JCOM 1 (2), June 2002

Scientists to the streets
Science, politics and the public moving towards new osmoses

Yurij Castelfranchi

Master's Degree course in Science Communication, ISAS, Trieste, Italy

What may be defined as the "standard model" of the public communication of science began to develop in the second half of the nineteenth century, gained a clear structure (especially in an Anglo-Saxon context) in the first three decades of the twentieth century and dominated until the nineties[i,ii]. Roughly speaking, the model tends to describe science as a compact social (and epistemic) corpus, largely separated from the rest of society by a type of semipermeable membrane. That is, information and actions can flow freely from science to the rest of society (through the application of technologies and the spread of scientific culture, for instance), but much more limitedly in the opposite direction (through science politics or the influence of sociocultural events on science itself). The public communication of science becomes, then, popularisation: an action of in-forming, an action that is substantially wide-reaching, unidirectional, following the top-down model, aiming at conveying the facts and the discoveries of science by translating complex terms and notions into simple ones. From this point of view, scientific communication is the mere outpouring of some scientific knowledge, thus inevitably becoming more or less approximated, banal, lacking in information, no longer rigorous as a scientific message should be. This is a model that tends, therefore, to found communicative actions not so much on the skills, the beliefs or the needs of the public in general (or in particular), but rather on their cultural and

cognitive voids, whether they are merely hypothesised or measured (the "deficit model").

Over the last twenty years, this model has been enlarged and redefined. Though, very recently it has also been criticised radically and in extreme detail. On the one hand, through mass communication theory, cognitive psychology and pedagogy we know that the public is not a homogeneous and passive subject, a sort of *tabula rasa* needing informing and shaping through a "hypodermic" or "silver-bullet" output of information, but is, in fact, a community of people with different interests and skills. It is an active community, which can use (or reject) and reinterpret the information it receives, and which can interact with it and negotiate its meaning[iii]. On the other hand, over the last few decades sociology, history and the philosophy of science have an increasingly polychromatic view of the scientific institution. It begins to work more like a social entity which interacts radically with other social institutions, and which has many different, complex and bi-directional osmoses with the rest of culture[iv].

Consequently, especially very recently, traditional top-down programmes to raise scientific literacy and awareness in the community have been repeatedly criticised and many modifications have been proposed[v,vi,vii,viii,ix,x,xi]. Numerous scholars have begun tackling the issue of how the public communication of science can accompany traditional transmission methods ("one-up versus one-down" methods) with new ways to interact: the key words in this context become "interaction", "engagement", "bi-directionality", "involving communication", "debate". The idea of a science that gives explanations to those who do not know or understand now goes hand in hand with the proposal of a science that listens. A popularisation of science which builds a temple and adorns it with the brilliant beads of discovery, invention and progress now goes hand in hand with a communication that is also a forum, where one can discuss the processes of science (tormented rather than linear), its method (still evolving), and its social, ethical and political, and often controversial implications. Science as an institution seems to have realised that internal communication among scientists is certainly fundamental for science[xii], but communication to the public has also become a necessity today. Not only for the public, but for science itself, too[xiii].

An interesting aspect of these various interactions, and one that has been less investigated, is the aspect of "science advocacy", of the lobbying and propagandistic practices that science has adopted to get support, funding and political feasibility. This aspect, as we will reveal, is also profoundly evolving. In addition, communication with the public is taking on a role that can no longer be neglected.

Traditional science lobbying

Scientists have always needed to be proactive in the search for funds and recognition. All the great natural philosophers of the seventeenth and eighteenth centuries had to pay dues to their patrons and supporters with countless gifts and dedications (for example the "Medicean" moons of Jupiter, discovered by Galileo). But at the beginning of the nineteenth century, when science began transforming into a social institution, into a craft forged in laboratories and research centres financed by national governments, scientists also needed to organize themselves into forms of collective political lobbying. In the United States of the first years after the war, the renowned Vannevar Bush report[xiv] highlighted the fact that scientists were aware that symbiosis with the political, military and industrial worlds was crucial. Some scientists chose to amplify their bargaining power and their influence on politicians by exploiting their public and media visibility. The majority of scientists, in fact, used their public visibility as a weapon to influence politicians, businesspeople and the military more deeply–though not to address the public directly.

More recently, government funds for science have been dogged by fits and starts; research projects related to military applications, space exploration, nuclear science and particle physics have been resized; health funds have been cut in several developed countries. On the other hand, there has been an impressive growth in research and development from the numerous multinational companies (especially those linked to the biomedical or the IT sectors): these factors have rendered scientific lobbying all the more important for entire research sectors. The archives of *Science* and *Nature* of the past five years contain dozens of individual situations which show (to varying degrees) the willingness of scientists to carry out active, explicit, official lobbying, especially in the USA but also in Australia[xv], New Zealand, Canada and Europe[xvi]. In November 1999, *Nature* attributed the hard fought increase of NIH funding in Congress to the power of the "scientific lobby"[xvii]. A survey carried out by *Science* in November 2001 showed the success of lobbying in the United States and counted dozens of lobbyist organizations, who employed personnel to put pressure on the government[xviii]. Boston University spent $760,000 in 1999 to pay for the services of Cassidy & Associates; *Science Coalition* paid 440,000 to Podesta/Matoon; FASEB 280,000 to Van Scoyoc Association, and so on[xix]:

Scientists and their institutions are deploying dozens of lobbyists in Washington and spending millions of dollars to press their case. In the process, researchers have shed their traditional distaste for politics and embraced such once-taboo tactics as hiring consultants and assembling focus groups to test their sales pitch.

The awareness of the need to lobby has been growing in Europe, too. Faced with the sometimes dramatic cuts to research carried out by various countries (for example, in plant biotechnologies), scientists have formed pressure groups on a national and European level. In Great Britain, the organization *Save British Science* has set its target to "improve the scientific health of the UK"[xx]:

We apply pressure directly to Government, the civil service, politicians and their advisers, to industry and the City […]. In short, we publicise issues of science policy whenever we can, to ensure that they can never be neglected. […]. SBS is remarkably successful at obtaining media coverage, gaining access to key decision-makers, and influencing the debate.

SBS, which actually enjoys a remarkable visibility[xxi], counts roughly 1,500 members: industries such as Advent, Astra Zeneca, British Telecom, Merke Sharp & Dome, Pfizer, Philips, Sharp, Shell, SmithKline Beecham, and some of the major scientific societies in Britain, as well as numerous universities[xxii]. Great Britain also saw the establishment of the *UK Life Sciences Committee* in 1997. In 1998, the committee organized a pressurising campaign to increase the salary of PhD students in the area of life sciences[xxiii].

In spring 1999, some Members of the European Parliament explicitly urged scientists to lobby, and to do so following the model of the companies that "lobby hard and efficiently" or of "pressure groups like Greenpeace"[xxiv]. Shortly thereafter, the scientists in the *European Cell Biology Organization* and in the newly born *European Life Science Organization* admitted that the traditional reluctance of scientists to coalesce to carry out political lobbying must be overcome[xxv]. At the end of 1999, the European Life Science Forum (ELSF) was established, with the objective of "presenting politicians with a single viewpoint of the needs of the community carrying out basic research in Europe", and of opening a dialogue with the European Commission. The US colleagues encouraged the coalition to imitate them and spend "a significant proportion of its budget on paying a full-time member of staff to 'worry about public advocacy', as well as [to organise] the services of a professional lobbyist"[xxvi]. In February 2000, the *European Plant Science Organization* (EPSO) was founded[xxvii]. In the same period, in Germany, heated controversy arose about scientists not being able to communicate with

politicians or explain the importance of their research. Walter Döllinger, a top ranking official at the Ministry of Research, declared that the scientific community and industry were responsible for the weakening of the political support for genomics research. The Minister could not find enough political reasons to increase his support for the German Genome Project[xxviii,xxix]. In November 2001, even the president of the *Swiss Science and Technology Council*, Gottfried Schatz, said: "researchers need a lobby"[xxx]. One month on, European physicists set up an exhibition in Brussels, within the Parliament, and launched a lobbying campaign to defend the construction of the international thermonuclear reactor ITER, which many MPs had deemed too expensive and little useful[xxxi].

So, scientific lobbying is now a fact. And it is expanding rapidly. A survey carried out by *Nature* showed that science was the topic of British parliamentary debates six times more frequently in 1999 than in 1989, with an increase from less than 1% to about 6%. Commenting on that, the authors of the survey said[xxxii]:

Our analysis shows that scientific issues have become increasingly important in the work of the UK Parliament over the past ten years. But does this reflect an increasing importance of science and technology within Parliament, or merely an increasing sophistication and efficiency of lobby groups at getting these issues on the agenda? Our guess is that both are factors.

However, it has been over the last five years that the traditional pressure has been increasingly accompanied by a conscious decision to look for media visibility and contact with the general public, at least by some scientists and scientific institutions. The awareness that lobbying is becoming a necessity begins to be associated with the idea that this lobbying must not be addressed to politicians or industry only, but also (and maybe above all) to the public at large, and that it must be founded on a practical communication of science. What is more, many have realised that communication with taxpayers is not only a necessity, and that it also must no longer be based on classical, top-down, literacy-bound popularisation only: communication must be dialogical, bi-directional, listening-oriented and include debate.

Towards an involvement of the public

Already in 1997, in the wake of a growing dispute on the use of applied science in biomedicine and biotechnology, *Nature* organized a conference together with the British Council in Paris. In the journal's own words[xxxiii]:

The biggest challenge facing those who have to grapple with bioethical issues is to find more sophisticated ways of involving the public in decision-making. There is a need to improve the supply of information, to make decision-making procedures more open […] It is "no longer sufficient for governments to take the advice of an expert committee and to expect the public to accept the conclusions without question".

In brief, the issue of public access to decision-making was being discussed in the scientific field, too[xxxiv]:

more can still be done to engage the public directly in regulating the impacts of modern science–including giving the media greater access to this process. Scientists, too, have a responsibility to open up.

Nature was also positive about Jonathan Slack's decision to discuss the importance and the ethical problems of his "headless" frog embryos in terms of his research: "scientists, too, have a responsibility to open up […] Their confidence that an informed public is a responsible public–more familiar as a political tradition in the United States–is welcome"[xxxv]. Slack himself underlined the importance of having contact with scientific journalists, whom he perceived as generally serious and responsible; he also pointed out that he was confident that "the better informed the public becomes, the more likely it is that controls [over research] will be reasonable rather than restrictive"[xxxvi].

In the same period, the major and most dignified scientific organizations in Europe and overseas also realised that interacting with the public was a tactical necessity, in accordance with science advocacy as well. Jane Lubchenco, who was elected president of the *American Association for the Advancement of Science* in 1997, inaugurated her office by stating that scientists must "communicate their knowledge and understanding widely in order to inform decisions of individuals and institutions"[xxxvii]. In the same period, Harold Varmus, director of the NIH, admitted that inputs coming from the public needed to be listened to more carefully, as suggested by a report commissioned by the US Congress[xxxviii].

On the other side of the Atlantic, the *Royal Institution* did more. The institution, which has been carrying out research and popularisation since it was founded in 1799, also had a new director, and for the first time a woman. Susan Greenfeld, a pharmacologist in Oxford, declared that she wanted to change the traditional form of popularisation, with "the scientist in the white coat 'talking down' to people". She also proposed creating a centre where politicians, scientists, humanists, artists and religious

representatives could meet and debate: people “don’t want just to be told the facts. They need a place where their concerns can be voiced and debated”[xxxix].

Therefore, science needs to (and, according to some, it must) make itself understood by people. But not only that. It also needs to (or must) understand people, respect their opinions, listen to their doubts or worries. Democratising knowledge or enhancing informed choices on the part of citizens are not the only objectives. As a matter of fact, alongside the traditional channel which views active scientific lobbying as an “infrared” pressure link, from the academic world to the political one, a new form of “public advocacy of science” is taking shape: there are groups of researchers or scientific institutions which choose to appeal directly to public opinion, to ask charities for funds or to claim both the legitimacy and the usefulness of their work.

At a conference organized in spring 1998 by the *Geological Society*, Sir John Nill, former director of the British *Natural Environment Research Council* declared that “by paying less attention to public interests, Earth scientists had lowered their stock in the eyes of policy-makers”[xl].

Not only that. Many are now beginning to argue that the lobbies in favour of science must study the tactics of groups expert in media and popular campaigns[xli]:

Other scientists […] pointed to the success of Greenpeace’s well-funded campaigns in Europe–such as that against genetically modified foods–which they said urgently needed to be matched by similarly competent campaigns by scientists.

Therefore, not only is there a need to pressure the political world directly, but also to be able to open doors, and actively look for public support. Scientists are, in fact, now ready to take to the streets. The event that contributed most dramatically to this phenomenon was certainly the Swiss referendum on biotechnologies.

Switzerland 1998: scientists to the streets

In May 1992, a group of organizations decided to mount a major attack on biotechnology research in Switzerland. The "Gene Protection Initiative" (GPI), with the support of Greenpeace Switzerland, WWF Switzerland, Pro Natura, Medical Doctors for Environmental Protection and about seventy more NGOs (and backed by the Green Party and a section of the Social Democrats), collected more than 110,000 signatures in one year in favour of a referendum to integrate the federal Constitution, so as to prohibit:

a) The production, purchase and transfer of genetically modified animals;
b) The release of genetically modified organisms into the environment;
c) The patenting of genetically modified animals and plants or their constituents, as well as the procedures or products involved.

The GPI also required that those intending to resort to methods of genetic engineering should be obliged to prove "the usefulness, safety and lack of alternatives", as well as to demonstrate that it corresponded to "ethical responsibility". The survival of Swiss biotechnology research *in toto* was virtually at stake, not only in the farm and food sectors but also in the industrial and medical. The Initiative started a remarkable media campaign, which intensified in the two years preceding the vote and culminated in the first five months of 1998.

The supporters of the GPI, with an 800,000-strong backing and proud of the results of the surveys carried out, according to which 62% of the Swiss were against genetic engineering in principle, launched a vigorous campaign. One of their slogans was: "They want to remake Creation. We prefer the original". They linked GMOs to highly emotional images, images of a "science of errors", recalling Chernobyl or the tragedy of bovine spongiform encephalopathy, for instance. On the opposite front, pharmaceutical and biotechnological industries spent more than 10 million euro to set up public conferences and debates, and to fill Swiss dailies and magazines with insertions. However, it was mainly the scientists, many of whom decided to take the field personally, who determined the ending of the battle. Researchers and technicians did not remain inactive in their laboratories: they did not limit themselves to protesting by writing letters to the newspapers or to politicians, but decided that rather than acting within academies on the inner side of politics, they needed to protest publicly. Allied with industry, they gave rise to coalitions such as *Gen Suisse* (founded in 1991) and the

industrial lobby *Wirtschaftsförderung*, which managed the media pro-biotech counter-campaign together with the Christian Democrats and the Swiss right-wing parties. "The involvement of scientists in this campaign had a tremendous impact on public opinion"[xlii], according to *Science* after the victory. The apocalyptic images of those in favour of the referendum were opposed by the demonstrations of researchers, who revealed that a victory of the yes-votes would have endangered at least 2,000 jobs. Not only that, but scientists took to the streets, as did many people affected with genetic diseases, some of whom were also in wheelchairs. In the meantime, parliamentary debate became heated in the unsuccessful attempt to pass a *Gen Lex* that would have satisfied the various interests and would have avoided a referendum. In the end, by the beginning of 1998, references to the referendum were part of the daily news. The Swiss Nobel prize-winners backed the yes-lobby, and the Government also declared that it was unanimously contrary to the GPI. Thousands of young researchers filled the streets and squares of Zurich and Geneva to publicise their views. The result was a landslide victory of the pro-biotech front: on the 7th June 1998 41% of the Swiss voted. And, in complete discordance with initial surveys, 67% of votes were against the GPI. The Initiative did not win in any single canton.

After the victory, the president of *Gen Suisse* wrote that scientists and industry had prevailed because they had "managed to shift the emphasis of public perception from protection of Man and his environment to prohibition of research and medical progress"[xliii].

The lesson to be learnt was that

emotional factors are important too. For this reason proponents and opponents both used emotional images, a beautiful picture-book countryside or a sick child sitting on a hospital bed. […] The problem in using emotional strategies is how far to go: an excess of emotionality may be damaging to credibility.

However, he also noted:

The public is capable of differentiating issues, even if they do not understand the technical details; scientists need to engage in dialogue with different groups of the public in their own language. This needs to be […] about benefits and costs and also about the public's worries; the public has the right to know what the aims of publicly funded research are […] Scientists need to acknowledge their obligation to the general public and be willing to debate[xliv].

Others commented similarly: "Scientists made a difference in this campaign by getting out of their labs and establishing a dialogue with the Swiss people […] Now

[…] scientists cannot withdraw back into an ivory tower. We have to keep up this dialogue with the public"[xlv].

The occurrence of the Swiss referendum, a victorious but certainly shocking one for the scientific community, reverberated all over the world. Scientists became more aware that they cannot limit themselves to explaining, to increasing people's knowledge of science, but from the point of view of tactics they must carry out a "lobbying that is independent of industry and government" and one that receives media coverage[xlvi]. Many said that "European scientists should talk more about the importance of their work–to both the public and politicians"[xlvii]. Today, courses in science communication are being praised with increasing frequency, as are university science faculties that are planning to add such courses to the student syllabus. The ability to effectively communicate not only with colleagues but also with non-scientists and the media "is becoming increasingly important"[xlviii]. *Nature* and *Science* regularly devote space to the situation of scientific journalism, to the idea that it may become a career for young people with a scientific training, and to its role in the establishment of new relations between science and society[xlix].

Letters and petitions of scientists to politicians are multiplying. With increasing frequency they take the form of open letters, addressed to the media or the public debate. On the 22nd February 2001 eighty Nobel prize-winners wrote an open letter to the US president George W. Bush[l], urging him to allow government-funded researchers to work on human pluripotent stem cells. They did so as a reply to the powerful anti-abortion lobby, which on the contrary pressured the Bush administration to block federal funding for research on embryonic stem cells. In the same period, the "march" of scientists to Rome also took shape (see this same issue of *Jekyll.comm*).

In addition to that, many believe that lobbying that is not sensitive to the perception and the attitude of the public is counterproductive, apart from being subject to criticism from an ethical point of view. For instance, a scientist replied with the following to the enthusiasm showed by some researchers on the victory obtained in blocking the actions of animal rights supporters, who were attempting to make the US Department of Agriculture regulations on experimentation on rats and mice more restrictive:

The deplorable aspect of this ostensible victory for biomedical research is that it is at the same time a resounding defeat for logical consistency, and hence for the rationality that forms the very basis of all scientific enquiry. If someone were to argue that mice, rats, and birds are not animals in the sense of the USDA rules regarding the use of experimental animals, he or she would be laughed at by any thinking member of the general public–and with good reason. This pyrrhic victory may well backfire by reinforcing the image of scientists as a bunch of self-serving sophists, thus ultimately contributing to the rising tide of antiscientific sentiment[li].

Commenting on the *Science and Society* report commissioned by the British Chamber of Lords, *Nature* stated the need to "reward scientists who communicate their findings to the public", and that the Public Understanding of Science movement should adopt a less patronising title[lii]. It also added that scientists should "learn to work with the media as they are" and hire communication consultants to contrast the campaigns of opposing pressure groups effectively. To counter the dramatic fall in the inscriptions to physics courses, scientists need to make "science accessible, rather than merely understandable", they should understand that Public Understanding does not lead inevitably to support for science, and that "dialogue rather than [unconditioned public] acceptance is the goal" [liii] of communication.

Conclusions: opportunities and risks in the public advocacy of science

Evaluating the shape and the consequences of the new forms of interaction between science, politics and the public in the next decade is no easy task. On the one hand, there is an evident risk that scientific institutions may find themselves pressured by the needs of marketing, and create a "populist" science, one that is based on audience ratings. This would do little to promote the absolutely crucial role of basic, non-instrumental research, and of science as a whole. A science that is a driving force for knowledge, more than for technology, goods or for any real or apparent immediate benefits. On the other hand, many pundits believe that an increased dialogue between scientific institutions and society is not only necessary but also inevitable for future democracies. The awareness that the public communication of science is becoming crucial not only for the public but for science is itself a significant fact. This public communication cannot become, though, simply a transmission of information with an educational purpose. It must also, and maybe more importantly, entail scientists

accepting real dialogue, one that may even be marked by conflict. Two authors, already quoted from *Nature*, wrote[liv]:

Scientists themselves will have to recognize that blind public acceptance of their work cannot be taken for granted. As a consequence, they and their representative bodies will have to examine their roles per se *and in unfamiliar territory, both political and public. The media as well as the scientific press will become an essential place for proactive discussion, debate and presentation.*

Similarly, parliamentarians must be more willing to adopt procedures for receiving direct input from the general public […] We need to find an interactive mechanism by which all stakeholders can participate in science and technology-related issues. There is a need for a debate on the extent to which governments and parliaments should seek or take account of public opinion […] and the mechanisms provided for such a task […] A new compact, then, is needed between parliamentarians, scientists and the general public that will involve new, as yet unknown, institutional arrangements. Let the experiments begin.

[i] J. Gregory, S. Miller, *Science in Public – Communication, Culture and Credibility*, Plenum Trade, New York, 1998.
[ii] R. Logan, "Science Mass Communication: Its Conceptual History"**,** *Science Communication*, vol. 23, n. 2, December 2001; M. Weigold, "Communicating Science: A Review of the Literature", *Science Communication*, vol. 23, n. 2, December 2001.
[iii] See, for example, M. Wolf, *Teorie delle comunicazioni di massa*, Bompiani, 1985.
[iv] For example, J. Ziman, *Il lavoro dello scienziato*, Laterza, 1987; J. Ziman, *Real Science – What it is, and what it means*, Cambridge Univ. Press, 2000.
[v] Office of Science and Technology, Wellcome Trust, *Science and the Public – A Review of Science. Communication and Public Attitudes to Science in Britain*, October 2000.
[vi] A. Boddington, T. Coe, "Where goes public understanding of science? - We need a clearer idea of what we are trying to achieve", *Science and Public Affairs*, February 2000, p. 24.
[vii] A partial review of the debate (not updated to recent developments and controversies), can be found in J. Pollock, D. Steven, "Now for the science bit–concentrate!–a report into the public understanding of science", River Path Associates, September 1997.
[viii] S. Miller, "Public Understanding of Science at the Crossroads", *Science Communication*, XXX, 2001.
[ix] J. Hughes, *"Science and Society: A Public Role for the History of Science in the 2000s*?", British Society for the History of Science, newsletter no. 62, June 2000, p. 20.
[x] House of Lords, Select Committee on Science and Technology, Third Report: "Science and Society", 23 February 2000.
[xi] R. Worcerster, "Science And Society: What Scientists And The Public Can Learn From Each Other", MORI report, 21 March 2001.
[xii] J. Ziman, *Il lavoro dello scienziato*, Laterza, 1987.
[xiii] P. Greco, *****
[xiv] V. Bush, "Science: the Endless Frontier", United States Government Printing Office, Washington: 1945.
[xv] W. Parsons, "Scientists and politicians: the need to communicate", *Public Understanding of Science*, 10 (2001) 303–314.
[xvi] See, for example: A. Lawler, "Selling Science: At What Price?", *Science*, 275, 1997, p. 296. And: *Nature*, vol. 391, 19 February 1998, p. 730; *Nature*, vol. 406, 17 August 2000, p. 663; *Science*, vol. 294, 16 November 2001, p. 1437. There are dozens of further examples.
[xvii] M. Wadman, "Science lobby 'ecstatic' after triumph in NIH budget battle", *Nature*, vol. 402, 25 November 1999, p. 334.
[xviii] D. Malakoff, *Science*, vol. 292, 4 May 2001, p. 830, p. 832, p. 833, p. 835.
[xix] D. Malakoff, "Perfecting the Art of the Science Deal", *Science*, vol. 292, 4 May 2001, p. 830.
[xx] Cf. http://www.savebritishscience.org.uk/about/aims.html
[xxi] N. Loder, "UK science spend 'not sensible'", *Nature*, vol. 404, 27 April 2000, p. 909; P. Aldhous, "Britain plumps for support of big projects…", *Nature*, vol. 408, 30 November 2000, p. 507.
[xxii] Cf. http://www.savebritshscience.org.uk/links/meml.html
[xxiii] "UK life science students seek better deal", *Nature*, vol. 395, 24 September 1998, p. 315.
[xxiv] A. Abbott, "Scientists urged to raise lobbying efforts", *Nature*, vol. 398, 22 April 1999, p. 646.
[xxv] A. Abbott, "Sell the message of research", *Nature*, vol. 399, 13 May 1999, p. 92.
[xxvi] A. Abbott, "European biologists unite to lobby for more money", *Nature*, vol. 401, 28 October 1999, p. 834.
[xxvii] L. Frank, "New European Group Lobbies for Support", *Science*, vol. 289, 7 July 2000, p. 26.
[xxviii] *Nature*, 402, 16 December 1999, p. 706
[xxix] *Nature* 403, 10 February 2000, p. 584.
[xxx] *Science*, vol. 294, 16 November 2001, p. 1437.
[xxxi]A. Abbott, "...as Europeans lobby for reactor construction", *Nature*, vol. 402, 9 December 1999, P. 570.
[xxxii]A. Padilla, I. Gibson, "Science moves to centre stage", *Nature*, vol. 403, 27 January 2000, p. 357.
[xxxiii] D. Butler, "Bioethics needs better input from public", *Nature*, vol. 389, p. 775, 1997.
[xxxiv] "Light in dark places", *Nature*, vol. 389, 23 October 1997, p. 767.
[xxxv] "Light in dark places", *Nature*, vol. 389, 23 October 1997, p. 767.
[xxxvi] "Headless tadpoles and informed public", *Nature*, vol. 390, p. 111 (1997).
[xxxvii] J. Lubchenco, *Science*, vol. 279, 1998, p. 491.
[xxxviii] *Nature*, vol. 394, 16 July 1998, p. 215.
[xxxix] E. Masood, "Highbrow 'club' seeks the common touch", *Nature*, vol. 396, 12 November 1998, p. 103. Cf. also *Nature*, vol. 411, 7 June 2001, p. 624.
[xl]E. Masood, "Heed public opinion, British geologist told", *Nature*, vol. 392, 23 April 1998, p. 748.
[xli] A. Abbott, "European biologists unite to lobby for more money", *Nature*, vol. 401, 28 November 1999, p. 834.
[xlii] R. Koenig, "Voters Reject Antigenetics Initiative", *Science*, vol. 280, 12 June 1998, p. 1685.
[xliii] R. Braun, "Lezioni dal referenrum svizzero sulle biotecnologie", Report n. 8 of the European Biotechnology Federation. Workgroup on the perception of biotechnologies, August 1998.
[xliv] Ibidem.
[xlv] R. Koenig, "Voters Reject Antigenetics Initiative", *Science*, vol. 280, 12 June 1998, p. 1685.
[xlvi] *Nature*, vol. 398, 11 March 1999, p. 91.
[xlvii] *Nature*, vol. 399, 92 (1999).

[xlviii] "Learning to speak and write", *Nature*, vol. 411, 3 May 2001, p. 1.
[xlix] Cf. *Nature*, vol. 393, 4 June 1998, p. 496; *Nature*, vol. 410, 2001, p. 1023; *Nature*, vol. 411, 2001, p. 13; *Nature*, vol. 411, 2001, p. 992; *Nature*, vol. 412, 2001, p. 855.
[l] G. Vogel, "Nobel Laureates Lobby for Stem Cells", *Science*, vol. 291, 2 March 2001, p. 1683.
[li]M. Bergmans, "Science Lobbying Tactics", *Science*, 293, p. 801, August 2001.
[lii] "Is there a spin doctor in the house?", *Nature*, vol. 404, 16 March 2000, p. 211.
[liii] "Germans engage with physics", *Nature*, vol. 406, 24 August 2000, p. 813.
[liv]A. Padilla, I. Gibson, "Science moves to centre stage", *Nature*, vol. 403, 27 January 2000, p. 357.