

Media, scientific journals and science communication: examining the construction of scientific controversies

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This paper analyzes the role of the media in the construction of the “water with memory” controversy. It demonstrates that the universality of the canons of the scientific enterprise transcends the scientific publications’ domain and can also influence mass media coverage of scientific controversies. Mass media can play a crucial role in scientific controversies. This role goes way beyond acting as secondary sources of news created in the scientific arena. The case study illustrates how media in times of crisis can assume the rhetorical role traditionally imparted to scientific journals, the latter adopting a passionate and sensationalistic approach usually attributed to mass media. The case study demonstrates that mass media’s role in science communication cannot be studied in isolation, and that scientific journals and mass media work in interaction in the construction of scientific controversies.

1. Introduction

In June 1988, the prestigious scientific journal *Nature* published an article that publicly marked a most unusual saga (Davenas et al., 1988). French scientist Jacques Benveniste and his team at INSERM (French National Institute for Health and Medical Research) presented conclusions that, if confirmed, not only would give scientific credibility to homeopathy, a controversial alternative medical practice, but also would radically challenge the theoretical bases of biochemical sciences. *Nature*’s article opened the door to a fierce debate, and what would later be known as the “water with memory” controversy rapidly came out of the restricted sphere of epidemiology. Not only did other scientific journals such as the American journal *Science* get involved, mainstream newspapers in France and in the United States became active participants in the social construction of a controversy that ultimately lasted more than ten years.

The “water with memory” episode provides an opportunity to explore a particular aspect of “controversy studies” in science studies. The central tenet of controversy studies is that the conflict and debate in a controversy allow hidden features of the social aspects of scientific practice to become more visible (Collins, 1985; Martin and Richards, 1995). But while many controversy studies have used mass media as a source, and some have commented on the media’s role in the controversy, few have considered what the media’s systematic presence in science’s social system might imply about science operation.

One exception is a line of research about science and media (e.g. Hilgartner, 1990; Shinn and Whitley, 1985) that culminated in a science communication model proposed by Lewenstein in his

examination of the cold fusion controversy (Lewenstein, 1995a). Continuing with this line of research, this paper will analyze the “water with memory” case and examine the role of *Le Monde* (a mainstream French newspaper, comparable to the *New York Times* in terms of audience and scope) and of *Nature* (the British scientific journal that published the controversial article), two main players in the controversy. We will show the nonlinear features of the public communication process in the “water with memory” context, as well as the permeability of the boundaries between such different media as newspapers and traditional scientific journals. We will go further, and argue that in times of crisis, attributes conventionally imparted to mass media and scientific journals can drastically change, scientific journals behaving in a manner traditionally assumed to be representative only of the mass media and vice versa. After a presentation of the theoretical framework, a summary of Benveniste’s controversial scientific claims and a brief portrayal of the practice of homeopathy, our analysis will proceed chronologically and will examine the role of the main actors at each stage of the controversy.

2. Theoretical framework

Research on media and controversies has for the most part examined specific communication problems, or general processes leading to communication problems such as the spiral of silence (Lewenstein, 1995b). Although providing some useful analyses, these studies generally relied on a simple diffusion model of science popularization, and therefore failed to give a complete view of the media’s role in scientific controversies (Lewenstein, 1995b).

Science communication is a complex phenomenon, for which boundaries between scientific journals and mass media can be permeable, rather than rigid as traditionally assumed. Some have argued that science communication should be conceptualized as a “continuum” rather than as a simple diffusion model. The “continuum” idea stresses the possible back and forth information flow between different scientific communication forms (Hilgartner, 1990). On the basis of an analysis of the cold fusion controversy, Lewenstein (1995a) proposed a circular or web communication model, with all forms of communication leading to each other. Mass media occupies a central place, and is a central node in the communication network.

The present analysis further tests these ideas, and focuses on the role of the media in the “water with memory” controversy. Our study will identify the main scientific communication forms and explore their relationships and interaction in the specific context of the “water with memory” case. To keep the analysis manageable, we will examine only scientific journals and mainstream newspapers, and will not include other media. Previous work has analyzed the construction of the water with memory controversy within the scientific community, focusing on scientific journals (Picard, 1994) or on the media (Kaufmann and Ridel, 1994), but no analysis has examined the potential interactive role of scientific journals and of the media in the construction of this controversy.

3. The controversial claims

Before examining the controversy around Benveniste’s claims, we need to emphasize that our paper does not attempt to argue whether the claims were scientifically credible, were due to an experimental artifact, or were due to methodological flaws. The goal of this analysis is to look at the debate in terms of the role and interaction of the different actors.

Benveniste’s group at INSERM (the French National Institute for Health and Medical Research, the equivalent of the US National Institutes of Health) analyzed the responses of

human polymorphonuclear basophils (a certain type of white blood cells with antibodies of the immunoglobulin E (IgE) type on its surface) to varying concentrations of anti-IgE antibodies in distilled water. According to Benveniste and his team, highly diluted solutions continue to be active even when the antibodies are diluted to such a degree that none of the active substance would have been left in the solution. Benveniste and his team claimed that the water used for dilution retained a “memory” of the potential action of the entity that had been diluted (Davenas et al., 1988). If verified, these results were revolutionary: they implied that biological matter was organized in a far more complex way than what was scientifically recognized (Benveniste, 1988a). Scientific knowledge in physics and in molecular biology that had been produced by two centuries of research could crumble with these results (Maddox, 1988a). And finally, Benveniste’s results gave scientific legitimacy to a particular alternative medical practice, homeopathy.

Homeopathy was born in 1796 when the German physician Samuel Hahnemann (1755–1843) drew the conclusion that if a medical compound (such as medication for malaria) caused symptoms in healthy volunteers, it could also be used as a remedy for patients who suffered from the same symptoms. This hypothesis (which would be known as the “like cures like” maxim) was apparently confirmed in therapeutic settings. Hahnemann also noticed that highly diluting and vigorously shaking his remedies did not diminish their curative power (as one might intuitively think), but instead tended to increase it. This led Hahnemann to believe that water could retain some sort of memory of the initial compound. Hahnemann’s two basic axioms (“like cures like” and “water with memory”) are still considered valid in certain circles even if they seem to be at odds with scientific knowledge developed over the next two centuries (Ernst and Hahn, 1998).

Homeopathy was popular in Europe and in the United States during the nineteenth century. The lack of serious adverse effects of homeopathic treatments when mainstream medicine was often limited and even hazardous may explain this early success. Mainstream medical practitioners, when acknowledging the apparent effectiveness of homeopathy, attributed it solely to placebo effects (Furnham, 1998).

Antagonism between homeopathy and mainstream medicine has its roots in the philosophical differences that exist between the two practices. Homeopathy, like other alternative medical practices such as acupuncture, is based on a vitalistic philosophy (the idea that the body and the psyche are maintained by an underlying energy or vital force), while biochemical sciences and medicine draw from a materialistic view (Picard, 1994). Homeopathy and modern mainstream medicine are still antagonistic today. Nonetheless, homeopathy is widely used in the public realm in Europe (Ernst and Hahn, 1998). It is particularly popular in France, where Benveniste did his work: 49 percent of the medical consultations in France in 1990 involved homeopathic practitioners and 25,000 physicians there practice homeopathy (Brinkhaus et al., 1997; Downey, 1997).

Homeopathy is not widely developed in the United States, as lobbying by the American Medical Association in the 1920s led to its decline (Downey, 1997). It has, however, recently experienced a boom along with other alternative medical practices. As reported by the *Journal of the American Medical Association*, at least 75 medical schools in the United States taught alternative medical practices, including homeopathy, in their curriculum in 1996 (Wetzel et al., 1998).

In summary, homeopathic practice is ambiguous, in that it is accepted and used by a large percentage of patients (at least in Europe, South America, and India), while no scientific explanation other than placebo effects has supported its therapeutic value (Downey, 1997). This ambiguity is particularly vivid in France; recognizing the ambivalence toward homeopathy is important for an understanding of the “water with memory” controversy, particularly in its early stages.

4. Methods

For this study, we chose to analyze the coverage of the “water with memory” controversy in two elite print publications in France and the United States, as they represent two ends of the spectrum of attitudes toward homeopathy. (Although one of the major players, *Nature*, is based in the United Kingdom, the intermediate position of homeopathy there made it seem less likely that stark differences would be apparent. We therefore chose an American newspaper instead of a British one.) We selected *Le Monde* and the *New York Times* among mainstream newspapers for the following reasons. First, *Le Monde*, a Parisian daily newspaper often reflecting the concern of the elite, is considered a major influence in French political and social life (Kuhn, 1995). Second, the *New York Times*, with similar readership characteristics and political stand as *Le Monde*, can be considered its American counterpart. And third, these two daily newspapers are both newspapers “of record” in their country of origin. Less systematically, we also noted some stories in other sources, such as the *Los Angeles Times*.

In terms of scientific journals, we looked at *Nature* (the British scientific journal that had published the controversial scientific paper) and at *Science* (its American counterpart), these publications being the two most prestigious international general scientific journals.

A literature search on the Lexis Nexis database was used to identify the articles published in the *New York Times* and in *Le Monde* that reported on the controversy, with “Benveniste” used as a keyword. A search on the PROQUEST database was used to retrieve scientific journal articles commenting on the controversy (excluding articles reporting exclusively scientific results). Since *Le Monde*’s issues prior to 1990 were not available through Lexis Nexis, *Le Monde*’s articles on the water with memory controversy for the period 1987–9 were ordered directly from *Le Monde*’s archives. For *Le Monde*, 28 articles were found for the period 1987–9, and 110 for the period 1990–7, for a total sample of $N = 138$. For the *New York Times*, five articles were found for the period 1987–97. Seven articles were found in *Nature*, and three in *Science*.

A qualitative content analysis of the articles of interest was then performed to analyze the water with memory controversy. Articles were analyzed in order to 1) reconstruct the time frame of the controversy; and 2) identify the main claims made by each type of publication (i.e. mainstream media vs. scientific journals).

5. The early stage of the controversy (1972–June 1988)

Some analysts of the “water with memory” controversy seem to take for granted that the publication of Benveniste’s article in the scientific journal *Nature* on 30 June 1988 started the controversy (e.g. Picard 1994). This is understandable since traditionally actors other than those belonging to the scientific sphere—such as the media—are not thought of as taking an active part in the construction of scientific controversies. The critical role of the media has, however, been clearly demonstrated in the context of the construction of the cold fusion controversy (Lewenstein, 1995a). Since Benveniste’s results had been presented outside the official scientific arena before *Nature* accepted the manuscript, it seems useful to look at the early stage of the debate, before the official involvement of a scientific journal, in order to analyze the role of other critical players.

First, who was Benveniste? Although he was not well known by the general public before the “water with memory” case, he had an outstanding scientific background. His 1972 discovery of PAF (Platelet Activating Factor), a human molecule regarded today as having a crucial role in asthma and inflammatory phenomena, had given him international recognition

(Nau and Nouchi, 1988). According to the *Science Citation Index*, 13 of Benveniste's publications had been cited more than one hundred times in 1988, and one of them (published in the *Journal of Experimental Medicine*) had been cited 643 times.

Despite his prolific publication record, Benveniste was not unanimously appreciated within the French scientific community in the 1980s. *Le Monde* described him as the *enfant terrible* of French medical and scientific research and as a scientist cultivating the image of an original, not eager to be fully part of the establishment. French scientists' lack of enthusiasm when Benveniste's discovery of PAF was internationally recognized could be explained partly by Benveniste's image among his peers as both "an exceptionally intelligent individual" and as "a maverick" and "a provocateur" (Nouchi, 1988a).¹

In the early 1980s, Benveniste, who directed an important laboratory of immunology and allergy (with 50 people on the staff) at the French National Institute for Health and Medical Research (INSERM), was approached by a young doctor claiming to be a homeopath. Benveniste gave the doctor permission to conduct a few experiments, despite claiming that homeopathy was a "bunch of baloney." Research funds were provided by an important homeopathic company (Lawren, 1992). It would be argued later on that starting research on homeopathy did not improve and even worsened Benveniste's image among his peers (Nouchi, 1988a).

In March 1985, Benveniste and his colleagues reported for the first time their results on high dilution. According to traditional science communication norms, new discoveries ought to be accepted for publication in the peer-reviewed literature before hitting the newsstand. However, Benveniste announced his results in *Le Monde* before submitting them for publication in a scientific journal (Nau, 1988a).

Why did Benveniste decide in 1985 to publicize in a newspaper instead of following the usual pattern of scientific publishing? In the absence of contemporaneous documentary or interview data, we can only make assumptions. On one hand, it could simply be argued that Benveniste's "provocateur" personality led him to favor an unusual process. On the other hand, Benveniste, being aware of the explosiveness of his results, might have attempted at that point to rally as many allies as possible to his cause before engaging in a battle in the scientific arena. Such uses of the media by scientists have been documented elsewhere (Gregory, 2003; Hilgartner, 1990; Kaufmann and Ridell, 1994; Lewenstein, 1995b). More generally, actor-network theory shows how, during a scientific controversy, actors tend to look for allies that will help them win the argumentation (Callon, 1986).

Because of its reputation as a quality newspaper, *Le Monde* and its readership were important allies to enroll. In 1985, *Le Monde* was (and still is) the newspaper most read by French top management (one fourth of its readers), college professors and college students. Sixty-three percent of *Le Monde* readers hold a college degree. *Le Monde*, owned mostly by its staff and an association of its readers, is also particularly concerned with the quality of the information it publishes and strives to be "independent of all manifestations of power." A mediator hired for two years is in charge of an editorial column specifically for evaluating the quality of the newspaper and functioning as a link with readers. The mediator's editorial text is not read by editors before publication, and therefore is never modified (*Le Monde*, 2007).

In 1985, the announcement of Benveniste's results in *Le Monde* provoked a violent reaction in the French scientific community. The most virulent attacks came mostly from scientists who rejected homeopathy. Although Benveniste claimed that his results did not in any way prove the scientific validity of homeopathy, critics objected that they could, however, be used for that purpose by homeopathic companies (Nau and Nouchi, 1988). In particular, critics charged that the methodology used by Benveniste for his experiment was not rigorous. To address the criticism, the INSERM team launched another series of experiments. Those experiments led to the submission of a scientific paper to *Nature* in 1986.

For two years, *Nature's* editorial team seemed reluctant to accept the paper “although we [the editors] could not find anything wrong [with the manuscript]” (Hilts, 1988). The presentation of Benveniste's results to the National Conference of Homeopathy in Strasbourg (France) on 27 May 1988 seemed to accelerate the process of publication. Demonstrating the interaction of forums described by Hilgartner (1990) and Lewenstein (1995a), *Le Monde* was again a player at this stage, and reported:

[It is a] strange situation in which we see an internationally renowned researcher, an immunity and inflammatory pharmacology specialist, come to announce to several hundred French homeopaths that the international scientific community would maybe soon be able to give a scientific explanation for homeopathy, which until now has been classified as heresy or even as fraud. (Nau, 1988b)

In a way, *Le Monde* was closing the distance between science and homeopathy. According to *Le Monde's* account, the French scientific community may have perceived Benveniste's presentation at the homeopathic conference as a challenge. Admitting the validity of Benveniste's paper would have meant much more than accepting a discussion about a strange and unexplainable phenomenon. More importantly, it would also have meant giving scientific credentials to homeopathy.

It is common for scientific research results to be presented at conferences before publication, and even to be discussed in the popular press in general terms. Although some journals such as the *New England Journal of Medicine* (NEJM) have policies tending to discourage public dissemination of detailed information before publication in their scientific journal (a policy known as the Ingelfinger rule for NEJM), this is not the case for *Nature* (for a discussion on the Ingelfinger rule, see Relman, 1981 and Kiernan, 1997).

In the particular context of the “water with memory” case, it seems that the diffusion of the information outside of the scientific sphere was what accelerated the process of publication. As *Nature's* editor-in-chief, John Maddox, explained later, *Nature* published the article because there were already “rumors” of the experiment in the popular press and so, once published, scientists could point out its flaws (Wade, 1988).

Nature specifically reported that *Le Monde's* article of 29–30 May 1988 (i.e. Nau, 1988a) covering the homeopathic conference had been a factor in its decision to speed up the publication process and to proceed with an investigation after publication (Nau, 1988c). This fact, apparently insignificant, is particularly important since it illustrates the importance not only of the media, but also of the interaction between public forums and various media in the construction of scientific controversies and more generally of scientific knowledge.

What was the essence of the rumors *Nature* was so eager to stop in 1988? *Nature* seemed to be particularly anxious to avoid giving scientific credibility to homeopathy. As Peter Newmark (*Nature's* deputy editor) pointed out to the *New York Times* on the day of the publication of Benveniste's article in *Nature*: “it is a bit unfortunate that this paper could be seen as lending credibility to homeopathic medicine” (Browne, 1988). It seems therefore clear that it was more the rumors of results giving scientific legitimacy to homeopathy (rumors that *Le Monde* publicized) than rumors about the scientific results themselves that finally persuaded *Nature* editors to accept Benveniste's manuscript. After all, in 1988, Benveniste had already published four times in *Nature*, and was therefore a scientist whose credentials could not easily be disputed in terms of scientific results. In other words, *Nature's* editorial team was eager to generate a debate that would eventually produce evidence killing off any scientific legitimacy to homeopathy claims.

Benveniste's article was finally published in *Nature* on 30 June 1988. In the same issue, an editorial titled “When to Believe the Unbelievable,” warned the readers to be particularly

cautious and to look for eventual problems in the methodology (Maddox, 1988a). As Maddox put it in his editorial: “When an unexpected observation requires that a substantial part of our intellectual heritage should be thrown away, it is prudent to ask more carefully than usual where the observation may be incorrect.” Although unusual (one may wonder why readers of such a prestigious publication would need such a warning), the editorial can be understood as a pre-emptive defense if the responses to the publication were as explosive as expected.

At this point, thinking in terms of actor-network theory, who were the allies of the two parties (Callon, 1986)? On one hand, Benveniste had on his side homeopaths and their patients (an important fraction of the French population), *Le Monde*, and five laboratories outside of France that claimed to have corroborated his results. On the other hand, *Nature*'s allies were centuries of chemistry, physics, and biological knowledge that had proved to be reliable when describing and predicting aspects of the natural world. It also had its reputation as an outstanding scientific journal. Moreover, *Nature* could expect its readers to become allies as they looked even more carefully than usual for flaws in published results.

By getting published in *Nature*, Benveniste's results were now formally the scientific community's responsibility. Only at that point, i.e. after significant amounts of communication and negotiation had already occurred, did the “official” scientific debate begin.

6. After publication in *Nature*: the scientific debate (30 June–27 October 1988)

Started in 1869 in London, *Nature* is nowadays an international weekly journal of science with editorial offices in London, Washington, Tokyo, Munich and Paris, and is among the most respected and cited scientific journals in the world. As stated on *Nature*'s web page: “[*Nature*'s] most important goal is that the material [it] publishes is of exceptionally high quality. [*Nature*] achieves these ends by rigorous standards of peer-review, editorial independence and rapid publication.”

Publishing Benveniste's work was therefore recognizing its high quality. According to *Nature*'s deputy editor, Peter Newmark, “A board of scientifically qualified critics has so far [in June 1988] been unable to find a flaw in the research that would nullify such a seemingly supernatural result” (as cited in Browne, 1988). However, Maddox's editorial did cast some doubt on the results.

The publication of Benveniste's article in *Nature* was reported in different ways in the popular press. *Le Monde* clearly chose to trust Benveniste's research; a long article signed by Benveniste (1988a) was published in the same issue of *Le Monde* as a front-page article titled “A French Discovery May Overthrow Physics' Scientific Foundations” (Nau and Nouchi: 1988). Jean-Marie Lehn, winner of the Nobel Prize in Chemistry in 1987, was quoted as saying:

These results are very disturbing ... but I want to emphasize that witch hunting does not exist in science, even if here we are experiencing a very passionate debate. The “water with memory” hypothesis, if confirmed, would overthrow the scientific basis of molecular science. It is not impossible for this to happen, but its probability is very small.

No verbatim comments from *Nature*'s editors were reported.

Le Monde's attitude at this point can be analyzed from different perspectives. First, perhaps *Le Monde* was merely adopting a chauvinistic standpoint: the nationality of the scientist under scrutiny might be more important to the newspaper than any other parameter in the debate. Second, it could be argued that *Le Monde* might trust Benveniste's account more than *Nature* did, not only because of Benveniste's known expertise, but also because in the French context his links with homeopathy were not seen by the newspaper as inappropriate (despite the scientific community's position). Third, *Le Monde* might also be trusting Benveniste's

account because “the attribution of expertise—specialized knowledge of what is true—cannot be divorced from the practical recognition of virtue” (Shapin, 1995: 403). In other words, within this perspective, an inappropriate behavior could not be conceived of as coming from a recognized scientist. Finally, perhaps *Le Monde* was striving to stay objective in the debate and was attempting to stick to the norm of universalism, usually thought to be a characteristic of the scientific community. According to this norm, truth-claims, whatever their source, are to be submitted to pre-established impersonal criteria (Merton, 1973).

In the same issue, *Le Monde* published an article stressing the ambiguous image of Benveniste among his peers (Nouchi, 1988a). Recall that terms such as “maverick” or “provocateur” were used by peer scientists when talking about Benveniste. Was *Le Monde* assuming, as Mitroff (1979) concluded in his study of “counter-norms,” that scientists couldn’t react to a theory without reacting simultaneously to its proponents? Mitroff (1979) explained his findings (in the specific context of Apollo moon rock research) by arguing that if emotional neutrality and universalism ought to be considered norms of science (Merton, 1973), then opposing counter-norms of emotional commitment and particularism had to exist too. By talking about this bias, perhaps *Le Monde* was preparing its readership for an eventual rejection of Benveniste’s paper that would be caused both by the results themselves (and their possible support for homeopathy), and by the personality of the researcher.

American newspapers’ reactions were drastically different from *Le Monde*’s. The *New York Times*, *Los Angeles Times*, and *Washington Post* chose to follow the lead given by *Nature*: they framed their articles around *Nature*’s reluctance to believe Benveniste’s results. These newspapers’ headlines were, respectively, “Journal Publishes Theory in Disbelief” (Browne, 1988), “French Scientist Produces ‘Unbelievable’ Solution” (Maugh, 1988), and “Scientists Publish Unbelievable Research Results” (Hilts, 1988). Newmark (*Nature*’s deputy editor) was quoted in the *New York Times* saying “There have been cases in the past of mass self-deception,” clearly implying that the scientific journal was beforehand assuming the outcome of the debate.

The lack of scientific foundation for homeopathy was also stressed in the American newspapers, an aspect neglected in *Le Monde*. According to the *New York Times* “most physicians consider homeopathy to be a cult entirely without scientific foundation” (Browne, 1988). Recall that homeopathy is not as widely accepted by the general public in the United States as it is in France, which might in part explain the American reporting. The contrast between the French and the American newspapers’ reactions was nevertheless important in that the former did not follow unquestioningly a scientific journal perspective, while the latter did it without further questioning.

At this stage of the controversy, *Nature*’s role began to shift: the objective stand that scientific journals are traditionally expected to adopt (National Academy of Science, 1992) was abandoned. *Nature* had accepted Benveniste’s article under the condition that a team of experts be allowed to conduct an investigation *in situ* in Benveniste’s laboratory, in order to replicate the experiment and assess the methodology used (Maddox, 1988a).

The investigation, which took place during the first week of July 1988, was unusual in several ways. First, the investigation took place after the article’s publication and not before, a fact that would be widely criticized later on, particularly by the scientific journal *Science* (“Unbelievable Results Spark a Controversy,” 1988). Second, a rather unusual team was sent to Paris. The team included *Nature* editor John Maddox (a journalist originally trained as a physicist), scientific fraud investigator Walter Stewart of the National Institutes of Health (USA) who had reviewed Benveniste’s article for *Nature*, magician James (The Amazing) Randi, whose presence, as explained by Maddox “was originally thought desirable in case the remarkable results reported had been produced by trickery,” and the technician Jose Alvarez (Maddox, 1988a). The team did not include anyone who specialized in immunology.

Nature's attitude was therefore particularly ambiguous: although it had accepted Benveniste's article (based on scientific reviewers' comments), *Nature* chose to rely on individuals whose objectivity could easily be disputed by observers. Maddox, trained as a physicist, might be inclined to find any reason to refute results that threatened the scientific foundations of traditional science. Randi, who did not have scientific training, had a highly controversial role to play. Stewart, whose main concern in the past had been the exposure of misconduct in science, could easily be described as biased in his judgment.²

The investigation team spent one week in Benveniste's laboratory in Clamart (France), in a somewhat relaxed atmosphere—Randi performing some of his tricks for Benveniste's staff—which grew more tense as time passed (Nouchi, 1988d). The team announced its conclusions in *Nature* on 28 July 1988:

The remarkable claims made in *Nature* (333: 816–18; 1988) by Dr. Jacques Benveniste and his associates are based chiefly on a extensive series of experiments which are statistically ill-controlled, from which no substantial effort has been made to exclude systematic error, including observer bias, and whose interpretation has been clouded by the exclusion of measurements in conflict with the claim that anti-IgE at "high dilution" will degranulate basophils. The phenomenon is not reproducible in the ordinary meaning of the word. (Maddox, Randi and Stewart, 1988)

We will not go into the details of the conclusions. We will just point out that the non-reproducibility of the experiment was concluded after one dilution tested on two blood samples, a point to which we will return.

The report of the investigation team provoked Benveniste's fury. Benveniste replied in the same issue of *Nature* that the whole business looked more like "Salem witchhunts or McCarthy-like prosecutions" than real science. The way the investigation had been conducted (such as wrapping code procedures into aluminum foil, stuffing them into an envelope to be taped on the ceiling for the night), had been particularly humiliating for a renowned laboratory team (Benveniste, 1988b). That *Nature* eventually declared the results invalid surprised very few in the scientific community. But as Picard (1994) put it: "The presentation and delivery of *Nature's* verdict, combined with Benveniste's response, read more like a French farce than a sober account of a scientific controversy." As an illustration of this atmosphere, Maddox et al.'s title ("High-Dilution Experiments a Delusion") suggested an irony at odds with the presumed neutral writing of a scientific journal.

What were other actors' reactions to *Nature's* actions and conclusions? *Le Monde* abandoned its neutral tone at this point, violently criticizing the composition of the investigation team and the investigation itself, and concluding that the team had found what they were looking for: a flaw in the results. *Le Monde* reported Benveniste's account of the investigation: "The team created during five days a climate of fear and suspicion, of psychological and intellectual pressure, in a Hollywood-like setting rendering real scientific work extremely difficult" (Nau, 1988c). More space was devoted to the analysis of the investigation team and of its behavior than to *Nature's* conclusions themselves. *Le Monde* was therefore in some sense trying to counterbalance the scope of Maddox et al.'s conclusions, by attempting to legitimize Benveniste's account.

What were American newspapers' reactions to *Nature's* investigation and conclusions? The *Los Angeles Times's* account was concordant with *Le Monde's*. The newspaper pointed out that the investigation team was odd and that it did not include any immunology specialist. It also gave Benveniste's account of the investigation climate. *The New York Times*, however, reported *Nature's* conclusions in a different way. The investigation team's strange composition was not commented on, although its members were listed. It was just reported that the investigators had visited the French laboratory and were allowed to look at and photograph

notebooks from earlier experiments, and had conducted “one experiment themselves, using rigorous measures to rule out any fraud or bias” (Browne, 1988).

The *New York Times* also explained that *Science*'s editor D.E. Koshland had declared that the initial report was not good enough for publication in the first place (Sullivan, 1988). The *New York Times* was therefore choosing to rely on the accounts of “scientific experts.” This would be even clearer later when it published an article signed by Maddox in August 1988 (about which, more later).

Before continuing to analyze the controversy, it seems useful to look at the conclusion stating that the experiment was not reproducible. Recall that Maddox had encouraged his readers to be even more critical than usual in his editorial of 30 June 1988, stating “When an unexpected observation requires that a substantial part of our intellectual heritage should be thrown away, it is prudent to ask more carefully than usual where the observation may be incorrect” (Maddox, 1988a).

We might assume from this remark that *Nature*'s editors could not conceive that the results might be correct, because the results were not compatible with the existing state of knowledge in physics, chemistry, or biology. In other words, Benveniste's results were at odds with the existing paradigms (Kuhn, [1962] 1996). For *Nature*'s editors, therefore, failure to replicate an experiment a few times would tend to prove that the theory was incorrect in the first place.

It is useful at this point to recall the concept of “the experimenter's regress.” According to Collins (1985), there is a cycle difficult to break in experimental science. First the researcher has to define the expected outcome for an experiment. The experimenter needs to define the proper experimental design and methodology to see if (s)he finds the expected outcome, but will not know if the design is good until the expected outcome happens. In other words, the experimenter is biased toward the expected outcome and will continue to experiment until the expected outcome occurs. Data obtained through experiments can be used as test results only if “the circle of the experimenter's regress” has previously been dismantled, to use Collins and Pinch's (1993) words.

In the present case, the expected outcome for Benveniste and his colleagues was to detect activity for highly diluted concentrations of anti-IgE antibodies in distilled water, a result difficult to obtain, challenging common assumptions of science and therefore less prone to experimenter's regress. On the other hand, the experts' team defining beforehand non-detection of activity as the universally agreed criterion of experimental quality fit the experimenter's regress. Within this context, a few experiments that yield negative results would be more powerful than a larger number of others leading to positive results. Maddox and his team were therefore able to conclude that the experiments were not reproducible after only one dilution for two samples, even if the experiments had been reproduced in five other laboratories.

Only *Le Monde* pointed out that the result of *one* double blind experiment was judged sufficient to discredit what had been observed in laboratories in Toronto, Milan, Jerusalem, Paris and Clamart. The newspaper was highlighting the problem that the theoretical framework of the experimenter's regress describes.

How did the scientific community react? On one hand, *Nature* had published Benveniste's results supposedly to give the scientific community the opportunity to refute them. On the other hand, the published results were accompanied by the editorial stating that an investigation team would be sent to Benveniste's laboratory.

In this context, it is not surprising that other laboratories did not try to replicate Benveniste's results or did not attempt to publish their conclusions. Only one laboratory publicly tried to replicate the experiment, after the investigation team's conclusions; it failed. Its results were published in a letter to *Nature*, under the rather ironic title “Only the Smile is Left” (Metzer and Dreskin, 1988). The only laboratory that officially attempted to replicate Benveniste's results was part of the US National Institutes of Health, the same institution for

which Stewart (a member of the investigation team) worked (Picard, 1994). In other words, only one laboratory tried to replicate results that had been published in a scientific journal. In contrast, in the cold fusion controversy, many laboratories tried to replicate the original experiment, which had not yet been published by any scientific journal (Lewenstein, 1995a).

It seems clear that at this point *Nature*, a prestigious scientific journal, had adopted a rather unusual rhetoric and line of action. *Nature* was extensively criticized by *Le Monde* on 31 July 1988. In an article devoted to the analysis of scientific communication, *Le Monde* argued:

Nature has authorized itself to increase its power on international scientific communication ... In other words this journal has intensively jeopardized an equilibrium—that we would have imagined was more stable—that insured the credibility of research work of international scope. This equilibrium is based on a rigorous system of control, grounded on the respect of the rules of the scientific community and the serious review of the manuscripts submitted ... Publishing has therefore a value of endorsement. *Nature* has violated the system. (“Scientific Communication Losing its Balance,” 1988)

In the same article, *Le Monde* vigorously criticized INSERM’s top management who had chosen to follow *Nature*’s conclusions and had not attempted to support one of its most productive laboratories. According to *Le Monde* (and as requested by Benveniste), INSERM should have created an international scientific committee in charge of examining Benveniste’s claims and of giving “real” scientific conclusions. Thus we see the irony of a newspaper such as *Le Monde* arguing to restore a more “scientific” atmosphere to a scientific debate that had been, as mentioned earlier, described as a farce (Picard, 1994).

Le Monde’s position, however, was isolated. The *New York Times* chose again to adopt a traditional perspective, by commenting on how difficult it was for experts to detect eventual misconduct or self-deception in science. In the same article, Benveniste’s case was compared to Darsee’s fraud and Blondlot’s self-deception, two widely cited cases in which made up scientific data had been published (Ashmore, 1993; Kohn, 1988).

At this stage of the controversy, it seems clear that Benveniste was more and more isolated, *Le Monde* being the only actor that, through its attempt to stay unbiased in the debate, would give Benveniste the benefit of the doubt.

Le Monde continued to publish articles on the controversy, although the subject was fading from public view elsewhere. On 10 August 1988, *Le Monde* attempted to resituate the debate, by explaining that two dissociated problems were at play. On one hand, it was necessary to discuss if *Nature* had made the right decision when accepting Benveniste’s manuscript for publication (i.e., before a proper investigation). On the other hand, *Le Monde* wondered if Benveniste and his team had made sure that they had used all necessary methodological and scientific precaution before publishing results that would provoke an intense reaction from physicists, chemists and biologists (Nau, 1988e).

Le Monde also synthesized the three major critiques that Benveniste had to address: the nature of the results he obtained, the difficulty of reproducing the results, and the funding of part of his research by the homeopathic company BOIRON. *Nature*’s editor Maddox had mentioned on several occasions that he considered suspicious the fact that part of Benveniste’s laboratory funding came from BOIRON, a homeopathic company (Maddox, 1988b). More precisely, Maddox and his co-authors wrote in the investigation team report that they had been “dismayed” to find out that the salaries of two of Benveniste’s researchers were paid by BOIRON. This dismay was seen by some as particularly peculiar, when (as *Le Monde* observed) the funding had been agreed to by INSERM top management and was part of an official contract (Nau, 1988d).

INSERM has a long history of relationships with private industries. In 1998, INSERM had 300 different industrial partners and 1,000 contracts with industries, 75 percent being

connected to drug research (INSERM, 2007). Despite its prevalence, collaboration between industries and academic research was at the end of the 1980s (and still is) a controversial topic. In the United States, the Bayh-Dole Act of 1980 explicitly encouraged academic researchers to seek patents for their research. However, in 1988 and 1989, several cases of scientific misconduct had led the scientific establishment to worry about the industry–academia relationship, and to be concerned about issues of conflict of interest.

What was Maddox’s real agenda? Was he concerned by the risks associated with the industry–academia relationship in general, as a number of scholars were at that time? Or was he using the information on industry funding as a strategic tool, to further discredit Benveniste in the eyes of some of his peers? Since homeopathy was not just “an industry,” but rather an industry with a somewhat suspect reputation, Benveniste’s links with BOIRON provided a powerful rhetorical tool. As Picard (1994) noted, the active alienation of homeopathy remained an unquestioned norm during the whole controversy.

Once again, *Le Monde* was the only actor that resituated academy–industry relationships in the broader context of scientific research. But *Le Monde*’s attempt to re-center the debate was not particularly successful. Maddox chose this stage of the debate to publish an article in the *New York Times*. In this article, Maddox defended *Nature*’s actions and argued that the whole process had been beneficial to science and to the general public:

Why did we not investigate first and publish only if the research proved valid? ... [Because] people should know what second-rate science is and that there is a lot of it ... Full-blooded criticism is in reality allowed only in private—at a lab seminar, in a private report or over lunch. This permits pockets of second-rate science to remain isolated from the daily drumbeat of skepticism. (Maddox, 1988b)

Maddox’s attitude was peculiar, in that he chose to criticize the science quality control system (private criticism being, according to him, an obligatory step) in a general newspaper. By doing this, Maddox was doing more than responding to critiques from his peers (at *Science* and the *New England Journal of Medicine*, among others). Others have explained how scientists use popularization in political ways to defend their institutional grounds (Hilgartner, 1990). In the “water with memory” context, Maddox went even further: Maddox was attempting to restore *Nature*’s expertise, criticized by *Le Monde* among others, by explaining his actions in the public sphere through the *New York Times*. Maddox was therefore positioning himself as the defender of science’s integrity, not only within the institution, but also within society as a whole. Boundaries between public communication of science and scientific communication were particularly blurred in the process.

The official scientific debate on “water with memory” came to an end with an article in *Nature* published on 27 October 1988, which closed all correspondence on the Benveniste affair. In this article, Maddox attempted to respond to the numerous letters *Nature* had received on the subject and to fully explain *Nature*’s actions (Maddox, 1988c). The article, clearly written in a detached tone, contrasts noticeably with Maddox’s passionate writing in the *New York Times* only a few weeks before. By contrast, Benveniste’s answer published in the same issue of *Nature* seemed rather confused and emotional.

7. The controversy continues (October 1988 onward)

But if for the scientific community the debate was officially closed and Benveniste’s results discredited, the controversy went on elsewhere. Benveniste refused to have his results refuted through what he considered an improper process, and he therefore continued his research on

water with memory. In 1989, an INSERM committee concluded that Benveniste's research on water with memory was "hurtful for INSERM's image and more generally for the French scientific community's image," and recommended that Benveniste stopped talking about his controversial work outside of prestigious scientific journals (Fottorino, 1997a). This may explain why the water with memory case was absent from the headlines in the following years.

Benveniste continued his research, however. Several scientists who had judged *Nature's* behavior unethical, among them Alfred Spira (a statistician who completely revised Benveniste's statistical approach), helped him. A scientific paper submitted to *Science* and *Nature* in 1991 and rejected by both journals then was presented at the April 1991 meeting of the Federation of American Societies for Experimental Biology in Atlanta. The paper was published in the *Journal of the French Academy of Sciences* (Académie des Sciences, 1991). With the exception of a notice in *New Scientist*, the press did not take note.

In December 1993, the publication in *Nature* of a British team's results that decisively discredited Benveniste's experimental conclusions brought the water with memory case back to public view (Hirst et al., 1993). Surprisingly, the *New York Times*, which had decisively supported *Nature's* assertions in 1988, reported in 1993 that the 1988 investigation team members, "concluded that the findings were influenced by human bias and were spurious, but they were unable to show exactly where the experiment went wrong" (Browne, 1993, emphasis added). At the same time, INSERM decided to close Benveniste's laboratory.

For the first time since the beginning of the controversy, a set of scholars and personalities gave public support to Benveniste with a letter sent to *Le Monde* in March 1994. Among the nine scholars were Jean Baudrillard (sociologist), Jacques Testard (biologist), and Haroun Tazieff (vulcanologist and former French Secretary of Scientific Research). These scholars reacted to the closing of Benveniste's laboratory with these words: "We do not want to take part in the scientific debate. We want to advocate for the freedom to search, which means freedom to think, for the right to 'be heretical.' It should not be so easy anymore to silence facts, ideas and men who disturb" (Baudrillard et al., 1994).

INSERM reacted the following day, by publishing an official statement in *Le Monde* explaining its position, and stating that it had given Benveniste every opportunity to support his claims. To this, and at the end of INSERM's official statement, *Le Monde* asked if the international scientific community had given Benveniste such chances ("Water With Memory Story," 1994). At this stage of the controversy, *Le Monde* was again attempting to counterbalance the scientific community's rejection of Benveniste, as it had done in 1988. But if in 1988 the newspaper was alone, now renowned scholars were also suggesting that the scientific community at large had failed to act as would have been expected of them.

At this point, a most unusual and complex schema had emerged: social scientists and scientists were using a newspaper to support a scientist who had been rejected by the scientific community, a rejection based on the conclusions of a prestigious scientific journal but one acting in unusual ways that often involved nonscientific media. Public communication of science was far from being linear (Hilgartner, 1990). Instead, boundaries between science and the public sphere were hard to delineate, as in the cold fusion saga (Lewenstein, 1995a). The controversy had failed to resolve, with the impulse for continuing action coming from *Le Monde*, a mainstream newspaper. *Nature* published a news article on the topic ("Protests Challenge INSERM Decision," 1994). Benveniste's "heretical ideas" were back in a scientific journal, though not in the "scientific" section. The cycle endured, suggesting that the circular model of science communication proposed by Lewenstein (1995a) was operating in the case of the water with memory controversy.

Public communication around Benveniste continued: in August 1994, the British television network BBC launched three programs on Jacques Benveniste, Linus Pauling and Hans Eysenck, with the common theme of "scientific heresy." Science was presented as arbitrary

and partisan, a perspective that was vigorously criticized in the *British Medical Journal* (Spence, 1994). Communications within the scientific community and in a broader public arena were once again inter-linked.

Why was Benveniste suddenly attracting media attention and concern, more than six years after the end of the “official” scientific debate? INSERM’s decision to close his laboratory and the resulting letter of support seemed to have given a new impulse to the polemic, at least in the public sphere. The French scientific community, however, did not share the new enthusiasm for Benveniste, whose image was worsening among his peers. BOIRON had stopped its funding, and Benveniste’s willingness to continue his work on water with memory was seen as provocative. His research was getting more and more controversial and even the few scientists initially committed to helping him (such as physics Nobel Prize winner Georges Charpak) were beginning to think that Benveniste was getting paranoid, megalomaniac and even crazy (Fottorino, 1997b).

In 1996, *Le Monde* attempted once again to counterbalance the scientific community’s ostracism of Benveniste, by letting him write an open letter in its columns. Benveniste used this opportunity to attack dogmatism and supposed sterility in French scientific research, an attack that did not help restore his image among his peers (Benveniste, 1996). Numerous scientists criticized *Le Monde* for accepting the claims of a researcher who had been ostracized by the scientific community (Fottorino, 1997a). *Le Monde*’s situation was therefore particularly difficult. On one hand *Le Monde* was committed to helping Benveniste get (what it said was) a fair trial within the scientific community. On the other hand, *Le Monde* had to deal with the passionate personality of the particular scientist, and with the reactions of French scientists (who, for the most part, were *Le Monde* readers). Jean-Pierre Changeux (President of the French Ethics Scientific Committee) wrote in a letter in *Le Monde* at that time: “You certainly know the role *Le Monde* has played for the promotion of this case. Now your journalists need to revise their opinion.” An eminent scientist was therefore publicly recognizing the role that a mainstream newspaper had played in a scientific controversy. It should be noted that the scientist was not referring to a “scientific controversy” but to a “case,” in other words a non-controversy being flogged by a popular newspaper.

In January 1997, *Le Monde* published, over three days, three full pages on the water with memory case. The articles reported the controversy on a timeline basis, and also discussed Benveniste’s personality and search for publicity. They also described his new research (started in 1993 in partnership with an American laboratory) using isolated guinea pigs’ hearts as material for testing his “water memory” hypothesis. French and international scientific community attitudes were also analyzed and criticized. Far from modifying *Le Monde*’s views, the report concluded: “Since 1988, a lot of water has gone under the bridges of science. The fraud allegations remain unproved. There remains the credible possibility of the experimental artifact. There remains also the hypothesis that [Benveniste’s] results were valid” (Fottorino, 1997c; also 1997a, 1997b). *Le Monde* was therefore deliberately choosing to oppose the French scientific community’s dominant view at the time, which was to refuse to reconsider Benveniste’s results mainly because of his paranoia and megalomania.

8. Concluding remarks

This review of the controversy ends not because the controversy itself has reached closure, but because the main ideas are clear. The water with memory controversy illustrates the complex communication mechanisms that are at play when a scientific controversy takes place, mechanisms that involve actors as diverse as popular media, scientific journals, or intellectuals outside the field of science.

First, this case analysis clearly shows that scientific communication is far from being the linear process traditionally taken for granted. In times of crisis such as during a controversy, science communication can be a more convoluted, interwoven process with mass media assuming a central place. We also saw how on multiple occasions scientific journals and scientists used the media to support their political agenda, in line with Hilgartner's (1990) argument that scientists use the media as a resource in public discourse.

Second, this case clearly illustrates how mass media can, in specific contexts, assume roles traditionally imparted to scientific journals. Obviously there are a number of reasons why *Le Monde* might have covered the "water with memory controversy" the way it did. We mentioned national pride. The newsworthiness of a story about an eccentric and well-known individual such as Benveniste's might also have played a role in the coverage. These are all attractive dimensions of a potential news item from a journalistic perspective (Schudson, 1989). More importantly though, through its defense of Benveniste, *Le Monde* may have been exercising the social control that "Science" (as an institution) had failed to perform. In particular, *Le Monde* may have been attempting to promote a respect by the scientific community of an agreed-upon norm, universalism: truth-claims, whatever their source, are to be submitted to pre-established impersonal criteria (Merton, 1973).

What is particularly striking in the water with memory case is that *Le Monde* did not change its views as time passed, although it must have been subjected to social influence itself since it is the French establishment newspaper of reference. In fact, this is particularly striking considering the ability of scientists to promote their views to the media. This might be in part due to the cultural and political role of national media such as *Le Monde* in France, which have a strong tradition of political and social commitment (*engagement*) and make a point to resist external influences (Lamizet, 1996).

On the other hand, the *New York Times* was obviously reflecting scientific community views when covering the water with memory story. From the scientific community perspective, it could be argued that Benveniste had failed to conform to another (unspoken) norm of the scientific community since he used homeopathy, a "heretical" industry, as a partner. Interestingly, the amount of coverage devoted to the issue by each of these two newspapers is symptomatic of the opinion they each endorsed. While *Le Monde* addressed the issue in more than 130 articles over a 10-year period, the *New York Times* did so with only a handful of stories, therefore dismissing the issue and rendering it unimportant.

This case study clearly demonstrates the complexity of the science communication process, and shows that a proper analysis of mass media's role (or any other communication media) within this process cannot accurately be achieved without taking simultaneously into consideration other players such as scientific journals. The implications of this case study for scientific controversies in general are important and should be pondered. What is and what should be the role of mass media in promoting and sustaining controversies in cases for which there seems to be consensus from a scientific community standpoint? Science, the media and the public do not and cannot function in isolation of each other.

Notes

- 1 It should be noted that French scientific research has a solid and established reputation. Between 2000 and 2004, 232,744 research papers that listed at least one author address in France were published in peer-reviewed journals. The citations-per-paper average for scientific papers from France in Benveniste's field, immunology, was 8% above the world average for the field (In-Cites, 2007).
- 2 Walter W. Stewart testified to the Dingell committee on 12 April 1988, in the context of the David Baltimore affair, a well-publicized case of scientific misconduct.

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