagree with them. In general, the scientific issue is presented as uncontroversial in more than 70 percent of cases.

Hence, there seems to be little support for the hypothesis put forward by some scholars and practitioners that the popular press tends to be interested in science only when some newsworthy controversy erupts that lends itself to being treated according to criteria of journalistic rather than scientific 'balance', thereby engendering the risk of over representing unorthodox science positions (Bodmer, 1985; Dearing, 1995). However, scientific controversy per se has little journalistic appeal because it tends to confuse both reporter and readers (Fahnestock, 1986; Stocking, 1999). Instead, media interest is aroused when it is possible to inject scientific expertise into hotly debated public issues, like the Bovine Spongiform Encephalopathy (BSE) emergency or the alleged dangers of electromagnetic fields.

Routine press coverage—the media 'background noise' of most interest to us here—appears to be substantially linear, unproblematic, and solidly backed by scientific sources. With regards to this, one can recall results such as the one obtained from a survey of British scientists and journalists, which found that more than one quarter of the articles on science published by daily newspapers stem from the initiative of the researchers themselves

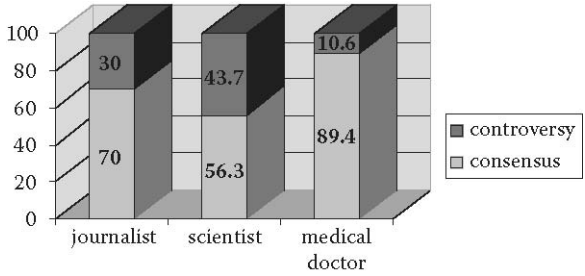

Figure 5.2 Presentation of the issue as consensual/controversial, by authorship (percent) in *Corriere della Sera*.

and their institutions (e.g., press releases, discovery announcements, willingness to be interviewed) (Hansen, 1994; Einsiedel, 1992).

Interestingly, scientists' articles most frequently present scientific facts as controversial, compared to those written by journalists and doctors. This seems to further belie the stereotype that journalists artificially inflate the controversial aspects of a scientific story. Frequently, scientists highlight the diverse standpoints that can be taken on an issue. An exception is medicine, where the linearity and certainty of the message probably sits well with the need to give practical, if not prescriptive, information.

The consequences of scientific discoveries and research as presented by the articles were also considered. Such consequences are described as positive by half of the articles analyzed (49.6 percent); they are explicitly considered to be harmful by just over one in every four of them (25.4 percent), while the remaining 25 percent present them as neutral. This predominantly positive tone of science coverage, documented also by other studies of the daily press, is again in contrast with many critical stereotypes and contributions (Einsiedel, 1989; Kepplinger, 1989).[7]

The consequences of the scientific events described are treated mainly in scientific (69.1 percent of cases) and socio-cultural (50.3 percent) terms;[8] less frequently are they couched in technological, ecological, economic, or political ones. They are generally depicted as consequences that can be at least partially controlled by human agency, to the point that the type of action suggested—explicitly or implicitly—is often the active promotion of change, and only in a very small number of cases active resistance to it.

Despite this strongly progressive image of science and its impact on society, coverage of science issues by *Il Corriere della Sera* does not fail to address the risks to human health raised by scientific activity: indeed, almost half the articles consider the risks attendant on the scientific event discussed. These risks are associated principally with medicine and biology (68.4 percent of the articles on medical topics and 42.1 percent of those on biological ones mention risk), and physics (48 percent), while much more

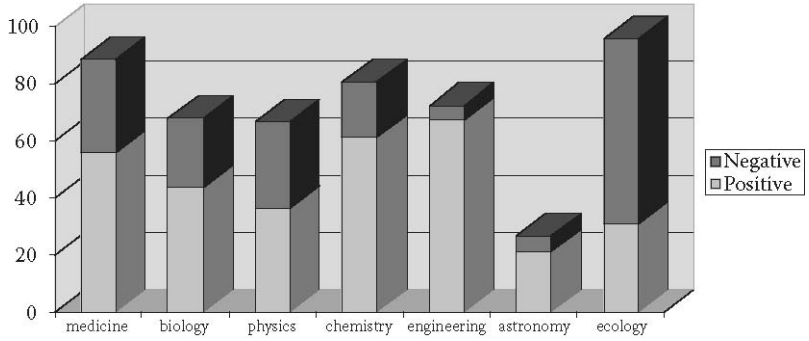

Figure 5.3 Science fields and consequences of scientific research in *Corriere della Sera*.

infrequent mention is made of risk in articles on engineering (14 percent) and chemistry (19.4 percent).

Contrary to what one might expect, discussion of risk is not confined to articles by journalists; indeed, the issue is addressed most often in articles authored by doctors, almost three-quarters (73.3 percent) of which envisage risks to human well-being, while the corresponding percentages of articles by journalists and scientists are 45.6 percent and 37.1 percent respectively.

Evaluation of the harmful consequences of a scientific fact is likewise associated with medicine and biology, and to a large extent also with articles on the environmental sciences. Engineering is once again the disciplinary area in which the consequences of scientific research seem most susceptible to human control; less so, it seems, are those of research conducted in the environmental-climatic and medical-biological fields.

LONG-PERIOD TRENDS

The length—50 years—of the period considered enabled us to examine the historical evolution of treatment given by *Corriere della Sera* to science. Our first finding was a marked quantitative increase in the coverage of scientific topics by the newspaper. This increase first became apparent in the mid-1950s (from 9 articles in the first half of that decade to an average of around 100 articles per quinquennium for the next 20 years), but it expanded exponentially from the early 1980s onwards. The number of articles almost doubled between 1981 and 1991, rising to 400 in the final phase of the period considered, which was a 4,000 percent increase over the first phase.

Table 5.2 shows the distribution of this growth between the newspaper's general sections and its special supplements on science and medicine. A large part of the increase took place during the past two decades, due to

Table 5.2 The distribution of articles on science in the period 1946–1997 between supplements and general sections (absolute values), *Corriere della Sera*

	Number of articles	*General sections*	*Supplements/ sectionson science and medicine*
1946–1950	9	9	0
1951–1955	30	30	0
1956–1960	74	74	0
1961–1965	92	77	15
1966–1970	126	58	68
1971–1975	89	63	26
1976–1980	99	60	39
1981–1985	140	48	92
1986–1990	277	87	190
1991–1997	401	92	309

the introduction of sections and supplements such as 'Corriere Scienza' (a weekly science section established in 1965) and 'Corriere Salute' (a weekly health supplement established in 1989). From the 1980s onwards, the majority of scientific articles were published in the supplements, which between 1991 and 1997 contained three times as many articles as the rest of the newspaper.

A method of measurement that takes account of the variation over time in the newspaper's overall volume—and therefore of the variation in the total number of articles—shows that the increased amount of space devoted to science is not only absolute but also relative. In other words, as the number of articles and pages has increased, so too has the amount of space devoted to scientific topics, both in the newspaper's general sections and as a result of the introduction of special supplements on science and medicine. The percentage of scientific articles in the total number of articles published in the newspaper rose from 0.7 percent in the period 1946–1950 to a steady 10 percent in the early 1980s; thereafter it continued to grow, doubling in the course of the second half of the decade (21.1 percent) and then reaching 28.6 percent in the period 1991–1997. In practice, more than one in every four articles published by the newspaper dealt with a scientific topic.

A more detailed analysis shows that this increase over time has not been homogeneous for the various disciplines. Medicine has displayed considerable expansion in terms of the number of articles, compared to a less marked quantitative increase in articles on biology, physics, and engineering. Physics in particular seems to be subject to cycles of interest that have also led—in recent years—to its loss of visibility. The recent expansion of

the biological disciplines has been slower yet constant, although this now seems to have stabilized.

However, the most striking feature again concerns medicine, articles about which more than quadrupled in the last 15 years surveyed: from 50 in the period 1981–1985 to 100 between 1986 and 1990, to fully 235 articles in the final period (1991–97). In the latter period, articles on medical topics accounted for more than 50 percent of the total.

It should be noted, however, that a major contribution to this development of medicine has been made by the increasingly frequent inclusion in the newspaper of special supplements and sections, in which, as we have seen, there is a preponderance of medical stories over those about other disciplines, which more frequently appear on the news pages. Thus, while we can agree with other studies that the creation of specific sections devoted to science or medicine does not automatically result in the 'ghettoization' of science coverage within the newspaper—which has grown, in the case of *Il Corriere della Sera*, in the general news section across time—it is clear that the proportion of stories contained in specific sections on the total of science stories (particularly in the biomedical area) has been continuously increasing during the years, accounting in the last period (1991–1996) for almost 80 percent of the total science stories (Bader, 1990).

If the articles are further grouped by disciplinary macro-area, it is possible to conduct even clearer comparison between the trends exhibited by the two sectors of biomedical disciplines (medicine, biology, zoology) and the physical-mathematical ones (physics, mathematics, astronomy). After constant growth since the beginning of the period surveyed, by the mid-1960s the biomedical sector had caught up with the physical-mathematical one, and then overtook it in the past 20 years.

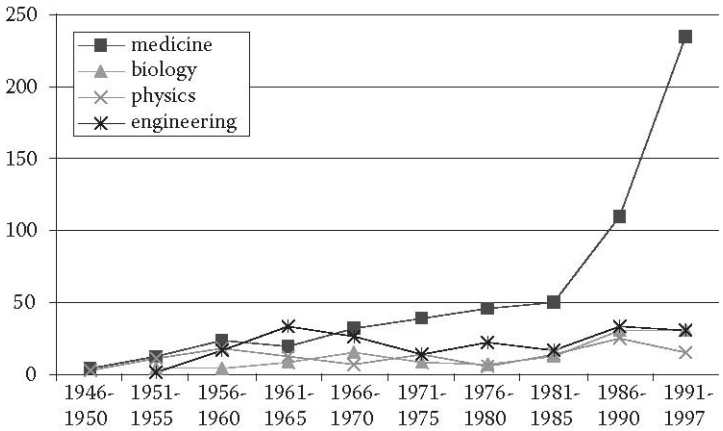

Figure 5.4 Articles on some science fields in *Corriere della Sera*, 1946–1997 (absolute values).

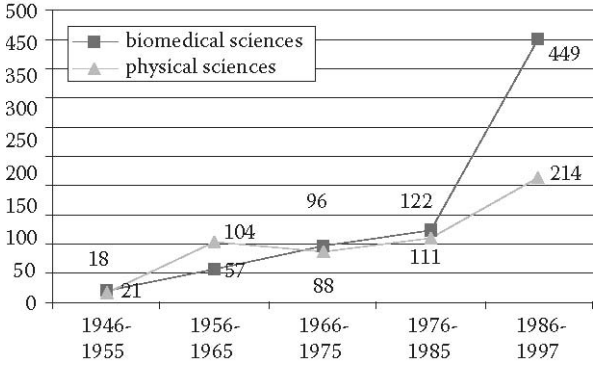

Figure 5.5 Articles on biomedical and physical sciences in *Corriere della Sera*, 1946–1997 (absolute values).

With time, articles on science have also grown longer: The percentage of those that were at most two columns in length, fell from more than 80 percent to around 60 percent between 1946 and 1997.

It should be noted that neither the quantity nor the length of articles can be measured in absolute terms, for *Corriere della Sera* changed both its size the number of pages during the period considered. In order to obtain a more reliable measure, therefore, we calculated the amount of space devoted to science compared to the total volume of the issue of the newspaper that they were published.

Although hampered by the difficulty of establishing the precise identities of article authors—especially in the early years—analysis of the presence of the various categories of author reveals a cyclical trend in the proportion of articles written by doctors and by researchers. The latter in particular seem to have enjoyed a period of special favor during the first half of the 1980s.

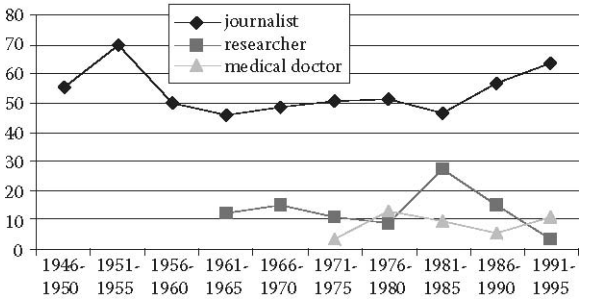

Figure 5.6 Authorship of articles in *Corriere della Sera*, 1946–1997 (percent).

Also, the tendency of the newspaper to represent science as a consensual and uncontroversial enterprise has consolidated over time. The proportion of articles on scientific controversies fell from almost half (46.1 percent in 1946–1955) to just over one-fifth (24.4 percent) in the period 1986–1997. This aspect is obviously influenced by the increasing prominence given to medicine compared to other disciplines; we have already pointed out, in fact, the greater likelihood that medical matters will be treated in neutral and unproblematic terms in the daily press.

One also observes fluctuations in the tendency to emphasize the possibly harmful consequences of the scientific activities described in an article. This feature first appeared at the end of the 1950s. It attenuated in the next decade and then definitively and emphatically came to the fore in the 1980s and 1990s. From 1986 onwards, the percentage of articles highlighting the undesirable consequences of research settled at around 30 percent (30.4 percent until 1990, 28.7 percent between 1991 and 1997). Still, even in the most recent period considered (1991–1997), the tone of science coverage remains predominantly positive, with more than 44 percent of articles mentioning positive consequences of research and 29 percent mentioning negative consequences.

Even in the earliest years of the period surveyed, much prominence was given to the risks of scientific research: Until 1955, more than seven in every 10 articles discussed this aspect. This was probably also sparked by the widespread public debate provoked by events such as the use of nuclear weapons against Japan. During the 1960s, the emphasis on risk eased, and then resumed and grew significantly in the next decade and thereafter. In this case, too, the increase was largely due to the general news pages, where, in the 1980s and 1990s, reference to human risks was made by 68.7 percent of all articles on science.

Table 5.3 Envisaged consequences of the scientific fact and presence of controversy, *Corriere della Sera,* 1947–1997

	Consequences of the scientific fact			*Presentation of the scientific topic*	
	Positive %	*Negative* %	*Neutral or non-explicit* %	*Consensual* %	*Controversial* %
1946–1955	56.7	6.6	36.7	53.8	46.1
1956–1965	62.4	13.3	24.3	65.4	33.9
1966–1975	38.6	11.8	49.6	60.6	37.9
1976–1985	39.4	19.2	41.4	74.4	25.2
1986–1997	40.2	29.5	30.3	75	24.4

DISCUSSION

As mentioned in the introduction, the present analysis drew considerably on a broader survey of the coverage of science by the British daily press conducted in 1995 by the London Science Museum. This study considered a sample of 6,000 articles published between 1946 and 1990 by seven newspapers: *The Times*, *The Guardian*, *The Independent*, *The Daily Mirror*, *The Daily Telegraph*, *The Sun*, and *The Daily Express*.

Elements for an international comparison

Our results generally match those of the British survey; for instance, with regard to the increasing amount of science coverage by newspapers, particularly in recent decades, both in terms of number and length of articles—a phenomenon documented also in other contexts, albeit more evident, in the British case, in the quality press than in the popular press (Kepplinger, 1989; Bauer, 1995; Australian Science Indicators Report, 1991).

Other common findings of the two studies concern the tendency to present science as consensual and uncontroversial, and the growing presence, across time, of stories pointing out the potentially harmful consequences of scientific activity.

However, it should be remembered that our research lacked a dimension that was of special importance for the analysis of science in the British daily press: the distinction between the 'quality' newspapers (*Times, Guardian, Independent,* and *Daily Telegraph*) and the 'tabloids' (*Sun*, *Daily Mirror*, *Daily Express*). This distinction is characteristic of the British context but absent from the Italian one, at least among newspapers.

One feature that sharply distinguishes the coverage of science by the British press from that by *Corriere della Sera* is the emphasis the British press puts on its national news: Sixty-eight percent of articles dealt with British scientific events or topics, while slightly more than one-quarter of the articles in *Corriere della Sera* referred to Italy. In this respect, Italian daily press coverage of science seems similar to that of other countries such as Canada, where the international dimension of science stories also seems dominant (Einsiedel, 1989).[9]

As regards the other main differences, one is the slightly diverse distribution of the articles among the various science fields: in fact, the British press more frequently covers the physical-mathematical sciences. The evolution over time of the disciplinary distribution of articles is entirely similar in both cases, with an initial phase characterized by the dominance of the physical-mathematical sciences, followed by a phase in which the biomedical sciences prevail. The British researchers posit a shift from a 'physical' paradigm of science in the daily press, typical of the post-war period, to a 'biomedical' one distinctive of the scenario from the 1980s onwards (Bauer, 1998). While this 'overtaking' of the physical by the biomedical sciences is also particu-

larly evident in the case of *Corriere della Sera*, the analysis conducted in Great Britain finds a dualism between the two categories of newspaper. The rise of the biomedical paradigm is much more evident in the tabloid press, whereas in the quality press, although there is an evident shift of emphasis towards biomedicine, it has not yet overtaken the physical sciences.

Finally, it is interesting to note a number of differences that help clarify aspects of the coverage of science by an Italian newspaper like *Corriere della Sera*. The first is the frequently mentioned presence of medical-scientific experts as authors. Articles by expert practitioners are much more frequent in *Corriere* (17 percent) than in the British press, where they account for only slightly more than 4 percent of the total.

The second difference acquires more salience if it is set against the findings of a similar survey conducted on articles published by the leading Bulgarian daily, *Rabotnichesko Delo*, 1946–1994 (Petkova, 2000). *Corriere della Sera* occupies an intermediate position between the British press and the Bulgarian newspaper. For example, the harmful consequences of scientific research are emphasized by 41.5 percent of British articles, 23 percent of those appearing in *Corriere della Sera*, and 12.2 percent of them in *Rabotnichesko Delo*. The positive consequences are covered by 57.1 percent of the Bulgarian articles, 43.4 percent of the Italian ones, and 20.2 percent of the British ones. The explanations offered for the differences between Bulgaria and the United Kingdom focus mainly on the differing significance given to science during the process of historical-social development and modernization in the two countries. In the case of Bulgaria, the press of the socialist period placed great emphasis on the role of science as the 'engine' of progress, amplifying and almost exclusively celebrating its positive aspects. It is of course difficult to draw such general conclusions as regards Italy, especially when they are based on analysis of only one newspaper. However, the coverage of science by the non-specialist Italian press displays a number of specific features that seemingly place it midway between the British and Bulgarian cases. These specific features should be investigated further, not only historically but to shed light on the current ambivalent status of science in the Italian public sphere, where an almost fideistic, general support for science and its institutions is combined with high levels of misinformation and marked critical attitudes to specific science and technology innovations (for instance Bucchi and Neresini, 2002). The hypothesis of a long-period 'convergence' in mass media images of science requires further elaboration and investigation with regard to the Italian media.

CONCLUDING REMARKS

The foregoing overview of the coverage given to science by Italy's leading daily newspaper has brought out features and trends that attenuate, when

they do not flatly contradict, certain stereotypes about the way in which the mass media treat science. It has particularly revealed an expansion of such coverage in both absolute and relative terms, especially in the past two decades, largely matched by an increased amount of space devoted to science by the newspaper:

- There is more and more science, but it is increasingly 'institutionalized' in special sections;
- An ever greater and increasingly dominant coverage of biomedical issues in comparison to other fields, with stories in this area concentrated mainly in special newspaper sections devoted to science or health;
- The significant involvement of scientific and medical experts, not only as sources or as interviewees, but also as the authors of articles; a general tendency to represent science in 'newsflash' form, with extremely short articles or even brief news—something that has also been documented in other studies, although in recent times lengthy articles accompanied by images have become more common; and
- A general and increasing tendency to represent science as consensual, linear, and uncontroversial, the articles using mainly single institutional sources such as universities and research institutes (Einsiedel, 1992).

This tendency is most evident in articles written by journalists and medical doctors, whereas scientists are more likely to present scientific issues as controversial. The information offered by scientists is generally positive in tone, but with an increasing emphasis on the possibly harmful consequences of scientific research for mankind and the difficulty of controlling those consequences, which are associated more often with biomedical disciplines than with physical-mathematical ones.

It would be tempting to conclude, paraphrasing Einsiedel's seminal study of science coverage by the Canadian daily press, that the typical science story in *Il Corriere della Sera* is on biomedical issues, refers to a geographical context outside Italy, relies on uncontested scientific expertise, and generally presents the consequences of science practice in a positive fashion (Einsiedel, ibid). However, this aggregate picture would mask other interesting features of the coverage under examination. Particularly when read in a long-term perspective, our results seem to suggest a more sophisticated hypothesis: the presence of a marked dualism, in the coverage of science by the daily press, between two distinct journalistic genres. We could name these two genres respectively *science-popularisation* and *science-as-new*s, referring also to the placement of stories in the various parts of the newspaper (special sections about science and health or news pages).[10] The former genre, overwhelmingly dominated by stories related to the biomedical field, depicts science as straightforward, consensual, and as bringing improvements to peoples' lives. The latter, hosting with more relative frequency stories on other science fields such as the physical sciences,

pays closer attention to controversy and to the harmful consequences of the scientific enterprise.

This hypothesis, which is similar to more general studies that suggest that when speaking of 'public communication of science' one is in fact referring to a plurality of media genres with distinct characteristics, seems to warrant further research of science coverage by the daily press.[11]

A final comment should perhaps be made, instead, on what is one of the most general and evident results of the study, i.e., the expansion of science coverage across time, and in particular, the expanding role of biomedical issues coverage. We have already mentioned the contribution to the expansion of science coverage—and in particular to the increasingly predominance of biomedical issues made by the thematic supplements on science, medicine, and health. However, the introduction of supplements is not on its own sufficient to explain such a striking expansion, since they are also part of it—being obviously a result of greater interest in science and medicine, rather than its cause.

Coming up with an interpretation in this regard would be beyond the scope of a predominantly descriptive analysis such as ours. However, it is possible to put forward some tentative hypotheses. The first—at least with regard to Italy—would stand the problem on its head and circumscribe the success of the 'physical-mathematical' paradigm to the period when the role of physics (nuclear physics in particular) provoked the greatest concern in times of war and peace. Accordingly, the predominance of this paradigm only temporarily delayed the inexorable rise of biomedical topics in the daily press.

A second hypothesis would center on a more general shift in public interest from such topics as military security, space exploration, and energy production—these being more closely tied to physical-mathematical matters—to ones concerning individual physical and mental well-being as part of a more general cultural change characterizing contemporary societies. That the biomedical paradigm forms a constant and undisputed thematic background (a 'master frame' more than a simple frame, as scholars of public discourse would put it) is indirectly confirmed by the fact that biomedical topics are largely confined to newspaper sections 'institutionally' dedicated to science.[12]

Physical-mathematical topics, although they receive less coverage overall, are more frequently given the status of news stories and indeed appear on the front pages.

ACKNOWLEDGEMENTS

A different version of this paper was published in the journal *Public Understanding of Science*, 12, 2003: 7–24. The authors wish to thank three anonymous reviewers of that journal for their comments and suggestions

on earlier versions of the manuscript. Gratitude should also be expressed to Martin Bauer and Kristina Petkova for supplying information on the British and Bulgarian studies. Research for this chapter was supported by a grant from the Italian Ministry for Scientific Research.

NOTES

1. For similar arguments in specific relation to the Italian context, see for instance Bettetini and Grasso (1988) and Jacobelli (1996).
2. The 'Di Bella affair' was centered on an alleged 'alternative' cure for cancer and for several weeks was one of the most visible issues in the Italian media, provoking a heated public debate. In the course of the debate, a document on the 'ethics of scientific information' was signed by scientists and scientific journalists, which berated the media for their treatment of the affair.
3. Cf. e.g., Clemens (1986, 1994) and Epstein (1996).
4. A similarly constructed study has also been carried out in Bulgaria (see Bauer et al. 2006) by Kristina Petkova et al., (2000)
5. Fourteen days (two for each weekday) were selected for each year since 1947. Once the first week of the first year (e.g., the eighth of the 52 weeks of the year) had been selected, the Monday of that week was considered. We then proceeded at four-week intervals (52/14 = 3.7 approximated to 4), thus selecting the 12th week and the Tuesday of that week, the 16th and the Wednesday of that week, and so on. The operation was repeated for the next year, but by moving the week forward by one unit (so that we now started with the ninth week rather than the eighth) and moving the weekday back by one unit (so that it was now Sunday rather than Monday).
6. Other scholars have shown that researchers are also among the most assiduous users of scientific coverage by the mass media, which enable them to filter the by now enormous volume of publications and research. According to a study in the United States, a paper published in the prestigious *New England Journal of Medicine* is three times more likely to be cited in the scientific literature if it has been mentioned by the *New York Times* (Phillips et al., 1991). Moreover, although scientists are often highly critical of the media coverage of science in general, their opinions are much more positive when asked about the treatment of a specific topic within their area of expertise (Hansen, 1994).
7. Kepplinger examined coverage of science in the German daily press between 1965 and 1985, considering its increasingly negative attitude towards science to be responsible for German citizens' vanishing confidence in scientific research
9. The total is more than 100 because an article title may refer to more than one aspect.
10. Einsedel's study, however, analyzes in detail only one year of science coverage (1987) by seven Canadian newspapers.
11. For a theoretical distinction between popularisation ('science-oriented public communication of science') and science-as-news ('problem-oriented public communication of science') see Peters, 1994 and Bucchi, 1998
12. See H P Peters (2000) 'Scientists as Public Experts' paper presented at the 6th PCST Conference, Geneva, 1st February.
13. For an analysis of media coverage of issues in terms of frames and 'symbolic packages' see Gamson and Modigliani (1989).

AU:
In updating the footnote numbers in the text, only 12 appeared. Please correct in text or here.

REFERENCES

Australian Science Indicators Report (1991) section 'Science and technology news in the media'.
Bader, R G (1990) 'How science news influence newspaper science coverage: a case study' *Journalism Quarterly,* 67, 88–96.
Bauer, M W (1998) 'The medicalization of science news—from the rocket-scalpel to the gene-meteorite complex' *Social Science Information*, 37, 731–751.
Bauer, M W et al. (2001) 'The dramatisation of biotechnology in elite mass media' in *Biotechnology 1996–2000: The Years of Controversy*, Gaskell, G and Bauer, M W (eds.) London: Science Museum, 35–52.
Bauer, M W et al. (2006) 'Long-term trends in the public representation of science across the 'Iron Curtain': 1946–1995', *Social Studies of Science*, 36, 99–131.
Bettetini, G and Grasso, A (eds.) (1988) *Lo specchio sporco della televisione* Torino: Fondazione Agnelli.
Bodmer, W F (1985) *The public understanding of science*, London: Royal Society.
Bucchi, M (1998) *Science and the media: alternative routes in scientific communication* London and New York: Routledge.
Bucchi, M and Neresini, F (2002) 'Biotech remains unloved by the more informed' *Nature*, 216, 461.
Burnham, J (1987) *How superstition won and science lost: popularizing science and health in the US* New Brunswick, NJ: Rutgers University Press.
Clemens, E S (1986) 'Of asteroids and dinosaurs: the role of the press in shaping the scientific debate' *Social Studies of Science*, 16, 421–456.
Clemens, E S (1994) 'The impact hypothesis and popular science: conditions and consequences of interdisciplinary debate' in *The mass-extinction debates: how science works in a crisis* Glen, W (ed.) Stanford, CA: Stanford University Press, 92–120.
Dearing, J W (1995) 'Newspaper coverage of maverick science: creating controversy through balancing' *Public Understanding of Science,* 4, 341–361.
DiBella, S M et al. (1991) 'Scientists' reasons for consenting to mass media interviews: a national survey' *Journalism Quarterly*, 68, 740–749.
Dunwoody, S and Scott, B T (1982) 'Scientists as mass media sources' *Journalism Quarterly*, 59,52–59.
Einsiedel, E F (1992) 'Framing science and technology in the Canadian press' *Public Understanding of Science*, 1, 89–103.
Epstein, S (1996) *Impure science: AIDS, activism and the politics of knowledge* Berkeley: University of California Press.
Fahnestock, J (1986) 'Accommodating science: the rhetorical life of scientific facts' *Written Communication,* 3, 275–296.
Farrands, P L (1993) *Don't panic, panic!* Melbourne: Text.
Friedman, S M et al. (eds.) (1986) *Scientists and journalists: Reporting science as news* New York: The Free Press.
Gamson, W A and Modigliani, A (1989) 'Media discourse and public opinion on nuclear power: a constructionist approach' *American Journal of Sociology*, 95, 1–37.
Gunter, B et al. (1999) 'The media and public understanding of biotechnology' *Science Communication,* 373–394.
Hansen, A (ed.) (1993) *The mass media and environmental issues* Leicester: Leicester University Press.
Hansen, A (1994) 'Journalistic practices and science reporting in the British press' *Public Understanding of Science*, 3, 111–134.

Hansen, A and Dickinson, R (1992) 'Science coverage in the British mass media: media output and source input' *Communication*, 17, 365–377.
Hilgartner, S (1990) 'The dominant view of popularization' *Social Studies of Science*, 20, 519–539.
Jacobelli, J (ed.) (1996) *Scienza e informazione* Roma-Bari: Laterza.
Jacobi, D and Schiele, B (eds.) (1988) *Vulgariser la science: le procès de l'ignorance* Paris: Champ Vallon.
Kepplinger, H M (1989) *Künstliche horizonte. Folgen, darstellung and akzeptanz von technik in der Bundesrepublik* Frankfurt: Campus.
La Follette, M C (1990) *Making science our own: Public images of science 1910–1955* Chicago: Chicago University Press.
Lewenstein, B V (1995) 'Science and the media' in *Science technology and society handbook* Jasanoff, S et al. (eds.) Thousand Oaks: Sage, 343–359.
Lewenstein, B V (1995b) 'From fax to facts: communication in the cold fusion saga' *Social Studies of Science,* 25, 403–436.
Lupton, D (1994) *Moral threats and dangerous desires: Aids in the news media* London: Taylor and Francis.
Pellechia, M G (1997) 'Trends in science coverage: a content analysis of three us newspapers' *Public Understanding of Science*, 6, 49–68.
Peters, H P (1994) 'Wissenschaftliche experte in der öffentliche kommunikation über technik, umwelt, und risiken' in *Öffentlichkeit, öffentliche meinung, soziale bewegungen*, Special Issue, *Kölner Zeitschrift für Soziologie und Sozialpsychologie*, 34, 162–190.
Petkova, K et al. (2000) *Modernisation and images of science: comparing Britain and Bulgaria 1946–1994*, Research Report, Budapest: Central European University.
Phillips, D M et al. (1991) 'Importance of the lay press in the transmission of medical knowledge to the scientific community' *New England Journal of Medicine*, 11 October: 1180–1183.
Shinn, T and Whitley, R (eds.) (1985) *Expository science: forms and functions of popularization* Dordrecht: Reidel.
Stocking, S H (1999) 'How journalists deal with scientific uncertainty' in *Communicating uncertainty: media coverage of controversial science*, Friedman, S M et al. (eds.) Mahwah, NJ: Lawrence Erlbaum, 23–42.
Wynne, B Bryan (1995) 'Public understanding of science' in *Science technology and society handbook,* Jasanoff, S et al. (eds.) Thousand Oaks, CA: Sage, 361–387.

6 Growing, but foreign source dependent

Science coverage in Latin America

Luisa Massarani, Bruno Buys, Luis Henrique Amorim, and Fernanda Veneu

In this chapter we present a panorama of the press coverage of science and technology in Latin America. We looked at seven newspapers and analyzed all 482 stories published by their science sections in April 2004. The newspapers were: *La Nación* in Argentina; *El Mercurio* in Chile; *Mural* in Mexico; *El Comercio* in Ecuador; *O Globo*, *Folha de S. Paulo* and *Jornal do Commercio* (Pernambuco) in Brazil. There are few studies on science journalism in Latin America and even fewer that attempt a comparison among countries. We believe that studies such as ours can lead to improved journalistic coverage of science and technology in the region.

Since the mid-1990s, science communication in Latin America has experienced significant growth (Massarani, 2004). Today, there are many channels being used to communicate scientific information in the region. These channels range from the most common—such as magazines, newspapers, radio, and television—to the most uncommon and even provocative. One of the sectors of science communication that grew most, especially in the last decade, was the area of science museums and centers. For example, at the moment, there are approximately 110 spread out over Brazil, with different sizes and objectives (Brito, Ferreira, and Massarani, 2005).

Science journalism reached a high point in some Latin American countries in the 1980s, with the appearance of new science magazines and allocation of more space to science sections in daily newspapers and weekly magazines. The Internet, too, opened up new possibilities—many of which were, however, very short-lived.

More recently, newspapers and magazines have reduced space for science sections and their staff; however, studies indicate that science and technology issues have become important presences in other sections, including sports, comics, inserts aimed at the family, and so forth (Massarani, Moreira, and Magalhães, 2003). In the last few years, we have seen more organized efforts made by science journalists on the continent, expressed through the creation of new associations for science journalism in countries where this practice is less consolidated, such as Peru (2003), Ecuador (2004), and Costa Rica (2005), as well as the Latin American Federation of Technological Journalists (2004).

However, there are still few studies on how science journalism is being practiced in Latin America and even fewer that seek to explore a comparison among countries.[1] Within this context—and following similar studies carried out in the scope of our research group, which analysed historical and contemporary science communication—we studied journalistic coverage of science and technology issues based on seven Latin American daily newspapers.

HOW WE ANALYZED THE COVERAGE

Many newspapers do not publish articles related to science and technology in a systematic way. As a starting point, we chose newspapers that have a 'science and technology' section and we restricted ourselves to the material published in this section. We also searched for newspapers that have professional writers specializing in science and technology.

Furthermore, we focussed on the electronically published material by these newspapers. This reduced the research costs since we did not need to subscribe to printed versions. Electronic versions are easily accessible to the public in other countries and, therefore, potentially have a readership beyond the country of origin.

The last criterion for choosing newspapers was the diversity of countries. Since few Latin American countries have routine coverage of science we decided to include only five countries: Argentina, Brazil, Chile, Ecuador, and Mexico.[2] We selected one newspaper in each country, except Brazil, where we have a particular interest in observing the local coverage of science and technology issues.

The Brazilian newspapers are *O Globo* and *Folha de S. Paulo,* among those with the largest print run in the country. The *Jornal do Commercio* in Pernambuco is included because of its emphasis on science and technology. It regularly dedicates space to regional research, outside of the central axis Rio de Janeiro-São Paulo, where most of the scientific activity of Brazil is concentrated. In Mexico, we chose *Mural,* which is published by the same group as *Reforma* and is considered one of the country's important newspapers. *Mural* reproduces stories published by *Reforma*, and makes electronic versions available free of charge. We then chose one each of the main Chilean and Argentine newspapers, *El Mercurio* and *La Nación*, respectively.

Our study, therefore, includes the newspapers listed in Table 6.1. The stories were collected in April 2004; an electronic database was built from the complete material of selected newspapers' science sections' editors.

Our methodology of analysis conjoins quantitative and qualitative methods. For quantitative analysis, we used as a starting point, an instrument developed by Bauer et al. (1995). We chose this instrument because it met some of our analytical interests and had been previously tested. Additionally, it allowed us to compare the experience of the so-called peripherical

Table 6.1 Details of the newspapers analyzed

Newspaper	*Daily print run*	*Population >15(in 1000s, 2005)*	*Circulation Ratio (WPT)*	*Ratio Pop/issue*	*Country*
El Mercurio	165,000	11,947	—	72	Chile
El Comercio	117,000	8,885	—	76	Ecuador
La Nación	162,000	29,429	56	182	Argentina
Mural	38,000	73,198	119	1926	México
Jornal do Commercio	39,000	137,480	64	3525	Brazil
Folha de S. Paulo	313,000	137,480	64	439	Brazil
O Globo	255,000	137,480	64	539	Brazil

Circulation ratio: Daily circulation per 1,000 adult population, WPT (2002).

countries with those of the centre. We will focus here only on very few of the variables in this instrument. A question that arises for us here is: to what extent does the specificity of each country context show itself in the practice of science journalism?[3]

INTENSITY AND FRAMING OF SCIENCE NEWS

One aspect of coverage is the salience or the number of articles devoted to science and technology in each newspaper. Of a total of 482, the distribution of science news was as follows in rising order of salience: 25 in *El Comercio* (Equador), an average of 0.8 article/day; 47 in the *Jornal do Commercio* (Brazil), an average of 1.5 article/day; 64 in the *Mural* (Mexico), an average of 2.1 articles/day; 64 in *O Globo* (Brazil), an average of 2.1 articles/day; 69 in *El Mercurio* (Chile), an average of 2.3 article/day; 104 in the *Folha de S. Paulo* (Brazil), average of 3.5 articles/day; 109 in *La Nación* (Argentina), average of 3.6 articles/day.

El Mercurio and *Jornal do Commercio* include many brief stories. All of the newspapers publish long science stories. They all publish stories written by specialist staff, although the influence of foreign news agencies can be observed, and they also reprint articles from foreign newspapers, such as *The New York Times*. In the Ecuadorian paper many articles are written by free-lancers. It also publishes stories produced by the Foundation for Science and Technology, written by science journalists who produce articles to be distributed to local newspapers and thus seek to increase the presence of science stories in local mass media.

Table 6.2 Science fields covered by newspaper articles in Brazil

Knowledge area	*Biology*	*Hard sciences*	*Human sciences*	*Environmental sciences*	*Medicine*	*Earth sciences*	*Computing*
El Mercurio	17%	45%	2%	19%		17%	
El Comercio	24%	29%		5%	5%	5%	33%
La Nación	60%	13%	2%	6%	13%	6%	
Mural	40%	31%		9%	2%	16%	2%
Jornal do Commercio	28%	19%		40%	7%	7%	
Folha de S. Paulo	15%	37%		20%	10%	10%	7%
O Globo	10%	23%	5%	16%	29%	16%	2%

Hard sciences=astronomy, physics, chemistry

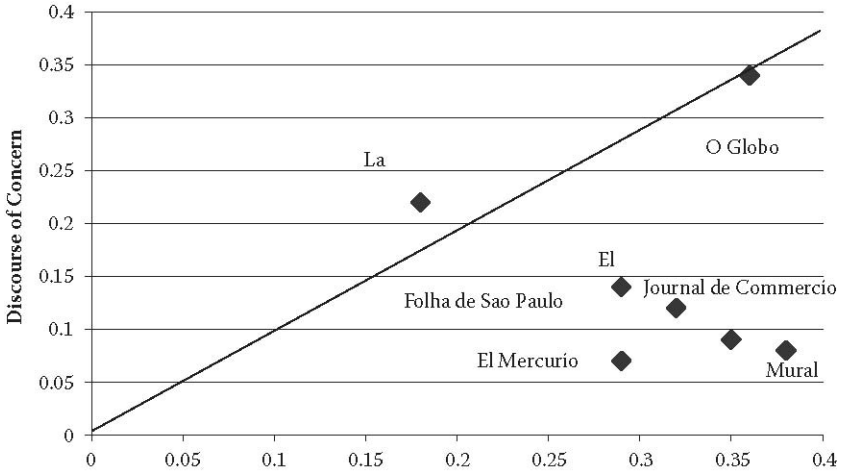

Figure 6.1 Stories of promise and concern in the newspapers.

With regard to areas of knowledge covered in the published stories, we find important differences between newspapers (see Figure 6.1). Forty-five percent of the texts published in *El Mercurio* are related to the hard sciences (physics, chemistry, or astronomy), reflecting also the emphasis given to technology by such newspapers. This theme also has significant presence in the *Folha de S. Paulo* (37%). In the case of *La Nación*, biological sciences make up 60% of the articles. Environmental themes are emphasized by *Jornal do Commercio*. One must consider, however, that these numbers reflect coverage during the month of April, and a different period might yield slightly different results. In a previous study, carried out in 2000 and 2001 in five Brazilian newspapers, we observed a strong presence of stories on biology/genetics covering the announcement of the mapping of the human genome and of other organisms, together with claims that human cloning is already possible (Massarani, Moreira, and Magalhães, 2003, op. cit.).

We also analysed the tone of the coverage in science sections, asking whether it emphasised a discourse of 'promise' or a discourse of 'concern' related to science and technology. To achieve this, we rated each article on a scale from 1 to 6, from big promise to great concern, including a neutral and an 'ambivalent' category.

Figure 6.1 shows the percentage of articles referring to promise and concern. The lower down on both scales a paper is located, the more neutral or ambivalent articles there are. *O Globo* had a smaller percentage of 'neutral' articles, but many articles stressing 'concern' and 'promise'. *La Nación* has more articles on concerns than on promise. *Mural* and *Jornal*

Table 6.3 News source of science stories

News Source	*National*	*Developing countries*	*First world*	*First World + national*	*Developing countries + national*
El Mercurio	33%	10%	57%	—	—
El Comercio	55%	5%	35%	5%	—
La Nación	51%	2%	42%	5%	1%
Mural	43%	3%	52%	2%	—
Jornal do Commercio	71%	2%	25%	2%	—
Folha de S. Paulo	26%	7%	64%	4%	—
O Globo	19%	10%	69%	—	22%

do Commercio are the most positive of all newspapers in terms of tone, while *O Globo* and *La Nación* carry the most negative material.

References to scientific controversies were few and far between in all of the newspapers, varying between 3% (*O Globo*) and 9% (*El Mercurio*). No mention of any controversy was recorded in the *Jornal do Commercio*. We observe similar ratios for risk stories related to science and technology. They vary between 4% (*El Mercurio*) to 11% (*El Comercio*). There are no risk stories at all in the *Jornal do Commercio*.

Reporting on research conducted abroad is dominant in these newspapers. The main reference is to so-call First World countries (see Table 6.3). In both *O Globo* and the *Folha de S. Paulo*, the figures were high: 70% and 62% of all articles referred to issues related to the developed world; in *El Mercurio*, the percentage was 58%. On the other hand, the *Jornal do Commercio*, *El Comercio*, and *La Nación* had higher rates for local research coverage (70%, 55%, and 41%), reflecting their formal editorial policy to cover local scientific achievements.

Of all newspapers analyzed, *Mural* most frequently discusses issues of science policy. This reflects the vision of Arturo Barba, *Mural/Reforma*'s science editor at the time, who considers science policy to be part of science journalism. It is interesting to compare this opinion to that of Marcelo Leite, the *Folha de S. Paulo*'s science editor at the time, who believes that, although science policy is important, it is not of interest to the general public and is not part of what he considers science journalism.[4] La Nación also dedicates space to policy. *Mural, Folha de S. Paulo*, and *La Nación* give additional room to legal questions involving science and technology, such as the regulation of transgenics and therapeutic cloning.

REFLECTIONS ON REPORTING SCIENCE IN LATIN AMERICA

We showed that science and technology has a considerable but variable presence in Latin American newspapers during April 2004. There is emphasis on the benefits of science, although less so than observed in a previous study in 2000 and 2001 where the focus was predominantly on genetics (WPT, 2002). Reportage of controversies—an important aspect in the dynamics of the scientific process—was uncommon in all newspapers, equally so the uncertainties and risks of new developments. The journalism practiced in Latin America is still uncritical toward science and its role in and impact on society. Also, journalists assume an uncritical attitude towards sources of information coming from the First World's news agencies and newspapers. This information is in several cases republished without effort to adapt or compare it to local reality. Generally, we observe that concern with local context and necessities is insufficient.

When questioned on the dominance of foreign research news in Latin American newspapers, journalists commonly argue that the research produced in First World countries is far greater than what is produced locally. Therefore it is resonable to reflect this difference. Nonetheless, at times stories are published on irrelevant scientific research; the only reason for their publication seems to be that they were produced in a foreign university. This also reflects the influence of international press agencies on Latin American news coverage.

Equally, there is the influence of services provided by scientific journals, such as *Nature*, *Science,* and *JAMA*, which distribute press releases to journalists world-wide, informing them about articles that will be published in an upcoming issue and that constitute a prime source of information for the analyzed newspapers.

This practice of using these international sources guarantees a certain qualitybecause the papers have been submitted to a rigorous peer-review process. These services also assist journalists in their day-by-day pressures of deadline and space. Latin Americans scientists lack a tradition of interacting with mass media and giving interviews to the press. In North America, however, scientists promptly respond to requests from journalists of any nationality. These issues stimulate the use of material supplied by these services.

These services, no doubt, have great merits, but unfortunate side effects. Firstly, they encourage a certain laziness among journalists; it is certainly easier to use information that arrives by electronic mail than going out in search of a newsworthy local subject. The latter may involve local press officers who often are not prepared to support journalists and lack of cooperation among Latin American scientists with the mass media. Finally,

these services are not infallible, do not always meet Latin American interests, and many times, give an exclusively First World perspective on the issue. This suggests that there is room for similar services to be created for Latin America, which would better meet the local agenda and interests. Another observation made in this study is the limited presence of news on the context in which research is performed.

We also must identify the fragility of science journalism in the region. In Latin America, its practice is essentially that of individuals who dedicate themselves to the area due to their personal choice and enthusiasm. There are few—if any—institutional attempts to consolidate the professional situation, for example, supported by the mass media themselves.

It is important to emphasize that the news material in our sample is generally of good quality and shows that journalism professionals dedicate themselves to the coverage of science and technology. With our analysis we want to make this work visible and to reflect on this professional practice. Though preliminary, and involving few countries, our data show that the comparative study of science journalism in Latin American countries provides an important panorama of activities here. This might be a starting point to gather momentum, to strengthen practice, and to conduct further research to understand and document the dynamics of this practice.

NOTES

1. A study that seeks to discuss the challenges of science journalism in Latin America was undertaken by Argelia Ferrer (2002).
2. The research presented here is part of Luis Henrique Amorim's Master's Dissertation.
3. We also conducted qualitative analyses using three different approaches.
4. Arturo Barba and Marcelo Leite made these statements, respectively, in a private conversation and during an interview with one of the authors (Massarani) of this chapter.

REFERENCES

Bauer M, Ragnarsdóttir Á, and Rúdólfsdóttir A (1995) *Science and Technology in the British Press, 1946–1990—A systematics content analysis of the press*, Technical report, Science Museum, London

Brito F, Ferreira J, and Massarani L (2005) *Centros e Museus de Ciência do Brasil*. (Science Centers and Museums in Brazil). Rio de Janeiro, ABCMC, Casa da Ciência/UFRJ and Museu da Vida/Casa de Oswaldo Cruz/Fiocruz$_{<0)}$

Ferrer A (2002) *Periodismo científico y desarrollo—Una Mirada desde América Latina*. (Science journalism and development—An approach from Latin America), PhD dissertation, Autonomous University of Barcelona

Massarani L (2004) Challenges for Science Communication in Latin America. SciDev.Net. Article accessed on May 31, 2005, in: http://www.scidev.net.

Massarani L, Moreira I, and Magalhães, I (2003) Quando a genética vira notícia: Um mapeamento da genética nos jornais diários (When genetics becomes news: A mapping of genetics in the daily newspapers), *Ciência e Ambiente, Santa Maria*, 26, 141–148

WPT (2002) *World Press Trends—2002 edition*, Paris: World Association of Newspapers

7 The latest boom in popular science books

Jon Turney

> Books on popular science are far the worst. They include gigantic and generally inept compendiums of knowledge brought out presumably for the benefit of publishers, accounts of recent work horribly mangled and misunderstood by amateur scientists and best-selling sermons by the most eminent of the profession. Among them are a few books which manage to be understandable and accurate at the same time, but they do not set the tone, and the proportion of them to the rest is far smaller than in the Victorian era. J. D. Bernal (1939) *The Social Function of Science*

> 'Popular Science' is a new art form, partaking simultaneously of the text book and the reportage, the philosophical essay and the sociological forecast. Aldous Huxley (1963) *Literature and Science*

A NEW ART FORM?

Publishing is a very fine-grained business, and reliable quantitative indicators are hard to come by, or are commercially confidential. But qualitatively, it would be hard to find anyone who did not maintain that the general run of books on popular science have improved immensely since Desmond Bernal recorded his rather curmudgeonly verdict before the Second World War.

This is not the place to rehearse a history of science books since the war, although the outlines of such a history have been sketched by Bruce Lewenstein. There was undoubtedly a gradual increase in popular books—in quantity and, perhaps, in quality—in the immediate post-war decades. By the time the American Association for the Advancement of Science-endorsed *A Guide to Science Reading* had reached its seventh edition in 1964, it highlighted 900 paperbound titles out of a possible 18,000. A perusal of the selections reveals that, while many were highly technical, there was a solid array of entry-level popular titles in most disciplines.

But by general consent, the twenty years up to the end of the millennium saw a boom in popular science publishing in the Anglo-American world. Large sales for a few conspicuous early successes, such as Richard Dawkins's *The Selfish Gene*, Steven Hawking's global winner *A Brief History of Time*, and the late Carl Sagan's *Cosmos*, prompted a rush of new titles, large author advances, and for some years, a sense among publishers, agents, and booksellers that science books were 'hot'. As another unsystematically compiled but useful benchmark, in 2000 a major British bookstore chain saw fit to issue its own *Guide to Popular Science Books*, running to more than 120 pages of brief reviews and featuring several hundred titles by 220 different authors.

The boom also registered with critics. In the USA, for example, as Lewenstein (2005) records, only two science related books won Pulitzer Prizes between the end of World War II and 1977. But between 1978 and 1984, there were five science winners under 'general nonfiction', a category introduced in the early 1960s. And there was roughly one science winner every two years from 1985 to 2000.

The boom helped more authors become 'visible scientists', in Rae Goodell's (1977) sense of the word, and created strong synergies with other media. As British novelist Melvyn Bragg, the long-time host of highbrow discussion programmes for BBC radio, put it, a generation of humanities intellectuals became fascinated by contemporary science just at a time when its practitioners were making a new effort to explain their work (Bragg, 1999). The well-known New York literary agent John Brockman even suggested that the new breed of science authors, many of whom were his clients, represented a 'third culture' of thinkers who could bridge the gap identified by C. P. Snow between the two cultures of science and literature (Brockman, 1995).

Booms fade, though, and popular science is no longer regarded so favourably in the trade. This is now, perhaps, a mature market. Sales have dipped. In the United Kingdom, the main provider of sales information to the trade, Nielsen Bookscan, recorded that sales of popular physics books were £3.6 million in 2001 but only £2.2 million in 2004. With a hardback typically selling for £20, such totals can easily be lifted again by two or three successful titles. But the subjects treated most often—typically in the life sciences, fundamental physics, and neurosciences—are now available to readers in many versions. New titles have to offer some distinctive theory, or fill in crucial details. A new cosmology title, for example, is not going to set a publishing editor's heart racing unless it is spectacularly good. As the UK agent, and former commissioning editor of science books, Peter Tallack (2004) has argued, popular science will go on, but the bar has been raised in terms of quality and originality—a good thing, in his view.

Tallack summed up the shift as he saw it in an essay in *Nature*:

> So many people—academics and journalists, as well as publishers and agents—jumped on the bandwagon that the market became saturated and publishers got their fingers burnt. The public is spoilt for choice when it comes to books on genetics or cosmology, mathematics or neuroscience. Just how many books do they really need on the impending threat from asteroids and comets, the sequencing of the human genome, or the challenge of the Riemann hypothesis?
>
> The pace of popular science publishing has outstripped that of scientific advance.

Whether or not this is the main reason for the change of fashion in publishing, it does make this a good time to consider the merits of these books more carefully. No one who cares about the communication of science can fail to be enthusiastic about the huge range of titles which have poured from the presses in recent decades. But their sheer number raises a number of questions which have been hard to pursue in the midst of the boom. Now things are a little quieter, in publishing terms, they can be raised more insistently.

To mention just three:

- Why, in an era when the media landscape has been transformed by broadcasting and electronic communication, do books remain an important vehicle for conveying aspects of science?
- At a time when there are so many science books, how can we tell which are the good ones?
- And, aside from pleasing readers who want to know about science, what other effects may this literature have in our culture?

Here I am going to give a sketch of how these questions might be answered—a full treatment of any of them would need a good deal more research—and then close with a few more anecdotal comments about the present state of popular science books.

WHY DO SCIENCE BOOKS SELL?

First, why do books retain their prominence as a way of packaging science for lay consumption? Part of the answer lies in the traditional virtues of the book. Books are cheap to produce. In the UK, a trade publisher (that is, one not catering for the academic or other specialist markets) expects to print enough copies of a paperback to bring the unit cost down to around one Euro or less. That depends on cheap printing without much illustration,

and there may be considerable investment behind it for a big-name author. But, title by title, it is not a particularly expensive to play this game.

Books are also easy to distribute, and remain user-friendly compared with reading on screen. To put it slightly more formally, printed and bound texts are still excellent for the kind of reading where a text needs to signal its own organisation. And while the text remains static, the dynamics of interaction mean that they are very adaptable to many different readers and kinds of reading.

These properties of text mean that it is well suited to conveying aspects of science. Scientific explanations are very often highly embedded—one thing depends on understanding several others and there is often a whole web of concepts and entities which have to be introduced to tie the explanation together. And books lend themselves to extended—often *very* extended—many-layered explanations.

It is hard to build a presentation of contemporary theoretical physics, for example, without going through something like the following steps. Once, there was a Newtonian universe, first successfully described in the scientific revolution. It was followed by two new theories, radically different in some ways from the old physics. One theory dealt with the macro-world, ruled by Einsteinian relativity's notions about space-time; one with the micro-world, governed by the even more counter-intuitive rules of quantum mechanics. Now, physicists are striving for a theory which will unify these two realms, and account for all the particles and forces which exist, and the properties of space and time, within a single overarching framework. And books on the candidate theories—whether superstring theory, loop quantum gravity, or something else, do tend to be quite long because most of them rehearse this history as well as dealing with the latest thinking.

Of course, not all books have to take you to such exotic realms, and among those that do some will be written for readers who already know the first half of the story. But printed text is still a great medium for the often necessary work of graciously reminding readers of something they need to know but may not recall clearly, while, perhaps, telling new readers stuff they did not know before.

Superstrings and the like also highlight one or two other advantages of unadorned words. They are good for discussing the unvisualisable, and for laying out thought experiments, which could never be realised in practice but which are often a powerful aid to understanding. And they lend themselves to operating on several different levels at once. Finally, they are a useful medium for trying out explanations and analogies. For example, one process we can see unfolding now is the gradual development of a set of ways of describing string theory in ways which non-physicists can begin to grasp. Watching this process suggests that it is, in some senses, evolutionary, and succeeds better when many authors contribute, and adopt and modify each others' analogies. Over time, some become conventional-

ized as the generally accepted 'best' ways of depicting certain features of a theory, just as you hardly ever read a sketch of relativity theory which does not liken the gravitational field to the distortion of a rubber sheet pulled down by a heavy weight.

WHAT MAKES A GOOD SCIENCE BOOK?

If these are some of the general advantages of the book, what criteria should we apply more particularly, to identify which are successful? For science books, as for any book, some of the answers will come from looking at these books in general literary terms. We can analyse the stories they tell, the quality of the writing, the brilliance of the metaphors. We can ask for elegance, wit, and unities of tone and style in science writing as in any other kind of writing.

But this is an unusual literature. Science is supposed to reveal truths about the physical universe and science books, while they may tell stories, are conveying those truths. This is a literature of reality, of *how things are*. So we also need critical approaches which relate to the special character of writing about science.

One feature to note is the way a book treats the nature of science. Every narrative which relates something of what science has found, and how it was found, takes a view on the status of scientific knowledge. Sometimes it is spelt out clearly, sometimes it is only implicit. But it is always there. And you do not have to delve very deep into the mass of popular science books to find that ideas about the nature of science vary a good deal, as I have discussed at greater length elsewhere. And analyses of particular books in this light are beginning to appear, such as Davida Charney's (2003) exemplary critique of Dava Sobel's best-selling *Longitude*, with its heroic image of the embattled inventor, Harrison.

But aside from such detailed academic scrutiny, there is a more impressionistic conclusion, which is that the most common take on the nature of science has been shaped by the promotional inclinations of publishers. Many books suggest that science can offer the best answers to everyone's questions about life, the universe, and everything. And this was also the most common pitch which publishers were making at the height of the boom. If you wanted to know why people do the things they do, understand the mind of God, or even fathom 'the meaning of it all', scientists were supposed to be able to tell you. The publisher of Stephen Pinker's *The Blank Slate*, which followed previous successful titles by the same author, put out a poster declaring excitedly that 'the man with the answers is back', without even saying what the question was.

But this oracular science was always going to disappoint. Science is about scepticism, tentative theories, and the fascination of unanswered questions,

not about the meaning of life. If some of the excitement around popular science has faded, perhaps it is because the public has caught on to the fact that readers were promised things that science really cannot deliver.

If so, then the things which it really can deliver may become more important. And one of the most important is clear explanations of complex ideas. This explaining is one of the core attributes of popular science texts and one of the things which distinguishes them from other non-fiction. One way of putting this is that it is a matter of redescribing the scientific account of some set of phenomena so that the entities in play can enact a series of events, and events which make the reader feel they understand the underlying forces or processes at work. The entities invoked by science can be extraordinarily diverse, and there is no ready formula for how to go about this using, in the main, unadorned words. So as I have argued elsewhere, analysing how explanations are built up is still something which deserves more critical attention.

Nevertheless, I think it is clear that explanation is one of the most important features of this kind of writing. It is also, I believe, where this literature of reality is most often genuinely creative. And it seems likely it is the source of the satisfaction which sends some readers back to these books, and to particular authors. It is not the satisfaction of finding answers to questions about the meaning of life, but of feeling that our human minds can understand the working of a small part of the universe.

I come now to the last of my three questions: Is that satisfaction—of understanding something new—the main effect these books have? Or are they doing other work in the culture which is worth pondering?

THE CULTURAL IMPACT

We know rather little about this. Research studies tend to focus on news media, although there are interesting treatments of the effect of books on publicising particular fields, such as Paul's (2004) study of chaos theory. But more broadly, the following things seem worth noting. The simplest is that, especially in view of the wealth of titles now available, one should consider the ensemble of books.

An individual title rarely reaches a mass audience. But I think that, aside from spectacular individual successes, the outpouring of popular science writing has cumulative effects above and beyond each single title. And there are various ways in which the existence of large numbers of books—and authors—enhances their impact.

One is that, in an Anglo-American publishing world where new titles can fall out of print with alarming speed, science books seem to have remarkably long shelf-lives. Modern classics like Dawkins's *The Selfish Gene* (1976), Weinberg's *The First Three Minutes* (1977), or Sagan's *Cosmos* (1980) are all still available, along with many others. This is good business

but means that a publisher—and authors—are very aware of competing with the backlist, and are constantly driven to find new topics, and new angles. The selection of topics is still in some ways a narrow cut across the whole of science and technology, but the large number of pop-science titles in any major bookstore does help create a sense that much of science is accessible.

A second consequence of the fact that the titles remain available is that their authors can easily see themselves as relating to a developing genre, with particular styles and techniques. Like any writers, they may define themselves as for or against these characteristics of what is already out there. But it seems to me that there is more of a common interest among science writers than those in many other genres. They cheerfully borrow analogies, metaphors, bits of explanation, even turns of phrase from one another. Some are re-used so often that they become common property—like the conventionalized images of relativity theory I referred to earlier. We end up with a common stock of explanatory stories, which are readily available for re-working and re-use. So there is a sense in which the whole ensemble of books becomes part of a larger cultural project to re-create scientific ideas in ways which are easier for non-scientists to appropriate.

In addition, and this again is a personal impression, books have a number of interesting second and third order effects on cultural production. This is not just because a book is still a cultural token of such high value. It is not just that a book is a common source for a TV documentary. It is also because the renderings of science which appear in popular books stimulate other creative people—novelists, poets, playwrights, film makers, artists, musicians, choreographers. They may of course be directly inspired by scientists or go and find some to talk to after being excited by a book. But a lot of the science-influenced art, which has been such an important growth area in the UK since the early to mid-1990s, shows traces of these non-fiction texts.

THE FUTURE OF POP SCIENCE

Finally, as these effects continue to unfold, what of current directions in popular science publishing? These will remain hard to sum up because, as I suggested at the beginning of this chapter, publishing is a fine-grained business. Many things happen at once. Some will be responses to current cultural conflicts. The present apparent resurgence of fundamentalism means it is not surprising that, at the time of writing, one arch-Darwininian, the philosopher Daniel Dennett, has just published a book about the origins of religious belief, and another, Richard Dawkins has authored a similar volume (Dawkins, 2006). More surprising, perhaps, is that the publisher of journalist Christopher Mooney's *The Republican War on Science*—a

critique of the treatment of science advice by the US administration—has sold the film rights to documentary-maker Morgan Spurlock.

These seem in some ways more traditional than the recent run of popular science books—attempts to intervene in immediate cultural or political struggles which we might expect to see at any time. By the same token, a whole series of hefty books about climate change, its causes, and consequences, were set for publication in 2006. This is significant as there has been relatively little engagement with political or environmental issues in the books which tended to typify the popular science boom. As with any generalisation in publishing, there are exceptions—such as E. O. Wilson's (2003) *The Future of Life* or Jared Diamond's more recent brilliant, unclassifiable *Collapse*. But the average pop science title seems content to offer the reader the pleasures of explanation.

One could argue, of course, that Diamond does this as well, both in *Collapse* and its even more celebrated predecessor, *Guns, Germs and Steel*. It is just that he attempts to offer a scientifically grounded explanation for historical events: the ascendancy of the colonial powers in the earlier book and the extinction of a variety of earlier cultures through ecological disaster in the later one. And this gives an indication of what is likely to happen more widely. If, as I have discussed, the market for the existing staples of popular science is generally well-catered for, then authors will find new areas—hitherto unoccupied corners of book space—to try and fill.

On closer examination, though, this is not simply a matter of coming up with new subjects. That can be a successful strategy, as Philip Ball's *Critical Mass* indicated in 2005. However, Ball's examination of the possible connections between physics and the science of human behaviour received relatively little attention until it won the UK Aventis Science Book Prize in 2005. And new subjects remain risky. However brilliant the treatment they may fail to catch on with readers.

So we are also seeing a filling out of the available space in terms of treatment of tried and tested subjects. This can be in terms of level—both lower and higher. So the publisher, who understandably wished to keep the Stephen Hawking franchise alive, brought us *A Briefer History of Time* in 2005. The book was adapted from the original by the former physicist, sometime Star Trek screenwriter, and accomplished popular author Leonard Mlodinov. However, reviewers tended to question the idea that the new version was really easier to understand.

For a shift to higher level, one needs look no further than Roger Penrose's massive *The Road to Reality*. This stands out against all the conventions of popular science publishing by including all the mathematics which is normally left out. It is, in effect, a university physics course for autodidacts and will, one imagines, be read mainly by physics students looking for an adjunct to their regular teaching. It seems unlikely to lead a tendency for trade books about science to turn into textbooks, although Richard

Dawkins's weighty version of the history of life on earth in his *The Ancestors' Tale* is a kind of textbook in disguise, containing all the elements of a systematic zoology. Reviewers were more respectful than enthusiastic.

There are other ways of refreshing familiar subjects. One is the tie-in with other media, or with print fiction—as in the 'Science of' genre given a boost by Laurence Krauss's *The Physics of Star Trek*. Notable recent titles in this vein include volumes devoted to the science of Harry Potter, Middle Earth, and two versions of the science of Dr Who—the BBC TV science fiction series revived to popular acclaim in 2005.

A further variation, harder to bring off because it depends on the right combination of contributors, is the book which blurs the fact-fiction boundary by offering a story with pedagogic intent. The leading example here is the trio of novels collectively labelled *The Science of Discworld*. These novels use the enormously successful Discworld setting created by Terry Pratchett, but team him with science authors Ian Stewart and Jack Cohen. Stewart and Cohen, who have collaborated successfully on a number of more straightforward popular science titles, thus won a large new audience for their ideas about cosmology, evolution, chaos theory, and the emergence of order and design.

Pratchett's long series has won its audience partly because he makes rather good jokes. Another man with a reputation for humour is author of the final title which must be considered as a marker for future popular science publishing. Bill Bryson's *A Brief History of Nearly Everything*. What is significant about Bryson's book is that it contains essentially nothing new, and is written by a man avowedly ignorant of science. His offer to the reader, aside from good humour, was to keep them company on a journey of discovery which both could share.

The result, sales of 400,000 hardbacks and more than a million paperbacks in the UK, with similar success in other countries and other languages, suggests that whatever else the popular science boom of the previous few decades did, it failed to reach a very large number of potential readers. In fact, Bryson draws heavily on many of the better recent books for the details he weaves into his own narrative. The reach of his book seems bound to encourage publishers to re-examine the possibilities of popular science. If only a percentage of Bryson's readers move on to more sophisticated treatments of some of the subjects he treats, or want to know more about things he does not try and explain, that is still an attractive market. And if they can all be persuaded to pick up another wide-ranging rehash, then popular science will retain the possibility which all trade publishers seek, of producing a title which breaks out of its normal readership and becomes a 'must have' book for a substantial proportion of the population. It is almost impossible to tell when this will happen, but it is the hope which supports publication of many titles which become, in their own way, successful, and will sustain popular science even if the boom days are now over.

REFERENCES

Ball, P (2004) *Critical Mass: The Physics of Society* London: Heinemann
Bernal, D (1939) *The Social Function of Science* London: George Routledge
Bragg, M (1999) *On Giant's Shoulders: Great Scientists and Their Discoveries From Archimedes to DNA* London: Wiley
Brockman, J (ed.) (1995) *The Third Culture* New York: Simon and Schuster
Bryson, B (2003) *A Short History of Nearly Everything* London: Doubleday
Charney, D (2003) 'Lone Genuises in Popular Science: The Devaluation of Scientific Consensus' *Written Communication* 20, 215–241
Dawkins, R (1976) *The Selfish Gene* Oxford: Oxford University Press, 30th Anniversary edition, 2006
Dawkins, R (2004) *The Ancestor's Tale: A Pilgrimage to the Dawn of Life* London: Weidenfeld and Nicolson
Dawkins, R (2006) *The God Delusion* Houghton Mifflin
Dennett, D (2006) *Breaking the Spell: Religion as a Natural Phenomenon* London: Allen Lane
Diamond, J (1997) *Guns, Germs and Steel: The Fates of Human Societies* New York: Norton
Diamond, J (2005) *Collapse: How Societies Choose to Fail or Survive* London: Allen Lane
Goodell, R (1977) *The Visible Scientists* Boston: Little Brown
Hawking, S (1988) *A Brief History of Time: From the Big Bang to Black Holes* London: Bantam Press
Hawking, S and Mlodinov, L (2005) *A Briefer History of Time* London: Bantam Press Huxley, A (1963) *Literature and Science* London: Chatto and Windus
Krauss, L (1995) *The Physics of Star Trek* New York: Basic Books
Lewenstein, B (2005) 'Science Books since World War II' *The History of the Book in America* Vol 5. National Endowment for the Humanities/American Antiquarian Society. Available from http://www.people.cornell.edu/pages/bvl1/Books2004.pdf
Mooney, C (2005) *The Republican War on Science* New York: Basic Books
Paul, P (2004) 'The Role of Popularisation in the Diffusion of Scientific Ideas' *Written Communication* 21, 32–68
Penrose, R (2005) *Road to Reality: A Complete Guide to the Laws of the Universe* New York: Knopf
Pinker, S (2002) *The Blank Slate: The Modern Denial of Human Nature* London: Allen Lane
Pratchett, T, Stewart, I, and Cohen, J (2002) *The Science of Discworld III: The Globe* London: Ebury Press
Sagan, C (1980) *Cosmos* New York: Random House
Sobel, D (1997) *Longitude* London: Fourth Estate
Tallack, P (2004) 'Echo of the big bang' *Nature* 432, 803–804 (16 December)
Weinberg, S (1977) *The First Three Minutes: A Modern View of the Origin of the Universe* New York: Bantam Books
Wilson, E (2003) *The Future of Life* (2nd edition) New York: Vintage

FURTHER READING

Deason, H (ed.) (1964) *A Guide to Science Reading* New York: New American Library

Reichhardt, T (2005) 'Pumping up the volume' *Nature*, 436, 326–327 (21 July)
Rennison, N (ed.) (2000) *The Waterstone's Guide to Popular Science Books* London: Waterstone's
Turney, J (1999) 'The Word and the World: Engaging with Science in Print' In, Scanlon, E, Whitelegg, E, and Yates, S (eds.) *Communicating Science: Contexts and Channels* pp 120–133 London: Routledge
Turney, J (2003) 'More than Story-Telling—Reflecting on Popular Science' In, Bryant, C and Stocklmeyer, S (eds.) *Science Communication in Theory and Practice* Dordrecht: Kluwer
Turney, J (2004) 'Accounting for Explanation in Popular Science Texts—An Analysis of Popularised Accounts of String Theory' *Public Understanding of Science* 13, 331–346

Part II

Science writing

Practitioners' perspectives

8 Scheherazade

Telling stories, not educating people

Tim Radford

Science writers—alone of the tribe of scribes—usually have a new story to tell. This is their strength, but it may also be part of their problem. Humans may be novelty-seekers, but many of them are not at all comfortable with the new, the untested, and the unknown. Editors, publishers, and readers, on the whole, prefer the familiar. There is always pressure on a successful thriller writer to keep writing the same kind of successful thriller. Nobody thanks a popular comic novelist for suddenly attempting a tragedy in verse. Sports writers enjoy spectacles that ultimately can end in one of only two ways and this suits their readers too. Political reporters too, seem to be witnesses to the democratic drama as soap opera in which the same plots recur, and in which characters seem to keep coming back. Economics correspondents chart the rise and fall in a nation's, or a region's, or an industry's fortunes, without ever being expected to depart from their difficult, but still limited, brief.

Science writers paradoxically, can find themselves concerned with the universe and any or everything within it and each day have the privilege of writing something that has—at least in the details—never been written before. A science reporter reads *Nature*, *Science*, and other journals, attends university press conferences, is briefed by government scientists and environmental campaigners, and thumbs or clicks through perhaps 20 or 30 press announcements a day, and gets a dozen or so phone calls from academics with axes to grind. In the course of a few days he or she may be expected to write about:

The dark energy that makes up 73% of the missing mass of the universe;
The discovery of a flotilla of longboats at an Egyptian royal tomb;
An attempt by US military scientists to train honeybees to sniff for explosives;
The development of machinery measured in billionths of a metre;
Yet another attempt to test Einstein's general relativity;
A genetic mutation linked to adult response to childhood abuse;
Yet another theory to explain the Mona Lisa's enigmatic smile;

Evidence that sheep can remember faces (of other sheep);
'Smart' bandages that can detect the first septic infection;
And of course, many other things as well.

Many such stories are inherently difficult to tell. They are outlined in language that varies between the unfamiliar and the completely incomprehensible.

LANGUAGE PROBLEMS

You can measure incomprehensibility by the frequency, so to speak, of a word that you might never hear beyond its disciplinary environment. There are some words that are used all the time by scientists, and never ever by laymen. You can eavesdrop in the alehouse or the football terraces or the bus queues for a lifetime and never hear anyone use the word *phenotype*, or *albedo*, or *isostasy*, or *Mesozoic*, or *strike-slip fault*, or *mitochondrion*, or *protease inhibitor*. These have, however, almost universal currency within science and they describe things for which there is no parallel in the lay world, because the lay world does not normally experience such phenomena at the scale or level of detail that requires such a coinage.

There is a second problem—of the Latinate, polysyllabic language in which academics tend to pontificate—but that presents less of a difficulty. Any journalist understands the value of being happy and bright, rather than felicitous and effulgent; any journalist knows that it is better to kill than exterminate, better to drool than salivate. Our business is words, and when we use them shortly, we use them properly. I do not claim that journalists are without fault. They have a weakness for lazy, hackneyed, and hand-me-down imagery: they rely on clichés that have through overuse become abraded of all colour and scoured of almost all meaning. Think of those weary modern metaphors for science: Frankenstein's monster, the magic bullet, Pandora's box, and so on. My friend Marc Abrahams of the *Annals of Improbable Research* once claimed to have spotted a journal reference to 'the Holy Grail of hair restorative therapy.' I found, in one short sentence in the *Economist*, three consecutive clichés, invoking greener pastures, new heights, and cutting edge economics. Journalese is journalism's way, to use another cliché, of shooting itself in the foot: of rendering language limp, rather than limpid.

But the problem is literally beyond words, too. The problem is not just one of translation: the fact is, science is hard. If it were easy, it would be done by dilettantes rather than by PhDs. So there is a problem in understanding not just the words, but the concepts concealed within those words. But there is a second and bigger challenge, and it seems to be Europe wide, and perhaps American wide, too. The problem is: nobody wants to know about science. I never actually met any lay readers who claimed that they

bought a newspaper to keep up with science news. They will often, however, admit to having bought a newspaper to keep up with the news.

A newspaper is a vehicle for news. It is also, of course, a vehicle for distraction, diversion, delight, and indignation. It is a kind of information clearing house, refreshed every 24 hours, and usually updated several times in the course of a night. But above all, it is a story-telling machine. Readers think a newspaper is full of items of news: newspapermen, however, think of news items as stories. This is no accident. Stories have shape, narrative, and point. They are fashioned things. Even at their clumsiest, they have a certain literary polish, they exploit literary tricks, and they appeal to the sense of humour, or drama, or poignancy: That is, they are sensational. Of course they are: why else would you read them? These stories are designed to be read swiftly and easily. The words *glib* and *slick* are not insults to newspaper people. Newspapers tend to be big—a paper like the *Guardian* is the equivalent of a Dickens novel, every day—but stories tend to be short. So a newspaper is also a bit of a fairground, filled with headlines that compete for attention, like barkers at a fairground.

The important thing to remember, here, is that the reader has a choice. Stories about science, the environment, and conservation jostle up against stories of robbery with bloodshed, kidnapping, and the nocturnal antics of footballers. Let me put the same thing another way: stories about things the reader does not understand and may never have seen—in one sample week, the genetics of the olfactory bulb, the forces that pinion a quark to a proton, and a protein label called ubiquitin—compete for attention among stories about fear in the home, and death in the streets, and what the footballer got up to in the strip club. Given the choice, which will you read? I write about science—and that includes very powerful themes such as biodiversity and conservation—but I do not for a second let myself believe that anybody bought a newspaper because he or she wanted to read about science. Science reporters are not really science writers, but storytellers.

So we have a paradox: scientists and journalists both want the truth. The difference is that journalists want their truth in the form of a story. A story is something you can say in a sentence, or a terse headline, and leave people wanting more, a lot more. A story is also something you can spin out to a thousand words, or even 100,000, and still keep your audience. A story gives you the big picture, whether a picture accompanies it or not. A story is, paradoxically, very hard to define, but very easy to tell.

A THOUGHT EXPERIMENT

Are journalists and scientists two completely different animals, or just two subspecies of *Homo inquisitivus*, Curiosity Man? Both find the phrase 'I don't know' a delightful starting point, rather than an admission of defeat.

Both use six little words as tools, and use them again and again: who, what, where, why, when, and how, systematically, to test a hypothesis and support a proposition. Here is a thought experiment I have proposed many times before, and I make no apology for proposing it again. Take a research institution. Let it have a director, a budget, a mission of sorts. Let it be filled with enthusiastic young researchers. Let one of them identify a project, discuss it with his director, do a literature survey, and then begin. He (or she, but for this argument let it be a he) will propose a hypothesis, and may amend it according to his discoveries, but at some point he will have to decide whether he is onto something worthwhile. If so, then he will complete his research, write a paper, submit it for review by a panel of his peers, discuss changes, and then see the paper published. Up to this point, I could be describing a laboratory, or a newspaper. However, there are two differences. One sounds huge, but is trivial. The other is simply huge.

In the case of a laboratory, the research takes as long as it takes, and the publication of the paper takes months. In a newspaper, every step is achieved in one day, between 11 am and about 9 pm. That is the trivial difference. The other difference, the one that matters, is that a scientific paper may be read by absolutely no one at all. But it will still be potentially important. It will establish precedence, status, and performance variously for the lab, the researcher, or the director. People will discover what it says by looking at an abstract on the academic network. They may even cite it because the abstract will tell them what they need to know.

But an article in a newspaper that is read by no one might as well have had no existence at all. Newspapers exist to be read. They exist only because they are read. I am fond of drawing a lesson from that fabulous archive of popular stories, *The Thousand and One Nights*, and once again, I repeat the lesson without apology. Queen Scheherazade had to tell stories every night, and keep the Caliph excited, and keep it up for 1001 nights, or she would die. So she told stories that have endured for centuries: of Aladdin, Ali Baba, Sinbad the Sailor, and so on. Newspapers follow the same imperative: the day the readers stop reading, they stop buying, and the newspaper dies. Even science stories in newspapers are above all stories, which certainly happen to be drawn from the world of science. But they are told so as to give pleasure. It is not our business to advance the public education in science, except as a kind of happy accident.

So there is a bargain struck between storyteller and listener: the storyteller must tell the kind of story that the listener is prepared to hear. This, of course, can be quite disconcerting for the scientist. A researcher may spend five years on a piece of research and then up to five months persuading *Nature* or some such journal to publish it. *Nature* will put out a press release, and follow it up with a proof of the scientific paper. A science journalist will spend about five minutes on the press release, and about five seconds on the paper. He or she will then phone the author, and spend another 5 or 10 or 15 minutes asking the scientist to explain his reasoning

and his evidence in words of one or two syllables. Then he spends between five hours and 45 minutes writing his story and it goes in the paper. The next morning, a reader casually starts to read. As soon as he sees a word he doesn't understand—*phenotype*, for instance, or *albedo*, or *mitochondrion* or *top quark*—he stops reading, in just one fifth of a second. So the language has to be chosen with some care. The consequence is that quite often the science itself gets left out, and the story is shaped around the results of that science. It is shaped in a way that evokes delight, or humour, or passion, or even disgust. It certainly does not include many of those caveats, those ifs and buts and maybes that scientists love so much. But why should it? Newspapers are strange things: they are vital to the health of a democracy because they are free. Journalists do an important job, but they dare not do it with a sense of self-importance: readers hate pomposity. A free press means a press free not just to be wrong, but wrongheaded.

So the relationship between journalism and science will be an uneasy one. It does not mean a condition of enmity, or misunderstanding. We are social animals: whatever we do, we do for each other. In the same way, scientists and doctors must share knowledge and understanding with the people around them: of course, because the knowledge only has value when it is shared. Above and beyond that, because the taxpayers and consumers ultimately underwrite all research, scientists and doctors have an obligation to share their knowledge as they gain it. The problem is that in a democracy every one of us has an obligation to explain, but in a democracy there is no corresponding obligation to listen. The stilted and troubling language of the science journal and the jargon of laboratory conversation, are languages that alienate and exclude. It would help if scientists, too, remembered that they were engaged in telling a story: at a different pace, but telling a story all the same.

9 The sex appeal of scientific news

Luca Carra

My specialization in the medical field leads me to pay special attention to the biomedical sciences. And, in this sector at least, I can see a growing and sometimes obsessive interest in the Italian press. In my opinion the main driving force behind this interest is what I would sum up as the 'sex appeal' of scientific journalism, which reached a turning point with the cloning of Dolly.

A 'SEXY' STORY

If I had to choose a 'successful press story', it would be the account of the cloning of Dolly the Sheep which I wrote for the Italian popular weekly magazine *Oggi* in 1997 shortly after the event and which was emblematically entitled 'I Won't Make Human Clones'. It was Ian Wilmut, Dolly's cloner, who told the story of all the difficulties and great satisfaction provided by this scientific achievement, one which was revolutionary in the field of biology. It was no mere chance that, with the unfailing instinct of the pressman, the copy editor of *Oggi* gave the article this heading, which he had extracted from a phrase of Wilmut's; it was as though the magazine instinctively wanted to present its wide readership with a story which was scientifically but also anthropologically revolutionary, 'hard hitting' and sexy, but at the same time intended to reassure its readers that nobody actually intended to go as far as human cloning, something which brought into play such delicate matters as identity and the 'sacredness' of natural reproduction.[1]

I cannot say whether this article of mine was more popular than others nor if it is the one I prefer for its scientific depth, style, and originality. What I do prefer about it is the sensation—one which a scientific journalist rarely experiences in his career—that I was dealing with a truly important matter, a turning point.

To avoid any misunderstanding, however, I must also say that this strange sensation of the event's having an objective journalistic importance had very little to do with the scientific importance of the discovery, even though the researchers and biologists immediately pinpointed this as being an important element. For the journalist, the enthusiasm for Dolly

depended on a number of factors which went much deeper and were much more human and sexy and which, all things considered, had very little really scientific about them in a strict sense.

Let me explain what I mean. The story of Dolly managed to strike many of the right chords in the 'basics of a successful journalistic subject' all at the same time, viz:

- The novelty and strangeness of the facts reported;
- The fear of death and the thirst for immortality;
- The terror and fascination caused by subversion of the natural order;
- Curiosity about the unknown;
- The hope in miracles;
- A good story to tell with some leading characters in it;
- The economic spin-off from a scientific discovery.

Dolly had it all: it was a brand new and strange event which subverted the natural order, gave hopes of great advances in medicine, could even presage the creation of photocopied, immortal beings and, obviously, was one which would have important economic consequences. But the true catalyst of public interest seemed to me to be the more 'sexual' side of the matter.

I don't mean sex simply as a form of pleasure and enjoyment. I mean Sex in all its aspects, ranging from reproduction issues to the new types of family, from emotions to fear, from Eros to Thanatos.

In this connection, I think that the Italian media were profoundly changed by the cloning of Dolly the Sheep (1996–2003). From that time on the Italian press also began to cover bioscience on its front pages: more frequently than in the past science left the scientific pages, which until a few years back had been completely given over to space trips and technological gadgets, to land on the front pages. This event so greatly affected public opinion that every political authority in the world took an ethical and political stance on animal and human cloning.

Jacques Monod was right when he said more than twenty years ago, that

> Science—and particularly molecular biology—has a power for destruction greater than that of an atomic bomb. An objective understanding of life does not destroy the physical world but demolishes, from its roots, the ancient alliance between Man and Nature which has always been the basis for commonly shared moral values. And since absolute certainties are no longer available, mankind is forced to start again from the beginning and thereby to discover its total solitude, its total strangeness. (Jacques Monod, 1970, English trans. 1971).

Now, to go back to sex appeal: Perhaps for the first time in the history of scientific journalism Dolly enabled us to grasp the exact meaning of this 'strangeness'. What are the factors that made Dolly such a great media suc-

cess? The strange fact was that for the first time a large animal, a mammal, not so far removed from a human being, had been created without a proper act of fertilization (i.e., by the fusion of two gametes). In other words, this sheep had a mother but no father. Some years after the cloning of Dolly, just a few days ago in fact, a new experiment with stem cells (another very important scientific topic which is on the front pages in this period) showed that the opposite was also possible, namely, the creation of a new individual from a father but without a mother: Scientists from the University of Pennsylvania succeeded in transforming embryonic stem cells (from male mice) into egg cells. For the first time in history, scientists had duplicated the process of egg formation and ovulation in the test tube.

If the contraceptive pill (1952) allowed people to have sex without reproduction, cloning allows people to reproduce not only without sex (like artificial insemination), but also without a partner!

I believe that what is really fascinating for people about cloning, even more than the problems of identity connected with it, and even more than its therapeutic value and consequences, is this radical dissociation between sex and reproduction.

WHEN CRITIQUE HAS TO CONFRONT HOPE: AN UNSUCCESSFUL STORY?

If, on the other hand, I have to think of an 'unsuccessful' news story, my mind turns to an article on melatonin written for the weekly *L'Espresso* in 1996 (Carra, 1996). Those were the years when, at least in Italy, melatonin had its moment of glory and was sold as the new 'elixir of life'. Melatonin's golden age lasted for six months. On 14th August 1995, the American weekly *Newsweek* sparked things off by coming out with a four-page report on a mysterious hormone which until then had been sold in supermarkets as a natural sleeping drug (Cowley, 1995. Their reporter Geoffrey Cowley had been able to take a look at the proofs of two books which saw melatonin as a drug with miraculous properties (Reiter, 1996; Pierpaoli, 1995). According to Russell Reiter and Walter Pierpaoli, the main authors of the two books, this hormone, which is produced by the pineal gland in the brain, did not merely serve to re-establish the sleeping and waking rhythm which is altered by intercontinental flights (jet lag) or by stress. It did much more than this: one pill of melatonin a day could actually halt the ravages of the ageing process. Pierpaoli, who went further than Reiter with his high-flown statements, proclaimed that the use of melatonin could mean that reaching an age of 120 was no longer an impossible dream. But, even more important than this, the old age of the new Methuselahs would be an active and satisfying old age, rejoicing in a potent sexual life, and free of those distressing degenerative diseases which normally affect the old: So no more cancer, Alzheimer's, or Parkinson's diseases, no more

strokes or heart attacks. Perhaps, Pierpaoli ventured, constant use of this hormone could even hold back the onset of AIDS in the HIV-positive and, in appropriate doses, could be a good alternative to the contraceptive pill. It is difficult indeed to ask more of a powder which costs almost nothing and which can be obtained relatively easily from the serotonin to be found in coffee. And one can easily see how melatonin had all the ingredients for good press coverage. As I said before, news like this arouses the natural interest of readers (especially elderly readers) in anything which will prolong life and defeat disease; furthermore, there is a long tradition in Italy of so-called miraculous cures, especially those for cancer, ranging from the Bonifacio serum, which was sold in one of the Rome churches, to the notorious treatment produced by Antonio Di Bella, the doctor which so stirred public opinion and political debate throughout the country.

However, as is the case with all discoveries of miraculous cures, melatonin's day of reckoning also came after six months of glory. The day of vengeance was 23 January when the Health Minister, Elio Guzzanti, ordered a melatonin-based dietary supplement called 'Biorn' to be withdrawn from sale. What had made the Drugs Committee suspicious were the product's specifications, which promised that it would regulate the body's rhythms and act as an immuno-stimulant and anti-oxidant. The Committee's experts decided that all this was more than enough to warrant regarding the product as a drug and, therefore, as one requiring full scientific documentation.

On the same day the miraculous elixir of life was struck another blow. The British journal *Nature* asked the neurobiologist Fred Turek (1996) to write a caustic editorial dampening the ardour of the followers of the cure-all hormone. Given its source, this article immediately acquired the standing of a Papal encyclical and Walter Pierpaoli, the immunologist from Milan (though resident in Switzerland) who, with William Regelson, had published the Bible of the new hormonal faith (Pierpaoli, 1995), became the heresiarch of the type of superficial medicine which spreads the cheap illusion that it is possible to stop the process of ageing and put an end to the degenerative diseases that go with it.

What better chance could there have been for the press, backed up by the authoritative article in *Nature*, to launch an attack on the umpteenth so-called discovery of these quacks? At moments like this a scientific journalist feels almost that he is one who can be of help to others, an intellectual who makes use of reason to dispel the pernicious illusions created by the wrong kind of medicine and by popular credulity. And so I went in full tilt to write my article, which featured prominently in the periodical and was accompanied by a half-serious interview with Walter Pierpaoli in which I tried to bring out the bragging and rashness lying behind the type of medicine which is based more on promises than on proof.

I waited anxiously for the issue to come out, albeit slightly worried that the pro-melatonin doctor might decide to bring a libel action against me.

But none of this happened—on the contrary, there was an unexpected development. A few days after the article had been published I was phoned by the secretary of one of the most influential businessmen in Italy, asking me for bibliographical background on melatonin. Shortly after this I received phone calls from friends, acquaintances, and total strangers, all asking for information about melatonin, one of whom informed me that although it had been withdrawn from Italian pharmacies it could still be found at the pharmacy in Vatican City across the Tiber. Just a few days later, I heard that my parents had decided to buy melatonin.

WHAT JOURNALISTS SAY AND WHAT READERS TAKE AWAY

I have to admit that I was young and naïve. I thought that an article attacking a miracle cure really would be read for what it was saying. I had not yet realized that one of the great mysteries of scientific (but not only scientific) journalism is the gap between what the journalist is trying to say and what the reader understands. This gap grows to huge proportions precisely in the case of miracle drugs, where what truly filters through is not what the journalist has written but the pure and imaginary existence of a new hope of treatment. Journalism is certainly no force against this; on the contrary, all things considered even the most enlightened press, by feigning a critical stance, merely give the news space and, therefore, credit, skilfully balancing the critical contents of the article against the more immediately evident features such as the headline given to it. It is no mere chance that my article in *L'Espresso* had (quite inconsistently, given its contents) been given the headline 'Melatonin—What Harm Do I Do You?'

This is why I have chosen this press story as an example of a failure. We might say that its failure lay precisely in my article's success.

MEDIA OBSESSION FOR MEDICAL NEWS

The interest of the media in medical news is not only obsessive, it is also often uncritical. This probably depends on the fact that, at least in Italy, the journalist who writes about medicine is subject to heavy promotional pressure from the pharmaceutical companies. As well as this, he tends culturally to stand in a kind of awe of scientific sources. Only in the last few years have journalists started to keep themselves at a healthy distance from the 'experts', to whom they had tended to turn as if to oracles, and to pay more attention to the scientific literature.

Many examples could be given of how medical and scientific information in the lay press in Italy often has clear promotional value. In the case of drugs one could quote the case of a new generation contraceptive pill

(Yasmin), which was launched about two years ago by the leading press as being 'free of side-effects', whereas reliable literature carried many reports of fatal cases which had induced Dutch and British doctors to advise their patients against taking the pill. In this case, the incorrectness of the information was compounded by an element of farce in that all the writers of the laudatory articles had signed them off from a tropical island (Santo Domingo) where the producers of the pill had held their press conference.

Another recent case of mystification serving to reassure the public about a piece of medical-scientific news is that of the American study, 'Women's Health Initiative', which demonstrated the cardiovascular repercussions of hormone replacement therapy used in the menopause. This news reached the public at large in Italy almost always through the filter of authoritative Italian experts who, in giving the information, felt the need to explain that the American results (which are usually taken as gospel) were not applicable to 'Italian women'.

This facile type of reassurance also prevails over critical reporting when the subject matter is screenings, diagnoses, and possible new therapies. It is, for example, extremely difficult to follow a prudent line of reasoning in the lay press when talking about new offers of mass screening: the daily and weekly press, as well as the television, has often allowed itself to be used as a promotional vehicle for the controversial prostate screening and, recently, also for lung screening by means of the 'magnificent' CAT spiral which it is claimed can stop most lung tumours.

Two years ago, in the middle of the gene therapy emergency caused by two children having contracted leukaemia after undergoing a clinical trial in which a gene grafting was used to combat the rare immunological disease ADA-SCID, hardly any of the press reported what had happened. However, every new possible, but remote application of gene therapy to a new disease and every new trial is reported as 'a hope from gene therapy'—which, incidentally, in 15 years has not yet been shown to cure a single disease.

Such glib reassurance does cease when there are big scandals, such as the recent inquiry by the Italian judiciary into Glaxo's bribery and corruption of Italian doctors to induce them to prescribe its drugs, or the withdrawal of certain drugs which had been heavily promoted in advertising campaigns (the anti-COX2) which proved to have adverse effects on the heart, or the link between Prozac and suicide. In cases like this the research published in authoritative scientific journals (*Nature, Science, New England Journal of Medicine, British Medical Journal, The Lancet*), or the information which filters through from the big international agencies (FDA, EPA, etc.), do also carry the media in their wake. It is as if the greater authority of international scientific sources, on which the media largely depend, prevails over that of the sponsors or local scientific experts/companies.

However, as I hope my melatonin story has shown, most of the time critical reasoning, supported by the most prestigious scientific media, fails

to have the slightest effect on the high hopes of the man in the street and on his faith in the new 'miracles of medicine'.

CONCLUDING REMARKS: MAKING NEWS BY SUBVERTING NATURAL ORDER?

It would be obviously inappropriate for me to draw general conclusions from my own specific experience. However, reflecting back on the two cases which I have shown as examples of 'success' and 'failure' I seem to find a strong common thread. Indeed, both stories—despite being very different one from another—make appeal to what seems to be a very powerful news value in contemporary media coverage of the biomedical sciences. This news value could be succinctly labelled as 'subversion of the natural order of things'. This subversion can be referred either the 'social order' of reproduction—as in the case of Dolly the sheep—or to the 'scientific order' of the scientific understanding and treatment of human disease as in the multiple cases of hope for (and hype of) miracle cures. From the point of view of this highly influential news value, successes and failures of scientific journalism appear to be the two sides of the same coin rather than the straightforward result of contradictory news-making practices.

NOTE

1. The issue of reproduction has acquired a significant relevance in Italy, as proved also by the heated debate which ensued in connection with the 2005 public referendum on assisted reproduction and embryo research.

REFERENCES

Carra, L. (1996), 'Melatonina: che male ti fo,' *L'Espresso*, 9 Feb., 110–112.
Dowley, G. (1995), 'Melatonin,' *Newsweek*, 7 Aug., 46–48.
Monod, J. (1970), *Le hazard et la nécessité*, Paris, Seuil, (English trans. *Chance and Necessity: An Essay on the Natural Philosophy of Modern Biology*, translated from the French by Austryn Wainhouse, Vintage 1971.
Peipaoli, W. (1995), *The Melatonin Miracle*, New York: Pocket Books.
Reiter, R. (1996), *Melatonina*, New York: Bantam.
Turek F. (1996), 'Melatonin Hype Hard to Swallow,' *Nature*, 279, 25 Jan., 295–296.

10 Science stories that cannot be told

Sylvie Coyaud

WHEN IS SCIENCE NEWS 'NEWS'?

Increasingly efficient press departments of research institutions provide their own newsworthy items, and the same science stories appear all over the Italian press as if 'news' in science were only the end product, often perishable, of a particular research. Editors love it, and ask us to write second-hand stories in the local idiom. If this weren't frustrating enough, there are many news items—in my view—that I can't write about. Am I the only one?

In the past few years, Italian researchers have protested on several occasions against research restrictions on such topics as GMOs; they have lamented lack of state funding or opposed government reforms of research institutions. Post-docs have scant career opportunities in Italy, and can find themselves chasing short-term contracts—salary: €1,200 per month, before taxes—until they are 40 or 45. A long wait for tenure is not unusual in Europe or in the US, but what is unusual in Italy is the recruitment system. On the cover of 3 November 2005 issue of *Nature,* a title boasted 'Italian Jobs', but inside the journal the 'Spotlight on Italy' actually consisted of advertisements for universities, research institutes, regional 'poles of excellence', and so on. Throughout the 20 pages of the *Nature* section, only two post-doctoral positions were offered, both in a tiny black and white ad placed by a new nanotechnology laboratory in Lecce.

Because research and academic jobs are scarce, there is a long list of patient, if not always bright, people who wait to be appointed or promoted: most of them are aged 40 years and older. There is also a list of 'raccomandati', undeserving friends or family of influential academics or politicians, who still consider that 'no one can be denied a job at the Post-Office' as the Italians say; that is, it is their privilege to get their protégés hired by the State, be it some research institute or a university. Recurring attempts to reform the recruitment process have been resisted, and a bill passed in October 2005 manages to increase its opacity. Not surprisingly, science is perceived as 'hard work, no money' by young people and by the better informed as somewhat corrupt. It is. Worthy candidates are often

blackmailed into withdrawing their applications, and if they insist they can expect retaliation. When they eventually manage to receive tenure, they can still be excluded from all committees and the contracts of post-doctoral researchers working with them may not renewed, and so forth.

Recently, a 30-year-old post-doc has been doing research on trehalose; she has an impressive CV including papers published in high impact journals, two European awards, and a Unesco-L'Oréal prize. Now trehalose is an interesting sugar which helps resurrect plants; for instance, it can enable them to spring back to life after a long drought, and it has potential applications in medicine, agriculture, and perhaps cosmetics. The post-doc would rather stay in Italy than go back to a CNRS lab in France where she worked last year. There are two research positions to be filled in her department, but she was told she had no chance and that she should not even try to compete with unqualified applicants who are over 40 and 'have to make a living'. She will have no other opportunity: from 2006 the new university reform has eliminated research posts in universities.

What are we journalists to do? If we only re-write the success stories fed us by press departments, we give a distorted picture which does not fit our job description, does it?

The young woman whom I mentioned may yet decide to fight openly, instead of begging around for a 'raccomandazione' and see it weighted against the influence of others. If she does, I will have a good story to write about. I will tell it to no avail: up to now all those who made their grievances public lost whatever position they had, and had to find a position abroad. Whistle-blowers are unloved everywhere, and scientific institutions are just as shame-proof as political ones. I have asked colleagues in Great Britain, France, and Germany, and only one—Alison Abbott of *Nature*—knew of a German whistle-blower who had been hired in the same country and, amazingly, in a better position than the one he had before he made his denunciation.

In the last four years, while the Italian economy was slowing down, a consensus emerged among political parties, business actors, trade unions, and the media: more research is needed to foster new, knowledge based, high-value products and services, and to put Italy among the global 'big players', particularly now that the country has no large industry left worth mentioning, and its exports of furniture, shoes, and clothes can barely withstand the competition of East Asian countries. The mantra 'research will save the economy' is repeated everyday in the media and in meetings all over the country. It is pure rhetoric. State funding is down to 0.6 per cent of GDP, and most of it goes into the salaries of professors and researchers—the amount of such salaries being decided centrally as a result of negotiations between the government and the public workers' unions. The single universities that employ these researchers have no say on this issue, and receive no equivalent increase in governmental funding even when salaries are raised by virtue of the government/trade union negotiation. Private funding is down to slightly under 0.3 per cent. Ironically, between 1989

and 2005 science events, festivals, conferences, and books have increased fifty-fold by some measures. Before 1992, the only newspaper with a daily science page was *L'Unità,* the Italian Communist Party newspaper. Before 1994 there was no 'science week'. Before 1989, when the first public lectures by famous scientists were held in Spoleto during the summer music festival, there was no 'science and culture' event. Today, there is an average of five such events in which scientists address the public each week (except August), the Genova science festival has a budget of €2 million, shorter science festivals are organized in Bologna, Naples, Trieste, and even in small towns like Bergamo and Perugia. And those events are crowded. For the first time, this year in Genoa I saw members of the audience behave like football fans: a man slapped an attendant because he had bought a ticket and found only standing room at a lecture by Gabriele Veneziano, a physicist working at Cern and at the Collège de France in Paris, who was to speak about string theory.

Journalists, as supposed communication experts, are enlisted for, or embedded in, all these events. We are glad to help the researchers, poor dears, to communicate with the general public; after all, most of them have to be honest—otherwise they would not have chosen the 'hard work, no money' career. But some of us engage in this collaborative communication task with second thoughts: should we make research sound attractive when we know the research situation is, with the usual exceptions, unattractive, and sometimes just rotten?

There is no labour market in science, and there is none in journalism either. Even in the leading newspapers, most articles are pieced together at the desk by young 'stagiaires' with short terms contracts, well aware that they will not be hired when their contracts expire. None of these people is ever asked to investigate a story (actually, they do not ask either), none could attend a conference out of town unless the organizers paid for travel and accommodation; none is ever sent to a lab to see how a new instrument works, or how stem-cells are harvested.

A few well-paid freelancers like me can afford to follow a story, but they work alone. I miss colleagues and editors with whom to discuss what I am doing, how and why. I misrepresented many results I am sure, especially at the beginning of my work in this field. Now my mistakes are less obvious because I have contacts and friends whom I can ask to check facts and interpretations. When the editors of this volume invited us to bring examples of failures in our coverage of science, I had plenty. But my main one, as every other week, was the failure of reporting on unfairness, bullying, mobbing, mafia-like behaviour, on mediocrity rewarded and bright people turned away from doing research—in Italy but also in other countries—and sometimes even from doing research *tout court*. This failure inevitably subtracts credibility from what I write.

Getting old has a distinct advantage: people do not dare interrupt you in public. So when I resent, too much, the silent complicity—Italians call

it 'omertà'—expected from me as a journalist, I let off steam, and air the dirty laundry (names omitted). I do so each time I'm asked to talk about science communication at conferences in universities or research institutions. They will not invite me much longer, I presume. *Pazienza* as the Italians say, it is just voluntary work anyhow, and I am late with my paid work already.

Still, even journalists have a sense of duty, and there is an uncomfortable lack of freedom in being unable to investigate each of those stories properly, and in failing to report them in my own radio programme or in the newspapers and magazines where I write. I really believe that science journalists have to reflect seriously on how they could address the issue of recruitment and resource management research—or if you want to put it more bluntly, how they could write stories about dreadful misconduct without causing our sources to lose their jobs. It would be one of the greatest services that we could do both to our readers and to the research community.

11 Science reporting as negotiation

Chiara Palmerini

It is not too inaccurate, in my opinion, to describe the routine of science writing as a process of negotiation. The process of arriving, through discussion, at a compromise or agreement over the angle and the content of a story catches some important aspects of the activity of a science journalist. But I will use the word 'negotiation' in two different contexts. In the first one, the negotiation happens inside the news office between science journalists and general editors. In the second, more problematic case, the negotiators are journalists and their sources: scientists and researchers.

NEGOTIATING WITH THE EDITORS: ERRORS OR HORRORS?

For the purposes of this book, I have been asked by the editors to discuss what I consider to have been a successful science story and one of a failed science story. For the 'successful' one, I have tried to think of a story that interested me and that I found important and intriguing to write about. I found these characteristics in an article about 'medical errors'. This is, in short, how the idea for that story came about.

The inspiration came from an article in the *New Yorker* magazine written by Atul Gawande (1999), a surgeon nearing the end of his residency at one of the best hospitals in Boston. Gawande is today an acclaimed medical writer, and the story on medical errors was one of his first articles. He was writing on that theme from an unusual point of view. The article starts with a breathtaking account of how he almost killed a woman who had arrived inconscious in the emergency room, because he could not insert a breathing tube into her trachea. Far from being a mere journalistic account of the disasters that can happen in an operating room, the piece is a deep reflection on medicine as an 'imperfect science'. Gawande makes it clear that mistakes cannot be completely eliminated from medicine, which is as complicated, unpredictable, and imperfect as every other field of human activity.

In the article, he goes on to explain that dramatic errors, more often than not, are the result of a chain of unnoticed events and distractions, and

not of unscrupulous physicians. He describes the amazing results obtained in other fields such as aviation to reduce mistakes. With some research I found out that in Italy too there was a growing debate on these themes among physicians, and programs to try to control and reduce errors were being set up. This is obviously a very delicate matter, where legal, financial, and ethical aspects are at stake.

It often happens that stories about science and medicine are the result of a negotiation between science writers and general editors. Both, of course, are journalists. They work in the same office, but they often feel they have different interests to defend. This process of negotiation, in my experience, has some positive and some negative aspects, and the article, as the final result, depends on the diplomatic abilities of negotiators. Control over stories depends of course on the experience of the journalist and from the status accorded to him or her in the news office. At a certain extent, though, even more experienced journalists cannot have complete control over their story as it goes outside the 'realm' of the science section.

I knew the words 'medical errors' would appeal to the editors. My sense was that they were too interested in the topic, and that they had different expectations from my own. At *Panorama*, it is usually the science chief editor who presents the story at the weekly meeting. She told me that when they heard that there was a story about medical mistakes, they wanted it to be a big article in the general news section, maybe the cover.

At this point, together with my chief editor, I stressed that the focus of the article was not horror stories of people with surgical instruments in the belly, or wrong legs amputated, but an account of the growing debate on how some kinds of errors can be prevented (with some interesting stories). From their point of view, this sounded less appealing than their original understanding of the story. Maybe, in these terms, it did not deserve the cover. In the end, the editors agreed to leave the story in the science section, which of course means giving it less relevance. I was in the ambiguous position of willing my story to be big, but at the same time concerned that it could be exaggerated or distorted. The cover is a very risky place for a science story to be!

The compromise we reached in the case of the medical errors story was that I would add small sidebars with examples of terrible errors doctors had done. I wrote the article I had in mind, adding stories of recent cases of people who had been seriously injured: a man who had the wrong leg amputated; another who died after being administered an IV of pure potassium; and so on. This was the result of the negotiation, and it is just an example (see the original article in box 1).

But it is not unusual for me to find myself in the position of hoping, especially for stories that have to do with medicine and health, that they stay in the science section. If they go outside, as many journalists are aware, there is a good possibility of sensationalism, exaggeration, headlines that promise more than the article can deliver. This is a problem in Italian newspapers

BOX 11.1 Errors in the wards

Knowing errors helps to avoid them. When a doctor makes a mistake (and it happens often), the consequences can be serious. Now, for the first time, 11 Italian hospitals experiment with new strategies to decrease risks. Accidents and slips will be reported and analyzed. The goal is to avoid repeating them in the future.

It's 2 pm on a cold winter Friday. A young doctor is cutting open the abdomen of a man who has been stabbed. Suddenly, his beeper goes off: there is another emergency. This time it's a woman in her thirties, very fat. She has had an accident, she is unconscious, and she is breathing with difficulty. She needs to be intubated because the oxymeter indicates that the oxygen in the blood has begun to decrease. The doctor can't insert the tube down the trachea, because the swollen vocal cords and the blood in the woman's throat obstruct its passage. Another attempt—the doctor thinks—and a spasm might close the air passage once and for all. And this is what really happened.

An emergency tracheotomy is required, but the young doctor has done it only once, on a goat. He starts repeating all the steps, panicking. He hesitates, cannot see well. In the end, he cuts. The wound is full of blood; the woman's heartbeat slows more and more. At that precise moment, the attending surgeon (Gawande's supervisor) arrives. When it seems that everything is lost, he succeeds in inserting the tube through the vocal cords. The woman's heart starts to beat again.

This is not the script of an *E.R*. episode. It's a real story that Atul Gawande, a surgical resident at Brigham and Women's Hospital in Boston, tells in an article published in the *New Yorker*. After coming close to disaster, Gawande and his superior prepared to discuss in front of their colleagues how things had gone, the awful chain of events almost caused a patient to die. In the future, in a similar situation, another physician will probably remember to immediately call a more expert surgeon, instead of waiting. And the hospital administration may install a better light on the operating table, since the insufficient lighting had contributed to making the surgeon's manoeuvres difficult. The physicians will try to learn from others' mistakes.

This sort of meeting could soon appear in Italian hospitals. The Court for patients' rights (Tribunale per i diritti del malato), together with Anaao and Fimmg, two important medical unions, is starting an initiative to register, analyze, and possibly prevent medical errors. The project, which will take place in 11 hospitals all over Italy, is to create what in

management language is called risk management units. In practical terms, they are groups of people with the task of understanding where, and why, the errors happen in their hospital….

Similar experiences have already been successfully conducted in the US, Sweden, Denmark, and Spain. 'Medical practice can never be at zero risk, but it's possible to increase the safety conditions. The goal is to identify risk factors and try to control them' says Stefano Inglese, responsible for the national policies of the Tribunale per i diritti del malato. Safety in medicine is becoming an issue that all the hospitals have to deal with. 'For the majority of people, and certainly for the lawyers and news media' writes Gawande 'only bad doctors make mistakes'. Stories of pliers forgotten in patients' bellies, of wrong legs amputated, or badly interpreted radiographs frighten patients and doctors alike, since both think: it could have happened to me.

There is a simple truth that few are willing to acknowledge: all doctors make mistakes. Hospitals can be dangerous places. The sensational errors, with fatal consequences, are very rare, although they strike the imagination. Usually, they are the last link of a chain of small mistakes, slips, lack of organization…. There are errors that tend to be made repeatedly in similar circumstances, as many studies on the human factor in disasters and accidents have shown. These are the mistakes that can be avoided.

In other sectors where safety is essential, such as aviation, the myth of infallibility does not exist. It's taken for granted that even the best pilots will make a mistake at some point. This is why airplanes are designed to do something about it, in the majority of cases. What's more, there are institutions that are set up to study the causes of accidents in order to avoid their repetition. Years ago, some countries, the US among others, created systems so pilots could make aconfidential report on a risky situation they had been involved in. In this way, passenger safety has steadily increased. The chance of dying in a plane accident today is 1 in 8 million in the US; in the seventies it was 1 in 2 million.

Medicine has started only recently to try to reduce risks. The first step is to admit that medical errors exist. 'It's necessary to talk about the errors, instead of hiding them', says Enrico Bollero, general manager of the Policlinico Tor Vergata in Rome. 'Italian physicians are not used to studying and analyzing errors because they lack the culture for doing this', says Francesca Rubboli, researcher at the Centro Studi of San Raffaele Hospital in Milan. To learn from mistakes, it is of course necessary to know when, where, and how they happen. More often than not, these data are not available. There is no reliable information on the frequency and the types of accidents.

Last year, a report of the US Institute of Medicine made a lot of noise: it estimates that in the US between 44,000 and 98,000 patients die every year because of medical errors. This number is more than death from car accidents, breast cancer, or AIDS. In Italy, the Tribunale per I diritti del malato has gathered data on the areas where medical errors happen most often. Risk management units will then draw a more detailed risk map. These groups, composed of five to six people, physicians, nurses, technicians, and engineers will collect voluntary reporting of errors, evaluate the litigation documents, and try to import to Italian hospitals the kind of meeting that the *E.R*. public know very well, so called 'morbidity and mortality conferences'….

The main advances in error management have happened in anaesthesiology, which is much safer today than it was 25 years ago…. Simple tricks in other sectors permit avoidance of trivial mistakes that can cause serious consequences. The San Raffaele Hospital has started to use in some departments a 'smart cart' that delivers drugs only when it recognises a patient's identity. Errors in the administration of drugs are among the most frequent accidents. According to an American study, up to 12 prescriptions in every 100 can be wrong. In the majority of cases, this has no serious consequences, but sometimes it can cause deaths.

According to most experts, technological fix is not enough. 'The main difficulty will be to convince physicians that reporting errors is not aimed against them' says Sandro Spinsanti, editor in chief of the medical journal *Janus*….

The issue of medical error does not interest only the most sensible physicians, but also hospital administrations, which are increasingly under pressure from insurance companies…. The problem is delicate, because some physicians are afraid that this road will arrive at a system where, as in the US, hospital workers live with the menace of lawsuits….

At the Ospedali Riuniti of Bergamo, a project to measure mistakes in the prescription and administration of drugs has been halted because, as the person responsible for the intensive care unit Gianmariano Marchesi, explains 'it bothered both the doctors and the nurses who had to report the errors'. It is not an easy way, and proponents of this kind of initiative do not expect it to be. They all agree that it is important to start. Gawande concludes in his article: 'sometimes medicine errs, and it is not reasonable to ask for it to be perfect, but it is reasonable to ask it to try'.

Original article 'Errori in corsia—Se lie conosci li eviti,' *Panorama*, 10 May 2001

and magazines that many journalists have often talked about, and I have not seen much improvement. Problems of control over what you write and the way the material is handled have been discussed several times. The feeling among general editors is that if a science story stays in the science section it can be 'boring', but if it goes outside the science section it has to be promoted, and made appealing to the readers. The means to make it appealing can vary: from pictures of almost naked women to headlines about miracle cures.

In the medical errors case, the story had a 'happy end'. I think the editors' idea really added something to the story, even if in the beginning it was conceived to satisfy their request for horror stories that scare people and that are sensational. Also, in looking for these cases, I found specific examples of preventable errors, where no doctors in particular had been particularly bad, but where some defects in the organisation, and bad luck, had caused terrible consequences: just the point of my article. Pressure from editors, in this as in many other cases, is positive in another sense: it compels the reporter to find convincing arguments that an issue is interesting in itself, without need of further promotion. Sometimes science journalists tend to think that the importance of science is self-evident, and that there is no need to make science news sexier than it already is. So, in the most successful cases, the editors are genuinely supporting the reader's interests by expressing their doubts and suggestions.

NEGOTIATING WITH SCIENTIFIC SOURCES: CHECKING OR CENSORING?

In my experience science reporting means 'negotiation' in another sense, that is to say, negotiation with sources of information: scientists and researchers. This is an area where I have seen relevant changes in the last few years.

Here too, I shall start with an example. In 2002, my science editor assigned me to do some research for an article on menopause: it was June, there was a big European congress, and she wanted to know if there was something new coming up on the topic in terms of research or medical treatments.

Researching for that article, I found out that the American National Institutes of Health (NIH) were to publish an important document in which many of the benefits attributed to estrogens in the prevention of various women's illnesses were questioned. What caught my attention at the time was that the entire volume had been prepared by a group of experts in collaboration with an Italian institution, and that it was going to be presented in Italy, too, a month later. This was a few weeks before the controversy over the effects of postmenopausal hormone therapy exploded in the news, because of the publication of the results of the Women Health Initiative, showing the therapy increased the risks of disease, instead of diminishing them. At that time I had trouble even finding someone available to comment on the subject. From the Italian institution involved in the study I was

told that the document had not yet been released, so it was impossible to comment on it. Then I found the study was already on the Internet.

I had appointments scheduled for interviews with gynaecologists to talk about news emerging from the menopause congress. But when I said that the focus of the story would have been the new findings on post-menopausal therapy, they reacted very nervously; one refused to talk. In the end, with the help of some other experts, I wrote the article and agreed to send it to people from the institution to read and check it. Someone re-wrote the lead of the article, completely changing its focus. I had written that the NIH document 'was not the final verdict, but surely a judgement that would have weighed a lot on the decision of women and their doctors about whether or not to take the hormone replacement therapy'. They changed it to read this way: 'The document is not a final verdict, but a critical and objective examination of international literature now available'. They added: 'It is important to stress that the document deals not with specific therapies, but with women's health in general'. In the rest of the article, every statement reporting what the document said with any certainty was systematically softened (The published article is reproduced in box 2).

So, what sort of reaction was that? First of all, I know there is some debate about whether or not it is ethical to have your sources read and check what you have written before it goes to print. I should say I normally do not have anything against this practice. If they can check the draft of the article and correct errors or misquotations, researchers usually trust you more and are more open. This, in the end, helps to build a relationship of mutual respect. And at times one has to rush writing on technical matters, so an additional check that the information is correct may help. But I have begun to think that there is something in this form of collaboration between science and medical journalists and their sources that does not work smoothly. Sometimes this conflict is open, as in the menopausal therapy article, sometimes it is much more hidden, but it exists.

In this case, the experts tried to influence what I was writing, suggesting not only what was and was not beneficial to tell the public, but also the tone and words which they judged it was correct to use. In my experience, this kind of incident is more likely to happen when one deals with medical issues, especially drugs. I do not think this pressure to influence what journalists write is new, but it is something that recently has become much more evident. I do not have answers, but only a series of questions I can share with you.

NEGOTIATING BETWEEN JOURNALISM AND SCIENCE PROMOTION

Both cases I have mentioned here reveal the constraints and negotiation under which science writers have to operate. However, while negotiation with journal editors has been familiar and widely discussed, negotiation

BOX 11.2 It's time to put the brake on estrogens

Hormone therapy works to alleviate the symptoms of menopause, but it does not, as was previously thought, prevent the diseases of aging.

It is not yet a definitive verdict, but certainly a decision that distinguishes precise merits from faults and will weigh on the choices of many women and their doctors. Hormone replacement therapy (HRT), prescribed for post-menopausal women, does not seem to be the panacea against the diseases of old age, from heart diseases to osteoporosis, to which it owns its fame.

On the other hand, it works well against the symptoms that affect more than half of menopausal women: hot flashes, insomnia, irritability, and dryness.

The authoritative NIH has recently published the first part of a document that describes studies of many of the expectations from prescription of estrogen. The entire volume, prepared by a group of 28 experts in collaboration with the Lorenzini Foundation, will be presented in Italy too, and aims at creating new guidelines for physicians of women's health: gynaecologists, cardiologists, orthopaedists, and oncologists.

In Italy, only 10 per cent of women use hormone therapy (20 per cent in the North, fewer in the South). HRTH is prescribed to many more women in other countries, such as the US, not only to combat the symptoms of menopause, but also as a therapy against aging in general. In this case it has to be taken, at least in theory, for many years, or for life. Specifically for these indications, the hormonal therapy has failed to demonstrate its efficacy in the most recent series of studies.

In past years, on the basis of large epidemiological studies, among which was a famous study of 70,000 nurses, various positive effects had been attributed HRT, beyond the treatment of menopausal symptoms. These beneficial effects were thought to counterbalance other increased risks, such us breast and uterine cancer. It was thought that the HRT could reduce the risk of heart attack, thrombosis, fractures, urinary incontinence, and could prevent Alzheimer's disease, and the decline of mental functions typical of old age. 'The problems with these studies', says Carlo La Vecchia, epidemiologist at the Instituto Mario

Negri 'is that the women who were chosen to use HRT were from the beginning the healthiest, so less prone to the diseases that the therapy itself should have prevented'. But in the last several years, controlled clinical trials have compared the efficacy of hormone therapy to that of a placebo. From these trials, and from a large ongoing study, the Women's Health Initiative, whose definitive results will be published in 2006, have emerged doubts that are also expressed in the new document. For example, concerning the prevention of cardiovascular disease, the situation appears much less rosy than has been depicted: not only do estrogens not protect, but also they seem to increase the risk of stroke and thrombosis in women who have already suffered similar episodes. These experts doubt that HRT is useful as a prevention of heart diseases even for healthy women. The NIH, when the first data from the Women's Health Initiative came in, signalled that in the first two years there had been more cases of stroke, thrombosis, and pulmonary embolisms among women treated with estrogens than among those under placebo.

The efficacy of the hormone therapy against osteoporosis is confirmed, but the prescription rule has changed. 'To give benefits, it has to be taken for life' says Pier Giorgio Crosignani, director of the Gynaecology Department at the University of Milan. This choice is not always favourable, if one considers the risks of the therapy. Concerning the prevention of urinary incontinence, depression, and Alzheimer's disease, the studies have not shown any positive effect of HRT….

More certainties on the advantages and disadvantages of the hormone therapy will be known in a few years, when studies on a thousand women will end. For now…the message of the experts to physicians and women is: use it to control menopause symptoms, for which it remains the most efficacious therapy. Do not take it to prevent cardiovascular diseases. For osteoporosis, risks and benefits have to be calculated carefully, considering the willingness of women to undergo therapy that lasts for decades, and existing alternatives: physical exercise and calcium, non-hormonal drugs.

Original article 'Estrogeni, e ora di frenare,' *Panorama*, 10 May 2001

with scientific sources has been largely taken for granted, despite the significant changes it has witnessed in the past few years.

This is due also to the fact that in many cases, in my experience, science writers tend to consider themselves on the same side of the barricade as scientists and they do not see it as a problem. Both researchers and science journalists like science, they share similar interests even if they are part of different communities. To keep a distance from sources is, of course, an issue in every field of journalism, but science writers tend not to consider it a problem in their coverage.

I have wondered what the reasons are for this change of mood. My impression is that the increasing pressure researchers have to communicate to the public, together with some misunderstanding of how this process should work, contributed to create some problems. Scientists look for visibility much more than they did in the past. And the institutions in which they work have a strong interest in getting the word out about what their people are doing, and have become more sophisticated in the last few years in doing it. This urge for the scientists to make themselves visible probably goes back to the issue of getting funding for their research. Sometimes bad or weak science is packaged in forms that are quite appealing for journalists. Researchers now have understood how important good press or bad press is for their research, their careers, their positions, and they tend to adapt to this new situation.

This pressure to communicate has not advanced at the same pace as researchers' understanding of the mechanisms of communication and the functioning of the media. Today scientists are most of the time very pleased to help journalists do their job. But they often still assume that the reporter is simply transcribing what they say. You ask, they answer, and you transcribe. They expect you to trust them even when they are not specific, when they make statements without numbers to support them, or when you ask for a 'second opinion' on their work.

Thus, 'negotiation', which was in some way acceptable to me as a form of cooperation (meaning 'we are both on the same side; we are allies') is becoming less and less acceptable.

A lot of attention has been given to the fact that science journalism is inaccurate from the point of view of scientists. And this is true. So, of the two words *science journalism*, *science* has been given a lot of attention. I wonder whether it is not time to turn the attention to the word *journalism*, and see whether science journalism is functioning not only according to the rules of science, but according to the rules of journalism.

REFERENCES

Gawande, A. (1999) 'When doctors make mistakes,' *New Yorker* 7, 40–55.

12 Why journalists report science as they do

Björn Fjæstad

Among scientists, especially natural scientists, in Europe and North America, it is not uncommon to feel that the reporting of science in the news media is inadequate in several respects. Among the points frequently mentioned are:

- Non- or underreporting of important scientific progress;
- Sensationalism and negativity in choice of science topics;
- Sensationalism and negativity in wording and in presentation;
- Inaccurate reporting;
- Reluctance to publish rejoinders and corrections.

Many scientists claim that the media do not fully appreciate the inherent importance and interest of science, particularly basic science; that journalists often have too little scientific education and that, in the end, they tend to obstruct rather than to facilitate communication between scientists and the public. The view is that the social responsibility to inform and educate the public can only be accomplished through a close and intimate, but so far lacking, co-operation between scientists and journalists.

If these scientists have analysed the situation correctly, news journalists seem not to have a constructive and rational view of science and tend not to understand what the public really needs or wants to read, listen to, and watch.

Is this a reasonable assessment of today's science journalism in the Western world? I am inclined to answer 'No'. The bottom line is rather that scientists and news journalists, as members of two different social institutions, have different professional roles and information functions. Therefore, the solution to the perceived problems is not, in my view, an amalgamation of the two professional roles in an intimate collaboration. Rather, let us review the respective informational responsibilities of scientists and journalists.

In the professional role of a scientist, the production and dissemination of information is a central aspect. A piece of research is not completed until a report is published. However, this refers mainly to communication within

the scientific community, and most scientists are satisfied to get their work published in scholarly publications. Information activities directed to the general public would take a lot of time and effort and are generally not seen as particularly rewarding, neither as an activity in itself, nor as furthering the scientist's academic career. On the contrary, being successful in popular science may even be detrimental to a scientist's career because it may be construed as exhibiting shallowness and as being a poor substitute for success in scholarly publications.

THE SCIENCE LOBBY

However, there is a minority of scientists who really are interested in a special aspect of outwardly-directed information: the science lobby. This loosely defined group of persons is made up of scientists who have accepted administrative or representative tasks: vice chancellors, deans, department chairs, members and leaders of academies and other scientific societies, scientists, and scientifically trained personnel at research councils and other funding bodies; information officers at scientific institutions of various kinds, and to some extent politicians and civil servants in ministries and agencies administrating science.

A sociologically oriented definition of the science lobby would be that it is comprised of persons interested in and working for: more money for science; within-science control of the money; within-science control of choice of projects, methods, and procedures; and no more demands from society than can be met with reasonable success.

This group of people is interested in using the media to further these goals. However, they do not usually refer to such activities as lobbying but tend to say that they want to be useful to society, to help disseminate knowledge that is beneficial to human well-being and the democratic process, and to make a cultural contribution.

Most certainly, science information can fulfil these three or four last-mentioned very important tasks, but for the science lobby they are not in themselves the main outcome in the short run. I would venture to state that is naïve to believe that there is no active science lobby working for more money and more control. And it would be naïve in two respects: first because it would be a distortion of the actual situation, and second because it presupposes that it would be in some sense illegitimate for a social institution and its representatives to lobby for resources or influence. But on the contrary, it is a fundamental democratic right to voice one's priorities, to argue for money and control, and to be taken seriously in doing this. But for many persons in the academic community notions such as advertising, public relations, and lobbying are not approved of, yes, even seen as of less moral value than scientific activities. Many scientists tend not to see them-

selves as another interest group among many—some even regard science as ideology-free—but claim the privilege of having special access to knowing what is true and good and what is not. However, no such privilege is recognised by media practitioners, who look at all social groups as having interests.

This latter view seems more realistic to me and most others who do research into science as a social system. All holders of power, all sources of information, including scientists, have their own reasons for offering information to the media. These purposes may well be charitable and well-meaning, but an overriding goal is to further the ideas and the good reputation of one's own organisation. As a result, favourable publicity is expected or, at least, hoped for from contacts with media people. Politicians, corporate heads, union leaders, artists, athletes, and so on are all advocates in their own causes. Everyone with an interest—and who hasn't got one?—tries to champion this interest, and this is quite acceptable and perfectly moral in itself.

When the science lobby examines the media, it finds that the media do not live up to its expectations. The media do not publish all press releases as they come in, but rather choose odd or controversial research projects to write about and describe them in negative and sensational terms. Newspapers and television are fraught with factual errors and errors of emphasis, and they do not refrain from criticising both science as an endeavour and individual scientists. This brings us back to the original problem: bad publicity allegedly due to journalistic standards based on lack of understanding of the scientific process, lack of factual knowledge, and a disobliging attitude toward science.

It is, as just stated, quite legitimate to further one's own interests by arguing in public, but for this very reason it is also important for citizens to be attentive to all who have a cause to advocate. The reason, of course, is that there is always a risk that the particular interest may be placed above the actual state of things or good ethics. Moreover, interests may contradict each other; we cannot all have it our own way all the time. For instance, already as young children we learn that advertisers want us to purchase their goods and services, and a little later we realise that politicians want our votes in general elections. As a result, we become more or less critical and careful in our choices. Still, both commercial advertising and political campaigning are vital and indispensable ingredients of our Western democratic societies.

For some reason, we citizens seem to have less doubt in the innocence and unselfishness of charitable organisations or of bishops or, for that matter, of national scientific institutions and distinguished professors of natural science. In spite of this, even these organisations and persons, with their lofty and admirable goals, are upholders of their respective causes and look forward to benign media publicity.

OPERATIONAL RULES AND THE FREEDOM OF EXPRESSION

Journalists do not see it as their task to work for any special interest, whatever its benefits. Their mission in Western societies is to serve their audience, the citizens, by informing them about recent developments ('news'), and by naming and warning of insufficiencies of various kinds. These tasks may be summarised as three C's:

- *Chronicle*—to inform about what has happened since the last instance of publication;
- *Criticism*—to protect the audience and warn of dangers and inadequacies;
- *Commentary*—to explain and interpret what is happening.

Sometimes a fourth C is added, for *Communication*—transfer of the social heritage between generations and between ethnic groups or social classes. (Also, *Entertainment* may be recognised as a separate media assignment.)

These social tasks are most obvious regarding politics and business. We citizens need information about what is going on in these fields, we need to know if someone in power misbehaves and we need help to understand what is occurring. It is important to stress that news media do *not* see it as their mission to help governments or corporations or universities or charities to build a better world. 'Publish and be damned', the motto of the *Washington Post*, sums it up well.

How applicable are these social tasks of the media regarding science? Most research projects, of the several million concluded each year in the world, are never addressed in the media, and rightly so because they all but lack public interest. And it is the media, not the scientists, which decide what is of interest to the public. When a topic *has* been defined as being of public interest, however, then the Cs are in full force. Scientists are then seen as news generators, power holders, interest mongers, in the same way as corporate leaders, union officials, or statesmen. It is not possible to say 'no thanks' to publicity and the only option is to make the unavoidable publicity as benevolent or at least as little damaging, as possible.

The societal tasks as mentioned above are not explicitly assigned to individual journalists as they are hired by the media. Rather, this role of the press is a liberal figure of thought from the late eighteenth century. The assumption is that public openness—publicity critical of the government as well as contradicting ideas competing in 'the market of information'—helps improve and develop the society and counteract misuse of power. With the later advent of universal franchise, an enlightened electorate is seen as agents acting upon media reports of, say, corruption among political leaders. To support this so-called watchdog function of the media, substantial legislation to protect press freedom exists in Western societies.

This means that media criticism of individual scientists or certain states of affairs in academic institutions is not based on bad will or inadequate education, but stems from journalists acting as representatives for the public—at least in principle. This criticism in the media can be structured in five major categories: Firstly, scientists sometimes create dangerous knowledge and products (e.g., weapons, toxins, radioactive substances, genetic engineering). Secondly, scientists sometimes use methods and procedures that may be unethical or even illegal (e.g., painful experiments on animals, humans as guinea pigs, research on aborted foetuses, integrity-threatening registers of individuals; also accepting financing from questionable partisan organisations, and instances of self-enrichment and downright fraud). Thirdly, scientists sometimes waste public funds on meaningless projects. Fourthly, scientists sometimes express opposite opinions on important matters; each of them claims to be right and on the other hand, dissident scientists are stigmatised by mainstream scientists. And finally, scientists sometimes withhold and repress information that ought to be made public.

The first points concern how scientists go about their job, the latter ones the way they interact with reporters and other external groups. The items are similar, in principle, to media criticism against other holders of power. When reporting alleged misbehaviour of decision-makers in industry and public administration, other categories having to do with environmental pollution, treatment of employees, and unfair appropriation of favours and money to oneself are added.

The task of criticizing the establishment is taken seriously by news journalists, leading to a special media interest in scandals and conflicts. For this reason, the picture painted by the media is by no means a mirror image of reality (whatever that is), but a dramatisation of a negative selection of events and situations. And a particular event has a higher news value than others if it is: surprising, topical, consequential, or critical of people in power; about people in conflict or distress; offering an opportunity for personal identification; close geographically or psychologically, easy to comprehend, and entertaining.

These traits are, of course, not very similar to what characterises a regular research report, rather the antithesis. In fact, journalists and scientists look quite differently at what constitutes valuable information:

Scientists	*Journalists*
Aim: dissemination of research results, teaching, PR for science	Aim: news, enlightenment, exposure, large audience
Slow information dissemination	Fast dissemination
Factual orientation	Personal orientation
Rational appeal	Emotional appeal

Consensus gives best picture	Diverging voices give best picture
Theoretical relevance important	Practical relevance important
Comprehensive	Selective coverage
Details important	Details unimportant
Results are qualified	Results are overstated
Work judged by colleagues, thus reinforced and reproduced	Work judged by colleagues thus reinforced and reproduced

There are also some differences within the media community worth noticing. Ranking three main characteristics of a piece of information—novelty, accuracy, and appeal —three different orders of preference present themselves:

Science	*News media*	*Magazines*
1. New	1. New	1. Interesting
2. Correct	2. Interesting	2. Correct
3. Interesting	3. Correct	3. New

The views on how best to produce and distribute information are so different that one could ask if it would not be more practical for scientists to just forget about the media. Not caring about the media is, in fact, a common attitude among not only scientists but also quite a few potential news generators, and trying not to be noticed often turns out to be a successful strategy. However, there are some reasons for this being an inferior way of handling the media: firstly, the media may unexpectedly put certain scientific or academic events or states on the public agenda; they may also influence perceptions and attitudes in an undesired direction. Secondly, any scientist may be sought out by the media asking questions about his or her research or other professional work: all scientists are potential news generators. And thirdly, scientists, especially those working with public funding, are expected to inform the public or certain client groups about their activities and results.

THE BIAS TOWARDS NEGATIVE NEWS

And, of course, everything about the media is not rose-coloured. The general tasks of the media, the Cs mentioned above, are healthy in theory but not without problems in practice.

The main basis for these problems is that all media want large audiences. Without an audience the overall mission cannot be fulfilled. But a large audience is also in demand for quite another reason: making money. All

media need income to carry their costs. It is even a standard phrase in the media industry that only a profitable newspaper or broadcast station dares to be free in relation to advertisers and government; that is, to be in a position to effectively carry out its watchdog function.

This last tenet is in itself valid, but commercialism is indeed a dilemma. From research in mass communication and social psychology we know that audiences like to hear about conflicts and scandals. Such contents sell newsstand copies and increase viewer ratings. But it may also lead to journalists seeing scandals and conflicts wherever they look.

Thus, what may occur is that the media invoke their social role as critics and use it to deliver criticism against decision-makers to a much larger extent than the role of watchdog really calls for, the real purpose being to increase circulation and viewer numbers. Thus, there is a commercial value in conflicts and critical reporting, which, in turn, may lead to exaggerated, inaccurate criticisms on the pretext of making a social contribution, and personal criticism in the reporting rather than criticisms directed at matters of principle.

This means that individual pieces of villainy may overshadow structural problems and deficiencies in society. There is also another problem related to the media task of being critical and the public demand for scandals and conflicts. If media attention is skewed towards reporting negative rather than positive aspects of governance, of corporate behaviour, and of other performance by holders of influence, the resulting publicity may very well render an unrepresentative picture of the world. Taken one by one, these critical stories about prominent persons or organisations taking questionable action are important and for the betterment of society, but seen as a whole they may express an excessively negative world view.

Due to the watchdog function of the press, persons in power who are honest tend to get less media coverage than the more or less shady leaders against whom the critical examination is directed. Naturally, this is both what to expect and what is desirable from a societal point of view. It is the rotten eggs that need to be exposed, not the fresh ones.

However, an unwanted result of this imbalance is that it may contribute to the view that it is not uncommon for politicians (or business or union leaders or, for that matter, scientists) to be crooked, even though these by all probability only constitute a quite small proportion. If such sentiments become widespread among the public, two unwelcome consequences may follow. First, the political system and, in continuation of this, the current practice of democracy may become less legitimate in the eyes of the public. Second, it may be more difficult for the public to realise when a power holder has really behaved in such a way that he or she ought to be separated from authority.

This situation is aggravated by a technicality in the way the media are published. The rhythm of publication probably leads to an even more negative picture, and to fast action, which, in turn, may lead to inaccuracies.

Even though there are many exceptions, positive events tend to take a longer time to play out than negative ones. Building a career or a good reputation, or for that matter physical entities such as a bridge, takes years, while they may be destroyed in a minute. And since the news media are published daily, or even more frequently, more negative than positive events occur at about the same temporal rate as media publishing.

The publication rhythm encourages speedy news journalists. They may only have a few hours to collect information and write a story about a subject that the source, for example, a scientist, has spent decades working on. If the journalist waits with the publication in order to check facts or collect supplementary information, a competing news medium may get the scoop. No wonder mistakes are made.

SOME FINAL ADMONITIONS

So, is there a solution to these dilemmas in science reporting? The answer is, no, not really, not without censorship—a solution still in use in many countries. In the Western world, we have to accept that the news media both tend towards the negative and critical and will continue to make factual errors of varying magnitude. But there are steps along the way.

Both the general public and potential news generators should be aware of the social tasks and inner workings of the media, explaining why the media do not publish mirror images of reality; thus media studies should be included in the compulsory school curriculum. Decision-makers and other potential news generators, among them scientists, should not overestimate the negative impact of singular instances of bad news, since these tend not to be very large.

Finally, based on my many years of experience both as a university researcher and as a science editor, please bear with me if I venture to be normative at the end of this overview and give a few pieces of concrete advice to potential news generators, among them scientists:

- Do care about the media and work proactively with a number of media-oriented instruments—written news releases, occasional press conferences and press seminars; utilise the knowledge of how the media work, i.e., organise media events such as the public opening of a new laboratory, appearances of celebrities);
- If there is a crisis, do not lie. Rather, refrain from commenting;
- If you cannot answer a certain question, say so and ask to return with an answer (and do so);
- Be prepared with short and instructive ready-made answers containing your most important points and arguments;
- Don't say anything off the record;

- Call back as soon as possible any journalist who has tried to reach you;
- And, principally—do not do anything that you wouldn't want to be made public.

RELATED READINGS (INCLUDING SOME CLASSICS)

Anton, T & McCourt, R (eds.) (1995) *The New Science Journalists* New York: Ballantine Books

Blum, D & Knudson, M (eds.) (1997) *A Field Guide for Science Writers* (2nd edition) New York: Oxford University Press/ National Association of Science Writers

Bryson, L (ed.) (1948) *The Communication of Ideas* New York: Harper & Brothers

Cater, D (1959) *The Fourth Branch of Government* Boston: Houghton Mifflin

Friedman, S (1986) *Scientists and Journalists. Reporting Science as News* New York: The Free Press

Friedman, S M, Dunwoody, S, & Rogers, C L (eds.) (1999) *Communicating Uncertainty: Media Coverage of New and Controversial Science* Mahwah, NJ: Lawrence Erlbaum

Franklin, J (1994) *Writing for Story. Craft Secrets of Dramatic Nonfiction* (reprint edition) New York: Plume

Gastel, B (1998) *Health Writer's Handbook* Ames: Iowa State University Press

Gregory, J & Miller, S (2000) *Science in Public. Communication, Culture, and Credibility* New York: Perseus Publishing

Halmos, P (ed.) (1969) *The Sociology of Mass Media Communicators* Sociological Review Monograph, 13

Levi, R (2001) *Medical Journalism. Exposing Fact, Fiction, Fraud* Ames: Iowa State University Press

Luechtefeld, L (2004) *Covering Pollution: An Investigative Reporter's Guide* Columbia, MO: Investigative Reporters and Editors

Meyer, P (2002) *Precision Journalism. A Reporter's Introduction to Social Science Methods* (4th edition) Lanham, MD: Rowman & Littlefield

Rivers, W L (1970) *The Adversaries. Politics and the Press* Boston: Beacon Press

Science Journalism (2002) Nieman Reports, 56, 3, Fall

13 How the Internet changed science journalism

Brian Trench

It is difficult to over-state the pervasiveness of Internet communication in science. And it is plausible to claim that journalists have been more thoroughly affected by technological change in recent decades than any other occupational group. In the cross-connection of these processes science journalism is being redefined.

New opportunities, media, and genres for reporting science have emerged, that challenge established modes of science journalism. Producing and distributing 'science news' comprises part or all of the professional responsibilities or personal pastimes of an increasingly diverse range of social actors.

In this chapter, we shall review changes in the information-gathering and publishing practices of science journalism, which is situated at the boundaries of two sets of professional communities that have both been deeply affected by developments in information and communication technologies in general, and in the Internet in particular. We shall also consider how, in the context of proliferating and diversifying sources of scientific information, the functions and responsibilities of science journalism are altered. Some proposals will be offered as to how these altered responsibilities might better be fulfilled.

We distinguish 'science reporting' and 'science news', as representing various forms of journalist activity around science, from 'science journalism' as a specialist practice within professional journalism. We are not here entering a long-running debate about whether special qualifications, for example, a university education in science, are necessary in order to report science adequately. We are merely underlining that there are many more people producing science news than there are people who can justifiably define themselves as science journalists. This may be a source of disappointment, even an object of complaint, for some. But, in the context of Internet publishing in particular, it is an inescapable reality, and it has clear implications for the practice of science journalism.

This specialist practice is located at the boundaries of two professional communities, boundaries that are weakening progressively through developments on both sides, as it were. Not the least of these influences is

the increasing use of Internet media in all spheres of science communication. Professional communication reaches external audiences, intentionally or not, and public communication connects discrete professional groups and interests. Science journalism, which has served as a boundary-minder and intermediary between internal scientific spheres of communication and external public spheres, risks being bypassed in both directions if it does not successfully adapt to the changed environment.

The web, which was developed for information-sharing among scientists, is increasingly used by research and educational institutions to recruit students, employees, and collaborators and to impress niche audiences in policy-making, scientific, and business sectors. These institutional websites frequently use mass media journalism formats, such as daily or weekly news updates. In this way, they make what may have been intended as peer communication publicly accessible.

These, and other such paradoxes, demonstrate how, like other technologies, the Internet has escaped the (altruistic) intentions of its originators. In the interaction between social organisations and new technologies, unexpected things can happen.

THE INTERNET FOR NEWS OR PROMOTION

The plethora of Internet-based media that have developed for the dissemination of scientific information to wider publics include versions of services already provided via print and broadcast media, but also new media formats, such as portals, e-zines, forums and weblogs (blogs). Publishers of science information include higher education and research institutions, established scientific publishers and scientific societies, but also science centres and museums, public education initiatives, individual scientists, interest groups, hobbyists, lobbyists, and many more.

Open access scientific publishing has as its principal intention to facilitate sharing of knowledge between scholars. But it also means that members of non-specialist, but interested, publics have access to information prepared by professionals for professionals. Some sites maintained by scholarly societies and scientific journals require only that users register by name, and parts of such sites are freely open to any passers-by. Access to the web has opened up many aspects of scientific research previously hidden from the general public.

This creates a crowded, noisy space, where discerning valid and valuable information becomes ever harder. The difficulty is compounded by the way in which scientific societies, research institutions, funders, governmental bodies, and others use the web for marketing or other promotional purposes. Scientific institutions increasingly use directly employed (or, we might say, 'embedded') science writers or communicators to ensure rapid and controlled publication of results over the web, and by other means.

The formats these institutional sites use are often those of 'news', but the purpose is much less that of providing accessible information on matters of public relevance than it is of boosting the profile and reputation of the organisation. 'News' or 'Headlines' is often the hook used to attract visitors to the site, and to keep them coming back. A search for 'science news', or its equivalent in other languages, is as likely to take the Internet user to the site of a higher education or research institution as to that of a journalism-centred service.

Many publicity services have been developed on the web with journalist audiences in mind and some, like the European press release distributor, AlphaGalileo, restrict access to reporters and correspondents who specialise in science. However, much of the material available through that service is also available directly—perhaps after some delay—from the original institutional sources, and can be accessed by any web user. There are more such information distribution services that operate without restriction.

Journalists specialising in science often have a routine of 'checking in' to institutional sites that cover areas of science in which they have a particular interest. But what they find there, other Internet users can find too. In space science, for example, the US agency, NASA, and its European counterpart, ESA, provide extensive resources for use by the media but these can be used, and are used, by many of the active amateurs who populate this territory.

Many sites of scientific organisations and societies offer e-mail alerts or bulletins that package information in easily accessible forms. These news services draw both on internal resources, in a form of direct publishing, but also—and in a further demonstration of the blurring of boundaries—on external services provided by established news organisations, such as news agencies, broadcasters, and newspapers.

As a consequence of this and other kinds of publishing activity, the Internet user may find on any substantial scientific topic working papers, personal home pages, research reports, university press releases, conference papers, news media reports, and formally published journal articles. In discussion groups and mailing lists, there may be commentaries and correspondence on any or all of these documents. The views of sceptics, dissidents and dogmatists may be accessible alongside each other.

In this communication environment, scientists cannot ensure that all scientific information reaching the public has been internally validated. Intensifying competition between sectors, institutions, and publishers, and the availability of means for much more rapid dissemination of new materials have greatly weakened the role of traditional peer review as a control on what information enters the public domain.

An Internet search for 'asthma cure' points the user to the websites of patient groups, and from there to papers published in medical journals, but also to those of asthmacure.com, of a company selling a salt pipe for

respiratory problems, and to another proposing a nutritional programme. And all this is in the first page of results.

Looking for material on malaria vaccine, the Internet user finds information from news media, research organisations, activist groups, companies selling therapies, funders, and others.

A search for 'nanotechnology applications' brings up ads for reagents, enthusiastic promotions of the prospects for nanotechnology, a link to the US government's National Nanotechnology Initiative, and a link to an article on nanotechnology at wisegeek.com. Drilling down several layers to identify the author of this article, it transpires that he is, among other things, the director of the Immortality Institute for Infinite Lifespan.

HOW TO MARK OUT THE 'PROFESSIONAL SITE'

As the Internet user interested in science or simply curious about some recent development experiences it, the Internet is a noisy bazaar of traders bidding for attention. The distinctions between validated and non-validated information and between journalists and non- or near-journalists are harder to draw. This has clear implications for media practitioners working with scientific information. The increasing range and complexity of public science and the proliferation of science information sources mean that Internet users have special need of guidance on the reliability and trustworthiness of information about science, and of science information sources.

One important criterion for distinguishing professional journalists is adherence to ethical codes, and here, a question of professional, ethical responsibility arises very clearly. The challenges of independent science journalism lie more than ever in interpretation and contextualisation, or, as we might say, information about information. That was always a function of responsible journalism; in the changing circumstances, it assumes a central importance.

The case of biomedical information is especially sensitive, because this information can have 'end-user' value as diagnosis or remedy, and thus significance for a person's quality of life, or life itself. Databases of medical-scientific materials that are the primary information resource for medical professionals can be accessed online free of charge, but so too can health information from drugs companies, patient and awareness groups, complementary medicine practitioners, and mystics. There are several self-regulating initiatives among biomedical publishers to establish standards for websites that would allow users to discern professional, and therefore credible, sources. But search engines make no clear discernment between information types and sources, and a majority of sites showing up in the kind of searches described above do not subscribe to publishing codes.

It is also around medical and health issues that we have some of the clearest demonstrations of the long-claimed Internet effects of consumer-

becoming-producer, or everyone-becoming-publisher-or-journalist. Patient groups are active information providers, often as selective re-publishers of material already available on the Internet. Individuals with a particular interest in some medical condition are often also information providers, through personal home pages, weblogs, and other means. Some of the same patterns of publication and republication can be seen in other publicly debated and contested domains of science such as genetically modified foods, climate change, and stem cell research.

Indeed, it is a characteristic of much of the science that comes into the public domain that it is uncertain and contested, both from within and from outside science. The more sources there are on a given subject and the greater the diversity of those sources and of the information they provide, the greater the audience's sense of uncertainty is bound to be. Use of web hyperlinks, indicating a link between one page and another, can compound this uncertainty, rendering it mere confusion. Equally, however, hypertextuality can provide the means for open, public, and continuing negotiation of the uncertainties that surround us.

In a conventional view, still with wide currency, the function of journalists reporting science is to transmit in accessible form the results of scientific research. The job of the journalist is simplification without distortion, and therein lies the specific expertise of the science journalist. Given the journalist's imperative to be clear and concise, this simplification removes, or reduces, any equivocation or uncertainty in the results.

But the mere fact of operating in an environment of multiple information sources and source-types tends to limit the possibility of presenting any publicly significant information as certain and unambiguous. As more and more of the publics for science journalism have access to the Internet and as they seek information from 'balancing' or alternative perspectives, ambiguity and uncertainty are set to increase. With multiple routes through a narrative and multiple sources comes multiplicity of meanings. In these circumstances, science journalism can no longer credibly function as it was previously required or expected to do.

'TRUST MANAGEMENT' TO REDUCE UNCERTAINTY

The scientific institutions' embedded science communicators do at least part of the job of rapid transmission of scientific information. The challenges and responsibilities of independent science journalism lie much more in proposing meaning, or meanings, and in locating new information in relevant contexts. And the web, with its hyperlinks, looks like a medium chosen for providing the assistance to publics to make sense of so-called news. It facilitates approaches to publishing science news that can more fully meet users' needs, helping them to negotiate the complex information

environment in which they find themselves. Practices to support users in this way include:

- Providing context for all 'news' by linking to any or all source material, source organisation, authors, previous reports on the same topic, current reports on related topics, and different points of view on the same topic;
- Providing information in multiple layers, allowing different groups of users to read the material in different ways, and at different levels;
- Using images of various kinds—photographs, diagrams, infographics—to support explanation of science news.

Science news publishers can boost their relations of trust with users by making their information traceable to source, and improving transparency. Hyperlinking provides the means of adding this information about information. But merely linking to related materials says nothing about the character of the connection between two documents. Science news sites can offer fuller navigational assistance to users, for example with:

- Labels and signposts that indicate what lies behind such a link and an indication as to whether it might be worth making that link;
- Identification of linked documents by category, e.g., as peer-reviewed papers, self-published research reports, corporate press releases, or advocacy group statements;
- Relevance rating based on editorial judgement rather than user-popularity (as Google does, for example).

All of this requires professional editorial judgement and that is what independent, professional journalists can, or should, bring to the burgeoning field of science communication. How science journalism could perform this role, and how far most established practice is from doing this in any comprehensive manner, can be illustrated by an example from research into asthma, as also used earlier. At the BA (British Association) Festival of Science in September 2005, a biochemist at the host university, Trinity College Dublin, presented findings on an association between infestation with the parasite, schistosoma, and reduced incidence of asthma. On the basis of this association, television news programmes and daily newspapers in Britain and Ireland reported that a treatment might be developed for asthma based on the active ingredients of the worm. As a simple Internet search at that time revealed, the association between asthma resistance and parasites—including schistosoma—has been under investigation in Gabon, Brazil, Venezuela, and other tropical and sub-tropical countries in recent years. An editorial in the *American Journal of Respiratory and Critical Care Medicine* two years earlier referred to the inconsistent findings of these studies but insisted that the associations were strong enough to merit

further research. Also in 2003, the Netherlands Organisation for Scientific Research reported that research it funded demonstrated that lipids from schistosoma can inhibit human immune responses and were, therefore, the basis of a possible new treatment of asthma.

Of ten reports in leading Irish and British media over a relevant 24-hour period, many of them written by established science journalists, only the item in The Irish Times drew attention to this related research and defined the Trinity College team's achievement more specifically as being the demonstration of the immune effect in mice. Other reports presented the Dublin research as if it lay in the identification of a possible new treatment. Even a not especially attentive Internet user could have seen how partial this view was.

Situating scientific expert claims in relevant contexts such as these qualifies those claims and, from the point of view of both scientists and journalists, may take something from the 'news' character of the story. On the other hand, not providing such a context exposes both scientists and journalists to increasing critical scrutiny, on the basis that they may both be presenting information as new that does not merit that designation.

WEB-BASED INFORMATION SOURCES

Constraints of time and space limit greatly how much context can be provided in 'old media' formats, but publishing on the web is not similarly constrained. However, only a small proportion of web-based information services have production strategies that realise this potential. My own observation is that there are both fewer science news sites offering significant web enhancement of their information, and that there is a lower level of such activity, even than was the case in the late 1990s, during the first flush of enthusiasm about the web. Some of the new Internet-native publications developed in that period and demonstrating good practice—for example, HMS Beagle, published as part of the BioMedNet site sponsored by publisher Elsevier—have ceased to exist. HMS Beagle closed in 2002, and BioMedNet followed it in 2004.

The web-based services of established science news media, such as the much-used online science news services of the British BBC or of the magazine *New Scientist*, provide external links with major stories that are generated mainly by automated means, linking the mention of a research centre in a story, for example, to the home page of that centre's website. The user may need to make substantial additional effort to drill down into the site to find the relevant report or statement. In other cases, such as links to journals that are mentioned in a news story, the user may meet a barrier that can only be crossed by those with a subscription to the journal or its online service. At the same time, there are many instances on sites such as these where the source information is, in fact, publicly available as a paper in an

open access journal or as a press release, or as both, and the links are still not made to those documents.

The web's facilities for interactivity offer yet more possibilities for communicating science in richer, more textured ways than traditional dissemination or transmission models of science journalism can encompass. Through e-mail, forums, and weblogs, as well as other services, the Internet facilitates three-way communication—from producer to consumer, from consumer to producer, and from consumer to consumer. These facilities are widely used by scientist communities and by various social interest groups; for example, patient groups and environmental activists, as they seek to make sense of new developments in science. This corresponds to the dialogue model of science communication, so widely lauded as a replacement for the supposedly discredited (but still prevalent) deficit model. It also reflects the expectation of an increasing number of web users that they will be able to participate in public communication on topics of interest to them.

On websites whose publishers are committed to such approaches, the latest information appears with an invitation to comment alongside. As well as news pages, these sites have thematic dossiers, assembled over time from various perspectives and with fuller contexts, and linked to forums or to blogs. To present scientific information in these formats is to present it as hypotheses, open to examination from various perspectives, including sceptical and critical ones.

Professional science journalism, which often appears committed to strengthening its own authority as well as that of science, tends to be uncomfortable with such approaches, and offers few examples of experimentation in these formats. As journalist communities diversify, it is interesting to note that examples of web publishing of science news that realise a large part of the potential of this medium, are more likely to be found on the sites of science centres, such as Cité des Sciences et de l'Industrie in Paris or the Science Museum in London, than on those of scientific institutions or established news media.

Scidev.net, a website on science and world development, is a relatively rare example of a journalist-driven service that demonstrates the power of the medium for rich communication. Through an agreement with the publishers of *Nature* and *Science*, Scidev.net can link a limited number of news reports each week directly to the papers in those journals to which they refer. The site examines large topics from various perspectives, and provides a platform for contending views about the applications and implications of science, though it orchestrates this debate carefully and has no facilities for open discussion.

News@Nature, the Internet news service associated with the scientific journal *Nature*, offers 'the best in science journalism', and provides lively, well-informed coverage of science and its institutions. This site's Specials correspond to the Dossiers on Scidev.net or Special Reports on *Guardian*

Unlimited, but their external linking is superficial. The gesture in the direction of newer formats—blogs—is also superficial; the blogs are written by *Nature* journalists as diaries from assignments, without the characteristic 'blogosphere' features of references to other sources, or facilities for comment. *Scientific American*'s website is more open in this regard; its journalists' blog entries on contested topics include links to external sites and a 'Trackback' comment feature.

These examples represent a partial, and uneven, adoption of the features of the Internet that can support and enhance science reporting, and have it contribute more effectively to the public discussion of, and participation in, science that are widely regarded as essential for the democratic health of society. The Internet provides the means to present new scientific developments in ways that promote dialogue and conversation. Achieving this requires that those reporting science take different stances from those of established science journalism. But specialist science journalists have had a privileged position for some decades as the principal arbiters of what scientific information enters the public domain and how it does it. Their prevailing practices—including those applied on the Internet—indicate that they aim to maintain this privilege.

WEBSITES MENTIONED

AlphaGalileo
News@Nature
HMS Beagle (until 2002)
BioMedNet (until 2004)
Scidev.net

FURTHER READING

Friedman, S, Dunwoody, S and Rogers, C (eds.) (1999) *Communicating Uncertainty: Media Coverage of New and Controversial Science* Mahwah, NJ: Lawrence Erlbaum

Pavlik, J (2000) 'The Impact of Technology on Journalism' *Journalism Studies*, 1 (2), 229–237

Renehan, E (2000) *Scientific American Guide to Science on the Internet* (Scientific American)—e-book downloadable at http://www.sciam.com

Rzepa, H (1998) 'The Internet as a Medium for Science Communication', in Scanlon, E, Hill, R, and Junker, K (eds.) *Communicating Science—Vol. 1: Professional Contexts* London: Routledge

Various articles in *Science Communication*, vol. 22, no.3; vol. 22, no. 4; vol. 24, no. 3

14 The end of science journalism[1]

Jon Franklin

I wanted to be a science writer for the same reason that many people probably wanted to be scientists. For my generation, at least in our youth, truth and beauty were as one. I dabbled in poetry and paleontology, astronomy and architecture. I finally chose writing because it gave me art and science as well. I'd never heard the phrase 'science writer' but science was always my subject. When I went into daily newspapering in the late 1960s I told my editor I wanted to be a science writer. He grunted and said the paper didn't need one of those. But history was against him, and the young kid he'd hired had a talent for finding science in any story he was assigned. Early on I turned a story about the city's rat eradication program into a piece that could have blended seamlessly with Zinsser's Rats, Lice and History. In my hands a zoning story metamorphosed into a piece on urban demographics. A school bond issue assignment came back to my editor in the form of an un-rejectable profile of a chemistry teacher. The editors grumbled but the readers loved it and soon everyone outside the paper referred to me as a 'science writer'. I will never forget the great victory it was, the first time my boss called me that. Or at least it seemed a victory at the time. Now it makes me incomparably sad. I was so young. We all were. And so, then, was our world.

POST-WAR IDOLATRY OF THE 1950S

World War II was the turning point of our age. After that science ceased to be an obscure practice of erratic geniuses with bubbling test tubes and Van de Graaff generators. Science won the war and produced the industrial momentum that carried us into a time of great progress. But high technology had a split personality. Its very conception was shrouded in secret, so that it both existed and didn't exist. I don't know about Oak Ridge but if you look at a vintage map of central New Mexico, circa 1945, Los Alamos just wasn't there. You could see its lights from Santa Fe, but it wasn't there. Military necessity notwithstanding, I think the secret kept so well in part because it struck a Freudian harmony. We were afraid. We were ashamed.

Maybe those are not the correct words, but whatever was happening was at least in one respect like sex, in that it could not bear public witness. Afterward science remained separate from what we thought of as 'normal life'. Some of us kids were interested in science, but others thought us odd. At one point I argued with one of my teachers that human beings would soon travel in space. The teacher called my mother, and my mother was so concerned she took me to a psychiatrist. He gave me a tongue-lashing about terrorizing grown-ups, and reassured my mother I was just going through a phase. The strangeness of science to the average American was a measure of their denial. I have just spent several years reading from the Fifties, everything from comic books to *Look* magazine, and science was oozing into contemporary life through every open pore, changing and redefining it at every level. Portable radios, automatic transmissions, antibiotics became commonplace. Television flickered alive. In the wake of agricultural change the great migration from the farm to the city was completed. Society got more complex and interwoven. This was all accompanied by a bright, Mary Poppins optimism that even sounded a bit tinny at the time.

I mean, it was bizarre. The optimism was a thin veneer over what I can only call stark terror. The world, we were told, could vanish in two hours. Guided missiles would later cut that to fifteen minutes. We were taught to crawl under our desks when the sirens went, and I think the grown-ups had convinced themselves that might really help. But we knew better. I'm talking grade school, now. Nuclear terror pervaded all of life, subsuming deeper terrors that were ultimately more important. Progress was wonderful but there was the feeling we were outdriving our cultural lights. Men whose fathers had plowed fields with mules now earned their livelihoods sitting at desks, moving bits of paper. Women prepared canned food, watched television—my God, they even wore pants! The children were unemployed and out of control, and use of the phrase 'juvenile delinquency' was common. There was poison in the water, fluoride it was. Senator Joe McCarthy waved a handful of documents that he said proved the State Department was full of communists— and the nation believed him.

My point, lest we squirm by it, is that the very fabric of the postwar era was a tapestry of science and technology, and if its woof was optimism and innocence its warp was the deepest kind of horror and the most degrading kind of corruption.

THE TWO CULTURES

From the beginning a few journalists had written about things scientific, of course, but they were few. It wasn't until the sixties that journalism could no longer ignore science. Editors had to do something. 'Doing something', to an editor, means assigning someone to it. Ah, the fates, they are fickle. Something pops into an editor's head, he scans the newsroom, and his eyes

come to rest on you. Take him. He's not doing anything important at the moment. Just like that, your life changes. Walter Sullivan, a familiar name in science writing, was originally a music writer. Science meanwhile was expanding far ahead of the average literacy curve.

When Sputnik went up in November 1957 my science teacher, who was also the coach, gathered us all around to reassure us that it was all a Big Red Lie. There was no Sputnik. He knew that because it violated one of the basic laws of physics, to wit: What goes up must come down. There were, as I say, two Americas. Physics was already an industry, having followed a growth curve that would later be duplicated by other sciences. There were thousands of physicists at work, discovering things, but I'd like to focus here on an observation made by a fellow called C.P. Snow (1959). Snow was a British physicist who had helped build the bomb and then later joined the cold war weapons bureaucracy. But he was also a novelist (and a rather good one), and as a novelist he was required to attend numerous academic cocktail parties. Because he wrote about the administration of science these gatherings attracted faculty members from both the sciences and the humanities.

Those of you whose existence predates the popularity of Perrier will remember the cocktail party as the high watermark of civilized boredom. Snow, in the grip of this boredom, amused himself by observing his fellow party-goers. And he noticed something rather odd: Scientists and humanists had a marked tendency to drift apart. It wasn't that the two groups hated each other, but they had little in the way of common language or interests. They tended to think differently. It was awkward for a physicist and a rhetorician to discuss child-rearing. They were polite, ate the olives out of their martinis, and drifted on in search of more suitable companions. The humanists and scientists aggregated in separate groups, birds of a feather. What Snow observed was a cleavage that would grow for the remainder of the century. Our culture was separating into two parts, scientists and everyone else. Most people were technologically ignorant. Those in the know composed an increasingly elite aristocracy that held power by its command of counterintuitive knowledge.

This was not new. Since the beginning of the Enlightenment people had tended to be either very literate in science or not literate at all. This ground was famously fought over in the eighteenth century by the rationalist Voltaire and the romanticist Rousseau. Voltaire had his way in the end, but Rousseaueans have often formed a separate class of technological naysayers. After World War II the schism was exacerbated by the pace of technological events. By 1960 it was palpable even at an academic reception. The rift was definitely there, and it was definitely increasing, and while we may argue about the social seismology involved there is one thing that any science writer can tell you for certain: the laboratory was on one side of the fault line, and the newsroom the other.

The river of language is deep. Most journalists who occupy beats are called 'reporters', as in 'court reporter', 'city hall reporter', or 'Washington reporter', at least until they became columnists or pundits. So it's remarkable that anyone who got the science beat instantly became a 'science writer'. But the universal experience on the science beat was that the reporting was a piece of cake. There was news everywhere, and people were eager to give it to you. The difficult part was figuring out what they were talking about and reducing it to the vernacular. Everything changed when you crossed the cultural barricades. The language underwent dramatic conversions, as did perceptions of relevance. Scientists saw the world as theory and fact, observation and prediction, statistical significance and probability. The rest of the world titrated experience in terms of motive and morality, right and justice, miracles and fate.

In some respects Walter Sullivan, the renowned science writer of the *New York Times*, who covered the physical sciences in a day when scientists were still revered, had it easy. If the reader misunderstood black holes or the space-time continuum, little harm was done. But when the second generation of science writers came along the action was in biology and medicine. There is a law of psychology that says our perspective on any given subject is degraded by its proximity to our selves, which is probably why we know more about astronomy than we do about human nature. In any event biology was closer, the reader was full of prejudices, and what you don't know about medicine can indeed hurt you. A lot of people are killed by their ignorance of their own bodies.

The first of my cohort came along about the time electron microscopes produced the first images of viruses. Suddenly everyone was talking about viruses. Viruses were indeed important, scientifically, because they contained all the essential elements of genetic programming. If you understood biology you knew that very quickly now somebody was going to figure out how the genetic code was packed in there. And people tried to write that story. But what caught the interest of editors and the public? Not some esoterica about replication. No, no, no! Everyone wanted to know whether or not the virus was alive. The lay culture was about a hundred years behind the molecular biologists, and was thinking in terms of vital principle. Viruses could vacillate between being a crystal and being a piece of life, and people were stunned by the mechanistic implications. In the mid-fifties the popular press printed endless discussions of whether or not viruses were alive. The reporters went to all the right scientists and asked all the wrong questions. They knew they were the wrong questions, they had to know. Certainly the scientists knew. But what was important wasn't what got into print. A few years later the discovery of the genetic code in DNA came as a total shock to the public psyche. This is the way it was. Biochemistry was deconstructing life and people wanted to know if fluoride was really a poison—they still do, many of them. Science writers men-

tioned life in the universe and the public thought UFO. We wanted to talk about cancer science. What they wanted was hope and miracle cures.

THE END OF IDOLATRY

Scientists are forever complaining that they are misunderstood and misrepresented, and I agree. But imagine what it's like to be the guy in the middle, to be caught up in the distortion process, to find yourself bargaining passionately for a tad more accuracy in a story, say, about UFOs or cold fusion. So we weren't science reporters, we were science writers, and our job was interpretation. We science writers learned how sausage was made, and worked within the system to communicate more clearly and more accurately, not to say more truthfully. But the distortion began as soon as the copy left our hands. No, let me be brutally honest. Distortion began the very moment we conceived the story, as we angled our perspective to please our editors. As soon as we picked up the phone we started censoring ourselves, second-guessing the story, trying somehow to make something useful out of whatever we had. A lot of my colleagues will deny this, but I think the result speaks for itself. Science, whatever its complaints about journalism, almost always came out on the glorious end of the story. That's why it could stay above the fray. Our tendency, with certain exceptions, was to idolize science. The public bought this. Science was Teflon, science spoke for Truth. In my era we didn't do investigative reporting on science, except maybe around the edges. Newsrooms are intensely political places and muckraking is a weapon wielded by killer reporters against political hard targets. We never, ever, went after science. Science was sacrosanct.

Scientists thought of themselves as apolitical. That they had that luxury was a measure of the privilege they enjoyed. In our political system nothing is apolitical. As soon as science started being financed by public dollars it was political. Science was the darling of both parties. Liberals had backed science from the very beginning of the Enlightenment, and conservatives had come aboard because of the Cold War. Scientists, innocents that they were, confused being in political favor with being apolitical. It is useful to think of science as the faith of the Enlightenment. Scientists hate this. They don't want the responsibilities of priesthood. But the role is embedded in the most fundamental first dogma of Enlightenment philosophers and scientists. In the medieval period we thought the world was an illusion, created by Satan, and it was faith, the wisdom of the heart, that was pure. Now we think the world is reality and faith is an illusion. I have a whole lecture I give about how we cast scientists as priests, in their white cloaks, with their stethoscopes or whatever. Oh, sure, beginning with Newton science gave religion lip service, but with every 'amen' they moved God yet another step away from daily life, until they had Him tucked back somewhere behind the big bang. Science can deny its religious role as much as it

likes, but when it's done denying we'll all genuflect. This sacred atmosphere was the air a science writer breathed.

The human mind was a duality, theme and counter-theme. History was made of that. In the medieval period, rationality was a counter-theme; in the Enlightenment, medieval thinking became a counter-theme to science. Such thinking favors emotional truth over empirical truth. I referred earlier to Voltaire and Rousseau. Voltaire championed science, reason, and progress; Rousseau's themes were echoed in a series of uprisings in which peasants wrecked the mechanical looms that were putting cottage weavers out of business. A number of insurgents were caught and hanged. Legend says that Ned Ludd, their leader, was among them. He was the Forrest Gump of his time. Many remember him today as a martyr.

By the seventies, when I went to work in Baltimore, Snow's cultural gap had become a chasm. Earlier science writers had found ignorance a problem; now there was hostility as well. You had to be an oyster not to notice it. Many journalists turned against science, were articulate about it. Animal rights activists called you at 3 am and told you what dress your daughter had worn to class that day. I am aware that most Americans still tell pollsters they believe in science. But talk to those people; the so-called 'science' they believe in includes astrology, yoga, and ESP. They don't know what science *is*. In one study of American science literacy, half did not understand that the earth travels around the sun. Only 6 per cent of adults could be considered scientifically literate. More than half the students at Hollins College believed in ghosts and mental telepathy.

If you believe in the power of the press the most frightening poll was taken at the Columbia Graduate School of Journalism, one of my profession's most elite institutions: 57 per cent of the student journalists believed in ESP; 57 per cent believed in dousing; 47 per cent in aura reading; and 25 per cent in the lost continent of Atlantis (see also the recent US Science Indicators, 2006). Another poll showed that two thirds of newspaper managing editors thought humans and dinosaurs lived at the same time, and that there was a 'dark' side of the moon, upon which light never fell.

THREE-MILE ISLAND: THE TURNING POINT

In the late 1970s I was forced to rethink my journalistic strategy. I had been reporting and explaining discoveries, but my stories were not being widely read. I generally used the word 'science' early in the story, thinking it would attract readers. The word generally ended up in the headline. But I now realized that the effect was to tell general readers what to avoid. They might trust science in theory, but in practice it had bad personal associations. It confused them, made them feel negative about themselves. Science pages ghettoized science news, gave people a whole section they could throw away unread. There was something more sinister afoot, as

well. As attitudes changed, editors started wanting a certain negative spin on science stories. If you didn't comply you got played inside, or your existence was otherwise made uncomfortable. Some science writers, especially those who identified with the ecology movement, saw hostility to science as a path to success. Many reporters, outspokenly neutral on other topics, found it easy to align themselves with the anti-science faction. This was often couched in terms favoring plurality, and an openness toward 'other ways of knowing'.

The turning point for me was when Three Mile Island blew on 28 March 1979. I am aware that TMI did not 'blow', but I'm talking journalism here, not science and in the newsroom, the story went off like Eniwetok. My editors didn't send me, though. They saw me as biased toward science, and so they assigned an environmental advocate who also happened to be outspokenly against nuclear power. The resulting headlines implied that Baltimore was in imminent danger. Years later, when Chernobyl went in April 1986, one of the wire services moved a story that said 200,000 people were killed in the first few minutes. That sounded reasonable to wire editors. This isn't an argument for nuclear power. I'm just relating experiences that you can appreciate. If this was a more biological audience I'd tell different horror stories. I actually have more of those, because most of my work was in medicine, biochemistry, neuropsychology, and the like.

These stories always have a personal side. I happened to be a gardener, and mine was the kind of newsroom where people brought in their produce and piled it on a table for others to take home. But at the end of the day my tomatoes, my cukes, my cantaloupes, they were still sitting on the table. This happened several times and I was really hurt, so I asked one of my friends. He hemmed and hawed and said, well, Franklin, you're a scientist and so they don't know *what* you may have done to those vegetables, or what you put on them, or anything. I wasn't a scientist. I only associated with scientists. But that was enough. They were afraid of me.

It was said, then, that there were more scientists working than had existed in all the years since Newton. Many were training graduate students and post-docs, so that there were ten scientists to take the place of each one who retired. This had been going on for decades, and there was an expectation of continued expansion. They were wonderful years for me, too. Once I started down the road of leaving the word 'science' out of my stories, I wrote about science as though it were a normal human activity. That sold surprisingly well. Pretty soon I was concentrating on essays and narrated stories, and getting a nice slice of readership. I won some prizes, which makes newsroom life easier, and I started thinking about books. Truly I loved that life. It gave me access to all these great minds on the cutting edge of knowledge. Once I asked a Nobel prizewinner for some advice. He was having a meeting at the time with several senior scientists. He shooed them out and spent the next three hours explaining restriction enzymes to me. Isn't that an amazing story? Yet it's true. It happened all the time.

Anyway, I was happy and science was good and the money was flowing. Richard Nixon, echoing John Kennedy's promise to land men on the moon by 1970, vowed to cure cancer in ten years. I didn't know a single cancer scientist who thought that likely, but nobody would say so on the record. They winked at me. They wanted a piece of the action. I am aware that there are exceptions to this bright picture, and they're significant. The post-Sputnik boom in physics had by the seventies produced a glutted market, and we were running stories about people with PhDs in physics who were unable to get jobs, who were driving taxi cabs. Will you be surprised, or shocked, if I tell you I have sat there on the city desk and watched editors and reporters read those stories and throw back their heads and laugh?

Over among the technologically unwashed, science had lost its halo, and a tension was building. It was already manifest in the arts. Very early in this period there was a remake of *Frankenstein*, originally written by Mary Shelley at about the time of the Luddite uprisings. Dr. Frankenstein, mad with power, usurped the prerogatives of the gods and accidentally unleashed forces of evil too powerful to contain. One result was his own death. That last part about his own death is an eternal element of good drama. It is a rule on TV that the bad guy has to get it in the neck before the final curtain falls.

Well, at about the time that journalists were laughing at out-of-work physicists a Pennsylvania research group was studying the growth of anti-science attitudes. One study showed that people who watched a lot of television tended to be biased against science. A follow-up focused on the mortality rates of the various professional groups portrayed on television. It turned out that TV scientists had the highest fatality rate of any occupational group on the airwaves, with fully 10 per cent of them dead before the closing credits. Even lawyers fared better. The message is clear: Science, like crime, doesn't pay. Or shouldn't. It's no different in the movies. Look, for instance, at *ET*. What did the scientists want to do to this friendly little feller from another world? Why, they wanted to cut him up, of course: Vivisection was what was on their minds. They were little better than butchers. The evil father, in *Star Wars*: what had happened to him? He had been touched by science. Or take *Jurassic Park*. Who was the villain there? These are all remakes of the Frankenstein theme, and they play well in Peoria.

Journalism, meanwhile, was changing. It became difficult and then impossible to get the time and space that good science writing required. I had enough clout to continue my own narrative work, at least for the moment, but the pressure was for 'harder' coverage investigative stories about science. Science writers who were pugnacious toward science had an edge in assignments and promotions. The gotcha story, so conspicuously absent from science coverage, now arrived. Reports surfaced about scientific malfeasance, misappropriation, and dishonesty. The dam-breaker was the story about the misuse of scientific overhead at Stanford. Later, the *Chicago Tribune* did a major take-out on the contradictory claims for the

discovery of the AIDS virus: very, very dirty laundry. Science was a sitting duck for this. Scientists were accustomed to solicitous, if perhaps inaccurate, treatment by the press. They had dealt with science writers. Now there were science reporters on their trail, and that was another thing entirely. It had never occurred to many scientists that their grant requests, their reports, their memos—this stuff is all public record. Science is a muckrakers' paradise, like shooting fish in a barrel, and I predict that you are going to see a whole lot more of it in the future.

THE END OF THE POST-WAR EXPANSION: STEADY STATE FUNDING

All this provided cover for those who would use the budget-cutting mood as an excuse to take the knife to science. Science budgets had once risen geometrically, but in recent years they hadn't kept up with inflation especially if you figured in the rapidly rising costs of regulation and administration. Many anti-science advocates, among them animal rights and anti-nuclear groups, have long advocated the use of regulation to suffocate science. Each regulation seems harmless enough, and is difficult to oppose, but together they can be deadly. This had an impact, and a lot of sciences were hurting already. Then came Congressman John Dingell and friends: Science, as a community, might be able to withstand the pressure, but science has never been a community. When NASA was in trouble, bench scientists lined up to take swipes at it. Climatologists despise particle physicists. Biologists well, I actually lost one good source, a research physician, by objecting to his intemperate criticism of both NASA and the supercollider. He got frosty and stayed that way. On the other hand, it's extremely easy to find a physicist who'll serve on the board of a creationist group. Scientists are all in this together, whether they like it or not, but they don't know that yet, and I'm not sure they're going to find out in time. What all this means is that science's political childhood is over, and what is true of science is doubly true for the science writer.

Not that science news is on the wane. Broadly defined, it takes up an increasing percentage of the news columns. A few days ago I read through my local paper as a reality check, and it was full of science news—social science, space science, a story on salmon ecology, another on medicine. Science is pervasive in our civic life as it is in our lives, generally. But a smaller and smaller percentage of this science journalism is being written by science writers, or even science reporters. Much of it, as a result, is grossly inaccurate if not in fact then in tone, play, and context. My scientist friends bitch a lot about this. I used to tell them not to judge the whole profession by how it covered science. Political coverage is much more in the journalistic tradition. Journalism grew up with democratic politics, has even been called the fourth estate of government. Many reporters have degrees in

political science, so they do a better job of politics, or at least they used to. Today, with so much of politics tangled up in science, I'm not sure that is true anymore. As for me, I saw the handwriting on the wall but thought I could be of some value educating the next generation of science writers. In 1989 I took a job as head of the science journalism department at Oregon State University. OSU is Oregon's premier science campus, and its journalism department was the only undergraduate science journalism department in the country. There are several graduate institutions that teach science journalism, but most journalists do not have advanced degrees.

In any event, shortly after I arrived the voters of Oregon approved a tax-cutting measure that fell heavily on higher education. OSU decided science journalism was expendable. I knew the news industry wasn't going to support the program, but I thought science might. The critical player was OSU's dean of sciences. I went to him, hat in hand. I'll never forget his response. 'That's your problem', he said. 'We don't need you'. I left the university, of course. Shortly thereafter they closed down science journalism. It looked for a while like they might also close the ballroom dance program. But they found money to keep that. Also, that year, the university undertook a multimillion-dollar renovation of its football stadium.

There comes a time in every professional life when circumstances bring you to a pause, and a reassessment. So I thought long and hard about what that science dean said. I finally decided that there was no anger there, and no arrogance, just indifference. He was stating what, to him, was a fact. My own writing in the meanwhile was doing quite well. I wasn't exactly getting rich, but I was writing well and people liked what I was doing, and my own future was being clarified. I no longer called myself a science writer very often, because it seemed to put people off. More and more of my thinking was about people not science, about human problems, and the courage or cowardice or determination or whatever human beings summon in response. So I pushed the science into the background. Pretty soon I had de-emphasized science so much that it almost wasn't there. No, no. That's not right. It was very much there. It was the fabric of the life in my stories, the scenery that seeped into everything. In my work, as in our lives, science had simply become a condition of existence.

By this time I was on the Internet, and beginning to realize its potential as a literary medium. I considered moderating a listserver for science writers, but started one for writers, instead. Several of us started assembling what I think will be the foundations for a literary marketplace. This is all wildly exciting and relevant here mainly because it adds perspective to some of the other things I've just said. My laments are not personal. Meanwhile, though, I did the professional autopsy. It seemed necessary. I had invested many years and a lot of creative energy in science writing. I'd thought I'd done good work for a good cause, translating science. I thought I was helping the two societies exist together in the modern world. But, you

know when you cut a corpse open and look at it piece by piece, there on the stainless steel, it's difficult to be romantic.

I'll tell you why I was a science writer, and there wasn't a drop of altruism in it. I like science. I like the game. I like the idea that knowledge is a frontier, that inquisitiveness is a force. I was enthralled by the revolution in neuroscience, and I followed it like some people follow baseball. I got to dabble in everything. Once I was at Kitt Peak, and got to bend over the lens container and stare down into that beautiful, bottomless piece of perfectly-ground glass that was the same color of the night sky. I remember seeing my first autopsy, my first brain operation. And hey! Have any of you guys ever seen a manned flight lift off, down at the Cape? The sound is what you remember. It doesn't come through the television speakers, it's too deep. You have to be there! It makes your bones vibrate for hours afterwards. I had a shot at the short list to ride that thing! And I'll tell you something else: It was some of the best material a writer could possibly ask for. It was like covering a major war and the United Nations and the White House and a mass murder, all at once, and with almost no competition. So much for altruism: I didn't do it for science, and I didn't do it for mankind. I did it for me, and it was worth it.

Saying that gives me space to say the other thing, which the moment requires. Because there was a lot of power there, for a little while, being a science writer, and if I wasn't serving any great altruistic purpose then what purpose was I serving? Journalistic power only comes when you somehow engage history. So what had I connected with? Once I asked the question the answer came to me in a fairly straightforward fashion, and I'll share it with you in a moment.

Meanwhile I also had the space to notice some other things. Whatever I may have misunderstood or glossed over in my science writing years, I had at least gotten the C.P. Snow thing right. There were two societies, as separate as oil and water. And the larger one, the one that included most of my family and friends and most Americans, was in real trouble. The culture was torn by factional strife. Millions were unemployed or employed doing work that was neither challenging nor respected, and those who had decent jobs lived in moment to moment terror of losing them. In frustration, they were lashing out at everything intellectual. School budgets were being cut, the core of our universities were being dismantled, it was as if the nonscientific culture had decided that it did not need science, or mathematics, and of course from that perspective learning is all the same, and so the animosity extended to history, literature, and the institutions of learning that harbored them.

This was old news, but as I rethought it I noticed for the first time that something was missing. Where were the clear, reasonable, intelligent voices of the best educated and most intelligent people I knew? Where were the scientists? On these great, visceral, life-and-death issues of the day, from

the crisis in education to the crisis in health care, the voice of the scientific community was conspicuous in its absence. Sure, a scientist might do Saturday in a soup kitchen, or support the local library, or whatever. But these were offhand and largely risk-free acts of individuals. When it came to taking important stands, and articulating basic principles, the scientific culture had pretty much taken a walk.

This realization was stunning. In our civic musings we had worried endlessly about how a democracy could function if the larger populace didn't care, or know enough to vote, or whatever. That was one of the justifications for journalistic privilege. But I had never heard anyone ask what would happen if the best and the brightest of us climbed up on an ivory tower and put their heads in a cloud and told themselves they were above it all. Well, that is apparently what happened. Our leaders, or at least the people I think should lead, turned out to be a bunch of political eunuchs. Okay. I admit it is more complicated than that, yes. But I have only an hour. Think about it. I would like to say, also, that to the extent that I describe reality, we have only ourselves to blame. There is a deep anti-intellectualism in the American culture, and our political system tends to reward it. In science, there has always been a certain otherworldliness, a sense of self-containment and aloofness, and abandonment to a sterile island might exquisitely suit the crime.

But those are asides. I came here to talk about science writing, and in the bill of particulars I have presented to you we are there with the rest. We were on duty, right at the epicenter, witnesses to the whole affair. We should have seen its implications, but it was not in our interest to do so. We allowed ourselves to be dazzled by the power of science, and we forgot the power of art. We yammered on about bridging the chasm between the cultures, and about translation. We called ourselves writers, but we failed in our artistic responsibility to look directly at the world and articulate what we saw. We allowed someone else's definition to be imposed on us and our art. 'Science writer!' It had such a ring. Like many others I didn't just acquiesce. I sought it, achieved it, internalized it, and wore it with pride. Meanwhile we all witlessly connived in putting a pretty face on the ugly thing that was transpiring all around us.

JUST GOOD WRITING, NOT SCIENCE WRITING

Let me suggest to you that science writing, as it appeared in the late fifties and in the sixties and is only now waning, was not at all what it claimed to be, that it was, rather, a part of a much broader, almost Freudian psychosocial urge to keep science comfortably compartmentalized, out of the mainstream of life. The science writer had a very unique, separate, ad hoc beat. By its very existence it defined science as a weird appendage that had attached itself to our culture—all these physicists and chemists and psy-

choanatomists and the like—you know, we can't live with 'em and we can't live without 'em: Gotta have a specialist to just report on them.

The science writer was supposed to be a translator, and it was often phrased exactly that way. Well, one of the things translators do is make it unnecessary for us to learn the other fellow's language. There is another danger, as well, as those of you who have ever done any international negotiating will know. The translator is always in great danger of becoming the de facto negotiator. That is, he is apt to start putting a spin on what Joe says, so as to prevent Sam from getting mad, and then making similar corrections when Sam answers back. First thing you know all the differences have been absorbed by the translator. The problem doesn't show up until it comes time to actually do the deal, which falls apart because each party agreed to different things. I think we science writers did that. We softened science's priestly image, concealed that aspect of its character that I call intelligent focus but others label arrogance. We helped carry science's political water, and in the process of all this we became acolytes and enablers for a society with a bad case of split personality. We helped it avoid confronting the problem.

The two cultures, and I mean both them, wanted to have their cake and eat it too. The humanistic culture wanted to embrace romanticism and do it on the Internet, while living 30 per cent longer and being 80 per cent richer. The scientific culture wanted to continue telling itself it was above the fray and apolitical, and that it was doing what it was doing for love of knowledge; that it was a priesthood, in short, but without priestly duties or responsibilities. Well, I quit. We can't have it both ways. Either we are going to live in the Enlightenment or we are not. We can be Voltaire or we can be Rousseau but we cannot be both. At least we cannot be both and survive without constructing some very rational psychosocial firewalls. I speak to you now not as a science writer but as a writer. It is my artistic observation that my civilization is on the brink of a great decision about itself, and that it is high time to dispense with translators. It is time for scientists to come to terms with the fact that they're eating at the political trough and that they'd damned well better make their political case, and make it in a way that real people can understand it. It is also time for people to come to terms with the fact that the world as we know it, as a haven for couch potatoes and New Agers and critical humanists, exists only because of science and technology, and was created at great cost not only in money but in individual effort, labor, and yes, faith. For empirically science is not a substitute for faith, it is a faith, it is a church, no less real for its austerity, and that is the other thing we have to deal with. Rather, you do, I don't.

An artist's place, a writer's place, is different. My generation has been very sterile, artistically, and I have touched on some of the causes, but it bears mention here that some of the best writing of our day focuses on the subject of science. I might mention, sort of offhand, Tom Wolfe's *The Right Stuff* and any number of pieces by John McPhee. But we don't call

them science writers, do we? No, we don't, any more than we would call Hemingway a war writer, or Steinbeck a poverty writer, or Mark Twain a children's writer. Writers by their nature deal with the central turmoil of the human condition that is to say, the human enigma. This enigma is something like the influenza virus, in that as soon as you think you've identified it, it changes its shape. It becomes something that has never before been seen in its present form but which, once you figure it out, is heavily foreshadowed by history. To switch metaphors, this is the stuff of Greek tragedy. We are all Oedipus. Each of us stands before the sphinx, and is given a new riddle.

If I mistook myself for a science writer, which is to say a specialty writer, well that was a measure of my own innocence and self-doubt, which was no less than anyone else's. It was an easy enough mistake to make, for any of us to make. Being a science writer, like being a scientist, seemed like a nice, pleasant, well-defined niche, but it was no such thing. For we were born into a moment in which the chief problem besetting our kind was the conflict between the two cultures, between ourselves and ourselves, between what we felt we knew and what we thought we felt. If science was ever a thing apart, a special way of living and of seeing things, that time is past. Today, science is the vital principle of our civilization. To do science is critical, to defend it is the kernel of political realism. To define it in words is to be, quite simply, a writer, working the historical mainstream of literature.

NOTE

1. A slightly different version of this text was first delivered as The Alfred and Julia Hill Lecture, University of Tennessee, March 17, 1997, ©1997 by Jon Franklin jonfrank@nasw.org.

REFERENCES

National Science Foundation (NSF) (2006) *Science Indicators*, chapter 7, public attitudes and understanding, Washington,D.C.: National Science Foundation

Snow G P (1959) 'The two cultures', *Encounter*, 69, June

Part III

Public relations for science

Practitioners' perspectives

15 The Royal Society and the debate on climate change

Bob Ward

The Royal Society is the UK national academy of science. Founded in 1660, it is the world's oldest science academy in continuous existence. The Society was established to promote the 'new experimental philosophy', namely that new knowledge is acquired by constantly testing ideas and theories through observation and experiment, and accepting only those for which there is evidence. This was the revolutionary idea behind the Royal Society and is embodied in its motto 'Nullius in verba'. Above all else, Fellows of the Royal Society have sought, through ceaseless enquiry, a better understanding of ourselves and the universe in which we live.

Throughout its history, the Society has attempted to ensure that policy-making takes account of the knowledge, insights, and evidence provided by science. Until recently, these efforts have been directed almost exclusively at policy-makers. However, over the past few years, the Society has increasingly sought to play a role in the public debate of science in policy-making, including its portrayal in the media.

The ambition to encourage informed public debate entered a new phase in 1998 when controversy arose in the UK media about the perceived benefits, limitations, and risks of genetic modification (GM). The Society sought to counter some of the inaccurate reporting of scientific evidence surrounding GM technology at a time when the academic scientific community found itself caught in the middle of an increasingly polarised debate, between industry on one side and anti-GM campaigners on the other, about its applications.

Since that time, the Society has strengthened its media relations activities. Today the Society's media relations team aims to improve the impact of the organisation's work by communicating information to targeted audiences through the print, broadcast, and online media in the UK and overseas. The Society does not seek media coverage for its own sake—it aims to use the media coverage to achieve the outcomes sought by the organisation. These outcomes, in no particular order, include:

- Informing a wide audience of new developments in science, engineering, and technology;

- Increasing an appreciation of the achievements and limitations of science and scientists and encouraging an interest among individuals of all ages;
- Ensuring that public discussion about major issues in science and technology include contributions from the national academy of science, and when appropriate, leading public debate;
- Creating and maintaining a positive profile for the Society with which supporters and funders will want to be associated;
- Mounting an effective response to reports and commentary affecting the reputation of the Society, its Officers, Council, Fellows, and staff;
- Soliciting support for the Society's views and exerting pressure on policy-makers to act upon the Society's advice;
- Complementing marketing and communication activities to solicit applications for schemes or grants, or to participate in activities; and
- Fulfilling a commitment to openness and transparency and thereby earning the confidence of the science community and wider society.

To achieve these aims, the Society has had to embrace the same modern methods of media relations that other organisations employ, whilst remaining non-partisan. As McNair pointed out:

> As the role of the media in mediating between politicians and public has increased, so has the importance of those publicists, press agents and others in what we may refer to as the political public relations industry. Brave (and probably doomed to failure) is the organisation which ventures into the contemporary political arena without a more or less sophisticated understanding of how the media work and the professional public relations machinery capable of putting that knowledge to good use. For all political actors, from presidents and prime ministers to trade union leaders and terrorists, this is now recognised to be a major prerequisite of successful intervention in public debate and governmental decision-making. (McNair, 2003: xiv)

This paper seeks to illustrate the methods employed by the Royal Society's media relations team by outlining a media campaign, started by the Society in January 2005, to tackle misrepresentation of the scientific evidence on climate change in the UK national print, broadcast, and online media. This paper describes the background to the campaign, how it was planned and executed, and the main lessons that have emerged from it.

SCIENTIFIC REPORTING OF CLIMATE CHANGE

Governments have recognised the need for authoritative advice on the causes and potential impacts of rising greenhouse levels and in 1988 established

the Intergovernmental Panel on Climate Change (IPCC), through the United Nations Environment Programme and the World Meteorological Organisation. The IPCC has published a number of authoritative documents to assist informed policy-making, including three major assessment reports.

The IPCC Third Assessment Report was published in four stages during 2001, and involved some 1,250 authors and reviewers from 56 countries. The report of Working Group I on the science of climate change (2001) took three years to prepare, involving 123 lead authors from around the world, drawing on 516 contributing authors. The report's 'Summary for Policymakers' concluded: 'There is new and stronger evidence that most of the warming observed over the last 50 years is attributable to human activities'. The Working Group had carefully considered the full range of views among climate scientists, including those holding comparatively marginal views, and quantifying any uncertainties in knowledge. The main findings of the IPCC reports have been accepted by the world's major scientific organisations (Royal Society, 2001; Ciccerone et al., 2001).

MEDIA COVERAGE OF CLIMATE CHANGE

Media reporting around the world of climate change does not always accurately reflect the consensus that is evident from the scientific literature. For instance, Kollmuss (2002) analysed samples of coverage of climate change in 'quality' newspapers in the United States, UK, Germany, and India between September 1999 and March 2000. She assessed not just the quantity of the coverage but its content relative to a five-point scale ranging from 'article refutes the existence of (human-induced) climate change strongly and attacks the mainstream scientists or politicians', to 'article acknowledges (human-induced) climate change and conveys urgency of the problem (…and use only quotes that strongly urge action)' (pp 179–180).

Kollmuss (ibid.) concluded that UK newspapers generally published more articles about climate change, but the tone of those appearing in *The Daily Telegraph* and *The Sunday Telegraph* tended to be closer, on average, to the 'refutes' end of the scale than those in *The Guardian*, *The Observer*, *The Times,* and *The Sunday Times*. She also indicated that 'the science of climate change is portrayed, especially in more conservative newspapers, as a debate between environmentalists and climate sceptics' (p 172).

In late 2004 and early 2005, the Royal Society media relations team carried out an informal assessment of how various UK national media were covering climate change issues, and particularly the science. None of the UK media had openly declared campaigns on climate change, and all, to varying degrees tended to report research on climate change in a way that reflected the scientific view. However, the editorial and opinion lines of some were similar in tone to campaigns. The assessment indicated that *The Guardian*, *The Observer*, *The Independent* and *The Independent on*

Sunday had adopted editorial and opinion lines that were strongly consistent with the scientific consensus and supported urgent action to tackle greenhouse gas emissions. In contrast, the *Daily Mail*, *The Daily Telegraph*, and *The Sunday Telegraph* appeared to have editorial and opinion lines that persistently opposed action to cut greenhouse gas emissions and expressed doubt about their contribution to climate change.

LOBBYING AND MEDIA COVERAGE OF CLIMATE CHANGE

There were signs in 2004 and at the beginning of 2005 that concerted efforts were being made to influence the way in which climate change science was covered by the UK media. These may have been prompted by the fact that the UK Prime Minister, Tony Blair, had indicated in June 2004 that climate change would be a major issue for the UK's presidency of the Group of Eight (G8) nations in 2005.

The United States Embassy in London held briefings with senior UK journalists at which individuals who opposed action on climate change, or who held views that were at odds with the IPCC consensus, were invited to outline their views. These briefings were attended by both science editors and news editors from the national print and broadcast media, including the BBC, and on one occasion featured the author Michael Crichton.

Lobby groups based in the United States also started to target the UK media. Many of these lobby groups oppose the Kyoto Protocol and particularly any attempts by the United States to honour the commitment made by President Clinton to reduce emissions. Their tactics include making efforts to undermine the case put forward by the IPCC. The staff of these lobby groups are not climate researchers and do not draw on their own new findings. Instead they tend to selectively cite, or even misrepresent, the scientific evidence to match their views. Sometimes they seek added credibility for their views by drawing on the reputations of a small minority of prominent dissenting scientists, who may or may not be climate researchers, but who reject the scientific consensus

The intentions of these lobby groups are illustrated by an 'Action Plan' (1998) produced for the American Petroleum Institute by the Global Climate Science Communications Team and reported by the *New York Times* in April 1998. The Team consisted of staff from lobby groups, such as Myron Ebell of Frontiers of Freedom, and industrial companies, such as Randy Randol of Exxon.

The Action Plan devised for the American Petroleum Institute outlined activities to persuade the United States Congress to reject the Kyoto Protocol and noted in its 'situation analysis' that 'those who oppose the treaty have done little to build a case against precipitous action on climate change based on the scientific uncertainty' (p 1). The 'project goal' was: 'a majority of the American public, including industry leadership, recognizes that sig-

nificant uncertainties exist in climate science, and therefore raises questions among those (e.g., Congress) who chart the future US course on global climate change' (p 3). The Action Plan outlined an objective to 'develop and implement a national media relations program to inform the media about uncertainties in climate science; to generate national, regional and local media coverage on scientific uncertainties, and thereby educate and inform the public, stimulating them to raise questions with policy makers' (p 4). A budget of '$600,000 plus paid advertising' (p 5) was proposed.

Further accounts of the efforts made by lobbyists to influence media coverage of climate change science in the United States are contained in Gelbspan (2004) and Mooney (2005).

In addition, the Royal Society's media relations team detected some examples of the media coverage in the UK in 2004 and early 2005 that appeared to be directly influenced by information distributed by lobby groups through their websites.

For instance, on 16 May 2005, *The Daily Telegraph* published an opinion piece by Neil Collins, drawing attention to a paper published in the journal *Advances in Space Physics* by Belov, Dorman, and others, describing the contribution of cosmic rays to global average temperatures (Belov et al., 2005). Collins said that the paper argued that 'cosmic ray intensity and variations in solar activity have been driving recent climate change'. This was completely untrue and a misrepresentation of the paper's contents. When Professor Dorman was alerted by the Royal Society's media relations team to the article by Collins, he made clear that the findings presented in the paper were completely consistent with the conclusion that emissions of greenhouse gases are the major cause of the recent rise in global average temperature.

It seems unlikely that Collins himself would have discovered the paper in the journal *Advances in Space Research* and interpreted its technical findings so rapidly. Indeed, even the authors were unaware that a pre-print version of their paper had appeared on the journal's website. However, Collins may have found out about the paper from its description on a website called 'Envirospin Watch', operated by a retired professor of geography, Philip Stott, who regularly appears in the UK media to reject the scientific consensus on climate change.

There are signs that the scientific community may also be using the World Wide Web to counter the spread of views rejecting the scientific consensus. A group of nine scientists established the website http://www.realclimate.org in 2004 to present a running commentary on climate change science and the activities of those who reject the scientific consensus.

THE ROYAL SOCIETY MEDIA CAMPAIGN ON CLIMATE CHANGE

In response to signs that lobby groups were starting to focus on influencing the UK media's coverage of climate change, the Royal Society's press

office initiated a media campaign in early 2005 to ensure that the views of the scientific community were not misrepresented or ignored.

The objectives of the campaign were to:

- Highlight the existence of a consensus view among scientists on climate change, taking appropriate account of uncertainties and dissenting views, as represented by the IPCC, and particularly its Third Assessment Report;
- Draw attention to examples of misrepresentations of the scientific evidence or views of the scientific community on climate change; and
- Raise the profile of the scientific community, and particularly the Royal Society, in the public debate about climate change, as another important key player alongside others such as environmental groups, anti-Kyoto lobby groups, and governments.

During the formulation of its campaign strategy, the Society was mindful that it has much smaller resources at its disposal than other organisations, such as major campaign groups and government, which also seek media coverage on climate change. For instance, Greenpeace International spent €2.5m in 2004 on its climate change campaign (Greenpeace Annual Report, 2005). And the UK Government announced in February 2005 that it would be funding a £12m 'climate change communications initiative' over three years (Department for Environment, Food and Rural Affairs, 2005). In contrast, the Royal Society's entire operational budget for media relations in 2005–2006 was £23.5k, across all areas of the organisation's work.

Despite the mismatch in budgets, the Society devised a strategy that incorporated many of the professional media relations tactics employed by these other key media players. The main features of the strategy were:

- Promoting a joint statement on 'Global Response to Climate Change' signed by the national science academies of the G8 nations, plus Brazil, China, and India (Royal Society and ten other national science academies, 2005b);
- Preparing and publishing 'A Guide to Facts and Fictions about Climate Change' on the Royal Society's website (Royal Society, 2005a); and
- Rebutting media coverage that does not accurately convey the weight of scientific evidence and scientific opinion on climate change (e.g., through letters to newspaper editors for publication, etc).

Before launching the campaign, the Society's media relations team undertook an assessment of the likely risks that were associated with the strategy, including:

- The Society would be attacked by campaign groups that felt they did not share the same views;

- The Society would be criticised within and outside the scientific community for engaging with the public debate and policy-making; and
- Spokespersons would become uncomfortable with being in the firing line and possibly being the subject of personal criticisms.

The media relations team also identified some risks of not launching a campaign, including:

- The Society would be criticised for not showing leadership and promoting the scientific consensus, particularly when it was being misrepresented or criticised; and
- Lobbying by campaign groups would persuade policy-makers to not take account of the consensus of scientific opinion on climate change.

Taking into account these risks and the potential benefits, the media relations team proceeded to execute the strategy.

THE JOINT ACADEMIES STATEMENT

Preparation of a joint statement by the national science academies of the G8 nations, plus Brazil, China, and India, was initiated in autumn 2004, with the intention of it informing discussions leading up to and at the Gleneagles summit in July 2005. The wording of the statement was agreed through a gradual process of negotiation between the academies. The final version stated (Royal Society and ten other national science academies, ibid.):

> The scientific understanding of climate change is now sufficiently clear to justify nations taking prompt action. It is vital that all nations identify cost-effective steps that they can take now to contribute to substantial and long-term reduction in net global greenhouse gas emissions. (Royal Society and ten other national science academies, 2005b: 1)

The publication and media launch of the statement was scheduled for 8 June 2005. On 6 June, the media relations team learned that a BBC journalist had learned of some of the content of the joint statement from 'a British official', and particularly that there had been much discussion between the academies about whether to use the word 'prompt' or 'urgent' when calling for action. The journalist broadcast his story on 7 June, which encouraged other journalists to pursue the story. It emerged that the Brazilian national academy had published an early version of the statement on its website, effectively pre-empting the media launch planned for 8 June. In response, the Royal Society issued a release on 7 June along with the final version of the statement.

The publication of the joint statement received extensive coverage in the UK media and abroad, and it was reported by agencies such as Reuters and Associated Press. It received some greater prominence, particularly by the UK broadcast media on 7 June, because the UK Prime Minister, Tony Blair, arrived on that date in Washington DC to discuss the upcoming G8 summit with President George W Bush.

The Independent devoted its front page on 8 June to publication of the statement under the headline 'G8 Scientists Tell Bush: Act Now—Or Else…'. Prominent articles also appeared in *The Guardian*, the *Financial Times,* and *The Times*. On 9 June, the statement was covered in a report in *The Daily Telegraph*, supported in an opinion article in *The Times*, and endorsed in a leading article in the *Financial Times*.

However, BBC Radio 4's *Today* programme sought to use the publication of the statement to give air-time to Professor Fred Singer, a US-based critic of the IPCC's findings. Despite a complaint from the Royal Society's media relations team in advance, *Today* featured sequential interviews of equal length with Singer and Stephen Cox, the Executive Secretary of the Royal Society, to provide a 'balanced' account of the science of climate change. During the course of his interview, Singer stated:

> There is simply no consensus. That's a myth. Even if there were a warming, it's a question of how much. Obviously the greenhouse effect is real; the problem is the data do not show a significant warming. (Professor Fred Singer, *Today*, 8 June 2005)

Singer's comments were included in the article describing the publication of the joint academies statement on the BBC news website.

In the United States, the publication of the statement received less media coverage than in the UK. The *Los Angeles Times* published a report on 8 June. *The New York Times*, however, published an article reporting that Mr Philip Cooney, chief of staff for the White House Council on Environmental Quality, had 'repeatedly edited government climate reports in ways that play down links between such emissions and global warming'. The statement was endorsed in a leading article in *The Philadelphia Inquirer* on 9 June.

A GUIDE TO FACTS AND FICTIONS ABOUT CLIMATE CHANGE

Preparation of *A Guide to Facts and Fictions about Climate Change* began in January 2005. As the primary audience was journalists, it was written in plain, non-technical language, listing 12 sets of misleading arguments that have been put forward by those who reject the consensus on climate change, together with evidence that shows why they are wrong (Royal

Society, 2005). It was compiled by the Society's media relations team in consultation with its policy section and under the supervision of Sir David Wallace, Vice-President of the Royal Society, and Sir John Houghton, a Fellow of the Royal Society and formerly chair of IPCC Working Group I on scientific aspects of the climate system and climate change.

The guide cited information presented in the 2001 IPCC Third Assessment Report, as well as major journal papers published subsequently. After review by an expert group, the document was approved by the Council of the Royal Society at its meeting on 17 February.

The Society media relations team set out three main tactics for the dissemination of the guide:

- Writing to 200 editors in the national media to draw attention to the issues, and providing a copy of the guide;
- Seeking coverage by the local and national media in the UK of the guide and the issues it raised; and
- Seeking coverage in the specialist media press of the issues and the guide.

The Society's media relations team decided to link publication of the guide to a speech due to be delivered by the President of the Royal Society, Robert May, on 7 March at the British Embassy in Berlin. The media relations team provided some additional text for the speech, focusing on the activities of the denial lobby and drawing attention to the publication of the guide. In order to create a news 'hook', the media relations team analysed up-to-date figures on greenhouse gas emissions by signatories to the Kyoto Protocol, and calculated that the increased output from the United States already negated the combined target reductions of all the other countries. The speech also included a warning about political leaders acting as 'modern day Neros over climate change, fiddling while the world burns'.

The Society issued a media release under embargo on Friday 4 March 2005, for publication on 7 March, leading on the emissions calculation and pointing out that Lord May's speech was being made a week before an important meeting of energy and environment ministers from the G8.

Media coverage was generally disappointing. Lord May was unable to give any interviews to the broadcast media on the day because he was committed to other activities. However, the BBC News website reported the speech, under the headline 'US Gases "Dwarf World Savings"'. *The Independent* newspaper devoted two pages to the story, under the headline 'Bush Accused of "Fiddling While World Burns" by Ignoring Climate Change'. Coverage also occurred in *The Scotsman*, on Ceefax, in local newspapers such as the *Morning Star*, and in environmental publications such as *The Ends Report*. A number of journalists from other parts of the media requested copies of the guide.

Following this proactive launch to the media, the Society targeted specialist media publications. On Thursday 21 April, the Society issued a media release, 'Royal Society Targets Misleading Media Coverage of Climate Change', aimed at professional journalist trade magazines. This release announced that the Society had despatched more than 100 letters to news editors and editors in the national print and broadcast media, accompanying copies of the guide. The release prompted prominent news articles on 29 April in *PR Week* ('Royal Society Fights the Climate Change Sceptics') and in *Press Gazette* ('Don't Be Fooled By Climate Change Doubters': Royal Society Issues Journalists' Guide to Counter Impact of Fringe Groups'). This author published a follow-up opinion article in *Press Gazette* on 6 May ('Anyone Who Tells You Global Warming Is a Myth Is Full of Hot Air: Contrary to Fringe Arguments Publicised in the Press, Evidence of the Greenhouse Effect Is Clear, Says the Royal Society's Bob Ward').

Not all the media coverage has been favourable. For instance, *The Sunday Telegraph* published an article by its science editor on 1 May, seeking to raise doubts about one of the journal papers used as evidence in the guide. The Society responded with a robust rebuttal in a letter to the editor published on 8 May. Similarly, on 16 May, *The Daily Telegraph* published an opinion piece by Neil Collins explicitly questioning the content of the guide. The Society responded with a detailed letter to the editor from Sir David Wallace, rebutting the main points on 19 May.

However, there have been some very notable successes. On 1 May 2005, ahead of the UK General Election, *The Observer* effectively endorsed the main elements of the Society's media campaign in a leading article under the heading 'Whoever We Choose, Our Planet Is the Vital Issue: Politicians Fiddle as the World Burns, but When Britain Hosts the G8 Summit in July, Climate Change Must Top the Agenda'. The article referred explicitly to the Royal Society, citing evidence given in the guide.

It is not clear to what extent the publication of the guide has persuaded the UK media to provide more representative coverage of the science of climate change. The *Daily Mail* has continued to report major research findings about climate change, but does not appear to have changed its editorial line. For instance, on 12 January 2006, the newspaper published a news article about the production of methane by living plants, under the headline: 'Can Planting More Trees Make Global Warming WORSE?' The report included the statement: 'Methane is just one gas that contributes to global warming'. However, on 13 January, the *Daily Mail* published an opinion article by Melanie Phillips about the same research findings, but under the headline: 'Does This Prove that Global Warming's All Hot Air?' The article repeated many of the assertions made by the lobby groups campaigning against the Kyoto Protocol and the IPCC, and claimed: 'The truth is that, for all the furore about global warming, the scientists who proclaim it as a demonstrable fact really haven't got much of a clue'.

However, in an opinion article published in *The Guardian* on 17 January 2006, George Monbiot attacked the argument put forward by Phillips, and recalled her previous claim that climate change is 'a massive scam based on flawed computer modelling, bad science and an anti-western ideology'. Monbiot pointed out:

> Soon afterwards, the Royal Society published a 'guide to facts and fictions about climate change', whose purpose was to address the arguments made by people like her. It destroyed all the claims she had been making. (George Monbiot, *The Guardian*, 17 January 2006)

REBUTTING MISLEADING COVERAGE OF CLIMATE CHANGE SCIENCE

A major part of the overall strategy has been to rebut misleading media coverage of the science. The aim was not to prevent any exchange of differing views from being covered, but instead to challenge any statements that were wrong, and to put forward the consensus view as outlined by the IPCC Third Assessment Report. This was necessarily focused on those parts of the print, broadcast, and online media that persistently presented a view of climate change science that differed from the IPCC's conclusions.

The major early task was to counter media coverage for a forum for dissenting voices organised by the Scientific Alliance on 27 January 2005. The forum, 'Apocalypse No: Assessing Catastrophic Climate Change', was deliberately scheduled just ahead of a major international meeting of climate researchers at the Hadley Centre, Exeter, organised to inform discussions ahead of the G8 summit in Gleneagles in July 2005. The forum featured only presentations by four leading dissenters on climate change science, including David Bellamy and Fred Singer.

The media relations team tipped off a journalist at *The Guardian* a few days prior to the event, drawing attention to the links between the Scientific Alliance and the George C Marshall Institute, a lobby group, with funding from ExxonMobil, which opposes the scientific consensus on climate change. As a result, the newspaper requested a feature article from the President of the Royal Society, Lord May, to be published on the same day as a news story about the Scientific Alliance forum. This article drew attention to the activities of the US-based lobby groups in the UK.

The feature article by Lord May was published in the 'Life' supplement of *The Guardian* on 27 January, under the headline 'Under-Informed, Over Here'. A news article appeared on the front page of the newspaper under the headline 'Oil Firms Fund Campaign to Deny Climate Change'. On 28 January, *The Guardian* reported on the Scientific Alliance forum under the headline 'Climate Change Impact Disputed', written in a slightly light-

hearted style, but also repeating many of the points from the previous day's article and referring to Lord May's main message about the existence of a 'denial lobby'.

The articles in *The Guardian* generated some prominent follow-up coverage in other parts of the media. For instance, *The Observer* devoted two pages on 30 January to an article on 'How We Put the Heat On Nature', quoting from Lord May's feature. Coverage also occurred in *The Sunday Herald*. *The Observer* published a half-page article, ''Denial Lobby' Turns Up the Heat', in its business section on 6 March, making essentially the same points as its previous piece.

CONCLUSIONS

The Royal Society has been running a major campaign to tackle misleading media coverage about the science of climate change since the beginning of 2005. This has been particularly challenging because climate change is not just a scientific issue but also a political and social one. Scientists must compete for media coverage on climate change with well-organised groups. Some of these groups accept the scientific consensus and even seek to present the science as more certain than it is, and some reject the consensus to varying degrees and seek to present the science as more uncertain than it is. There are a number of US and UK-based lobby groups that have well-funded campaigns, and that are adept at promoting their causes through the media. The scientific community traditionally finds it difficult to counter these campaigns.

In addition, the practice of journalistic 'balance' tends to misrepresent the science of climate change, seeking to convey the range of views but without conveying where the overwhelming weight of opinion lies. Some journalists are suspicious of consensus and prefer to champion minority views, particularly if they are pitted against a perceived 'establishment view', regardless of what the scientific evidence shows.

The following main conclusions have been drawn from the campaign.

1. Even on an issue such as climate change, where it may be difficult to find a new angle, it is still possible to mount a successful media campaign.
2. A successful campaign requires time and effort, with buy-in from high-profile spokespersons and support from other staff not directly involved in media relations (e.g., policy advisers).
3. The same main message can be conveyed a number of times by targeting different parts of the media separately and finding news 'hooks'.
4. Messages can be conveyed effectively through key phrases (or sound bites) e.g., 'denial lobby', 'fiddling while the world burns'.

5. Opportunities can be missed if spokespersons are badly briefed, do not buy into the key messages, or are simply not available for interviews.
6. Good coverage can be secured by judicious use of exclusives for 'friendly' journalists, producing high quality media releases written in a news style, and issuing releases under embargo.
7. Effective campaigns mean carrying out both well-planned proactive activities as well as rapid responses to external events, and effective proactive activities increase the number of reactive opportunities (i.e., media will seek comments on other occasions).
8. Effective campaigns include activities that raise visibility and awareness without necessarily generating immediate coverage.
9. 'Rebutting the opposition' can be an effective method of conveying key messages.
10. Websites are becoming an increasingly important public relations tool for disseminating messages, and are competing with and affecting media coverage.
11. Coverage arising from media campaigns is almost never uniformly positive, but a successful campaign means the good coverage should outweigh the bad.

REFERENCES

Belov, A V et al. (2005) 'Prediction of expected global climate change by forecasting of galactic cosmic ray intensity time variation in near future based on solar magnetic field data' *Advances in Space Research*, 35, 491–495

Ciccerone, R J et al. (2001) *Climate Change Science: An analysis of some key questions* Washington D.C.: National Research Council, National Academies Press, http://fermat.nap.edu/html/climatechange/

Department for Environment, Food and Rural Affairs (2005) 'Changing public attitudes to climate change News release' 71/05: http://www.defra.gov.uk/news/2005/050216d.htm

Envirospin Watch: http://greenspin.blogspot.com/2005_05_15_greenspin_archive.html

Gelbspan, R (2004) *Boiling Point*. New York: Basic Books

Global Climate Science Communications Team (1998) http://www.environmentaldefense.org/documents/3860_GlobalClimateSciencePlanMemo.pdf

Greenpeace (2005) *Greenpeace Annual Report:* http://www.greenpeace.org/raw/content/international/press/reports/annual-report-2005.pdf

Intergovernmental Panel on Climate Change (2001) *Climate Change 2001* 4 volumes Cambridge: Cambridge University Press: http://www.ipcc.ch

Kollmuss, A (2002) 'The role of the media in environmental issues: Newspaper coverage in four countries' In: Susskind, L et al. (eds.) *Transboundary Environmental Negotiation: New approaches to global cooperation* San Francisco: Jossey-Bass, pp.172–199

McNair, B (2003) *An Introduction to Political Communication*, Abingdon, UK: Routledge

Mooney, C (2005) *The Republican War on Science* New York: Basic Books

Royal Society (2005) *Guide to Facts and Fictions about Climate Change:* http://www.royalsoc.ac.uk/page.asp?id=2986

Royal Society and 10 other national science academies (2005) *Global Response to Climate Change:* http://www.royalsoc.ac.uk/document.asp?tip=0&id=3222

Royal Society and 15 other national science academies (2001) *The Science of Climate Change:* http://www.royalsoc.ac.uk/document.asp?tip=0&id=1433

16 PR for the physics of matter
Tops…and flops

Manuela Arata

In 1994, when INFM—the Italian Institute for the Physics of Matter—was founded as a national public research institution, I was in Rome at the headquarters of the Italian Ministry for University and Scientific Research, where an operative brainstorming was going on.

I had recently been appointed General Director, and, as a consequence, I was ready to accept that my competencies and skills should deal with budget, investments, research politics, and so on, when an unexpected, enlightening question posed by a colleague made me understand that, as manager of a public institution, my tasks would become much engaging and relevant:
'So, Mrs Arata, could you tell me in a few words what the physics of matter is?' In subsequent years, I have heard that question so many times! And every time, my feelings were strengthened that—besides budgets and accounts—my job *had* to deal with the whole of society. As we were a public institution, we had to carry out a very special duty: explain, make clear, report about the 'know-how' and the activities of the 3,000 and more physicists and researchers of the Institute, whose daily job was mainly made possible by public finance.

And, to answer that question—so difficult but at the same time so important—I immediately focused most of my attention on outreach activities: public awareness and education activities with the aim of reaching the general public and in particular the young generation, as well as technology transfer actions directed to the Italian productive and industrial system, thus contributing to the economical growth of our country by transferring new technologies and processes.

What guided me and all the managing staff of INFM was, among other things, the idea that it is a duty of the scientific community to inform people about their activities, which are mainly funded by taxpayers' money, and publicly justify them. People often see scientists as solitary people closed up in their ivory towers but nowadays things are different, and the best scientific discoveries are a result of a strong international and interdisciplinary collaboration. And this is the reason why we thought we should literally bring scientists out of their laboratories and research institutions,

encouraging them to talk with people, engage in dialogue with them, and—why not—have fun with them! We can say that the scientific community is hopefully poised to increasingly understand how important this task has become—or, 'No public awareness, no money'.

One of the first steps towards INFN developing communication with the general public was the setting up of a communications office, with the following tasks:

- Communication activities within INFM, operating as a support office for the community of physicists spread all over Italy;
- Communication activities outside INFM, operating as a press office that should try to get the attention of the mass media (newspapers, TV, radio, and everybody else having a potential interest in this field outside of the expert community) with regard to INFM studies and research papers.

INFM was one of the first Italian public institutions to hire a person dedicated to media relations, something which we have done since 1996, and we entrusted this task to a person able to integrate the skills of the scientific community with the journalistic know-how that is so important if one is to reach the mass media. And, in fact, the media quickly gave us some communication lessons, simple 'rules' that could lead us to great success or great failure. Here are some examples.

Rule number one: The media have a low interest in research policy as such

In 1994, INFM was set up as a public research institution that had its origins in a former university consortium grouping of several research teams from all over Italy. I remember it as a moment of great enthusiasm, and of course we wanted to inform journalists about such a governmental investment in the area of physics of matter, which was highly strategic for the technological and cultural development of the country. However, all the journalists that we contacted inevitably asked: 'Where is the news?' From their point of view, our institutional transformation from a consortium of universities to a public research institution hardly deserved a report. Thus, the result of our PR efforts eventually consisted of very few and very brief news items that fell short of our expectations.

An important achievement in our efforts to resonate with the public came a few years later, in 1998, when the chief editor of *Il Sole del 24 Ore*—the leading Italian business newspaper—published a long article by me concerning the INFM management procedures. The article contained—at last!—a general description of the Institute and its activities. It was a great success for us, and many people in the physics community still remember it as one of the first, truly significant occasions of visibility.

However, as often happens, the reasons that brought this strong communication about may be found in a particular interest of the Italian media: at the time, the media were particularly sensitive to the issue of modernizing processes within Italian public institutions. Our innovative management experience—based on limited bureaucracy, flexibility in the administration of research funds, and cost control—appeared to journalists and editors quite interesting in that respect.

We had another confirmation of this rule some years later, when we decided to inform journalists about the establishment of the first INFM research and development centres—research structures aimed at developing and sharply focusing the most advanced and relevant studies in the field of the physics of matter and materials technology.

The initiative was launched in 2001, and it had strong policy relevance because it identified the key sectors of the research and the areas in which investment had to be concentrated. Beginning in 2001, INFM set up ten research and development centres in several Italian cities, and they all were focused on advanced research fields: in Rome, a centre was established for the study of the behaviour of complex systems; in Pisa, Modena, and Lecce research centres were established dedicated to nanotechnologies and nanobio technologies; in Naples a centre focused on superconductivity; in Trento a centre was set up devoted to ultra-cold physics, and in particular to the Bose-Einstein Condensation phenomenon (strictly related to recent Nobel Prizes in physics) for a total, remarkable investment of more than €8 million. However, even in this occasion, we did not get the expected media impact: why? See Box 167.1 for a copy of the press release.

The text is very long and complex, and it requires particular attention by the reader because it is full of information, and not easy to understand. I am of course not implying that journalists are not attentive, but as nowadays information runs so fast, a useful press release is expected to give the news immediately (this is the reason why press releases exist).

Furthermore—and in my opinion this is the most important aspect—this text is lacking 'true' scientific information: scientific results, goals, and discoveries. Perhaps this is obvious because these research and development centres had just beenset up, but this was one of the key-points highlighted by journalists.

Journalists were not interested in the establishment itself of these centres, they wanted to know about the research activities carried on and possibly the results: an easier way to talk about the whole initiative. So, as an immediate result, while at a regional level—particularly in the cities where the centres were established—we received some interesting articles and media reports, at a national level there was very little coverage of our launch.

Rule number two: become a regular and reliable media source

As we discovered throughout the years, one of the most important goals of a PR officer in a research institution is to establish direct contact with

Box 16.1 The Italian National Institute for the Physics of Matter (INFM) Launches Three Research and Development Centres

The Italian INFM—National Institute for the Physics of Matter has recently approved the institution of three Research and Development Centres in the cities of Rome, Pisa and Lecce, with the aim of developing and concentrating advanced and relevant studies in the field of the physics of matter and materials technology. In particular:

The Centre in Rome, which will be co-ordinated by Giorgio Parisi, will be focused on the theoretical study of statistical mechanics and complex systems. The main objective of the Centre will be the study of the collective emergent properties of systems with a very large number of components which show a complex behaviour. This problem is central in the study of many physical systems and its full mastering is instrumental to the possibility of developing many applications of physical methodology to many other fields (a very partial list of examples ranges from traffic to the immune system, from the Internet to memory and cognitive processes, from earthquakes to finance).

The Centre in Pisa, co-ordinated by Fabio Beltram, will be a world-class research centre where interdisciplinary teams of computational, experimental, and theoretical physicists together with molecular biologists and chemists will investigate key issues of Nanoscale Physics and exploit the new acquired knowledge to develop innovative nano-biotechnological tools, and nanoelectronic and photonic devices and architectures.

The Centre in Lecce, co-ordinated by Roberto Cingolani, will be dedicated to the Nanotechnologies: the target will be the exploration and development of new concepts and new nano-systems exploiting either the bottom-up (self assembling and molecular engineering for hybrid organic/inorganic systems and mesoscopic systems) and the top-down approaches (ultimate resolution nanotechnologies applied to semiconductor nanostructures), in the same mainframe. The Centre activity will be complemented by the X-ray lithography techniques achieved by INFM research teams in the Synchrotron Laboratories of Trieste.

The investment provided is about €8 million for the next five years.

These three Centres, which have been selected by a panel of international scientists, are the first step of a INFM plan aimed at creating about 10 Research and Development Centres in the next three years.

The new INFM Research and Development Centres will be officially presented to the international scientific community during the INFMeeting 2001—National Congress on Physics of Matter, which will be held in Rome from 18th June to 21st June 2001.

Genova, 30th April 2001

For further information: Francesca Gorini, INFM Press Office
tel: +39/010/6598742—email: gorini@infm.it

journalists working in the relevant area, becoming a reliable source of information for them, even beyond the goal of immediate visibility.

In fact, a 'spot' of media exposure once in a while can probably turn out to be much more dangerous than a total lack of media exposure. One reason is that it encourages media to write or talk about science on a few occasions: a press conference, a congress, or a new discovery, without a 'before' as well as an 'after', and without any more in-depth information. This fashion, so frequent in Italian journalism, can easily arrive at silly paradoxes, as, for example, the 'evergreen articles' about the daily cup of coffee or the chocolate bar: one day it is good, the next it is bad, one day it makes you older, or fatter, or whatever else….

In the case of INFM research and development centres, by simply informing journalists about them and the scientific excellence of the studies carried on, we may not have obtained immediate visibility but rather triggered a long-term relationship with our audience. We had begun to build that 'communication ecosystem' which the scientific community, the general public, the mass media, and the communication officers are a part of. During the following months, several articles were published about our centres. This is not surprising given the fact that each of these articles stemmed from a specific fact or event related to the centres: an important scientific publication, a patent, a congress. What is truly important is that at the right moment journalists could get the appropriate information, without falling into the trap of the third rule.

Rule number three: The media are mostly interested in sensational/exciting/emotional stories

Besides having scant enthusiasm for research policy, science journalists tend to prefer emotional or exciting stories. Issues dealing with particular diseases, promises of new miracle drugs, guru surgeons, or alarms connected with epidemics are among the most common cases of wide media coverage.

In INFM, our goal was to capture media attention on the physics of matter—a field that in most cases has no emotional aspects at all. We also wanted to avoid trivial media exposure that could potentially damage our public image. In this light, a key role has to be played by the *public information officer* of a research institution like ours: he or she is the person who can provide an added value to any news, transforming an esoteric 'scientific finding' into 'scientific news'. Here are some clear examples.

In 2002, an INFM research team based in Florence—made up of both chemists and physicists—achieved an important discovery, published in the international scientific journal *Science*. The research team set up an innovative polymerization technique. Combining high pressure and laser light they managed to transform the *buthadiene* chemical element in a new high-quality polymer: *polybuthadiene*.

This was an extremely important result, but clearly was too technical a piece of news for the general media and public, because only a scientist—and in particular, a chemist—could understand the significance of the study. The INFM public information officer had a great idea: gathering information on her own, she discovered that polybuthadiene is commonly used in the automotive industry to make tyres, seatbelts, decorative elements, and other car components that must be cold resistant. So, the title of the press release announcing the discovery was: 'New materials: INFM researchers set up an innovative technique to realize polymers. New perspectives for the automotive industry and in the environmental field'

The whole information campaign was based on this aspect of the discovery, one that was relevant in everyday life. It was a great success, with many articles in the major newspapers! There is another important aspect which I would like to highlight: the researchers involved were truly happy about this unexpected result, as they were totally unaware about the use of polybuthadiene in the automotive industry. They were mainly theoretical scientists, so they couldn't integrate the scientific know-how with practical examples. Thus, in this case, the INFM press office found the key element to enthuse the general public. And it came as no surprise that all newspapers wrote about 'ecological benefits and cheaper tyres'.

Some scientists, however, prove to have great ability on their own in communicating about science, and are capable of raising public interest, even on very complex scientific matters. As President in Chief of the Genova Science Festival—the leading Italian science festival—I am always fascinated by the enthusiasm of hundreds of scientists (often unknown to the general public, but widely acknowledged in their discipline) talking with people, dialoguing with them, having fun with them. And sometimes it is funny to see how a little, unexpected event can provoke a real media 'cascade' in terms of information, as shown in the example below.

For several years we have been organising workshops, summer schools, and technical seminars at the INFM Genova headquarters. This routine was broken when an Italian physicist entitled his nanotechnology work-

shop with the bizarre name 'Nano-things' (in Italian 'nanocose'): this title suddenly captured the interest of several local and national media, and in a truly unexpected way the congress was invaded by print and TV journalists interviewing the amazed scientists attending, about 'what nano-things are' and about the 'technology of our future'.

Rule number four: The importance of 'linking structures'

I have noted these examples because I think that they point to the main Italian problem with regard to science communication. It is not true that our country lacks for media interest about science and technology. Our journalists are literally *starving* for science news, but what they miss is an intermediate level of 'scientific translation' between a specialized publication (e.g., *Science*, *Nature,* and all the specialised science journals and newsletters) and an article for the general public.

I firmly believe that Italian research institutions have to find a better way to provide scientific information to media, offering new ideas for science articles with the appropriate language, revealing the 'secrets of science', but at the same time maintaining the solidity and rigour of science.

Otherwise, how could we explain the incredible media attention received by the three Genova Science Festivals, with twelve days of indoor and outdoor science performances and events each year, and thousands of articles on newspapers and magazines, hundreds of TV and radio broadcasts, from local to national and international media?

Nowadays, I can see very many new training initiatives, master's programs, and other courses aimed at providing journalists and information officers working in the field of science communication with specialised knowledge. I think this is a fundamental step, in that it acknowledges the 'dignity' of the communication of science as well as any other form of journalism. As yet there is no training available for *researchers* to enable them to communicate information about their work to the media and the general public. I feel it is essential that future researchers be able to communicate their latest advancements directly to journalists, school teachers, students, and citizens (without suffering anxiety attacks as happens nowadays), and that they consider the diffusion of information and education as part of their routine professional duties.

Otherwise we can witness one of the classical Italian 'paradoxes' in science coverage as well, namely the fact that often national discoveries are reported in foreign media before they are mentioned in our national media.

In INFM we encountered this peculiar paradox some years ago, when a research team based in Genova (next door to us) made an important discovery about a new superconducting material, the magnesium diboride, and patented a prototype of thin films of this new material. Magnesium diboride has some important advantages: it can carry electricity with vir-

tually no resistance at very low temperatures, it is easy and cheap to work with, and has potential uses for magnets and electric motors.

The discovery had gone totally unnoticed among our national media when the *New York Times* reported it; as a consequence, media from all over the world—including the Italian media—became attracted, not so much by the discovery itself, but rather by the story of 'the Italian researchers who conquered the *New York Times* columns'.

Rule number five: Develop the appropriate communication tools

At INFM our challenge was to provide new forms and ways of science communication targeted at different audiences: media as well as the general public, students, families, men and women from all social levels, entrepreneurs, and politicians.

As a first step, we set up an online 'press room' available on our website http://www.infm.it, containing a regular update of the studies carried on within the INFM scientific community (PDF résumés). Our intention was to meet the need to set up an ongoing dialogue with science journalists, instead of addressing them only on the occasion of press conferences or main events.

The press room reported all kinds of INFM studies and researches—even the less important, or those which were not suitable to a wide communication campaign—so these web pages showed the vitality and quality of the INFM scientific community, also providing a general idea of the aims and processes of scientific research. This broad landscape may make it easier to understand that science cannot give an answer to every human question, but rather, it is a long, non-linear path aimed at discovering the *unknown*, where successes, failures, and open questions are part of the process, and where sensational discoveries often occur by chance.

Our main target is the young generations, the potential science students and researchers of the future, who are, in general, more attentive to innovation than older members of the general public. Some of our programs include:

- **Interactive science exhibitions.** *'Frammenti di Imparagiocando—La Scienza in gioco'* (Learning science by playing) gives visitors the opportunity to make scientific experiments with light, colours, images, and sounds. The visitor is encouraged to touch the various exhibits and discover that the magic world of science is very close to daily life. Since 1998, the exhibition has travelled to several Italian cities (Rimini, Modena, Salerno, L'Aquila, Bari, Faenza, Napoli, Cosenza, Pisa) attracting over 100,000 visitors.
- ***Semplice e Complesso*** (Simple and complex) is another exhibition dedicated to scientific research on the edge, such as granular systems, disorder, complexity, and chaos. The prototypes start from daily phenomena and use common materials such as sand, rice, coffee, and

soap foam. The scientific content is integrated with artistic images, collateral events (i.e., conferences, debates). These exhibitions have circulated in several Italian cities, and have been visited by about 170,000 people.

- **Science on stage.** a 'package' for public awareness of science which includes the play *'Time Beyond the Sea, the Fascinating Story of the Measurement of Longitude'*. The play tells the story of the invention of the marine chronometer. 'Science on stage' consists of debates, workshops, demonstrations of experiments, and the temporary exhibition 'Imparagiocando foyer' organized in the foyer of the theatre itself. In the last two years this play was staged in many Italian theatres with considerable success.
- **IT tools for science learning at school.** In collaboration with its spin-off company INFMedia s.r.l, INFM has realized ten scientific multimedia products on several scientific subjects (e.g., physics of matter, materials science, energy, safety in research laboratories), rich in animations, simulations, and educational interactive games. So far more than 7,000 CDs have been distributed and the INFM group, author of the CD-Rom 'From Silicon to Computer', was awarded the Premio Pirelli 'INTERNETional Award 2000'. Furthermore, in 2000 INFM promoted the new, free, web portal Informando (http://informando.infm.it) as a national reference for training, education at school, and scientific information: an 'open door' between the world of scientists and other non-scientist groups. On the portal http://informando.infm.it you can find 'Archimedes', a multimedia archive on science and technology in contemporary Italy, as well as a lot of information about projects, courses, and science news. In the last few months, the site was enriched with an interactive web guide of the Italian and European science museums.
- Finally the **Genova Science Festival**, which I have mentioned already. One of the main strengths of this initiative is to be found in the hundreds of students and young people involved in its creation: every year we recruit more than 600 young people who take care of the public during their visits and serve as exhibition guides. If, in 2003, the Festival at its first test obtained a great and unexpected success, the figures of the second and of the recently concluded third festival confirm great interest and attention for science from the whole of society. The 2005 edition of the Festival sold 54,000 tickets, an increase of 50 per cent compared to the previous year, and a total of 216,000 visits to the numerous programmed events. The 77 locations, dispersed around Genova and Liguria, hosted 250 events (141 conferences, 37 events, 36 between shows and films, 33 workshops, 28 exhibitions), almost always sold out to the public: a participating public who were informed and prepared, not only prizing the more noted names but also the specific themes, discussions, and debates.

For me it is something extraordinary to see whole families, children, older people, students, professionals, housewives, and intellectuals crowding the events, queuing up to reach the conferences sites, asking for more. It was a strong signal, allowing us to understand how much people are asking for science information, not just science as a source of technology and economic growth, but as a resource for culture and society.

Thus, if I had to summarize my 'recipe' for how (and how not) to do PR in the area of physics of matter, I would say that you have to: widen the remit to science in general; know the operating rules of the mass media; build the competences and the appropriate tools in your own research institution; and last but not least, consider scientific imagination and culture as a resource for all to build a society on.

17 Communication by scientists or stars?

Bronwyn Terrill

Efforts in science communication can vary dramatically between cultures, countries, and institutions. Although an organisation's science communication involvement would be best driven by the intended outcomes, it often comes down to the staff's knowledge about traditional or achievable options, the way they wish to be perceived, and the opportunities presented.

To compare and contrast two organisations' approaches from a similar time, I've focused on 'DNA50' in 2003—events surrounding the 50th anniversary of the discovery of the structure of DNA. On this significant anniversary, institutions across the globe held rolling celebrations, including: a calendar of DNA-related art and performance; lavish commemorative dinners in the USA and UK; exhibitions at science centres and museums; and a five-part TV series with spin-off books, large-screen movies, and online resources.

Although I was fortunate enough to be involved in a number of the DNA50 celebrations, the two events I find most interesting to reflect on are:

- DNA at 50: Finding the Double Helix
  Public talks by James D. Watson at the Dolan DNA Learning Center, Cold Spring Harbor, NY, USA; and
- *DNA Day: Circles of Life*
  A triple celebration in Hinxton, Cambridge, UK: 50 years of the double helix (1953); 10 years of the Sanger Institute (1993); and the completion of the human genome (2003).

I thank staff from both organisations for providing additional detail and support materials for this chapter.

DNA AT 50: FINDING THE DOUBLE HELIX

Background and motivation

The first event was held by the Dolan DNA Learning Center (DNALC) in Cold Spring Harbor, New York. The DNALC is the public education arm of

Cold Spring Harbor Laboratory (CSHL), an internationally renowned centre for genetics, cancer, and neurobiology research. Positioned on the north shore of Long Island, NY, the laboratory is funded through a mixture of sources: national and international grants, technology transfer, press and meetings, and fund-raising, primarily in the local, very wealthy community.

At the time of the event, CSHL's President was Dr Jim Watson, Nobel Laureate and co-discoverer of DNA's structure. Watson was heavily in demand for the DNA50 anniversary—being one of the best known players in the double helix discovery—the others being Maurice Wilkins, Francis Crick, and Rosalind Franklin.[1] However, at age 75, he granted very few interviews and chose his appearances carefully. Watson is a great supporter of DNALC activities though, and seeing an opportunity to bring its work to more people's attention, Watson suggested doing a series of talks that would mark the start of the anniversary.

In the minds of many people, a talk by Jim Watson could be a mixed blessing. Popular science author and friend, Matt Ridley, commented, 'what a much duller—and safer—history DNA would have had without Watson stirring things up' (Inglis, Sambrook, & Witkowski, 2003, p. xv).

As a scientist, Watson is best known as half of Watson and Crick—the pair who deduced the structure of DNA by building models. He is also known as the controversial figure who bullied American decision-makers into providing funding for the Human Genome Project. I know him as a man with the insight to encourage Mary-Claire King to locate the first 'breast cancer gene', and who bought Nobel Laureate-to-be Kerry Mullis drinks all week after reading his work on the polymerase chain reaction (a discovery that had a huge impact on gene technology).

Jim Watson's books and statements have provoked differing responses. As author of *The Double Helix* in 1968, he was condemned as a bringer of scandal, yet hailed as someone who 'did so much towards communicating science effectively to the public'. Gushed one commentator, 'His readers were made aware of the paradigms of practice, the cultural metaphors, the social conventions, and the competitive struggles that characterise science-in-action'.

Throughout his career, Watson continued to pen more personal and group memoirs, and some well-known textbooks. He is now seen as a provocative commentator—someone good for a sound bite and likely to offend, or at least stir up controversy.

Watson was offering the DNALC his last ever set of public talks (he has appeared 'in conversation' since) an opportunity to capitalize on his experience and celebrity to draw visitors in from great distances.

Aims

Unlike lengthy exhibition projects, the aims of a single event are rarely written about or argued. However, I've drafted these retrospectively to reflect the organising team's thoughts at the time. The aims were to:

- Celebrate the history of 50 years of DNA (at CSHL), where Jim Watson gave his first double helix talk;
- Promote science as an inspirational endeavour with current applications and implications;
- Attract 1,000 members of the public to visit the DNALC and its exhibits.

The last aim was extrapolated not from the mission of the DNALC—'to prepare students and families to thrive in the gene age' (Dolan DNA Learning Center Internet site, 2003)—but from Watson's spoken and written words. He often fluctuates between wanting to speak about scientific process and its impacts:

> …**there remains general ignorance about how science is 'done.'** That is not to say that all science is done in the manner described here. This is far from the case, for styles of scientific research vary almost as much as human personalities. On the other hand, I do not believe that the way DNA came out constitutes an odd exception to a scientific world complicated by the contradictory pulls of ambition and the sense of fair play. (JDW, preface, *The Double Helix,* 1968)

> …DNA has moved from being an esoteric molecule only of interest to a handful of specialists to being the heart of a technology that is **transforming many aspects of the way we all live**. With that transformation has come a host of difficult questions about its impact—practical, social, and ethical. (JDW, authors' note, *DNA: The Secret of Life,* 2003)

Investment and practicalities

The restrictions on the event were set by Watson—he would do enough talks in a month to bring approximately 1,000 people visit the DNALC. This meant nine talks over three Saturdays in January/February 2003. Each was conducted in a standard lecture format: an introduction by a close colleague; a 15- to 20-minute lecture; followed by approximately 30 minutes of questions.

The DNALC is already well prepared for this type of event, with:

- An 'intimate' 104-seater multimedia-equipped lecture theatre—large enough to make the audience seem worthwhile but small enough for a question and answer session to be conducted without roving microphones;
- Comfortable offices near the lecture theatre that could act as breakout/green rooms;

- Purpose-built exhibits for visitors to browse before and after a talk (a bonus that can make a trip feel worthwhile for a long-distance traveller); and
- Knowledgeable staff trained in communication/education.

Compared with more interactive experiences, these events required a relatively low level of organisation. The talks were marketed through existing mailing lists, DNA50 websites, and newspaper advertisements. Most of the effort went into crowd control: creating an efficient booking system; dealing with parking; organising staff to act as ticket takers, ushers, and general helpers/docents around the displays; devising methods of regulating personal interactions with Watson and keeping him secure. Each event required more than five staff members in the centre itself, with additional security staff in the centre and car park.

Outcomes

The timing and rarity of Watson's appearance guaranteed that every session was sold out; each also had a waiting list. Audiences were comprised of local VIPs (including CSHL donors), adults and families, and small school groups (from as far away as South Carolina).

Each of the talks was slightly different—although advertised as 'finding the double helix'—Watson tended to do one on the events of the 1950s, one on discoveries since, and one on the social and ethical implications of genetics. The last session therefore tended to be the most variable and the most controversial.

Local radio, newspapers, and TV covered each of the days (many of whom had been turned down for personal interviews during the anniversary year).

The events were not evaluated. However, the questions asked, crowds gathered after each lecture, and anecdotes told after the event suggested that Watson made an impression on his audience. The questions ranged from 'do you have religion?' to 'how do you feel having been alive from the double helix to the Human Genome Project?' He was asked for autographs and photographs after each session.

A DNA OPEN DAY

Background

This event was a triple celebration—the 50th anniversary of the DNA double helix, 10 years of the Wellcome Trust Genome Campus, and the completion of the Human Genome Project. Led by staff of one of the onsite organisations—the Wellcome Trust Sanger Institute in Cambridge, UK—

this event was the Campus's first large-scale attempt to open its doors to local/regional community members and students.

Although many aspects of the Sanger Institute resemble Cold Spring Harbor Laboratory, the face the Institute showed to the public in this event was very different. The Sanger Institute is Europe's largest genome research centre, funded almost entirely by an independent biomedical charity, the Wellcome Trust. Initially a production house of high quality genome sequence, the Sanger Institute sequenced and analysed almost a third of the human genome. This was the largest single contribution to the Human Genome Project. Until the Project was finished (officially in 2004), the loyal staff were united by a common purpose and further unified by the public/private genome dispute.[2] The overwhelming feeling from staff at the triple celebration was that they had been part of an important project that provided a resource for all, and they were keen for people to understand why.

Aims

I distilled the following aims through discussions with the main organisers, one to two years after the event:

- To provide locals and Institute stakeholders with insight into the workings of the Genome Campus
- To enable direct interaction between scientists and students
- To celebrate DNA50 and the completion of the biggest project in biology (to date)

Their motivation was relatively clear: they hoped to provide a friendly, down-to-earth, approachable, and interactive experience that would inspire teachers; enthuse students about scientific careers; and show how science is really done (e.g., in teams) rather than a 'dumbed-down', inaccurate representation of science. They also hoped to place the relatively-new Institute into an historical and cultural context that grounded its success.

Investment and practicalities

The Genome Campus had an abundance of enthusiasm but few of the DNALC's inbuilt public facilities to draw on. Although the Hinxton Hall Conference Centre could be used during lecture-style segments of the event, and some display material, a marquee had to be hired to hold the bulk of the exhibits and people. The site already had parking, security, and a reprographics department to produce staff posters. However, the style of the event—a comprehensive half-day visit—made it necessary to provide food and beverages, and a number of additional public toilets.

Teams were responsible for producing posters and activities on a particular aspect of biology, genomes, health, society, or community. Staff

members were incredibly enthusiastic but untrained in communication; therefore the time invested in this event—developing and revising the offer—was considerable. Genomic research is also notoriously abstract, so each of the developed activities tended to require some kind of manufactured component or the hire of a large computer screen. Additional staff and real costs went into:

- Marketing through mailings to schools and individuals
- Production of souvenirs, visitor badges, and staff T-shirts
- Consumables for laboratory activities
- Hire of two 'blockbuster' exhibits—a 3-dimensional virtual reality cave, and a huge DNA structure

Outcomes

More than 1,200 visitors visited the Genome Campus over two consecutive days in June 2003. Many more remained on a waiting list. Audiences included VIPs, local families, secondary schools (from up to 100 miles away), and regional primary schools. The places for the event were advertised in May 2003; it was fully booked within days.

Staff of the Genome Campus developed between 50 and 100 educational posters and participative activities for the *Circles of Life* temporary exhibition. Enthusiastic scientists of all ages explained their research and guided students and families through brief activities; visitors could also go on one of 27 laboratory tours or a lab-based workshop (six groups of 50 participants).

The event was covered on the Cambridge Evening News and in the local paper (*The Reporter*, July 10, 2003, p 11) the following week.

Staff from the Sanger Institute collected approximately 50 surveys and pieces of correspondence about the event. Comments included: '…scientists spoke with enthusiasm and authority'; 'great enthusiasm from exhibitors and those running the workshops'; '…great fun and enlightening'; '…impressed with the openness of staff and willingness to engage with discussion'; '…entertaining, interesting!'; 'brilliant!';'…friendly and informative'; '…the institute shows they care and like to share interests…not behind "closed doors"'; and '…young scientists were inspirational'.

ANALYSIS AND COMMENTS

As neither event was extensively evaluated, and this is a practitioner chapter, I'll limit my reflections to how the events appeared to meet desirable science communication criteria and the 'type' of scientist they convey.

The audiences' (anecdotal) responses to the events (under the vowel analogy) (Burns, O'Connor, & Stocklmayer, 2003), suggested that those who listened to and questioned Watson were likely to come away with:

some enjoyment or other affective responses to science; perhaps an interest in science; and may be forming, re-forming, or confirming science-related opinions. From a single presentation, the audience's awareness or understanding of science was unlikely to alter considerably. The more collaborative, comprehensive displays at the Genome Campus could, however, have touched upon each of the areas, although at much greater cost to the Institutes involved.

If categorising the events according to definitions of public understanding (Millar, 1996 in Burns et al., 2003), I would suggest that the DNALC/Watson event favoured 'understanding the methods of enquiry' and 'understanding of science as a social enterprise' rather than 'understanding of content'. Unlike the Genome Campus, the DNALC event focused more on 'scientific culture' rather than awareness or literacy (apart from cultural literacy).

The impact of both events had a local focus—restricted to attendees and perhaps their immediate family and friends. Watson's reticence about interviews during the anniversary year benefited the coverage of the DNALC talks, but the broad Genome Campus event lacked an angle for coverage beyond a local feature.

Although the potential understanding, awareness, and coverage in these events were different, my major interest was in the scientific 'image' portrayed. Sociologists of science have studied the idealist image of the scientist, as they state that the image of science and its 'actors' influences the image and very existence of science: 'its recruitment, its degree of relative autonomy, and the recognition and application of its results'.

The DNALC event capitalised on Watson's history and 'celebrity' status to provide an insight into his scientific career and opinions. Watson fulfils the role of the 'ideal' scientist (Petkova and Boyadjieva, 1994)—a 'mediator of truth', someone 'strange, unusual, and different from other people' whose 'detachment should receive positive social evaluation'. From the continuous clamour of audiences and media around Watson, we could conclude that audiences remain fascinated by him as a figure who saw what others didn't see; is notoriously single-minded and driven; and someone who commands attention.

The Genome Campus scientist, however, has a somewhat different appeal. A quote from the local news coverage demonstrates a more modest, humble scientific view: 'We have been delighted by the response—both from the huge number of visitors and by all the wonderful feedback they have given us…our staff have really enjoyed talking about what we do, sharing our enthusiasm, and discussing the significance of genetic research. The special reward for us is the great interest shown by the public'. The emphasis is quite different here—there are no perceived rewards in detachment, no hint that they who 'hold the knowledge' are not willing to let others into their realm.

When I questioned organizers of the Genome Campus event about the lack of 'stardom' in their approach, they explained it as part of the

Figure 17.1 Scenes of public engagement I.

collaborative structure of the organisation. However, they also expressed regret that there aren't enough strong scientific 'ambassadors' to make statements that attract the attention of journalists and members of the public.

My initial interpretation of the styles was to attribute the differences to understated English attitudes vs. brash US culture. However, it seems (as always) far more complex than that. Interpretation of the public from a recent British Association report (Whitmarsh, Kean, Russell, & Peacock, 2005) is that the majority of the public still respects scientists and their opinions, but question those in authority, including those in control of science. According to the BA authors, 'despite generally commanding respect

Figure 17.2 Scenes of public engagement II.

Figure 17.3 Scenes of public engagement III.

and trust, the public sees scientists as being "not quite like us" and the research they do "behind closed doors" is viewed with some suspicion'.

Perhaps the Sanger Institute was subconsciously responding to messages embodied in the House of Lords Science and Society (2000) report, that recommended all researchers—from students to senior positions—should be given 'every encouragement to share their research with the public'. More likely, its staff had been part of something they believed in and wanted to personally share their work with the people it would impact.

Regardless, these two organisations provided visitors with insight into scientific processes and engaged a variety of audiences with science. Their impact on the audiences is relatively unknown, but perhaps, as practitioners, we can use these cases to reflect upon our own approaches and motivation.

NOTES

1. Rosalind Franklin had passed away before the Nobel Prizes were awarded in 1962, Maurice Wilkins rarely spoke publicly, and Francis Crick was already ill with stomach cancer (both Wilkins and Crick died soon after the 51st anniversary—on October 5, 2004 and July 28, 2004 respectively).
2. The Human Genome Project became a 'race' in the eyes of media and public when a US private company, Celera, announced intentions of completing the human genome faster than the International Public Consortium, and selling the data it generated.

REFERENCES

Burns, T W, O'Connor D J, & Stocklmayer, S M (2003) 'Science Communication: A Contemporary Definition'. Public Understanding of Science, 12, 183–202

Dolan DNA Learning Center Internet site (2003) About the Dolan DNA Learning Center: Mission and Vision, http://www.dnalc.org/ddnalc/about/

Inglis, J, Sambrook, J, & Witkowski, J (eds.) (2003) *Inspiring Science: Jim Watson and the age of DNA*, Cold Spring Harbor, NY: Cold Spring Harbor Laboratory Press

Millar, S (1996) in Burns T W, O'Connor D J, & Stocklmayer, S M (2003) 'Science Communication: A Contemporary Definition'. *Public Understanding of Science*, 12, 183–202

Petkova, K & Boyadjieva, P (1994) The image of the scientist and its function, *Public Understanding Science* 3, 2, 215–224

Whitmarsh, L, Kean, S, Russell, C, & Peacock, M (2005) *Connecting Science: What we know and what we don't know about science in society, the BA* (British Association for the Advancement of Science)

18 A PR strategy without a PR office?

Claudio A. Pantarotto and Armanda Jori

THE HISTORY AND MISSION OF THE MARIO NEGRI INSTITUTE

The Mario Negri Institute, considered to be one of the international centres of excellence for biomedical research, was founded in 1961. It was the creation of a well-known goldsmith, the owner of an important jewellery shop in the glamorous Via Montenapoleone in Milan. Although he had no specific scientific training, Mario Negri was fascinated by research studies in biomedicine. By purchasing a small pharmaceutical company, Negri got in contact with the Institute of Pharmacology of Milan University where he met pharmacologist Silvio Garattini.

When Negri died unexpectedly of cancer, his will set aside a significant sum for establishing a research institute. He also specified what the institute should do: basic research, no patent on discoveries, communication of results, information and dissemination, training of researchers at all levels. The then young Silvio Garattini was appointed director for life and work started with the 21 scientists who had been his colleagues at the university. Research activity began when the Institute was still under construction. The dream conceived by this first group had come true, namely doing research outside the boundaries of university departments and industrial laboratories, in line with the best international models. Surprisingly for those times, the Institute grew on foundations of modern communication strategies. Its activity aimed at contributing to the protection of health and of human life by acquiring, through basic research, knowledge of the biological mechanisms related to the rise of different pathologies.

The main sectors in which the Institute now operates are the following: research, dissemination of scientific information, teaching and hands-on training. Research is focused on: fighting cancer and diseases affecting the brain and the central nervous system, heart and blood vessels or kidneys, as well as on diabetes, rare diseases, and transplants (with special reference to children and old persons), in addition to research on environmental protection and drug dependence. Each of these aspects is dealt with at molecular, biochemical, and cellular level. Moreover special attention

is given to clinical and epidemiological studies. Research results are then published in international scientific journals and are presented at conferences worldwide. To date more than 10,000 studies have been published by Institute staff in addition to 4,000 non-specialist publications and 200 books. The Institute for Scientific Information lists four scientists from the Mario Negri Institute among the most cited biomedical researchers worldwide in 2005.

Training includes laboratory technicians and postgraduate research programmes in which approximately 4,000 young people so far have been trained. The Institute runs three-year full-time courses certified by the Regional Council. In addition to these courses, postgraduates may apply for a PhD. Each student receives a grant; since Mario Negri was established, 5,650 researchers have already been funded.

The Mario Negri Institute currently includes four centres in Milan, Bergamo, Ranica (near Bergamo), and Santa Maria Imbaro (in the South of Italy, near Chieti), with 900 staff members.

In Milan the Institute comprises six departments including 35 laboratories, subdivided into 38 operational units, and other offices and services. Members of staff—researchers, lab technicians, postgraduates and other students, administrative and service staff—amount to approximately 470, including some of the 22 founding members.

The Milan headquarters—on the Northern outskirts of the city—covering 9,300 square metres, was built in 1962 and later extended in 1971 and 1983, the latter extension thanks to the Valenti donation for whom our tower is named. In the Milan campus there are also the Catullo and Daniela Borgomaineirio, a 1,200 square metre building established with a contribution granted by Mrs. Marchegiano in memory of her deceased young daughter, and the George Washington Pfeiffer International House, a residential building covering 1,400 square metres, donated by the Pfeiffer Foundation (USA) designed for foreign and Italian researchers living far from the Institute's HQ.

The Negri Bergamo Labs are based in Bergamo, covering 3,000 square metres and located in an eighteenth century building, refurbished in 1983. In Ranica we find the Aldo and Cele Daccò Centre for Clinical Research in Rare Diseases located in the nineteenth century 'Villa Camozzi', a neoclassical building of 8,000 square metres. Next to the villa is the Transplant Research Centre, which opened in 2003.

In Santa Maria Imbaro, near Chieti, the Mario Negri Southern Italy Consortium, the Centre for Pharmacological and Biomedical Research, active since 1987, was established through a joint venture with the local Provincial and Regional Councils. This structure is endowed with a number of different buildings covering a total area of 18,000 square metres.

The Institute's centres as a whole occupy a total area of almost 38,000 square metres, with appliances and instrumentation worth approximately €26 million. In all the centres the Gustavus A. Pfeiffer Memorial Library, a

gift from the Pfeiffer Foundation, regularly receives the main international scientific periodicals and holds a vast number of monographs, treatises, handbooks, conference proceedings, and scientific reports. They also hold online databases.

At present the new Milan headquarters are under construction covering an area of laboratories, offices and residential accommodation of approximately 29,000 square metres and in the near future we plan to build a new structure in Bergamo.

Since its foundation, the Institute has developed following a number of unwritten principles:

- Never spend money we do not have;
- Avoid bureaucracy;
- Promote staff self-discipline;
- Avoid single contributions exceeding 10 per cent of total budget;
- Waive patents on discoveries of therapeutic interest;
- Preserve independence from politics and the economy.

COMMUNICATION STRATEGIES AND ACTIVITIES

In the past few years, patients and citizens have expressed an increasing interest in knowledge of and involvement in the choices concerning their health and in general information regarding research and therapeutic developments in science and medicine. In an attempt to meet these needs, often the non-specialist press emphasises or misrepresents news and is prone to focusing on sensational facts. This way of presenting news is not in line with accurate information that should be given when dealing with people's health.

The Institute is recognised, both by the scientific community and by the lay public, as a source of reliable and unbiased information. It has always tried to be on the side of the patient/consumer in its areas of competence. It has done so both through articles published in the lay press and through its own publications, as well as by having its researchers and director take part in television programmes.

The number of articles that have appeared in the Italian press, in which the Institute is mentioned, clearly proves its high reputation. These articles may be subdivided into four main categories:

1. Articles concerning general activities and projects;
2. Articles related to relevant scientific results obtained by the Institute's different laboratories;
3. Articles concerning issues related to human health and health policy;
4. Articles related to events organized by the Institute raise funds for research. **Figure 18.1 near here**

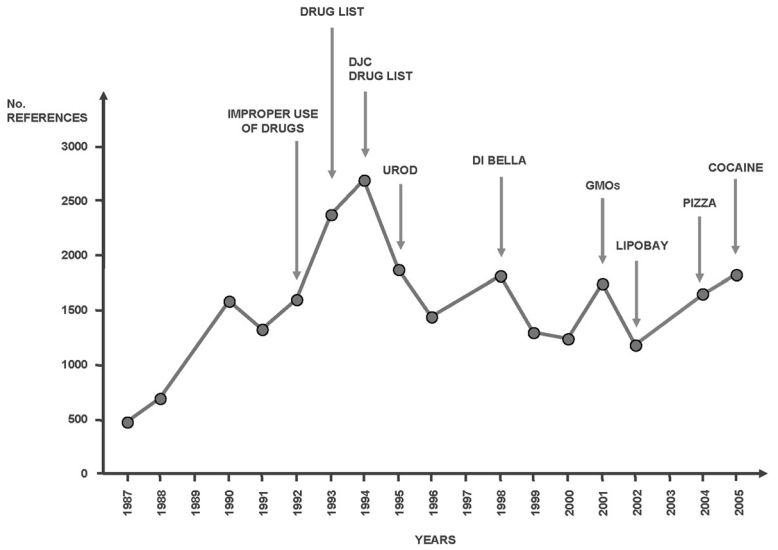

Figure 18.1 Italian daily press articles citing Istituto Mario Negri, 1987–2006.

As Figure 18.1 shows, the Institute is mentioned more than 1,000 times a year on average in the Italian daily press. The number of instances greatly increases when major public health issues are discussed. Greater value may be attached to references (2,800) appearing in the years 1992 to 1994 concerning the restructuring of the Ministry of Health; the improper use of pharmaceutical products; the establishment of the Drug Joint Commission (DJC); and the publication of the National Drug List. The latter entirely modified the list of drugs reimbursed by the National Health Service according to specific categories, thus guaranteeing citizens treatments granted by basic medical care and subdividing all drugs into two main classes: free drugs and paid drugs.

The Institute always tries to base its information on evidence, avoiding emphasis on any news that could give consumers false hopes. The over 1,700 references in the press in 1995 are due to debates on the effectiveness of the UROD methodology (Ultra Rapid Opiate Detoxification), a one day detoxification procedure that rapidly eliminates dependence by anaesthesia in subjects addicted to opiates. This is obtained by administering drugs which act as antagonists of opiate receptors thus inducing an extreme addiction crisis. Patients are then treated by psychologists for a few months. Clearly the plague of drug addiction and detoxification practice is of great interest for drug addicts, people close to them, and for society at large. Bear in mind that this treatment has not been approved by the Italian Ministry of Health. Over 1,500 references a year are again found in 1998 in connection with the so-called Di Bella case, when a heated public

debate ensued with regard to an alternative cancer therapy. The Institute made its disapproval clear.

In 2001 the over 1,500 references are mainly due to worries related to the use of genetically modified organisms (GMOs) and also to the Institute's efforts to try to clarify an issue with ethical implications above all, but also of social, economic, environmental, and medical importance. In 2002 the case of Lipobay, a drug produced by Bayer to combat cholesterol, which was withdrawn from the market for allegedly causing the death of over 50 people worldwide, triggered a real psychosis accompanied by the understandable fears of all other users (approximately 400,000 people in Italy). The information provided was so skimpy and piecemeal to cause such an alarm that even medical authorities considered it excessive. These peaks are evidence that the Institute is called upon to provide expert witnesses.

Finally in the years 2004 and 2005, approximately 1,500 references each year were due to epidemiological studies on pizza consumption linked with reduced incidence of tumours affecting the digestive tract, and to laboratory analysis of the concentration in river waters of a cocaine biotransformation product, namely benzoilecgonina, thereby verifying the level of cocaine consumption in various areas. For instance it was deduced that in a specific part of Lombardy, approximately 1,000 young adults, at least 27 cocaine doses are used daily.

The Institute also tries to offer sound, unbiased scientific information throughout the scientific community, in an attempt to avoid and possibly reveal conflicts of interests involving pharmaceutical companies. Finally, the Institute also aims to raise interest in basic research, and not only in research targeted at immediate therapeutic results. Biomedical research is never easy or fast and all the efforts made towards a certain aim are worthy of interest. Furthermore, campaigns are organised to warn physicians and ill people about the damage caused by smoking, alcohol and drug abuse. Prevention goals are also pursued by national campaigns against environmental pollution due to toxic and carcinogenic chemicals. To this end, the Institute sends approximately 20 press releases per year on average to the main newspapers.

In 2005 the name of the Mario Negri Institute appeared in 65 different national newspapers and in 62 weekly magazines. *Il Corriere della Sera*, the leading national newspaper published 93 articles in 2005 mentioning the Institute. Likewise *Il Sole 24 Ore*, the main financial newspaper in Italy, dealt with the Institute in 74 articles. The areas attracting greatest interest were the following: smoking, cancer, food, drug addiction, mother and child health, and behaviour.

The Institute has two house organs. The first is the newsletter *Negri News*, which is mailed to all the Institute's backers and to a selected number of researchers, academics, managers, and opinion leaders. With this publication the Institute aims to provide information in simple and clear language,

on general health problems, drugs policy, health care assistance, as well as providing updates on its ongoing research. The first issue was published in September 1967 and the present circulation is around 40,000 copies.

The other publication, *Ricerca e Pratica*, was established in 1985. It is mainly aimed at medical doctors and healthcare workers, and tries to help them to better understand public health care and the importance of independence and conflicts of interest in evaluating the quality of health care interventions. Its contributors include the most advanced Italian research teams, as well as independent scholars attached to the International Society of Drug Bulletins. By a careful balance between benefits and risks as well as costs by reliable and relevant data, the journal promotes the gradual improvement of people's health in Italy within a European perspective.

A website has also been created to provide general information on the Institute, detailed information on the different research areas and programmes, and includes a section devoted to the press and general public with news, press releases, and articles published in the lay press. Other website sections deal with specific areas of medicine such as oncology, cardiology, etc. One of the most recent additions is a site created in partnership with the Italian Cochrane Centre and the agency for scientific journalism, Zadig. This site, called *Partecipasalute* is addressed to patients and provides reliable information on the effects of health care interventions. It also informs consumers on the world of clinical and epidemiological research. Patients, consumers, and their associations are thus enabled to actively participate in healthcare decisions.

Other centres, associations, and committees are based at the Mario Negri Institute or collaborate with it at various levels. Through their activity they help establish relationships with the lay public, with patients and their associations, but also with political and administrative bodies. These bodies help to extend the Institute's communication efforts on a wider scale at both a national and international level entirely avoiding costly promotional campaigns.

The Centre for Clinical Research on Rare Diseases was established in 1992 at Villa Camozzi. Its remit is those 'orphan diseases' that affect a small percentage of the population and elicit very limited commercial interest. Besides doing research on rare diseases it provides information, through a toll-free call centre for physicians and patients, on rare diseases, on the possible therapies available, and on the best centres in Italy and abroad.

The activities of our Geriatric Neuropsychiatry Laboratory and our Mother and Child Health Laboratory include a drug information service providing direct line consulting to physicians, health professionals and citizens, on issues concerning the correct use of drugs, their side effects and interactions in old age, pregnancy, and the perinatal, neonatal, and childhood developmental stages. The service is part of the network of drug information centres of the Italian Drug Agency.

Some yearly public events are at the core of Mario Negri strategies to improve its public visibility and incentive donations.

The first and most important is organized in the context of the Negri-Weizmann Committee, set up to support the ongoing scientific cooperation between Mario Negri and the Weizmann Institute, also named after its founder, whose dream to establish an important research centre in the Israeli desert has been realised. Activities mainly focus on fund raising for common projects and promotion of the two institutes' public image. Almost every year since the late eighties, a glamorous cultural event, *Music and Research Together for Health,* has been organized at La Scala in Milan. With time, the event has become an important rendezvous for VIPs and opinion leaders who support the activity of the two institutes. Due to its importance—also in terms of musical contents since it features the best international conductors—the concert receives full television coverage.

Some key elements of the event are:

- Cooperation between internationally acclaimed research centres;
- High profile audiences (politicians, businessmen, and intellectuals);
- Special musical programmes (last year focusing on the 2006 Mozart celebrations);
- Select venue, the world famous La Scala in Milan;
- Top conductors (Gilbert Kaplan, Riccardo Muti, Zubin Mehta, Mstislav Rostropovich, Salvatore Accardo, Valery Gergiev, Jeffrey Tate, etc.), orchestras and choirs (Orchestra e Coro Filarmonico della Scala, Israel National Philarmonic Orchestra, the London Symphony Orchestra, Orchestra da Camera Italiana, Wiener Philarmoniker, Orchestra and Choir of Saint Petersburg's Mariinskij-Kirov Theatre, Bayerisches Staatsorchester), and the following soloists: Radu Lupu, Maxim Vengerov, Pinchas Zukerman, Maurizio Pollini Julia Fisher, Itamar Golan, Saleem Abboud Ashkar, Dieter Flury, Charlotte Balzereit.

This event is prepared with the utmost care and is always presented to public and press in an appropriate venue, generally the best hotel in Milan, to announce the concert and to illustrate the results springing from the collaboration between the two institutes. The same criteria have also been successfully applied in other prestigious events such as 'Art and Research' for which well-known contemporary artists generously offered their works, sculptures, paintings, drawings and signed prints to be sold in support of our research programmes.

A third major event is the 'Derby del Cuore', a football match played by some of the most popular Italian singers and TV personalities, wearing for the occasion the colours of Inter FC and Milan AC, the two prestigious Milan football clubs. The match is broadcast in prime time on national tele-

vision and the city stadium (80,000 seats) is usually sold out, with all revenues given to a group of charities which include the Mario Negri Institute.

Communication policies are also of paramount importance with regard to donors. The Institute budget is covered by research contracts, reimbursement of actual costs and financial earnings, but an important chapter of the budget includes gifts and donations to the Institute that may even reach over 30% of the total, well in line with the high public profile and reputation acquired by the Institute. During the first years of activity, funds mainly came from abroad, but very soon donations started to come also from Milanese private benefactors. This was due to personal acquaintances of each of the 22 founders. Among them a prominent role was played by the late Professor Alfredo Leonardi, Secretary General, who combined scientific competence with organisational skills, making him one of the earliest 'research and communication managers'.

All donors have personal ID numbers, so that the Institute can track donor data and keep in touch with them. Donors may also want to devote their contribution to a specific research project or study currently underway in the institute. On the basis of a given choice it is possible to identify the field of interest and provide constant information in that area. Each donor is sent both a receipt and a personal letter. Subsequently is also possible to send further notices concerning the area of interest and information regarding the use of the contribution in addition to the latest copy of our newsletter.

Equal attention is paid to all contributors, even those whose donation is very limited. To date, more than 5,000 donors have been registered, of whom 1,800 send an annual contribution. A strong point of this action is to create a group of regular contributors through constant and personal contact.

Public relation and communication activities in the Institute are managed by three different offices cooperating with one another, namely the Studies Office, the External Relations Office and, more recently, the Press Office. They employ three people in addition to a full-time and a part-time secretary. The Studies Office is in charge of:

- Collecting articles concerning the Institute appearing in the press;
- Maintaining contacts with people and bodies supporting our research;
- Publishing the house organ *Negri News*;
- Coordinating the activities of the Mario Negri Alumni Association;
- Monitoring activities aimed at raising funds for research, together with the External Relations Office;
- Monitoring and promoting the Institute's role in campaigns on information programmes concerning the usefulness of animal experimentation in the development of new and more effective drugs.

The External Relations Office deals with:

- Maintaining contacts between the Institute and both Italian and foreign authorities and other bodies;
- Monitoring construction of the new headquarters of the Institute (29,000 sq m) in Milan as regards authorisations, permits, tenders, mortgage, and funding applications etc;
- Legacies, inventories and sales of movable and real estates;
- Legal and administrative suits;
- Fundraising (in partnership with the Studies Office);
- Supporting the activities of the associations cooperating with the Institute.

The Press Office is responsible for:

- Preparing press releases and organizing press conferences;
- Monitoring publication of the Institute's brochures;
- Cooperating with the IT Laboratory, the Library, and the Institute's scientific bodies in compiling and updating our website.

CONCLUDING REMARKS: PUBLIC RELATIONS WITHOUT A PR OFFICE?

As described, the way the Mario Negri Institute tackles communication and public relations activities is probably quite different from other research institutes in the same area. In place of an integrated communication policy managed by a specific PR office, the Institute has a broad set of activities implemented at different levels and in different operational contexts, with two main public events in terms of visibility and fundraising. While in the long run this may engender a risk of fragmentation and repetition at the communicative level, it has so far well served the purposes of respecting the autonomy and peculiarities of the different fields and audiences touched by the Negri activities. Furthermore, coherence and consistence in communication has been provided by our belief that those performing public relations and outreach activities must combine at least three distinctive qualities. First of all, scientific competence: it is not possible to promote research without a thorough knowledge of the objectives to be pursued and an ability to translate results and their relevance to the public in simple and understandable form. Second, administrative and legal skills: contacts between a scientific environment and the outer world are always subject to bureaucratic procedures concerning research contracts, project proposals, standards of evaluation, and public as well as private funding. And finally,

and its importance must not be under-estimated, communication of our mission and activities requires awareness of the history of the Institute, necessary to foster both progress and consistency with the past.

ACKNOWLEDGEMENTS

We wish to thank Paolo Zanna and Isabella Bordogna for their precious assistance and useful suggestions in the preparation of this chapter.

19 Public engagement of science in the private sector

A new form of PR?

Jane Gregory, Jon Agar, Simon Lock, and Susie Harris

This chapter considers the development of the recent programme of interventions in the science–society relationship in the UK, in the context of an evolving commercial environment for science and technology. It characterises the potentially conflicting trajectories of these, and identifies tensions in the present position, in which private companies are being encouraged to undertake public engagement—a process potentially at odds with traditional methods of PR and marketing. These tensions were explored in the RSA Forum for Technology, Citizens and the Market, a project that looked at ways of encouraging social learning in industry, to facilitate the development of welcome and beneficial applications of new technology. The Forum undertook a series of qualitative interviews with marketing and research staff in science-based companies operating in the UK. These interviews revealed a broad range of attitudes to engagement with the public, ranging from strong advocacy, via indifference to any kind of public engagement except where it could be conflated with traditional public relations, to active rejection for various reasons including reputational risk and lack of the necessary resources.

THE CONTEXT OF PUBLIC ENGAGEMENT WITH SCIENCE IN THE UK

Since the Royal Society published its report on the public understanding of science in 1985, the public institutions of science in the UK have maintained a programme of interventions in the science–society relationship (Royal Society, 1985). These interventions have enjoyed various labels, among them 'science communication', 'public understanding of science', and 'science and society', and in many institutions these labels replaced public relations (PR) in the relevant officers' job titles. Insofar as these labels represent any real difference in the phenomena they describe, this difference is summed up, in historical sequence, by the phrase 'from deficit to dialogue'.

In the early 'deficit' phase, the deficit identified was in the public's knowledge of science, and this was held to be responsible for supposed negative attitudes to science. The response to this deficit was to encourage the provision of scientific information to the public, in forms usually designed to amaze and delight. While various authors enumerated the personal and social value of this exercise, others identified it as a marketing and image-building exercise for science, and pinpointed the self-interestedness of the institutions—mostly public institutions—that were taking part (Lewenstein, 1992). In many ways, then, this approach had much in common with PR.

In the context of the public understanding of science, a challenge to this 'deficit' approach soon emerged. It consisted of two key arguments: firstly, it became clear that greater knowledge did not correlate with more positive attitudes in the way anticipated: people who learn more about a scientific issue or technique do not necessarily feel more positive towards it as a result of that learning. Secondly, social scientists identified an alternative process, the contextual approach, in which scientific issues that arose in local circumstances could be discussed between experts and laypeople in ways that did not privilege particular types of expertise—moral, local, personal, or technical—and which required all parties to listen to, and respect, each other's point of view (Wynne and Irwin, 1996). Over a period of around 15 years, this contextual approach acquired the label 'dialogue', and the process by which dialogue is achieved is now known as 'public engagement'.[1] Dialogue and public engagement have become the paradigm for social learning in the UK, and require of institutions and their publics that they co-construct a discussion on topics of mutual interest, and that the results of this discussion contribute to the shaping of science and science policy. In this mode, the public are seen not as mere recipients of information, but as contributors to social intelligence, fulfilling their responsibilities as citizens in a technoscientific world that is shaped by common values, concerns, and aspirations.

In some ways, engagement is like market research, except that its scope extends much more broadly beyond products. An engagement exercise might require market researchers to find ways to test products that do not yet exist, or to discuss a company's intention to set up a factory in China, or to open its own canteen and deprive local shops of lunchtime business, or to fit smart tags to the shirts it makes to report how often they are washed. The public who participates in this form of engagement may have absolutely no intention of buying anything from the company.

Like PR, engagement allows a company to exhibit its resources, stake its claims, and construct its own image. However, engagement also allows the public to exhibit its resources, stake its claims, and construct its own image. PR officers may find that their public brings its own agenda to an engagement, and is interested in issues that had never occurred to the company; that the bad news, rumours, and misunderstandings get as much attention as the good news; that they have to listen as much as talk; and

that they are not in control of the flow of news and opinion. From the point of view of institutions that are used to managing the flow of information about themselves and their place in society, this process of engagement may thus seem the antithesis of PR: it is unruly, spontaneous, and conflictual; and its outcomes are often unpredictable.

SCIENCE IN THE COMMERCIAL SECTOR IN THE UK

Over the same 20 years during which 'deficit' has been turning into 'dialogue', the organisation of science in Britain has been changing too. In a period beginning with Margaret Thatcher's tenure as Minister for Science in 1970, science in the public sector has increasingly been organised on a commercial model, with both government and university science often farmed out to small, specialized, and sometimes short-lived enterprises. According to Williams, 4 per cent of spin-offs date from before 1980, 21 per cent from the 1980s, 22 per cent from the early 1990s, and 53 per cent from 1995 to 2003, giving a median age for spin-off companies of seven years.[2] Also, new companies have started up to explore the potential of new technologies that might in the past have been explored—rather more slowly—in universities. Competition favours rapid innovation and a high degree of attrition—to use Williams's jargon, these 'spin-off' and 'start-up' companies are 'tadpoles' not 'babies'. The distance from lab bench to commercial product is considerably shortened in this new environment.

This situation is not unique to the UK. Historian of economics Mirowski has identified a similar long-term trend in the USA (Mirowski, 2005). He describes how the Cold War provided a frame for highly stable, physics-based industries, usually centralised, government-controlled, and specific to their host nation, with limited, if any, competition. This situation was replaced by one in which industries passed into private ownership, and the economic and political climate favoured the proliferation of smaller, often transient companies, whose geographical location is irrelevant to their operation except insofar as they can take advantage of different regulatory regimes in different countries. Such companies have highly educated workers undertaking specialist tasks, often in the biomedical sciences: biotech start-ups are typical of this period. Mirowski is not alone in claiming that such changes indicate a significant shift in the place of science in society: from a situation in which science was largely in public institutions and accessible to democratic governance, to one in which it is largely corralled in the private sector. There it is subject not only to the formal containment resulting from intellectual property rights and non-disclosure agreements, but also to the secrecy required in a competitive market, and more subtle forms of privacy conferred by corporate instability and rebranding. If the icon for biotechnology is the double helix—the product of a university laboratory—the icon for nanotechnology (according to a recent straw

poll of STS scholars) is explicitly corporate: it is the IBM logo written in atoms.[3]

Yet it is precisely this environment of privatised science that the lobbyists for public engagement now have in their sights. Although the potential of dialogue is contested,[4] it has become a valued tool for guiding public sector planning and services, and part of the UK Government's policy strategy for encouraging innovation in science-based businesses.[5] The Government was unnerved by the public rejection of GM food, which saw street protests, destruction of test crops, and a consumer boycott of GM products, to the point where GM business left the UK. Fearing a similar rejection of forthcoming innovations, in 2005 the Government offered incentives to institutions that engage citizens in dialogue about nanotechnology, energy generation, and animal experimentation (with a view to its role in the pharmaceuticals industry). This initiative, despite being hosted by the Department of Trade and Industry, nevertheless attracted overwhelmingly public sector bids.

PUBLIC ENGAGEMENT: VIEWS FROM SCIENCE-BASED INDUSTRY

This is the context in which the Royal Society for the Encouragement of Arts, Manufacture and Commerce (RSA), in collaboration with the Science & Technology Studies Department at University College London, ran its Forum for Technology, Citizens and the Market.[6] The RSA was founded in London in 1754, in a culture of enlightenment and industrial revolution, to encourage the development of a principled and prosperous society. It now runs a programme of projects and meetings that acknowledge and seek to promote the connectedness of businesses and other specialised institutions with the wider society. The Forum was set up within the RSA to explore ways of encouraging social learning in industry in order to facilitate the development of welcome and beneficial applications of new technology. The underlying principle was that businesses shape not just the market but also society more widely, and that they are therefore significant for, and subject to scrutiny from, a wider community than just their customers. The impetus for the Forum came from RSA members who wanted to avoid the kinds of social dislocation (and compromised profits) experienced by companies involved in the introduction of GM food in the UK, and who saw more than just misguided customer resistance in the misfortunes that befell that industry.

In the particular context of the Forum, 'dialogue' would mean that science-based businesses and the public would engage on equal terms in discussion on topics of mutual interest, and that the results of this discussion would contribute to the shaping of research, development, and manufacturing. However, the private sector poses different challenges from the

public sector for anyone who would look to encourage dialogue. While the public sector can be seen as duty-bound to engage with the public, and has a sense of its role in the wider community, much of the private sector has no such tradition. Indeed, while hospitals, schools, and welfare institutions meet 'the public' every day, it is a less familiar entity to private sector institutions. (One of the tasks of the Forum was to explore what 'the public' might mean for businesses.)[7] However, businesses in the UK are aware of a dislocation with wider society—the recent rise of 'corporate social responsibility' is a testament to the perception within industry that relations with the public are a matter of more than public relations. There is also empirical evidence to suggest that relations are deteriorating: survey data show that the British public have, over the last 20 years, lost their faith in businesses to contribute positively to the wider world, and trust in business leaders is now only slightly higher than in politicians and far lower than in police officers, scientists, and teachers (Dewhurst, 2003).[8] Our experience in the Forum was that the GM protests were often cited by science-based businesses as indicating that any new science-based product was at risk. Past successes and failures tended to be categorised thus: successful science-based products are good products; and unsuccessful science-based products are victims of negative public attitudes to science. In one Forum discussion, the GM controversy was described as 'a classic case of the breakdown of public acceptance of science', and resistance to GM food was compared to the initial resistance to pasteurised milk and electric light bulbs. Such negative attitudes to things we don't yet realise that we really want was generally attributed by companies to public ignorance, bad schooling, poor understanding of probability, and widespread and undifferentiated risk-aversion, all stirred up by irresponsible journalists. It was clear that the range of views about 'public understanding of science' that we have encountered in universities and policy organizations over the last 20 years is thriving in the private sector—including sophisticated approaches to public engagement; for example, in the nuclear industry.[9]

In order to explore the potential for and constraints on dialogue between businesses and their publics, the Forum commissioned a series of qualitative interviews with marketing and research staff in 12 science-based companies operating in the UK.[10] Much of the data generated remains to be analysed; however, we have assessed the responses to see how they might help us to think about the potential for engagement between science-based companies and their publics (RSA report, 2004).

WHAT IS 'THE PUBLIC'?

Some valuable business practices are necessarily contrary to the spirit of inclusiveness, openness, responsiveness, and transparency that informs fruitful dialogue. Issues of intellectual property, non-disclosure agreements, and

simple matters of competition are acknowledged in the private sector. But is there anything about the public itself, according to our respondents that might mean engaging would or would not be useful? Some respondents told us that the public are not interested in knowing what goes into the making of the products they buy; others said that they had tried to hold open days and similar events, but that no-one had turned up. Others were sceptical of there being a public at all for issues of science and industry, and attributed the publicness of such issues to the mischievousness of the media:

> What public? My mother-in-law didn't care less about the publicity about GM crops. [Public protest] generally means…what appears in the media…(Senior male technologist, energy sector)

Some respondents thought that the public do not have strong or consistent views, and so would not be able to generate any clear or useful messages. Several respondents thought that their business was simply too esoteric for public input to be meaningful, and that engaging in dialogue about it was just too difficult.

Some respondents could see significant disadvantages in engaging with their local communities, and expressed this in terms of 'stirring up trouble' or 'blowing things out of proportion'. They wanted a clear view of the positive returns. Some respondents spelled out what these returns might be: an enhanced social mandate was one; another was to avoid the suspicions that might arise if a company gave the impression of being secretive. Others saw engaging with the public as a way of picking up on risks to their reputation; though others suggested that reputational risk only matters if a company *has* a reputation: some of the companies in our sample were small, new companies focused on new technologies and selling to industry or government, and with no reputation at all in the wider society. These 'tadpole' companies are in a very different position from those companies that sell on the high street or are household names (the more stable, though rarer, 'frogs'). Others, though, thought reputation was an old-fashioned idea: reputation management had been replaced for them by the management of expectations: so instead of asking about attitudes—what the public thinks of a company—one should now ask about expectations. Expectations are more about what the public wants from a company or, perhaps, what they will literally and metaphorically 'buy'. Here a company is in marketing mode, and is thinking not about its public, but about its customers.

Some respondents argued that building a relationship with their public is a slow process, and it is difficult to act quickly when disaster strikes. Some companies had learnt the lesson of 'act now, don't wait' from the experience of Monsanto, which has now pulled out of the UK after public protests against its GM products. Several respondents suggested that some interest in a wider range of views might have helped Monsanto in that situation. Some respondents thought that companies had become 'arrogant'—

this word was used many times—and that companies could treat the public with more respect. Others told us that engaging with the public was going to prove vital in the present climate, for moral and economic reasons:

> This is a journey that people are having to go on, whether we like it or not. Some of us recognise that it's also a good thing and frankly the people in the lead will reap commercial benefits from it in due course and the ones that don't will struggle. (Senior male technical officer, energy sector)

ENGAGING: WHEN AND WITH WHOM?

Who should take responsibility for the contact? We had a range of current practice, but much of it was passive: respondents said 'we tend to wait for [feedback] to come' or 'we're very open if people come to us'.

From whom might this feedback come? For our respondents, the public was invariably 'the customer, but not…the non-customer'. It was 'people who decide whether or not they buy things'. And the rationale for this was : 'In a capitalist company that's what you do'. Many science-based companies are one link in a supply chain and a long way from the high street, which was one reason for their understanding that while their public was their customers, their customers were not the public. In such long supply chains there are disincentives to determine which company or companies have responsibilities for public engagement over the science involved. So 'The general public are fine, but on their own are irrelevant because they don't buy our products'. As for a company's community: 'Community to me tends to mean…an industry community'. One other public mentioned is investors: 'keeping them informed is a major priority…'; and the last was NGOs, though some respondents found them hard to handle: they are ' a bit more relevant [than the general public], but you have a less constructive debate'. So mostly the relationship with people outside the company was financial, rather than social, and a company's public was the people with whom it had a financial relationship. This is a rather different group from the active citizenry invoked by the ideal of public engagement.

As for timing, respondents advised that engagement should take place early on in the R&D process:

> I think when you start to get these big scientific changes…society needs to be engaged with it really very early on…we've got to get into this…. (Senior male technical officer, energy sector)

One advantage of talking about research early on was that it offered a glimpse of the future, which is what investors would want to see. But starting the talking early means exposing the uncertainties in the system,

and, like some scientists, some companies are not comfortable with uncertainty—'We tend not to publicise too much about what we do until we're actually 101 per cent sure'—and they recognised the difficulty of predicting the future:

> If you're talking to somebody that says 'Do you want this in ten years' time?', I mean, that is quite a difficult thing to ask yourself. (Senior male research director, agricultural sector)

Others thought they should have more confidence, both in themselves and in the public, and talk more about the risks and benefits.

THE CONTENT OF ENGAGEMENT

What sort of discussion might one have? A range of views emerged, and a familiar tension arose: some argued for giving out more information—'more convincing data'—in the hope of achieving the desired effect, while others argued that:

> You…have to wise up to the fact that there's more to this than just being technically right. You have to understand why other people, even if you are technically right, might not think it's a good idea.… (Senior female director of technology, energy sector)

To explore the space around 'the customer', we asked our interviewees about wider issues and wider communities. For some, the emphasis on the public-as-customer meant that questions about the wider community were baffling. Others deployed a standard PR model:

> …how…we anticipate reactions of society at large is we make sure through the communications process that they have sufficiently proper information about the company to make decisions about us that are relevant to us…so hopefully we can anticipate reactions by managing those expectations properly. (Senior male corporate affairs officer, engineering sector)

On the question of these wider issues, one respondent suggested that companies' focus on products per se was not always appropriate. Talking about an innovation in agricultural technology, he argued that it was symptomatic of the bigger system in which it was used, and that the bigger system itself might merit some attention:

> …what I think would be useful is if there was a bit more discussion about what…people really want their agriculture to do, and then you

> can go back and address the technology. The technology is trivial really. (Senior male research director, agricultural sector)

But other respondents thought that they would not be influential in the wider context:

> I don't think we would regard ourselves as having the opportunity or the resources to sufficiently influence the ultimate environment to our benefit. (Senior male corporate communications director, engineering sector)

ENGAGING WITH ENGAGEMENT

We wondered whether public engagement was something our respondents knew about, so we asked them about the GM Nation exercise, which took place in 2004, as a point of reference. GM Nation was a nationwide, government-sponsored public engagement exercise led by an independent steering group and chaired by an academic lawyer. Despite being haunted by the ghost of the GM protests, few of our respondents had heard of GM Nation, and one who had, said:

> I think the Government did a good job in doing the consultation. Quite apart from whether or not it was actually effective, it was a brilliant publicity stunt, good PR. (Senior female communications director, biotechnology sector)

Another respondent was happier with a 'try it and see' approach:

> …the Government is going around consulting…. You know…these things are better done in practice…you use it, see how it goes, and then see what people say. (Senior male corporate affairs officer, engineering sector)

SUMMARY OF RESPONSES

Thus it seems that in our small sample, there is a broad range of views about the value and potential of public engagement. Our respondents' attitudes ranged from strong advocacy, via indifference to any kind of public engagement except where it could be conflated with traditional public relations, to active rejection for various reasons including reputational risk and lack of the necessary resources. We have not analysed our data to see how variables such as job responsibilities, the size or age of the business or its present public profile might affect responses. But responses for and against engagement can be summarised as follows:

Reasons to engage	*Reasons not to engage*
Can generate useful feedback	Feedback will be irrelevant
Can protect reputation	Can jeopardise reputation
Can develop social mandate	Public are not interested
Can deliver commercial return	It's difficult, and returns are poor
Can broaden influence in community/society	Companies don't have broader influence anyway
Talk can guide action	Prefer action to talk

This was the context in which in February 2005 the Forum for Technology, Citizens and the Market launched its Guidance for Science-Based Businesses on Engaging with the Public. This is a web-based tool that enables businesses to weigh up the pros and cons of engagement, plan an engagement exercise if and when that is appropriate, and act on its outcomes. It can be found at http://www.techforum.org.uk/guidance. One section of the Guidance deals with the integration of engagement into business practice, and this may be where the biggest challenge lies.

The Forum's web-based tool is now being recommended by the UK Government to businesses looking to innovate in areas where some form of social negotiation would lead to better investments, better products, and a happier co-existence between the market and the wider community. The tool has a feedback function, and we will be looking forward to following closely how the guidance works as a practical business tool, and, in particular, whether companies find they can accommodate engagement alongside the more traditional activities of market research and PR.

NOTES

1. For the shift from deficit to dialogue, see Gregory and Miller (1998).
2. tp://www.auril.org.uk/webpages/Too-Few-University-Spin-outs-EWilliams.pdf
3. Question posed by Jane Gregory at the 'Science for Sale' conference, Cornell University, April 2005.
4. See, for example, Djurodie (2003).
5. See, for example, Department of Trade and Industry/HM Treasury (2004).
6. http://www.techforum.org.uk
7. See Gregory, J (2004); or http://www.rsa.org.uk/acrobat/who_is_the_man_in_the_street_12_05.pdf
8. Trust in scientists in industry is also lower than in scientists in other sectors. See: MORI (2005)
9. See also Sharon Beder's work, for example, Beder (1999).
10. The interviews were conducted by a CSR consultancy, the Virtuous Circle: Tony Hoskins and Peter Emery, Binfield Place, Forest Road, Binfield, Berkshire RG42 4EA, UK.

REFERENCES

Beder, S (1999) 'Public participation or public relations?' In Martin, B (ed.) *Technology and Public Participation* Wollongong, NSW: University of Wollongong)

Department of Trade and Industry/HM Treasury (2004) *Science & Innovation Investment Framework 2004–2014*, pp.103–105

Dewhurst, M (2003) *The Rise and Rise of Red Tape* London: MORI

Djurodie, B (2003) 'Limitations of public dialogue in science and the rise of the new "experts"'. *Critical Review of International Social and Political Philosophy*, 6 (4), 82–92

Gregory, J (2004) 'Who is "the man in the street"?' *RSA Journal*, Summer

Gregory, J and Miller, S (1998) *Science in Public: Communication, Culture and Credibility* New York: Plenum/Basic Books

Lewenstein, B V (1992) 'The meaning of 'public understanding of science' in the United States after World War II' *Public Understanding of Science* 1(1), 45–68

MORI (2005) *Science in Society: Findings from Qualitative and Quantitative Research* London: Author

Mirowski, P (2005) 'Caveat Emptor: Rethinking the commercialization of the laboratory.' Paper presented at 'Science for Sale? The Public Communication of Science in a Corporate World,' Cornell University, 15–17 April 2005.

Royal Society (1985) *The Public Understanding of Science* London: Royal Society

RSA Report (2005) *What's There to Talk About?* London: Royal Society of Arts

Wynne, B and Irwin, A (1996) *Misunderstanding Science: the Public Reconstruction of Science & Technology* Cambridge: Cambridge University Press

20 The strength of PR and the weakness of science journalism

Winfried Göpfert

For a long time science was perceived as something positive and presented favorably in the media. In the mid-seventies perception and media coverage became more critical (Kepplinger 1989; Bauer et al. 1995). Certain practices were no longer accepted by the population. Science and technology had gotten into an acceptance crisis. Scientists and researchers felt compelled to justify their work and campaign for more public support. In the mid-eighties, this task was approached consequently in Great Britain when a series of measures were put into practice using the 'Public Understanding of Science' (PUS) project as a framework, supported by the government (Gregory & Miller, 1998, 1–18).

The German-language countries followed these deliberations. In 1999, the German science organizations founded the PUSH initiative (Public Understanding of the Sciences and Humanities). Amongst the many activities since then,, a communicator prize was set up, each year awarding around 50,000 Euro to scientists who successfully managed to communicate their research to the public. Science festivals were planned, investing several millions. Media training for scientists is offered on a regular basis (Peters & Göpfert, 1995). Great efforts are being taken to intensify science communication.

But this strengthening of public relations occurs in a quite peculiar situation; one might call it the weak phase of journalism. This weakness of journalism as a phenomenon is true for journalism as a whole and for science journalism in particular: Editorial staff is being reduced, spheres of competence are being outsourced, and PR products replace journalistic products without being sufficiently identified as PR.

Public relations is gaining influence, but independent journalistic coverage is decreasing. The growing influence of PR on journalism results in a biased coverage that tends to support the interests of the PR makers. Science coverage only catering to the needs of science PR can only lead to a distorted view of science. Criticism, one of the main journalistic functions, falls by the wayside. Hence, reservations the public might bear towards science are no longer given a forum for further discussion.

In the following section, the relation between public relations and journalism will undergo further analysis, taking science coverage as a set

example. Which role does public relations play for the sake of science? Which are the legitimate tasks of PR, and which practices of exerting influence are not acceptable on a long-term basis?

PUBLIC UNDERSTANDING OF SCIENCE ACTIVITIES IN THE UNITED STATES, GREAT BRITAIN, AND GERMANY

The year 1957 can be considered an important landmark in the development of American PUS efforts. After the Sputnik-shock, the National Science Foundation initiated the program 'Public Understanding of Science', aimed at altering people's attitudes towards science and education (Lewenstein 1992, 60). Over the next two decades, the American government provided several billions of dollars for the promotion of scientific education (Gregory & Miller 1998, 4). The development in Great Britain was mainly triggered by a 1985 report of the Royal Society, the supreme science authority. As a result of the report, the Committee on the Public Understanding of Science (COPUS) was founded. This committee launched a wide range of activities, bringing forth the creation of a downright public-understanding-of-science industry (Gregory & Miller 1998, 7). The science counselors of the British government spend around £4.5 million per annum on PUS-measures. An even bigger sum is contributed by foundations, the national lottery, and individual science institutions (Krebs 1999, 18). The PUS-measures can be characterized as follows:

- Public lectures
- Courses in adult colleges
- Scientists' sponsoring of school classes
- Open days
- Science street events/exhibitions/festivals
- Science theatre/comedy
- Promotion of science museums and science centers
- Awarding prizes to successful communicators of science (scientists or journalists)
- Consensus meetings
- Trainee programs or internships for scientists
- Trainee programs or internships for journalists
- Improvement of public relations work of scientific institutions
- Accompanying research

German science organizations strive to realize very similar programs. By choosing the acronym PUSH—Public Understanding of the Sciences and Humanities—they have overtly stated their commitment to the Anglo-American example, although verbally, they continually emphasize that their intentions are not only driven by self-interest: neither gaining acceptance

nor polishing the image, but creating a constructive dialogue between science and society was their main target. On the other hand, those organizations consider it their task to convince people that economic prosperity and high living standards are mainly to be owed to scientific research. This formula of the German PUSH initiative defines a task clearly belonging to the realms of PR. It can be derived from pure self-interest, whereas the wish for critical dialogue appears to be in no way connected to substantial plans.

The PUSH initiative and the accompanying strengthening of public relations have to be seen in the light of a changing media system. The relation between science PR and science journalism is presently shifting, just as much as the relation between journalism and PR as a whole. This context will be analyzed in the following chapter.

THE POINT OF VIEW OF COMMUNICATION RESEARCH

In communication science, the relationship between journalism and public relations has recently been conceptualized by two competing hypotheses. According to the 'determination hypothesis': 'The more influence public relations gain, the less influence can be attributed to journalism and vice versa' (Baerns 1991, 17). The determination hypothesis, however, fails to take into account selection criteria and further processing of PR material that come into effect on the side of journalism.

On the other hand, the model of intereffication postulates that the PR system and the journalistic system, with their specific communication performances, enable the communication performance of the respective other system. The PR system, for instance, needs media publicity to be successful, whereas the media system depends on the information and the communicational willingness of the PR system (Bentele et al., 1997, 240). This model is criticized mainly because it suggests that without PR, there is no journalism, and vice versa. And, more importantly, the model fails to take into consideration the antagonism between the two systems. Russ-Mohl therefore proposes the use of the term 'interprenetation' and warns: 'If PR manages to overrun journalism and if we fail to establish a balance between the two systems, this might eventually be fatal for both systems and even for the freedom of information and the press in a democracy' (Russ-Mohl, 1999, 171).

The theoretical approach of Weischenberg seems particularly appropriate for our analysis, since it accentuates the social function of each system:

> What is and remains important is to draw a clear line between the function of each sphere. In public communication, journalism and public relations have to fulfil different purposes. Journalists construct 'true realities' on the basis of constitutional preconditions and within the framework of professional standards.... Public Relations create

> 'desirable realities' for the sake of the customer.... Both, journalism and PR, are necessary today. But both have to play different roles. (Weischenberg, 2000)

Nevertheless, recent developments seem to counterpoise this functionally important distinction between both communication systems.

WEAKNESS OF JOURNALISM—BOOST OF PUBLIC RELATIONS

In the following section some tendencies pointing up the ongoing weakening of journalism will be highlighted:

- Decreasing numbers of publishing houses accompanied by diminishing competition between publishing houses;
- Tendency towards free alternative offers;
- Reduction of editorial staff and outsourcing of journalistic spheres of competence;
- Closing down of specialized editorial departments.

Present statistics and balance sheets give proof of the decreasing number of published units and the resulting decrease of competing publishing houses: The number of published units in Germany decreased from 225 in 1954 to 119 in 1989. After reunification, some East German newspapers were added. Today 135 units are published in Germany, altogether selling an edition of almost 25 million copies. In some regions of Germany, for instance, over 80 percent of the counties and larger cities have only one local newspaper.

The development of alternative offers that are free of charge is also proved by the statistics: Especially in the countryside, traditional newspapers are threatened by promotional material and free newspapers. In 1980, the promotional material had already reached 700 titles, in 1998 their number amounted to 1,300 titles of some 85 million copies (Rager 1999).

Concerning the reduction of editorial staff and the outsourcing of journalistic spheres of competence, no summarizing analysis has been made available so far. But several individual reports all point in the same direction—even when it comes to the public broadcasting stations. For example, since the mid-nineties 600 jobs were lost at the public broadcasting station ZDF. Since then, employees keep complaining about the drastic loss in programming quality (Fichtner et al. 2000, 21). Hints of more examples can be found in a variety of sources (Kaiser 1999; Ritzert 1999, 37; Röper 1999, 46; Weischenberg 2000).

As for the closing of specialized editorial departments, we also lack a summarizing survey. However, the general tendency can be estimated

by looking at individual examples: At the *Westdeutsche Allgemeine Zeitung*, specialized editorial departments were closed down and replaced by centralized editorial offices delivering theme pages like 'health', 'automobile', or 'computer' to all regional newspapers. Should this trend prevail, the existing science, health, and medical editorial departments will soon become dispensable.

The following tendencies may stand as proof for the growing influence of public relations:

- The number of PR workers grows dynamically;
- Public relations increasingly copies journalistic working methods;
- Public relations increasingly uses journalistic personnel;
- Concerning science journalism: evaluation criteria of the scientific community influence media coverage.

The following figures show the development of personnel working in public relations: at the present time Germany has an estimated 70,000 journalists and 50,000 PR specialists. Five years ago the numbers were 50,000 journalists and 16,000 PR specialists. These numbers are interesting when compared to the U.S., where at the beginning of the nineties around 122,000 journalists and 162,000 PR specialists were counted. The number of PR workers is growing dynamically and was expected to reach 200,000 in 2000 (Russ-Mohl 1999, 164). Germany is likely to experience a similar development and other European countries will follow the same direction.

Concerning the copying of journalistic working methods by PR, the following facts may serve as proofs: press information and PR kits are increasingly often presented in a journalistically useful style, so they can be directly integrated into the print system or broadcasting schedule without any further processing (Weischenberg 2000). During the eighties, Barbara Baerns analyzed the influence of public relations on journalism. She reached the conclusion that public relations control subject matter and timing of media coverage. Around 60 percent of the total coverage derived from public relations' material (Baerns 1991, 98). In an analysis specifically dealing with science coverage the author comes up with a very similar result: two thirds of the science coverage of news agencies are based on information from public relations (Baerns 1990, 47). Naturally, one of the tasks of the newspaper editor is to actually check on the offers of public relations (and the news agencies) and to publish them, should they prove to be sufficiently relevant. But with two thirds of all science news published deriving directly from public relations one might consider this a precarious and somehow imbalanced proportion; because this means that only one third of science coverage is due to the initiative and independent research of a journalist.

Reports of practitioners give an impression of how public relations influences and gets a grip on journalists. First of all, they criticize the poor fees usually paid to freelance authors. They are forced to extend their journalistic

work to the field of PR in order to patch up their insufficient income. This mixture of journalistic and PR work is an unhappy combination:

> …because of the bad financial situation (of the journalists) science coverage slowly degenerates and becomes mere propagandistic journalism. Instead of investigating their own questions and finding subjects on their own, journalists rewrite press information and 'do' congresses. And this mingling with PR is how the independence of science journalism is jeopardized. (J. Göpfert 2000, 58)

The science journalist Barbara Ritzert writes: 'A freelance journalist—being also a kind of entrepreneur—is forced to do a mixed calculation: Only a well paid hosting of a PR conference or the organization of the press team for a congress enables the journalist to write articles for renowned but starving papers like the ZEIT, the 'Süddeutsche Zeitung' or 'Bild der Wissenschaft'. This may serve as sufficient proof for the fact that even these honorable media, after all, depend on the industry. Because it's the industry that provides the funds to finance the freelancers, who spend their nights in front of a computer, writing articles they don't get appropriately paid for' (Ritzert, cited in J. Göpfert 2000, 58).

The evaluation criteria of the science community influence journalistic coverage by their publishing habits and the accompanying public relations. In a survey, Carola Pahl analyzed half a year of medical coverage on the science pages of eight nationwide daily and weekly newspapers in Germany (Pahl 1997, 10).

The survey researched the sources of almost 1,200 articles on medical topics: 450 could be directly derived from an article in a professional scientific journal—that's almost 40 percent of the total coverage. Interestingly, the source was not always mentioned. Only about 80 percent of the articles referring to a specialized publication bothered to mention their source. Most of the articles followed a simple principle by only summarizing what was said in the journal article.

Journals with a high 'impact factor' get the most quotations among all journalistically processed scientific journals. The impact factor shows how often an article in a journal is quoted in other professional publications. In other words, it indicates the reputation of a journal within the scientific community.

All these professional journals adhere to the peer review system; that is, an article can only be published after independent experts have stated its reliability and significance. There are obvious advantages to this kind of quality control, but some people also criticize this self-policing of science as resulting in 'quotation cartels' and a narrowing view on research. Nevertheless, there is no viable alternative to the procedure. It is firmly established in the scientific system.

By adhering to the publishing practices of the scientific community, journalistic coverage also copies its evaluation criteria. Even more, the accom-

panying public relations also influence the media coverage. The professional journals usually issue press information, especially on articles they consider important. Additionally, these publications are highlighted in the respective journal's editorial. Analysis has shown that such highlighted articles preferably become the basis of a newspaper article. Thus, press information and editorial comments substantially influence the subject selection of newspaper editors.

We have thus shown that the publishing system of the scientific community is cunningly built and manages to control media awareness to a certain extent. This influencing and pinning-down of science journalism to the viewpoints of the scientific system has also been criticized by Kohring. In an extensive paper, he gathered manifold examples proving how professional journalists and even researchers of journalism adhere to the 'paradigm of science popularization':

> The paradigm states that the task of science journalism consists in the popularization of science. It deprives journalism of its capacity to critically observe science. This 'dream vision' of journalism in fact made public relations workers come to think that science journalism and science PR sit in the same boat—a concept that we simply consider as being wrong. The concept of a science coverage that merely serves to popularize science leads to the assumption that journalism would only communicate those observations to the environment of the scientific system, that—taken from the point of view of the scientific system itself—were apt to form the basis of desired social expectations towards science. (Kohring 1997, 278–279)

SPREADING ILLEGITIMATE PR METHODS TO INFLUENCE JOURNALISM

It is the legitimate aim of public relations to call the public's attention to its subjects. But public relations should, at the same time, respect the functional division of tasks. PR has to accept that offers made to journalism have to undergo a necessary process of selection. This means that public relations have to leave the task of subject choice and subject processing to journalism. PR should refrain from gaining influence undercover, to infiltrate or even replace journalism. If independent coverage in reality derives from clever PR measures, then the recipient is being cheated. In the following some tendencies will be highlighted that prove the increase in illegitimate forms of taking influence:

- Hidden sponsoring and subsidies
- Employing and influencing journalistic personnel
- No transparency in usage of PR material

- PR in pseudo-journalistic shape

There is only vague evidence on the extent of hidden sponsoring. Both public as well as privately owned television and broadcasting stations are presently outsourcing editorial planning and production processes. In most cases, the most inexpensive bids are accepted, that quite often cannot even cover the production costs. Knowingly or unknowingly, both sides take into account that the producers will have to look for other funds to finance the project. As a consequence, radio or TV broadcasts are being sponsored by third parties, either by coverage in favor of a certain product or by seemingly accidental name-dropping or demonstrations of a product. Sponsors often are not even mentioned by name, but they influence the choice of topics and the tendency of coverage. W. Göpfert (1990) and Busche (1998) have discussed plenty of examples. This mixing of journalism with PR is by no means a new phenomenon, it has happened before. But never before has this tendency been accelerating as it is today. And the public seems indifferent to this fact.

Similar tendencies can be seen in online journalism. One characteristic of this particular form of publication is the linking up of journalistic articles with further information offers. This can pave the way for hidden subsidies, since every link can theoretically lead to a commercial site. Online products are usually free of charge and economically dependent on advertisements. Many online newspapers of today have their content sponsored by commercial links—without making this fact recognizable to the user (Schön 2000, 49).

Employing personnel that (also) work in the journalistic field enables PR to influence the content of the coverage. According to practicing journalists this tendency is mainly discernible when one looks at the ratio of independent and hired journalists. Ritzert (1999, 37) counted the respective numbers of journalists working for mass media and for professional journals that attended the yearly conference of the 'German Society of Gynecology and Birth Medicine', one of the largest scientific societies in Germany. Within a few years, the percentage of mass media participants sank from 65 to below 10.

On the other hand, the number of journalists writing for medical journals increased considerably. They are obviously invited by the pharmaceutical industry to take part in satellite symposia alongside the main conference. Travel expenses and hotel costs are fully taken care of. As compensation, the journalists are expected to report on these satellite conferences where the industry usually presents its own point of view on certain topics.

In daily newspapers, only every third article based on information from a PR source bothers to mention the source; in magazines, only one in ten articles do so (Schröter 1992, 108). Seemingly, journalists don't want to disclose their dependency on public relations. PR utilizes this weakness of journalism by increasingly offering material that can be directly processed.

Lehmkuhl (2000, 17) investigated the choice methods of a news agency and hints at an interesting side effect: 'The more journalistic press information appears, the less likely it becomes a further research on the respective subject. In the editorial department analyzed here it never occurred [to editors] that the correctness or relevance of information was double-checked with third parties.'

Working journalists also complain about the growing influence of public relations on coverage:

> New media products are made fit for the target audiences of the advertising industry. Journalism becomes a mere 'advertising-add-on'. And what is even more aggravating: the reduction of personnel and the outsourcing of tasks. Only very few quality media can afford specialized editorial departments for medicine and science.... The fees for freelance authors are stagnating or even sinking.... More and more, it is the pure financial power of content providers, delivering professional offers (texts, photos, etc.) to the editors and by that means facilitating their work, that decides which topics are taken up and which are not. (Ritzert 1999, 37)

The following hints prove that journalistic forms are increasingly imitated by public relations: many firms nowadays disguise entrepreneurial PR in the shape of a lifestyle magazine that they provide for their customers. Mostly, these magazines are distributed free of charge, but in some cases they are even sold in the stores. The *New World* of Siemens AG (Neidhart 1997, 30) or *Future*, published by Aventis Communications and Public Affairs, may serve as examples. The number of similar customer magazines has meanwhile reached a number of 2,000 titles—with more than 340 million copies per edition. This means that the customer magazines have long overtaken the popular press with its estimated 126 million copies. And each year, over 100 titles can be added (Anon, 1999, 7–8). Quite a few surveys have proved that public acceptance of customer magazines basically is no worse than the acceptance of sold products (Martini 1998, 47).

A recent example may demonstrate to what extent public relations for science considers the assumption of journalistic tasks as a matter of course: at the *Badische Zeitung* in Freiburg, once a week the reports on science and research were no longer written by journalists. The newspaper left this task to the local university. The press office of the university edited the paper's science page and filled it with own news and articles. The credits on the science page mentioned the press office as an 'editorial'. At present this cooperation has been stopped. But there are other examples: the weekly science page of the *Vancouver Sun*, for instance, is created by the local 'H. R. Macmillan Space Centre'. The page is laid out like a regular newspaper page, and bears the centre's logo at the bottom. PR replaces journalism.

HOW WILL IT WORK OUT?

Journalism and public relations undoubtedly depend on each other; they can and they should work hand in hand. But they have different functions to fulfil. It is the most important social task of journalism to critically inform the public and act as a controlling entity. Possible false developments should be discovered and published by journalists. Should journalism experience a further weakening, this important social function will disappear. Public relations cannot and should not try to fill this gap. Today's scientific system is not responsible for the present weakness of journalism. However, science should take serious interest in the proper functioning of journalism. In public relations, the science organizations should learn to draw the line between critical and uncritical strategies. Measures to provide information and the opportunity for dialogue are definitely permitted. But those measures aimed at suppressing critical journalism have to be put under scrutiny. To evaluate singular PR strategies, it has to be asked: what do the respective strategies contribute to an independent journalistic coverage? Classical means of public relations like press information, press conferences, publication in professional journals, or brochures aimed at the general public can be considered as general offers to the journalist for further processing. They are welcome. But PR trying to imitate journalistic working methods and employing journalistic personnel should be criticized, since this might result in the further weakening of classical journalism. If such strategies try to directly replace journalism (e.g., by having a whole page of a daily newspaper edited by the press office of a scientific organization) or to pay journalists for launching certain topics into the mass media, they are to be rejected. They can be considered overt attempts to exert influence and since they disguise themselves as journalistic products they also mislead the recipient.

Media training for scientists or visits of journalists to scientific laboratories are generally welcome, since they help facilitating the journalistic work. The provision of ready-made texts, images, radio or TV interviews produced for the sake of self-representation is problematic, since it tends to replace journalism with self-made products. By usually disguising the real authorship, such products strive to fake an independent coverage.

Once independent coverage is replaced by interest-driven coverage, science gets looked at from a distorted point of view. Public relations alone cannot be capable of discovering developments in their own system that might be worth criticizing and discussing in public. Illegitimate methods of public relations particularly jeopardize an independent coverage. But this journalistic independence plays a crucial part in forming public opinion, which is one of the main tasks of journalism.

Eventually, science itself will not gain any profit from being covered in journalistic products that have lost their credibility. No matter how favorable or easy-going the coverage—it will not be able to restore acceptance

and respect on the side of the reader. The acceptance crisis of science is by no means over. On the contrary, new developments continually create new problems that have to be solved by public debate, either in ethical councils, citizens' groups, or by public vote. And that needs independent journalism. The example of the Badische Zeitung shows the problems that might arise if Freiburg University was sued for fraud. The press office, which is responsible for the science pages of the Badische Zeitung, would have to play the part of investigator as well as advocate. This example makes clear that public relations are overtaxed if one expects them to do the work of critical journalism. The readers of the Badische Zeitung are unlikely, for example, to celebrate the fact that the press office of the university informs them about a scandal taking place in that very university, should a crisis occur.

REFERENCES

Anon (1999) Kunden-Magazine: Daten, Fakten & Analysen—Der Markt. *Media-Digest* —1999 Kundenmagazine

Baerns, B (1990) Wissenschaftsjournalismus und Öffentlichkeitsarbeit: Zur Informationsleistung der Pressedienste und Agenturen. In Russ-Mohl, S (ed.) *Wissenschaftsjournalismus und Öffentlichkeitsarbeit, Materialien und Berichte der Robert Bosch Stiftung*, Band 32, Gerlingen: Bleicher, 37–53

Baerns, B (1991) *Öffentlichkeitsarbeit oder Journalismus? Zum Einfluss im Mediensystem*. Köln: Nottbeck

Bauer, M, Durant, J, Ragnarsdottir, A, & Rudolphsdottir, A (1995*) Science and Technology in the British Press, 1946–1990* London:

Bentele, G, Liebert, T & Seeling, S (1997) Von der Determination zur Intereffikation. In G Bentele & M Haller (eds.) *Aktuelle Entstehung von Öffentlichkeit*. Konstanz: UVK, pp. 225–250

Busche, M (1998) Offene Türen. *Journalist* 6/98, 36–40

Fichtner, U, Minkmar, N, & Rückert, S (2000) ...wie es sinkt und lacht. *Dossier der ZEIT* 38/00, 17–22

Göpfert, J (2000) Der freie Wissenschaftsjournalist. In: Winfried Göpfert & Stephan Russ-Mohl (eds.) *Wissenschaftsjournalismus—ein Handbuch für Ausbildung und Praxis*. München, Leipzig: List, 52–59

Göpfert, W (1990) Wissenschaftsjournalismus—verlängerter Arm der Öffentlichkeitsarbeit. In Russ-Mohl, S (eds.) *Wissenschaftsjournalismus und Öffentlichkeitsarbeit, Materialien und Berichte der Robert Bosch Stiftung*, Band 32. Gerlingen: Bleicher, 23–36

Gregory, J & Miller, S (1998) *Science in Public—Communication, Culture and Credibility*. New York and London: Plenum

Kaiser, U (1999) Journalismus GmbH&CO.KG—Outsourcing in Redaktionen. *Journalist* 7/99, 12–15

Kepplinger, H M (1989) *Künstliche Horizonte*. Frankfurt/New York: Campus

Kohring, M (1997) *Die Funktion des Wissenschaftsjournalismus. Ein systemtheoretischer Entwurf*. Opladen: Westdeutscher Verlag

Krebs, J (1999) Verständnis für die Öffentlichkeit. In: *Dialog—Wissenschaft und Gesellschaft. Symposium Public Understanding of the Sciences and Humanities—International and German Perspectives*, 27. May, Wissenschaftszentrum Bonn. Essen: Stifterverband, 14–19

Lehmkuhl, M (2000) Panikmache aus Versehen. *Journalistik Journal* 3/1, 16–17
Lewenstein, B (1992) Public understanding of science in the United States after World War II. *Public Understanding of Science* 1, 45–68
Martini, B-J (1998) Exklusiv für Kunden. *Journalist* 5/98, 45–47
Neidhart, T (1997) Gut fürs Image. *Journalist* 3/97, 30–31
Pahl, C (1997) Die Bedeutung von Wissen-schaftsjournalen für die Themenauswahl in den Wissenschaftsressorts deutscher Zeitungen—am Beispiel medizinischer Themen. Forschungsbericht, Freie Universität Berlin, Arbeitsgebiet Wissenschaftsjournalismus, (WWW–Dokument) URL:
http://www.kommwiss.fu-berlin.de/~wissjour/ab/german/pahl/pahl_fobe.pdf
Peters, H P & Göpfert, W (1995) Medientraining für Wissenschaftler. Zu einem im Forschungszentrum Jülich erprobten Konzept. *Publizistik* 40(2), 208–211
Rager, G (1999) Konzepte gefragt. *Journalist* 12/99, Beilage 50 Jahre DJV, 66–69
Ritzert, B (1999) Checks and Balances? *Gegenworte*, 3, 36–38
Röper, H (1999) Medienmultis. *Journalist* 12/99, Beilage 50 Jahre DJV, 46–49
Russ-Mohl, S (1999) Spoonfeeding, Spinning, Whistleblowing. In Rolke, L & Wolff, V (Hg.) *Wie die Medien die Wirklichkeit steuern und selber gesteuert werden*. Opladen/Wiesbaden, 163–176
Schön, G (2000) Übergreifende Trends. *MediumMagazin* 1/2000, 48–49
Schröter, D (1992) *Qualität im Journalismus*. Testfall: Unternehmensberichterstattung in Printmedien. München
Weischenberg, S (2000) Fußballspieler, Parasiten und Trittbrettfahrer'. *Public Relations Forum* 3/00, 121–122

21 The use of scientific expertise for political PR

The 'Doñana' and 'Prestige' cases in Spain

Carlos Elias

Scientific advice plays an important role in modern politics (Jasanoff, 1990). This chapter explores the relationships between scientific expertise and politics in the context of crisis management, in particular when it appears that scientific advice follows political expediency rather than scientific evidence. I demonstrate that after two environmental disasters, the Spanish government defended political decisions by selecting loyal scientists and by avoiding scientists who might speak out to the media. The cases in question are two ecological disasters that caused international alarm, where the political establishment could be criticised for failure in environmental affairs. I show how the government's public relations strategy amounted to an 'instumentalisation of scientific expertise' in the cases of Doñana (1998) and Prestige (2002). However, this 'instrumentalising' strategy was thwarted in the latter case by whistle blowing and Spanish scientists' protests.

A PUTATIVE PR STRATAGEM FOR ENVIRONMENTAL CRISES

In the case of an environmental disaster, political instrumentalisation of science might include all or several of the following elements of a public relations strategy (see Elias, 2003b):

- Appointment of experts on the basis of non-scientific criteria: members of the scientific advisory committee are selected according to political loyalty rather than scientific expertise;
- Centralisation of public communication: the chair of the advisory committee is the only official source to the mass media;
- Feed rather than inform: publish reports to feed and satisfy the journalistic need for information, rather than to inform the public accurately and at the right time;
- Discredit independent sources: independent scientists who speak to the mass media are to be attacked and their expertise discredited.

Government scientists are not free to speak without permission from their superiors;
- Restricted access to relevant data: access to actual data and information is restricted to the appointed committee;
- Immediacy of action: this strategy requires immediacy in order to avoid journalists establishing alternative sources of information.

What makes it necessary for some governments to mobilise 'scientific expertise' even if the purpose is not the dissemination of scientific information? The reasons are to be found in the credibility gap between politicians and scientists in public opinion and the general lack of scientific information in a context of a generally technophile Spanish society.

In 2002 the Spanish Foundation of Science and Technology carried out an opinion poll about the perception of science in Spanish society (Echevarria et al., 2003). It showed that scientists were the second most respected profession after medical doctors. Eighty-three per cent of those polled declared moderate to strong appreciation of scientists as a source of information; engineers reached 75 per cent. For politicians the score is a poor 17 per cent at the end of the list, with sports people, artists, journalists, lawyers, and religious leaders scoring much higher. These data are confirmed by Eurobarometer 63.1 (2005) for Spain: 61 per cent (compared to EU-25: 52 per cent) consider scientists working at a university or in a government laboratory as best qualified to explain science and its impact on society. In Spain scientists have a better reputation than in many other EU countries. At the bottom of the ranking, government employees reach 9 per cent (EU-25: 6 per cent), politicians, 6 per cent (EU-25: 5 per cent), religious leaders, 1 per cent (EU-25: 2 per cent), and the military, 1 per cent (EU-25: 2 per cent).

A previous opinion poll of Spanish attitudes to science (Centro de Investigaciones Sociologicas CIS, 1996) showed that 63 per cent were 'very interested' in news about scientific discoveries. Only 26 per cent considered that the published information on such matters was enough. Comparing these two figures suggests an information gap of 37 per cent in 1996 (63 per cent 'interested', 26 per cent 'informed'). The gap for political news was only 5 per cent. According to Eurobarometer 2005, the Spanish gap for scientific discoveries has declined to 24 per cent (35 per cent, 'interested'; 11 per cent, 'informed'), while the political gap reached 0 per cent.

Environmental news commanded considerable interest among Spaniards in 2005, 35 per cent (EU-25: 38 per cent) indicated that they were 'very interested' and 51 per cent (EU-25: 49 per cent) that they were 'moderately interested' in this topic. 'New medical discoveries' followed with similar rates, 30 per cent (EU: 33 per cent) 'very interested' and 51 per cent (EU: 50 per cent) moderately interested. Lower rates were recorded for politics, 15 per cent (EU-25: 22 per cent) 'very' and 42 per cent (EU-25: 49 per cent) 'moderately interested'; while 42 per cent are not interested at all in politics, which is one of the highest rates in the EU.

In 2005, the Spanish showed confidence in science and technological advances since 73 per cent (EU-25: 78 per cent) agreed that they 'make our lives healthier, easier and more comfortable' and only 5 per cent (EU-25: 6 per cent) disagreed. Only 21 per cent agreed with the statement 'scientific knowledge is not needed for anything in our daily life'.

From this data we can conclude that scientists, doctors, and engineers are the most prestigious professions in Spain, whose opinions society is inclined to attend to. On the other hand, politicians are among the least credible groups in society. The people are generally techno-optimistic, and in need of more scientific information. In the public view, despite being less interested in science in 2005 than in 1996, the mass media tackle politics sufficiently, but not scientific topics. This situation might explain why Spanish politicians shield themselves with credible scientists who guarantee political decisions using evidence, especially if those decisions are controversial. Politicians take refuge behind science and harness its image through PR efforts and alliances. In such contexts, science runs the risk of being used as an instrument of political expediency. In Spain such a tendency remains a legacy of the authoritarian regime of Francisco Franco (1939–1975).

HOW DOES THIS STRATEGY WORK?

One might argue that three tactics can be employed to implement the strategy of instrumentalising scientific expertise: monopolise information, create an artificial controversy to counter overwhelming evidence, and offer a scientific career path through political patronage.

Monopolizing the information

Here, the key point is that access to relevant information is controlled and restricted to the 'scientific committee'. Furthermore, in the scientific committee the role of public speaker is restricted to the chair of the committee. The effect of this tactic is likely to be threefold: the mass media will rely on the only official source available; there will be no real public debate as political opinion is presented as scientific evidence; and the public will think that political decisions are based on the best scientific evidence.

Creating an artificial controversy that relativises an overwhelming scientific consensus

At times, independent scientists may already have had a voice in the events in question, and the mass media may have already had the opportunity to identify highly qualified sources on the subject, outside official government channels. In such cases, when the advantage of time has passed, a

government can control the situation by stimulating an artificial controversy by setting government experts against independent scientists. This leaves the public confused when facing competing scientific evidence and explanations on the events and its consequences. Never mind that one view may be objective and the other one politically expedient. As the public and the journalists are not always in a position to thoroughly assess scientific theories and evidence, they may not be able to adjudicate between competing theories. Disagreement is normal among active scientists, but they have little time and desire to fight battles against bogus opinions in the mass media. Instead, they publish their views in obscure scientific journals. Public relations experts know that academics shy away from conducting debates in the mass media, also that journalists are more interested in glamorous sources and titles such as the 'The President of the Advisory Scientific Committee' than a distinguished, but publicly unknown professor. The key for governments, it seems, is to find loyal presidents for the Advisory Scientific Committee or other national scientific organization, who need not be leading experts in their field, to conduct the controversy on their behalf. The effect will be that without agreement among scientists the public may lean toward the official government position, because it has the advantage of political authority.

Political patronage of scientific careers

Finally, there is the strategy of political patronage. There seem to be several ways of making scientific careers. The first way, and the favourite among scientists, is the path of reputation through research and scholarly publications. In this context promotion on the career ladder follows the publication of scientific results in journals with high scores on the science citation index (SCI). The second way to be successful in a scientific career is through the industrial R&D path, producing substances that qualify for patenting, which will thereby be of economic benefit, and will count in the scientist's favour as having patents in his or her name. The third path to career success for scientists, at least in some countries like Spain, is through political patronage. The directorships of important scientific institutions, such the Higher Council of Scientific Research in Spain (CSIC, Consejo Superior de Investigaciones Cientificas), NASA in the United States, or the European Space Agency, are political appointments. These positions are not selected by scientists, but by governments. If scientists please politicians and their parties through a loyal relationship, then they can be rewarded by being appointed into administrative leadership positions. Furthermore, such directorships of scientific institutions can come with a privilege to choose researchers to work with. It is therefore hard to find scientists who will take the role of dissenter, and speak out publicly against pronouncements of official sources. Does a prestigious political appointment indicate

success in a scientific career? This is a difficult question to answer. This kind of appointment is clearly less influential from the point of view of the history of science. But from the perspective of professional ambitions, scientists may see politics and publicity as an alternative career route. Scientific reputation and mass media publicity are two independent co-ordinate axes of a scientific career path (see Weingart, 1998).

It appears that scientists are themselves in the best position to counteract the political instrumentalisation of science; many academies and scholars are independent of the political powers that be. When there is a lack of independence, instrumentalised science will appear in the mass media spaces. Spain seems to be a prototypical country where independence of scientific institutions is not in evidence, and this can be shown in the way environmental disasters evolved. The Spanish Royal Academy of Sciences might have national prestige and standing, but it does not have the national and international influence of the British Royal Society of London. It is easily sidelined by governments, when old fashioned and detached scholarship traditions compete with modern day media savvy which includes a professional press office and a PR strategy. By contrast, in the USA, the academies of sciences or the American Association for the Advancement of Sciences (AAAS) are prepared to contradict political authorities, which is unlikely to occur in Spain.

INSTRUMENTALISED SCIENCE FOR POLITICAL PR IN TWO SPANISH ENVIRONMENTAL DISASTERS

In order to illustrate the PR instrumentalisation of scientific expertise by political power, I have chosen two ecological disasters: the toxic waste flood in the nature reserve of Doñana, the biggest ecological disaster of southern Europe (April 1998), and the Prestige catastrophe, the oil spill on the Galician coast (November 2002). In the first case the government's attempt to control scientific evidence was successful, in the second case the government found its match in the protesting scientific community.

Political and government institutions are traditionally more proactive in public relations and mass media relationships than research universities. We take press coverage as an indicator of the kind of scientific information that prevails during events: independent science or political government views dressed as scientific evidence.

In a study of six Spanish newspapers (*El País, El Mundo, ABC, Diario 16, El Periódico de Cataluña* and *La Vanguardia*) we looked at the news stories 4 months after the disasters (Elias, 2003a). The most prominent news source was the CSIC, an organisation created under the dictatorship and surviving its demise. Its founding mission is, according to Francisco Franco's opening speech of 1940, 'to translate scientific knowledge into the

raison d'etat', which means to subordinate scientific truth to the powers of the state. Since the return of democracy in 1975, teaching and research at Spanish universities is formally free from political control. But government retained control over many scientific institutions. The presidency of CSIC, the most important scientific institution in Spain, remains a political appointment.

An analysis of 6 months of coverage, February to July 1998, showed that 48 per cent of 1,458 scientific newspaper items referred to CSIC, when it only produces 16 per cent of Spanish scientific publications. Spanish universities produce 77 per cent of scientific publications but only make 7 per cent of the news. Spanish mass media over-represent CSIC as a news source and widely ignore its government dependent status.

WHEN GOVERNMENT TAKES CONTROL: THE DOÑANA CASE (1998)

The toxic flood of April 1998 devastated the last stretch of the Agrio River and 62 kilometers of the channel and banks of the Guadiamar River. It affected a total area of 4,634 hectares, 98 of which belonged to The Doñana National Park. This is the most important European area for bird migration from Europe to Africa: Almost a year after the flood, a total of 19,900 birds of 18 species were still contaminated with high levels of heavy metal. The Doñana Affair is one of the worst environmental disasters in European history.

What was the mass media coverage of the events? In the early period, from April to May we analyzed 454 news items and found that 53 per cent referred to the CSIC as a primary source. In the later period, from April 26 to June 30 during the peak news time, 407 pieces of news were published and 55 per cent mentioned CSIC. In this last period the former CSIC's president, Cesar Nombela, was named 74 times. Scientists from universities or independent academies had little presence in the mass media (Elias, 2001).

From the analysis of how the news coverage initially developed, I conclude that the journalists simply did not know which scientists were the experts. It seems that at first journalistic good sense prevailed: they consulted scientists most closely linked to the Doñana National Park. One of the first scientists appearing in public was the then president of the Spanish Royal Academy of Sciences, Angel Martin Municio. To the question 'How long will the environmental pollution persist?' Municio responded 'Eternally' (*El Mundo*, 1 May) which excluded him as a useful expert for government purposes. Another scientific source initially consulted by the media was the former head of Doñana's Biological Research Station, Miguel Delibes de Castro, who defended an ecologist point of view on radio and television, and by reference in a review article in *El Pais* (4 May). Under the headline 'Delibes: The Ecologists Were Right', he affirmed 'At first they persuaded

The Doñana chronology

During the night from 24 to 25 April 1998 a large gap opened up in the dam that holds back a basin of mining sludge that derives from pyrite washing. Pyrite is processed by Boliden-Apirsa, a company owned by Swedish-Canadian capital, in the municipal area of Aznalcollar, near Seville in Southern Spain. In consequence, 6 billion litres or the equivalent of four hours of the total water flow of the Spanish river Ebro, of highly acid (pH2) water and sludge escaped into the environment, containing high levels of toxic and heavy metals such as arsenic, zinc, lead, copper, cobalt, and manganese. Curiously all media reportage of the damage mentioned only the official figure of 'six cubic hectometers' or 6 hm3, without translation, a volume measure which nobody but experts were able to understand.

25-04-98 A large gap opens up in the dam; the escaping flood devastates the Doñana National Park.

26-04-98 The ecological catastrophe is front page news in the Spanish press and internationally.

29-04-98 The Spanish government appoints the Scientific Advisory Committee for Doñana events and holds its first meeting this day, followed by a press conference.

25 to 29-4-98 Various newspapers publish a declaration of independent scientists suggesting contamination that will persist for 20 or 100 years. These scientists, the most important authorities on the Doñana ecology, are not members of the advisory committee.

30-04-98 The first government scientific report, as well a declaration by the president of the Official Advisory Committee, are published in all newspapers. The committee's opinions are described as the 'voice of wise science' in the headlines.

05-05-1998 The second scientific report is made public in other press conferences. Independent scientists with real knowledge about Doñana have hardly appeared in the Spanish press since this date; they were eclipsed by the Official Advisory Committee.Between April and June 1998 every 10 days an official government report was published. In May, the month of peak interest, four reports are distributed. Only three reports were published during 1999. Public interest for Doñana had declined.

26-01-2001 The last scientific report is published on the CSIC website (checked Feb 2006). Contamination at the Doñana National Park persists.

us [the government technicians] that this disaster could never happen, and we had been persuaded. Ecologists were the only group to raise their voice'. Delibes also referred to the 1996 report that ecologists had sent to the European Union forewarning of impending disasters. He thus equally disqualified himself for government purposes. At the time, local and national governments, and for that matter also the European Union, denied possible ecological risks.

Our analysis suggests that journalists were initially well informed, following journalistic common sense and looking for real experts as sources. But from the moment that the powerful press office of CSIC appeared on the scene, journalists began to publish what they were fed by the CSIC Press Office and the Scientific Advisory Committee. The latter committee was appointed just five days into the disaster. After the initial five days of varied sourcing, most of the news published had its origin in the CSIC and the advisory committee appointed by the Spanish Prime Minister. The most cited source was the chair and spokesman of that committee, appointed by government. Only three of the seventeen members of the committee could be considered experts on Doñana. The committee's president, a geneticist and also the president of CSIC, had no previous association with Doñana. Public relations professionals knew that from the point of view of Spanish journalists and the public it was irrelevant whether committee members were experts on Doñana or on anything else. Members were chosen in accordance with political criteria and not with scientific ones; it was the committee's national prestige that counted.

The problem was less the experts who were appointed than those who were not. It seemed odd, if not scandalous, that two of the most important CSIC researchers on the Doñana ecosystem, Miguel Delibes and Javier Castroviejo, were excluded, probably because they had previously been critical of government policy. Castroviejo was the first head of the Doñana's Biological Research Station for 14 years. He was also considered the world's foremost scientific authority on the ecosystem of the Natural Park.

During the Doñana Affair, from 25 April to 31 July, Cesar Nombela (President of CSIC and chair of the scientific committee) appeared in 81 news items. On the other hand, Miguel Delibes appeared in only four, Martin Municio in three, and the most important scientific authority, Castroviejo, in only one news item. The head, at this time, of the Biological Research Station, Miguel Ferrer (appointed by the then President of CSIC) appeared in 33 news items. Statements by Cesar Nombela indicate that he was partisan to the government, but he tried to spread the idea that the CSIC and himself were the 'real voice of Spanish science'. He for example said: 'CSIC congratulates the Environmental Department for the emergency steps taken', (Headline of *Abc*, 3 May). Only later it became clear that the scientific community did not agree with Nombela, but their views did not appear in the mass media.

The Prestige chronology

On 19 November 2002, the 80,000 ton oil tanker Prestige sank off Spain's northwest coast causing extensive pollution due to leakage. 18,000 tons were collected at sea and 40,000 tons at the coast. The Spanish Ornithology Society reported that the spill is the worst episode of sea bird mortality in Spain, and the second in Europe (the impact of the Erika spill of December 1999 was even larger). Two months after the disaster 13,221 birds of 62 species had been collected from the Spanish, Portuguese and French coasts, of which 9,348 were dead. All the marine fauna of the affected zones was destroyed.1

3-11-02 The oil tanker Prestige drifts off the northwest Galician coast of Spain.

19-11-02 The tanker sinks. An official government source (of CSIC) declares: 'fuel oil will be coagulated into a block due to sea pressure', suggesting that the problem will sort itself out.

20-11-02 French scientists (in Liberation and Le Monde) criticize this Spanish scientific version.

29-11-02 The Spanish newspaper El Mundo publishes a French scientific report about cancerous effects of oil spills on humans.

13-12-02 The fissure in the oil tanker is sealed. But according to French observations fuel continued to leak.

0-12-02 First press conference of the Spanish Scientific Advisory Committee for the Prestige affair, 26 days after the event. The list of members of the committee is not published.

12-12-02 Spanish universities denounce the Spanish Government for ignoring or trying to silence relevant researches and competent scientists.

15-12-02 Mass e-mail to all government scientists not to speak publicly about the oil spill.

29-12-02 The newspaper El Pais shows that a report written by the Official Advisory Committee of CSIC was copied from a French report.

24-01-03 The journal Science publishes a letter signed by 422 Spanish scientists criticizing the government for silencing the scientists. The CSIC president resigned.

20-02-03 The last of fifteen scientific reports of the Prestige Advisory Committee is published on the CSIC website.

The analysis of what had happened at Doñana shows that what appeared in public was not the concert of the best experts at Spanish universities, academies and the CSIC, but only the voice of the CSIC. Thus the public information was handled by politicians wishing to avoid and shift responsibility.

SCIENTISTS IN OPEN DISSENT: THE PRESTIGE CASE (2002)

In the *Prestige* oil tanker disaster the same strategy was attempted by the government, with the appointment of a Scientific Advisory Committee. However, there were three important differences from the Doñana case. First, the government decided that Rolf Tarrach, the president of CSIC (2002), could not be trusted. He was replaced on the scientific committee by Emilio Lora-Tamayo, a scientist loyal to the conservative Spanish government, and the son of a Franco government minister who at the time closed five universities and used police repression against students and teachers who asked for freedom. Lora-Tamayo was a nano-engineer and not a marine biologist. Secondly, access to the disaster area could not be cordoned off, so independent scientists could gain access to the polluted area from the open sea. In the Doñana case only government scientists obtained samples because the area was sealed off. Finally, in the *Prestige* case 26 days passed between the event and the appointment of the Advisory Scientific Committee. In the absence of government spin, journalists looked for alternative scientific sources. Due to lack of official information many independent scientists appeared in the media. When the advisory committee finally began to publish scientific reports, it turned out that they freely copied from the French CEDRE (Centre de Documentation de Recherche et d'Expérimentations sur les Pollutions Accidentelles des Eaux). Some of their results were distorted and researchers complained about it in the press. In these 26 days a close relationship between independent scientists and journalists was established.

For the first time in the history of Spanish science, the strategy of instrumentalising science by government came under public scrutiny from universities and scientists. The Prestige affair culminated on 24 January 2003, when the international journal *Science* published a letter of protest signed by 422 scientists, from 32 universities, the CSIC and the Spanish Institute of Oceanography (also a government scientific institution), accusing the Spanish conservative government of silencing scientists (Serret et al., 2003). In the *Science* section 'News of the Week', two commentators (Bohannon and Bosh, 2003) explained the situation under the headline: 'Spanish Researchers Vent Anger Over Handling of Oil Spill' (*Science*, p. 490). They wrote 'now scientists are adding their voices, en masse, to the din of protest…marine and atmospheric scientists accuse the government of largely ignoring the scientific community in the aftermath of the spill'.

The Spanish government worked harder to defend their management of the crisis. According to one of the letter's lead authors, marine ecologist Antonio Bode of the Spanish Institute of Oceanography, government scientists, also at his institute, were told in a mass e-mail of 15 December 'not to speak with the press about *Prestige*'. He and many others defied the order in penning the letter to *Science*. The *Science* letter was published on the front pages in many Spanish newspapers. In the aftermath the president of the CSIC, Rolf Tarrach, resigned. He was then replaced by the president of the *Prestige* scientific advisory committee, Emilio Lora-Tamayo.

CONCLUSION

We argued in this chapter that governments might be temped to manage emergencies such as environmental disasters by controlling the information flow in order to avoid responsibilities and to defend their policies. Because of a general lack of public credibility, politicians may decide to shield behind scientific advisers and experts who present 'scientific evidence' on their behalf. We identified a putative stratagem including three tactics that governments might apply to control the situation: (1) monopolising public information through an official scientific advisory committee; (2) creating an artificial controversy in cases where the scientific consensus is not in line with adopted policy; and (3) patronising scientific careers within government institutions. Using two Spanish case studies, we illustrated the first and the latter tactics at work. In the Doñana case these tactics were successful. The mass media remained fixated on official sources that capitalised on their authority status as a 'national institution of science'. In the *Prestige* case this tactic failed. The government advisory committee was unable to control the public information flow. The key difference was the timing of the government PR effort, and the government's inability to control access to primary data on the incident. In the Doñana case independent scientists could effectively be barred from access to pollution data, while in the *Prestige* case this exclusion could not be achieved. Direct access to the oil spill by sea led to independent assessment of the situation and to public dissent by Spanish scientists and international scientists, a first in the recent history of the country.

In principle, scientists are in the best position to challenge the practice of instrumentalising science for political purposes, provided they find an internal cohesion that has been lacking in many recent cases. A key role, in this light, may be played by scientific academies and societies. While governments will inevitably continue to appoint their own official committees, scientific societies may appoint parallel committees to shadow the efforts to monopolize information flow on the events.

Journalists, following their own rules of operation, prefer certainty to uncertainty. The Doñana case showed that they preferred the less qualified opinions of the President of the official advisory committee over the qualified opinions of a scientist who had studied the Doñana ecosystem for over a decade. Public relations experts know this mode of operation, and they try to exploit it for their own purposes.

Instrumentalising science for political PR, however, is not unique to the Spanish context, it can occur in every country. Still, it is possible that this phenomenon is more prevalent in countries where expertise in the natural sciences has no long tradition, particularly in the context of democratic politics. Mediterranean and Latin American countries may belong to this group. However, the tactics described here are occurring in countries with a long democratic tradition as well. Kennedy (2005) showed in his book *Crimes Against Nature* how in a country like the United States the appointment of scientists to influential positions and on powerful committees according to political rather than competence criteria was endemic.

REFERENCES

Bohannon, J and Bosh, X (2003) 'Spanish Researchers Vent Anger over Handling of Oil Spill' *Science* 299, 490

Centro de Investigaciones Sociologicas (CIS) (1996). Opinion Poll number 2,213.

Echevarria, J et al. (2003) Percepción Social de la Ciencia y la Tecnología en España FECYT

Elias, C (2001) 'Periodismo especializado en medio ambiente: el caso Doñana como paradigma de manipulación informativa' *Ámbitos, Revista Internacional de Comunicación* 6, 297–303

Elias, C (2003) *Tres Cantos*, Novola libros y ediciones

Elias, C (2003a) 'Adaptación de la metodología de observación participante al estudio de los gabinetes de prensa como fuentes periodísticas.' *Empiria, Revista de Metodología de las Ciencias Sociales* 6,. 145–159

Eurobarometer (2005) Number: 63.1 (224) Europeans, Science & Technology, Brussels

Jasanoff, S (1990) *The Fifth Branch: Science Advisers as Policy Makers* Cambridge, MA: Harvard University Press

Kennedy, R Jr. (2005) *Crimes against Nature* Penguin: London

Serret, P et al. (2003) 'Spain's Earth Scientist and the Oil Spill' *Science* 299, 511

Sholz, A (2004) 'Merchants of Diversity: Scientists as Traffickers of Plants and Institutions', in *Local and Global in Environmental Governance*, Jasanoff, S and Martello, M (eds) Cambridge, MA: MIT Press

Weingart, P (1998) 'Science and the Media' *Research Policy*, 27, 869–879

Part IV
International commentary

22 United States
Focus on the audience

Sharon Dunwoody

As will be the experience of many readers of this text, I found it a pleasure to encounter the thoughtful reflections of journalists, public relations practitioners, and scholars that dominate this book. In an effort to link these discussions to the American science communication scene, I will draw on a thread woven through many of these essays: a focus on the audience for science messages and the extent to which journalists and science (via PR practitioners) cater to them.

Media organizations must care about audiences, as those in the commercial sector—and in the United States that includes nearly everyone—are in the business of delivering audiences to advertisers. Despite this, the organizations, the science journalists they employ, and science itself have long been comfortable with relatively superficial understandings of audience. By that, I mean that these actors adopted audience orientations that served their specific needs but, until recently, never sought the kind of deeper understanding that could actually serve audience members themselves. The chapters in this text send a clear message that this orientation is changing in Europe, and I want to argue in this brief commentary that it is changing in the United States as well.

First, permit me to characterize the historic audience orientations of these actors in my country. American media organizations, for instance, have long concentrated on viewing their audiences as products that can be sold to advertisers. Sometimes the product is valued because of its sheer size; at other times, its value stems from its demographic characteristics. A classic example of the former is the newspaper, with its emphasis on accumulating as many subscribers as possible, usually within geographic boundaries, so as to assure an advertiser that his expensive, full-page shopping ad can be seen by thousands of potential consumers. Magazines and, now, websites are good examples of the latter. Dominating the subscriber lists of popular science magazines and the visitor ranks of science websites in the United States are highly educated males. Since that subset of America also buys expensive products, these media organizations tailor their pages to that group and then seek advertisers (automobiles, electronics) who regard these men as fertile ground. I can still remember one popular science magazine

that, in a determined bid for advertisers some 20 years ago, touted itself as 'the gentlemen's quarterly for science'.

What about the historic audience orientations of science journalists who work for these media organizations? To their credit, American journalists have always earnestly rejected financial motivations for caring about audience. But they have long substituted that notion of audience-as-profit-center with superficial, almost stereotypical understandings of audience. Sociologist Herb Gans long ago noted journalists' apparent indifference to the nature of their audience and attributed it to a functional imperative: To know what your audience wants and needs constrains you as a journalist from covering the issues that interest you. It is better, Gans speculated, to be ignorant of audience, as that ignorance frees the journalist to focus on the issues that strike him or her as interesting or important (Gans, 1979).

Science's historic interest in audience has been in service to maintaining public support for science, its processes, and its products. Articulated as a responsibility to educate the public about science, this orientation takes learning seriously, as it has long assumed that knowledge gain goes hand in hand with increased admiration and respect. That the two factors can be functionally independent of each other goes virtually unnoticed within the scientific community even today. Public relations practitioners who work for science organizations, thus, are charged with both teaching and persuasion functions.

The chapters and essays in this book, however, tell a different story about audience perceptions among these actors. Instead of being satisfied with a relatively simplistic view of audiences, science and science communication professionals reflected in these texts have become increasingly preoccupied with the nuances of audience reactions to their work. I think that trend is both sane and an important step, for several reasons:

1. Few people *have* to read, listen to, or watch media science stories, and increasing numbers are, in fact, abandoning the task. In the United States, at least, newspaper readers and television news viewers are declining steadily in numbers. In 1950, for example, 123% of households bought a newspaper; in other words the average household purchased more than one newspaper. By 1990, only 67% of households bought a newspaper. By 2000, it was 53% (http://www.editorandpublisher.com). Viewers of the traditional 'big three' network newscasts (NBC, CBS, ABC), similarly, have dropped by some 45% over the course of a quarter century, from 52.1 million in 1980 to 28.8 million in 2004 (http://www.stateofthenewsmedia.org). Media organizations can no longer take it for granted that their typical audience is paying attention. As a result, they must focus increasingly on ways to lure people to stories.

2. New channels such as the World Wide Web allow audience members to control what they ingest, when, and from whom. Typically, media organizations provide information on schedules devised by the organizations themselves. While those schedules are governed to a large extent by

news values—judgments about information that are exquisitely sensitive to audience needs and imperatives—the typical daily news operation simply cannot be responsive to *individual* information needs. Audiences had to live with that state of affairs for centuries (I don't know about the rest of you, but I spent much time a couple decades ago clipping and filing possibly relevant stories in the hope that, when I needed to invest in learning about an issue or topic, I could then retrieve the texts), but the Internet has revolutionized this landscape. Now individuals can go on information-seeking binges when the time is right for them. In this configuration, media organizations no longer dominate; instead they join virtually thousands of sources to which the information-seeker can attend. Standing out in that crowd requires media organizations, journalists, and science to figure out audience needs and information-seeking patterns and then to try to configure story structures and delivery to meet those needs and patterns.

3. Even when they ingest science stories, audience members may come up with unanticipated interpretations of the content. Historically, media practitioners and policy makers in the United States have assumed that media stories have strong, direct effects. That assumption would mean that, should a reader encounter a story pooh-poohing the risks of sugar substitutes in soft drinks, she should declare the beverages to be inconsequential to her health and behave accordingly. But decades of studies of audience reactions to media accounts have demonstrated that those accounts are typically 'filtered' through a person's belief system. Should there be a poor fit between the media message and a person's beliefs, it is the message—not the belief—that suffers. Luca Carra's reflection, in this book, on his efforts to debunk claims of melatonin's anti-aging properties, only to find that some readers of the story were spurred to seek out the hormone instead, is a good example of this pattern. Carra concludes in the chapter, 'One of the great mysteries of scientific (but not only scientific) journalism is the gap between what the journalist is trying to say and what the reader understands'. It is a mystery amenable to solution, and the authors presented in this book seem to be actively engaged in doing so.

It is refreshing to encounter professional communicators who are working to understand audiences better. Typical is science journalist and editor Tim Radford, who argues in his chapter on behalf of the importance of storytelling as a means of luring readers and viewers to a text and then keeping them engaged in it. Journalists have always been storytellers, but they are redoubling their efforts—on all continents—to adopt story styles that will reliably connect with readers and viewers. For example, a popular science writing text in the United States, *A Field Guide for Science Writers* (Blum et. al., 2006) devotes an entire section to advice from senior writers on 'varying your writing style.' Scholars, too, have begun to increase their efforts to better understand the power of narratives to attract attention and, subsequently, to structure meaning (see, for example, Shanahan & McComas, 1999.

In some ways, though, it is the scientific institutions that have evolved most rapidly toward a better understanding of audiences. The offerings in this book that reflect public relations practices and information campaign efforts speak to those growing competencies. From designing information campaigns to structuring information for journalists that increases the chances that journalists will reflect—not reconstruct—the information, public relations practitioners have turned audience analysis into a fine-tuned process that serves their needs well.

Those needs will continue to be dominated by an effort to rally public support; we would expect no less from institutions dependent largely on public funds. But PR practitioners in the United States (who tend to prefer the label 'public information officers,' or PIOs) are increasingly arguing that their centrality to their scientific employers rests less on their persuasion skills than on their ability to help their institutions interact with society for the greater good.

For example, Rick Borchelt, currently communications director of the Johns Hopkins University Genetics and Public Policy Center, articulates three key roles for PIOs. One is a translational role, the process of making complex scientific information accessible to a variety of publics. Second is the ability of PIOs to serve as 'in-house media sociologists', helping scientists understand the normative behaviors of journalists in service to high-quality interactions with those individuals. PIOs are particularly well suited, notes Borchelt, for the third role, 'management counseling'. Here the public information practitioner is centrally involved in helping her or his institution weather the prevailing cultural currents by providing advice about the state of public perceptions of science and what influences them (Ben-Ari, 1998).

Across the board and across the oceans, then, one can find an increasingly sophisticated focus on the nature of the audiences for science information. While an increasingly nuanced understanding of audience obviously will make persuasion more effective, for good or ill, it also makes it possible for communicators to 'tell' science stories more effectively in service to informing and learning. That means this trend speaks clearly and strongly to a steady increase in quality of science communication on a global scale. As one of the millions of avid science readers/viewers, I think that is very good news, indeed.

REFERENCES

Ben-Ari, E T (1998) Making science news. *Bioscience* 48(11): 893–898

Blum, D, Knudson, M, & Henig, R M (2006) *A Field Guide for Science Writers*, 2nd ed. Cambridge: Cambridge University Press

Editor and Publisher Yearbook Online data, 1940–2003, http://www.editorandpublisher.com

Gans, H J (1979) *Deciding What's News: A Study of the CBS Evening News, NBC Nightly News, Newsweek and Time*. New York: Vintage Books
Shanahan, J & McComas, K (1999) *Nature Stories: Depictions of the Environment and Their Effects*. Cresskill, NJ: Hampton
The State of the News Media (2005) http://www.stateofthenewsmedia.org

23 Australia
Co-ordination and professionalisation

Toss Gascoigne

Many of the issues raised in the book have international impact, and Australia has been affected along with other comparable nations. Our answers and responses will be familiar to people in other parts of the world. Our scientists are under increasing pressure to perform research with commercially significant outcomes; our media is being concentrated into a smaller pool of owners; our science journalists are expected to do more with less; and Australian media outlets are being consolidated into fewer hands and offering fewer real choices.

The Internet is expanding its reach and offers both bright promise and sinister threat, as the freedom of individual posting battles with commercial entities trying to work out how to manipulate and commercialise web opportunities.

None of these factors is out of step with the broad positioning of this book. But science communication in Australia does have differences: some to do with economics, some with geography, and others with the philosophical approach taken by Australians.

On many points the position in Australia coincides with that outlined in the book. We are finding a diminution of the role of the science journalist in the mainstream media. The outlets are limited at the best of times: one or perhaps two science journalists working on each of the six major regional newspapers and the two national ones. Opportunities on radio are limited to speciality programs attracting only a small proportion of listeners; and there is not one single science specialist working in any TV news program in Australia.

This does not mean that science stories are not covered, but frequently they will be reported by journalists with no qualifications or special knowledge of science. Applied science stories are still widely reported, particularly in the areas of health and environment, because they are seen to matter to the readers and listeners and viewers. There are also opportunities for unusual or 'quirky' stories: how to control methane emissions from cows, or managing aquaculture operations when all the male fish prematurely turn into females.

The lack of specialists increases the chances of errors creeping into the reports, or uncritical reporting of a difficult issue. It maximises the chance

of PR taking over a story, airbrushing out the uncertainties, exaggerating the potential, and promising another cancer breakthrough 'if only additional funds are made available for this important research'.

It can also give rise to a lazy form of writing where the journalist will quote an oppositional viewpoint with equal weight to the recognised expert, without considering where the weight of the science lies. A notorious example in Australia occurred when a respected national TV science program 'balanced' a story on the benefits of infant vaccination by giving equal time to an oppositional group.

There is an increasing pressure on government-funded research agencies to make a direct return to government for the investment of public money. In Australia this has led some agencies to control more tightly the media's access to their scientists. Their science communication efforts are put into selling the benefits of the work of the agency, to the detriment of any responsibility they may once have had to keep the public informed and allow their scientists to enter public debates. Today, the media has to be 'managed', with the job of keeping the research agency out of the media just as important as gaining positive media coverage for the good work the agency does.

The reliance on philanthropy as a major source of research funds has not occurred in Australia to the same extent it has in countries overseas, but people are increasingly aware of the link between positive media coverage and donations. One of Australia's more recent Nobel Prize winners worked in the US. He was woken at 4 am by a telephone call from Sweden informing him of the judges' decision: he said his first call was to his family in Australia, and his second to the head of fundraising at his university in the US. He recognised instantly that his prize was a major opportunity for his university.

The growing internationalism of media limits the opportunities for coverage of local stories. It is easier and cheaper for an editor to reprint a story from the *New York Times* or the UK's *Daily Telegraph*, than to commission one of the paper's own journalists to cover a local story. Limited media ownership and technological advances make this a simple process.

It has always been difficult to encourage mainstream media to run stories on issues of science policy or science method. And yet how can citizens get any perspective on issues like global warming or GM foods without some understanding of how science develops ideas through debate? How can they appreciate that this debate is an honest and painful seeking of the truth, rather than an example of science being unable to make up its collective mind?

Australia is part of all these international trends. But where are things different in this country?

One difference is that investment in research and development by private industry is lower in Australia than in almost any other country in the OECD. This is partly because the population of the country is too small to

sustain its own internationally-competitive industry, and we tend instead to be a branch economy housing local representatives of a company based in the US, Europe, or Japan. Because industry is weaker, the PR side of science communication is dominated by government-funded research institutions.

A second point is that Australians have always been pragmatic in their outlook. The emphasis in this country is on finding solutions to practical problems (Australians pride themselves on being a 'can-do' nation): the corresponding weakness is in our attitude towards examining the theory and the philosophy behind the decisions. Science communicators in this country tend to concentrate on building a better Internet site or staging a successful science event. We invest much less in the theoretical side, and the discussions in Europe on discourse and culture are uncommon here.

A third point of difference lies in the geography of Australia. Our country is big, the same size as the US but with one fourteenth of the population (20 million people). We are a long way from other parts of the world: eight hours flight from our major cities to the nearest Asian capital, and about 30 hours to most of the centres of Europe. We have adopted two solutions to this problem. The first is not specific to science communication but to life, and that is a propensity to travel and to explore other parts of the world and bring back solutions and ideas.

The second is specific to science communication. In 1994 a new organisation was established to overcome the isolation of people involved in science communication—Australian Science Communicators (ASC). At that time, every science agency, every research group had one person whose job it was to handle 'communication'. Their positions included a number of responsibilities:

- Preparing media releases
- Designing posters
- Organising exhibitions and displays
- Writing annual reports, brochures
- Preparing internal newsletters
- Organising seminars and meetings
- Liaising with industry

The difficulty was that many institutions employed only one person to carry out these functions. They had no avenue to discuss matters of common concern with colleagues, no people in their field to whom they could turn for advice on professional or ethical issues. ASC has filled that gap, primarily by enabling a network of like-minded individuals.

ASC organises regular regional meetings in each of Australia's major cities, generally on professional or technical matters. It operates an e-mail discussion list, where the 450 members and another 200 subscribers can post questions, advertise positions, debate issues, and publicise science meetings and conferences.

One matter hotly debated at the establishment of ASC was that of exclusivity: should only practising science writers be allowed to join, or should anyone interested in the issues be accepted? The decision was to allow anyone to join, partly on the grounds of egalitarianism, and partly on the grounds that the number of science writers was too small in Australia to allow a viable organisation to develop.

This hybrid nature has enriched discussions in ASC: the title 'science communicator' can be interpreted in many ways. Members include writers, broadcasters, editors, scientists, people responsible for a variety of tasks in research agencies, people in public relations and business liaison, teachers, students, and so on. There are vigorous discussions with ASC between those who write the media releases and those who report the news, and which reflect the tensions between the two wings of science communication.

ASC has had a major influence on science communication in Australia, to the extent of helping define a new career and a consequent mini explosion in tertiary courses in science communication. The ASC model has been adopted in South Africa and New Zealand.

So how will science communication develop in the future? The trends suggest that the tensions will continue and may become more sharply focussed. The media's role of scrutinising science could diminish with the steady demise of the science specialist journalist, and the corporatisation and internationalisation of the media. This will be countered by the rise of coverage and scrutiny through Internet-based sources.

Tensions between science writers and public relations people could also increase, as governments and industry focus more closely on commercial outcomes to the research they fund. Science writers will defend vigorously the notion that all available information should be put into the public domain so that the public has the best sources of information in matters where it has to make decisions.

24 South Africa
Building capacity

Marina Joubert

South Africa faces particular challenges in making science more accessible to the broad society, but also shares many of the barriers and opportunities found in developed countries. The diversity of cultures, literacy levels, and languages, including 11 official languages, as well as vast distances between settlements in sparsely populated parts of the country, are some of the factors to be taken into account when developing large-scale science communication strategies.

Little more than 10 years into its new democracy, South Africa's government has implemented a wide range of public science engagement initiatives, designed to make science more relevant and accessible to the broad public, with special emphasis on previously disadvantaged communities.

Over the decade several new science festivals, science weeks, and other science outreach efforts, were launched. The biggest national science festival is the SASOL SciFest. Launched in 1997, this annual event now attracts more than 40,000 people every year to Grahamstown, while many more are reached via 'SciFest on the Road'outreach efforts, taking some of the festival's activities to rural communities. A small number of science centres around the country provide another important platform for engaging public audiences, especially educators and learners.

The country also participates in international initiatives such as the 'DNA 50 celebrations' and the 'World Year of Physics'. At the same time, the government is making a special effort to engage the public in scientific topics of local significance such as astronomy, biosciences, palaeontology (or African origins), and the country's research efforts in Antarctica. The Department of Science and Technology has declared 'focus months' for each of these topics and makes special funding available for communication activities that promote these 'science platforms'.

In both global and local initiatives, it remains a challenge to make the science relevant and meaningful to poor people living in rural areas where everyday life may seem very disconnected from cutting edge science. Another ongoing challenge is to measure and prove the impact of these science communication activities to government and other investors.

In most of these science communication activities, the so-called 'deficit' model of science communication is still largely prevalent. Some science communicators are beginning to use more innovative approaches to engage their audiences, such as science theatre and interactive displays. Opportunities for public dialogue, debate, and direct engagement in science are still quite rare and there is very little public debate about issues such as priority areas for research funding and science ethics.

A few small surveys of the public's attitude towards science and technology support the notion that the South African public is largely trustful of science and its outcomes. For example: Despite the efforts of a few lobby groups and considerable media coverage of the GM debate, there has been almost no significant public opposition to an increasing percentage of unlabeled genetically modified foods on our supermarket shelves.

As in many other countries, of the mass media, radio remains the single most important source for reaching large parts of the population. Internet access is still too limited to provide a viable alternative for reaching the general population.

The relationship and mutual understanding between scientists and journalists require more work and capacity building on both sides. Most scientists complain that there is too little science, especially local science, in our press. On the other hand, journalists complain of uncooperative scientists and how hard it is to find good local science stories. While South African science journalists are also able to subscribe to science news services and press releases from abroad, they have a difficult time getting hold of local science news and local scientists able to comment on global science news. Many of the 'science stories' that come from scientific institutions are closer to public relations and contain very little science. Add to this the facts that there is no dedicated science press service, that there are very few dedicated science writers, and that many scientists prefer not to be interviewed by the media, and it becomes obvious why local media contain more science stories from abroad than from local sources.

When interviewed by a journalist for a story, most scientists insist on reading the copy before the article appears and assume they have the right to change the focus and angle of the story if they don't like what the journalist has written. This, understandably, leads to conflict between scientists and journalists. Younger journalists especially are often intimidated by scientists and find it difficult to 'defend' their stories.

In general, South African scientists also lack an appreciation for the way the media work, and the pressures faced by journalists. They expect an interview to result in positive publicity for them and their research institution, and have difficulty accepting it when a journalist takes a more critical approach.

Media skills workshops, where scientists get to know journalists and get some hands-on experience of being interviewed, provides an excellent opportunity for building relationships between scientists and journalists and breaking down some of the stereotypes on both sides. Public science events,

such as science festivals and science theatre, also provide a useful hook and angle to sell science more effectively to the mass media in South Africa.

On the whole, scientists enjoy freedom of speech and may speak out against government policies that they disagree with. There has been considerable debate between some scientists and some government officials (including the health minister) over the issue of using some foods (lemon, garlic, and the African potato) as a treatment for HIV/Aids. There have been allegations in the media about doctors in the public sector that have been penalised as a result of their criticism of the government's policy and handling of anti-retrovirals for HIV-positive patients.

There is ongoing media coverage about environmental issues such as climate change and its potentially negative impacts on biodiversity in South Africa, especially the potentially disastrous impact on unique biomes such as the *fynbos* of the Western Cape. The media coverage largely reflects the 'mainstream' coverage in the US and European media, with very little coverage of those who reject the scientific consensus on climate change.

In the science job market, many highly qualified white scientists (ranging from young PhDs to older scientists) find it very hard to find work because of the government's affirmative action policies. On the positive side, these policies are beginning to create a new generation of highly skilled black researchers.

Black scientists are valuable as role models: they make science more 'real' to black urban and rural communities. Black scientists are often invited to speak to youth groups about how they became interested in science and succeeded in their studies and early careers, as a way of attracting more black youths to research careers. They are also the most credible sources to explain the relevance and meaning of their research, and science in general, to these audiences.

There is a growing interest from young science graduates in science communication as a career and academic discipline. South Africa's first part-time pilot course in science communication was presented during 2005, in collaboration with Cornell University and with funding from various local and overseas partners. Scientists are also more willing to acknowledge their responsibility to make their research more accessible to the broader community, via mass media and other channels.

The increasing awareness of the role and importance of science communication, combined with more government support for science outreach and engagement activities, present many opportunities for bridging the gap between science and society. While much more capacity building and skills development are required, the outlook for science communication in South Africa is definitely positive.

25 South Korea
The scandal of Professor Hwang Woo-Sok

Hak-Soo Kim

The Hwang scandal is a science fraud case that involved Dr. Hwang Woo-Suk, a South Korean veterinary researcher, and his Seoul National University research team. They published two articles on human stem cell cloning in *Science*, first online, on 12 February 2004 and 19 May 2005, and then in print, on 12 March 2004 and 17 June 2005. But a Seoul National University panel investigating their work released a report on 10 January 2006 demonstrating that the Hwang team fabricated evidence of human cloning. So the Hwang scandal is added to other world-famous science frauds.

This is a brief comment on the scandal that I have closely observed. I have known Dr. Hwang for several years; we have served as civic members of the National Science & Technology Council, the top decision-making body of the South Korean government's science policy and R&D budget. We have also been members of the Korea Science Foundation Board of Directors. As a communications scholar, I am also very familiar with South Korean journalism. Thus, this piece might be a reflexive but somewhat professional account, arguing that the Hwang scandal is a product of co-engagement of the three key players: politics, public relations, and media.

First, let me describe how politics contributed to the Hwang scandal. The new President Roh Moo-Hyun's regime, which came to power in February 2003, set scientific advancement as one of the key national objectives. One year later, the Ministry of Science and Technology announced the 'ScienceKorea' movement, commemorating the 37th National Science Day on 21 April 2004. The movement aimed to enhance the public's scientific literacy and positive attitudes toward science and technology. For example, it began to provide and support public locations where a voluntary teacher could help mothers to enhance their children's interest in science.

Along with the ScienceKorea movement, the position of the Minister of S & T was upgraded to that of a more powerful Deputy Prime Minister whose responsibility is to coordinate all policies and budgets related to science and technology within the cabinet. This was a symbol that demonstrated President Roh's government concern with scientific advancement. Then, the Ministry of S & T might have been highly motivated or pressured to demonstrate a few dramatic scientific achievements and heroes toward

the public. The Hwang team's research, which was ethically controversial but scientifically acclaimed in the international arena, was enough to attract the government's attention. Dr. Hwang was quickly elevated to the status of national hero, supported by President Roh and powerful politicians.

Dr. Hwang's shrewd management of journalism is well described in one former journalist's recent book, *Hwang Woo-Suk's Country* (Seoul: Bada Publications, March 2006). The author, Lee Sung-Zoo, was a science/health journalist on a major daily *Dong-A Ilbo* for 14 years. He resigned in order to write that book. Unfortunately, senior staff members of the daily would not accept his news stories casting doubt on the Hwang research team's achievements. Finally, he became committed to leaving a history of how Dr. Hwang managed media and politics and why South Korea's mainstream journalism failed to discover truth earlier.

Dr. Hwang is a very attractive man, with perfect Confucian manners; he bows courteously and his speech is humble. He is also known to be very skillful at managing journalists. According to Mr. Lee's book, he leaked news tips to the most powerful daily *Chosun Ilbo* so that the other media could climb on the bandwagon. He often held barbecue parties at his stock farm with delicious meat that he, originally a clinical veterinarian, could select professionally. Guests invited were influential senior journalists and politicians.

In addition, Dr. Hwang's elevation to national hero took place because of his eloquent communication skills, which might have led the public to regard him as an excellent scientist despite his serious lack of research publications. His adroit usage of patriotism and proper examples and analogies was enough to excite the public. No scientist could raise questions on Dr. Hwang's arguments publicly and loudly. His famous quotes include: 'Science has no national borders, but a scientist has a native country' (emphasizing patriotism); 'We have now opened major main gates, there remain only a few small gates' (emphasizing research breakthroughs); and 'We scientists should change criticism or envy of peers into praise for them' (deflecting criticism).

In a sense, his science communication is exemplary. He would highlight such incurable diseases as spinal paralysis. In order to stress the problem of spinal illness, he used celebrity patients, for example, the late TV series *Superman* actor Christopher Reeve and a famous Korean singer who had a motorcycle accident, Kang Won-Rae. This attracted the public's attention and the issue quickly developed into the public's agenda. Then, he related his stem cell research and breakthroughs to 'directly and in the near future' solving the agenda of incurable diseases. The public could not help being excited at emerging contributions of his stem cell research.

Scientists are more concerned about social 'disuse' of scientific knowledge, while the public is more concerned about social 'misuse' of it, so scientists are eager to educate the public with scientific knowledge, neglecting the public's concern about its misuse, but the public is difficult or unwilling to learn science. Dr. Hwang did not use this learning-theory-based

A brief chronology of the 'Hwang case': from national hero to indictment

2004

Jan Hwang et al. publish first stem cell paper in Science (303, 1669–74) Professor Hwang acquires status as a national hero of scienc

2005

May Hwang et al. publish second stem cell paper in Science (308, 1777–83)

May Nature alleges irregularities on egg donations

Aug Hwang et al. publish paper in Nature (436, p 641); cloned dog 'Snuppy'

Nov 12 US collaborator (Schatten) breaks collaboration with Hwang

Nov 17 Nature calls for Korean investigation into egg donation issue

Nov 22 TV reportage on Korean TV network Hwang admits irregularities on egg donations: public apology BRIC, a Korean biological research NGO offers website to discuss the case

Dec 23 Korean commission concludes: 9 of 11 embryonic stem cell lines are fakes

2006

Jan 9 Korean Commission confirms the falsification of data in both Science papers;

Jan 12 Science retracts both papers; Hwang's public apology

Mar 8 Cloned dog 'Snuppy' is found to be a 'real' clone (Nature).

Mar 13 Hwang and co-authors expelled from Korean Molecular Biology society

Mar 20 Hwang is sacked by Seoul National University together with five collaborators

May 12 Hwang and 5 colleagues are criminally indicted for embezzlement of public funds.

approach. Instead, he emphasized, first, the public's problem, and then related science to solving the problem. This could bring about the public's engagement with the problem and subsequently with science. Finally, the public became familiar with and impressed by, for example, scientific terms such as *stem cell*, *cloning*, *research*, *science*, etc. However, Dr. Hwang's key communicatory flaw was his 'overuse' or 'abuse' of science beyond scientific facts. Otherwise, he would have been an example of effective science communication, demonstrating a new science communication model I have developed, 'PEP/IS' (public engagement with a problem or issue relative to science). The above shows how Dr. Hwang's personal skills and

the media's proactive responses enabled his public relations to overcome journalism.

However, South Korea is one of the most competitive news markets in the world. Print, broadcast, and Internet journalism compete sharply within the same kind of media and between different kinds of media. In addition, South Korea is no longer a country lagging behind in scientific research. Well-trained scientists are abundant and compete with each other in all kinds of areas, including biosciences. These conditions did not leave the Hwang team's products unexamined. A national TV corporation *MBC* began to broadcast its investigative reports on 22 November, 1, 2, and 15 December 2005. This work was led by two cultural program producers Choi Sung-Ho and Hwang Hak-Soo and resulted in revealing the Hwang team's fraud. However, looking back, the champion for science journalism is said to be an Internet newspaper *PRESSian*. Its reporter Kang Yang-Koo continued to question Dr. Hwang's achievements for a long time. Also a group of young biologists called BRIC discovered duplicated photos in the Hwang team's research articles. Media began to cover the BRIC's webpage. Dr. Hwang's shrewd but deceptive public relations could not survive active science journalism in South Korea.

The Hwang scandal delivered many lessons to Korean society; for example, the importance of a scientist's integrity, science journalism's active role as a watchdog, and political non-intervention in scientific research. We realized that we should be concerned about not only disuse and misuse of science, but also overuse and abuse of it. These must be lessons for the rest of the world, too.

26 Japan
A boom in science news

Kenji Makino

'Our country is currently experiencing a science communications bubble'. Science communications practitioners in Japan have been murmuring such sentiments for a few years now. Their comments show that science communications is quite a trend in Japan, and that it provides the general public with a variety of activities related to science. However, the word 'bubble' also implies an element of concern, as there was for Japan's bubble economy more than ten years ago; we sense some issues underlying the current celebration of science communications, and several years down the road we might have to deal with the possible collapse of this science communications bubble.

This goes back to the Meiji period (1868–1912) when Japanese people started enthusiastically organizing activities which they called 'scientific enlightenment', and it is only now, in the early twenty-first century, that a concept called 'science communications' has taken over from 'scientific enlightenment'. Scholars and practitioners have pointed out that scientific enlightenment required only one-way communications from scientists to the general public (Deficit Model), which limits the potential for social applications of science. Instead, they have started to promote the concept of science communications, which employs a two-way, interactive model.

Although some people have been using the phrase 'science communications' since the mid-1990s, it is only recently that the concept has come under the social spotlight, after *Science Communication* by S. Stocklemyer was translated into Japanese in 2003, and three major universities launched the first training programs for science communicators and journalists with the aid of government grants in 2005. For several years, various cities and towns, such as Tokyo, Kyoto, and Sapporo, have been competing with each other to set up an enjoyable science café. During the science and technology week 2006 there were 21 science café events in Japan. Moreover, lectures, symposiums, and workshops related to science communications are blooming everywhere.

The Japanese government set the stage for this mini-bubble phenomenon, spending science and technology grants not only on bench research but also on the examination of issues with social implications. One of these issues

was that younger generations were losing their curiosity about science, a trend which became a public concern in the 1980s. In the late 80s, embracing the slogan of 'seeking to be a world leader in science and technology' as a national policy, the Japanese government started taking measures to deal with the issue of the younger generations.

The 1990s in Japan was a dark period for ten years after the bubble economy collapsed in 1991. Nevertheless, the country began constructing a national strategic framework for the promotion of science and technology, exemplified by the Science and Technology Basic Law in 1995 and the Science and Technology Basic Plan in 1996. The movement initiated by the government eventually led to the current boom in science communications.

The Japanese government's thinking on science communications appears in a white paper on science and technology issued in 2003. In this paper, a special topic, 'Science and Technology and Society' states the significance of communication between the scientific community and society, which was the first such statement in this series of white papers. The 2003 paper even proposed a novel interactive culture between scientists and the general public.

The above is an overview of science communications in Japan, and what follows are my comments on the situation in European countries, such as the UK and Italy, from my Japanese perspective.

What T. Radford introduces is also happening in Japan. Although the younger generations tend not to read newspapers as much, newspapers are still socially influential because of their high penetration rate and well-organized distribution systems (both morning and evening editions are distributed to all subscribers every day). Science news articles in newspapers are delivered to people who do not necessarily want to read them. But they might chance to scan the science news articles if the articles intrigue them. This is a different situation from the Internet, where people click only on the news they are interested in.

S. Coyaud's experience in Italy is of importance. Press releases are increasing in number in Japan as well, and especially since there has traditionally been a press club here, it has been pointed out that it takes too much time to publish a news article after a press conference and the release of a press release. However, investigative reporting is highly valued as well, and pursuing socially urgent problems from science journalists' perspectives is very common. A good example is the reporting on asbestos in 2005. Asbestos has caused several serious diseases (medium skin swelling) among workers in factories where asbestos was used, and this time company K acknowledged that residents near its factories were also suffering from asbestos-related illnesses without necessarily acknowledging a cause-and-effect relationship. But the company decided to compensate the residents for their illness, and the event popularized the issue of asbestos nationwide. Local communities all over the country took steps to assess their own asbestos problems, and a new national law (the Asbestos Relief Law) was enacted.

Newspaper publishing company M scooped the event, and this stands as a typical case where science news has changed Japanese society.

L. Carra points out that in Italy journalists are under advertising pressure from pharmaceutical companies; in Japan the pressure is not so great, even though the industries' public relations and advertising activities are brisk. Most science journalists are hired by the major media and have secure jobs, so they are able to resist the pressure. Even though many articles are written by freelance science journalists, we do not find so many news articles terribly tainted by industry views.

As B. Trench writes, the Internet has been changing the form of science journalism over the longer term. The younger generations read science news only on the Internet, blogs have come into fashion, and scientists and scientific institutions deliver information directly to the general public online. My concern is that the accuracy/interpretation of the information is not reliable; science journalists and professionals should play key roles in straightening out science journalism activities on the Internet.

C. Palmerini's point could be applied to Japan. Scientists often complain that science reporting is not accurate in terms of science; however, the journalist's perspective in reporting should be better appreciated. Scientists and science journalists have different ways of thinking about science. Ideally, the two views should be well-balanced, and have a continuing, though tense relationship.

Recently, there has been a systemic reorganization of public relations offices at scientific institutions, which has been speeded up by the boom in science communications. In the third five-year program of science and technology, starting in 2006, the government is supposed to spend as much as $250 billion in a bid to get public support for its activities, and this program will enrich activities dedicated to public understanding of science and technology. On the other hand, science journalism is expected to be more independent of the government and to be critical of science policies, so there is a slight concern that the star player in the mass media might move over. In Japan, science journalism is not so influential socially compared with other journalistic reporting on politics, economics, and social issues. In describing this situation one might say the level of science journalism is between first and second-class. If the government focuses mainly on promoting public relations activities, as W. Goepfert describes, science journalism activities will possibly be less effective. However, the good news in Japan is that science journalism in newspapers and national public TV programs (NHK) is lively; the major nationwide papers cover quite a lot of science topics, and there are about thirty science reporters in every newspaper company. I assume the development of a healthy science communications movement will improve science journalism by synergy.

The situation in Spain, introduced by C. Elias, is also a great concern in Japan. Politicians and industries occasionally make improper use of scientific facts and knowledge, and it is a challenge to stop this happening.

For example, Japan was once in a chaotic situation concerning Minamata disease. Organic mercury in effluents from a chemical factory went into the ocean, the mercury accumulated in fish, and sadly consumers of the fish suffered organic mercury poisoning. Under the circumstances, a scientist concealed the real reason for the consumers' poisoning, and there were many scholars whose views supported the industry in power. Here was a crucial role for science journalism, and science journalists had the responsibility to expose the facts.

Scientists' comments have to be evaluated and assessed objectively according to their situations and those situations' social contexts. Scientists who are on the boards of science and technology-related governmental councils tend to be much too generous to politicians. However, a committee related to nuclear energy now has one anti-nuclear member which is to be somewhat commended.

In Japan, the shift from a deficit model to an interactive model has already occurred, and people are working on activities to encourage 'public involvement', as J. Gregory explains. Japan may be following the situation of the U.K., and in many respects the general public in Japan has started thinking about science and technology as their own issues. That has led the society to create more non-profit organizations and social groups of science for the public, and members of the community are enjoying researching the relationship of science and technology with society from the citizen's perspective.

I was surprised at B. Ward's case that there was a misleading report among the British media reports on global warming, and I do not remember there being any such case in Japan.

Contributors

Jon Agar has taught history of science and technology at Cambridge and Manchester universities, and is a visiting fellow at the Department of Science & Technology Studies, University College London, and a visiting professor at History of Science, Harvard University. He was research manager of the RSA Forum for Technology, Citizens and the Market.

Luis Henrique Amorim is a science journalist. He holds a master's degree from the Oswaldo Cruz Foundation. Amorim works at the *Jornal da Ciência* newspaper, published by the Brazilian Society for the Advancement of Science.

Manuela Arata is the head of the Office for Promotion & Collaboration Development, Directorate General of CNR-National Research Council. From 1995 until June 2005 she was General Director of the Italian Institute for the Physics of Matter (INFM). She has been chairperson of the Science Festival, Genoa since 2003. In March 2005 she was decorated by the President of the Italian Republic, Carlo Azeglio Ciampi, with the Award of Merit of the Italian Republic.

Martin W Bauer is Reader in Social Psychology and Research Methodology at the London School of Economics and Director of the MSc Social and Public Communication. Recent books include *Biotechnology—The Making of a Global Controversy* (Cambridge, 2002) and *Genomics and Society* (Earthscan, 2006), both with G Gaskell. He publishes scholarly papers in *Science, Nature, Public Understanding of Science, Science, Social Studies of Science, Technology and Human Values, Science Communication.*

Massimiano Bucchi teaches Sociology of Science at the University of Trento, Italy, where he also chairs the Science in Society programme. He has published several essays in international journals such as *Nature*, *Science,* and *Public Understanding of Science,* and seven books including *Science and the Media* (Routledge, 1998) and *Science in Society. An Introduction to Social Studies of Science* (Routledge, 2004).

Bruno Buys is a biologist who specializes in science journalism, and is currently working on the Museum of Life.

Luca Carra works for the Italian scientific news agency Zadig, based in Milan. He mainly writes on health and environmental issues for the news magazine *L'Espresso* and the newspaper *Corriere della Sera*..

Sylvie Coyaud writes for *Il Sole 24 Ore* and *D-Repubblica*. Her radio programme about science, "Il Volo delle Oche", is broadcast weekly on Radio24.

Sharon Dunwoody is Evjue-Bascom Professor of Journalism and Mass Communication and Associate Dean for Social Studies in the Graduate School at the University of Wisconsin-Madison. She studies the science communication process and has most recently focused on studies of scientists' perceptions of media coverage, the role of the World Wide Web in informal science learning, and individuals' use of different information channels to inform their risk judgments. She earned a BA in journalism at Indiana University, a MA in mass communication at Temple University, and a PhD in mass communication at Indiana University.

Carlos Elias is Senior Lecturer in Scientific Journalism at University Carlos III of Madrid, and he was a Visiting Fellow at LSE Social Psychology (2005–2006). Educated in chemistry (MA) and journalism (PhD) at the University of La Laguna, he worked as a political journalist for EFE News Agency and as scientific correspondent for *El Mundo*. His research focuses on the relationship between policy-making, science, and mass media culture. He has published two books in this field.

Björn Fjæstad is Adjunct Professor of Science Communication at Mid Sweden University, Östersund, and editor-in-chief of *Forskning & Framsteg*, a leading Swedish popular science magazine. His doctoral dissertation, at the Stockholm School of Economics, analysed the institutional relationships between business and the media.

Jon Franklin, one of the profession's most innovative writers, is a pioneer in both narrative non-fiction and explanatory journalism. He won the first Pulitzers ever awarded for feature writing (1979) and explanatory journalism (1985). He is currently Philip Merrill Professor of Journalism at the University of Maryland, College of Journalism.

Toss Gascoigne is Executive Director of the Council for the Humanities, Arts and Social Sciences (CHASS) in Australia, and prior to that he ran a similar organisation for scientists (FASTS). Both organisations represent the policy interests of university researchers, and work closely with governments and politicians. He is President of the PCST (Public Communication of Science Communication) network, and is a founding member of Australian Science Communicators.

Winfried Goepfert used to be science editor in both radio and television of *Sender Freies Berlin*. He was a reporter and producer at major science magazines on German TV channel I. In 1990 he was appointed as full-time professor of science journalism at the Institute of Journalism and Mass Communications at the Free University Berlin.

Paola Govoni is an historian of science at the University of Bologna. She works on the history and communication of science in modern and contemporary Europe. She is the author of *Un pubblico per la scienza. La divulgazione scientifica nell'Italia in formazione* (Rome, 2002), and *Che cos'è la storia della scienza* (Rome, 2004).

Jane Gregory is senior lecturer in the Department of Science & Technology Studies at University College London, where she specialises in twentieth-century science and the public understanding of science. She was project manager of the the RSA Forum for Technology, Citizens and the Market.

Susie Harries is a project director at the RSA (Royal Society for the Encouragement of Arts, Manufactures and Commerce). Currently directing the RSA's Commission on Illegal Drugs, Communities and Public Policy, she was project director for the RSA Forum for Technology, Citizens and the Market.

Jeff Hughes is currently Senior Lecturer in the History of Science and Technology at Manchester University. His research focuses on the history of radioactivity and nuclear physics, the history of science in twentieth-century Britain. Recent publications include *The Manhattan Project and the Birth of Big Science* (Icon Books, 2002). He teaches courses on science and the public, and on the nuclear age after Hiroshima.

Armanda Jori is Director of Research at Mario Negri Institute and Secretary of the European Biomedical Research Association.

Marina Joubert is a science communication consultant. From 2001 to 2005 she managed the communication unit at the South African Agency for Science and Technology Advancement (SAASTA). She coordinates communications for South Africa's bid to host a major new radio telescope (SKA), and the construction of the Karoo Array Telescope (KAT)—see http://www.ska.ac.za. She regularly talks at workshops on popular science writing and publishing, teaches media skills to researchers, and serves on the Advisory Panel of the national science festival, SASOL SciFest; she is a member of the PCST Committee.

Hak-Soo Kim (PhD University of Washington, 1982) is Dean of the College of Communication and the Graduate School of Mass Communication, Sogang University, Seoul, South Korea. He also directs the Academy for Scientific Culture as well as the Science Communication Laboratory (http://www.scicomlab.com) of the same university. His e-mail address is: hskim@sogang.ac.kr.

Simon Lock is completing a PhD in the Department of Science & Technology Studies, at University College London, which examines debates surrounding the public understanding of science in the UK. He has also worked on public engagement initiatives at the UK government's Office of Science and Innovation and at The Royal Society, and he was project researcher for the RSA Forum for Technology, Citizens and the Market.

Kenji Makino is science journalist and Professor of Sociology of Science at Tokyo University of Science. He was born in 1934, He has an MS in chemistry from Osaka University, worked for newspapers more than 30 years, then freelanced. He established JASTJ (Japanese Association of Science and Technology Journalists) and MJAJ (Medical Journalists Association of Japan). He is the author of a book, *Introduction to Science Writing for Young Scientists*.

Luisa Massarani is a Brazilian science journalist, with background in communication. She has a PhD from the Federal University of Rio de Janeiro, and undertakes both research and practical activities. Massarani works at the Museum of Life, in Oswaldo Cruz House/Fiocruz, and she is the regional coordinator of SciDev.Net (http://www.scidev.net) for Latin America and the Caribbean.

Chiara Palmerini specialized in science journalism at Boston University. She is currently a science reporter for the Italian news magazine *Panorama*, based in Milan, for which she mainly covers biomedicine. She co-authored a book on stem cells research, *La rivoluzione delle cellule staminali*.

Claudio Pantarotto, trained in chemistry, joined the Mario Negri Institute in 1969. He carried out research on drug metabolism and has published extensively on this topic. He is now in charge of the Institute's external relations. He has received some of the highest Italian and foreign academic and civil honours.

Tim Radford was until 2005, science editor of the *Guardian*. He was born in New Zealand in 1940, and worked for more than 48 years in weekly, evening, and daily newspapers in New Zealand and the UK. He has also been arts editor and literary editor of the *Guardian*. He won the Association of British Science Writers' annual award four times.

Bronwyn Terrill is a science communicator, educator, and writer with experience across three continents. Specializing in the communication of genetics and molecular biology, she has curated exhibitions in Australia and the U.S.A. and produced award-winning online resources for Cold Spring Harbor Laboratory, New York. Bronwyn currently manages the Communication and Public Engagement programme for the Wellcome Trust Sanger Institute in Cambridge, U.K.

Brian Trench is senior lecturer, Head of School, and co-ordinator of the MSc Science Communication in the School of Communications, Dublin City University. He was previously a full-time journalist for over 20 years. His research interests are in public attitudes to emerging technologies, Internet media, the knowledge economy, and models of science communication. He is a member of the scientific committee of the PCST network, and was a member of the Irish government's Council for Science Technology and Innovation. He is a member of the national advisory committee of the Irish Children's Museum, and chair of the university's Ethics Committee.

Jon Turney is a science writer and editor and course leader for the MSc in Creative Non-Fiction at Imperial College London. He was previously a science journalist, science policy adviser, university lecturer, and publisher. His books include *Frankenstein's Footsteps: Science, genetics and Popular Culture* (Yale, 1998), *Lovelock and Giaia* (Icon Books/Columbia University Press) and, with Jess Buxton, *The Rough Guide to Genetics and Cloning* (2007); http://www.jonturney.dsl.pipex.com

Fernanda Veneu is a Brazilian science journalist, with a background in communication. She has a MSc in Science, Technology and Society from Salamanca University (Spain) and she is a PhD student at Oswaldo Cruz Foundation, and joins both research and practical activities.

Bob Ward is Director of Global Science Networks at Risk Management Solutions Ltd. Between 1999 and September 2006 he worked for the Royal Society, latterly heading its press office as the senior manager for policy communication. He has a degree in geology and an unfinished PhD thesis on the deformation of carbonate rocks. He has published articles in a number of publications and completed short stints as a reporter for *The Daily Telegraph*.

Index