

Hot and Cold: The Press and Cold Fusion

by

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Abstract

On March 23rd, 1989, cold fusion exploded into our consciousness. We faced the possibility that our dreams had come true; a safe and practically unlimited source of power had been discovered. As the days went on, the discovery became confusion and salvation turned into uncertainty. The claims of Pons and Fleischmann proved difficult to duplicate, and impossible to verify.

Cold fusion was not merely a scientific phenomenon, but a social one. The immense publicity exposed the human side of science to an eager audience. Bickering and yelling echoed in the normally quiet laboratories. Money, reputation, and scientific advancement were on the line as the drama unfolded.

Currently, the public's understanding of the cold fusion episode results from what the popular press wrote about the stunning announcement. Fortunately, the popular press collectively provided excellent and responsible coverage. In the past, such as in the case of high temperature superconductivity, the press has been irresponsible in its coverage of science, too often not displaying enough skepticism. However, with cold fusion, most journalists overcame significant difficulties and waded through the many side-issues to present a balanced account of the confusing episode.

Thesis Supervisor: Professor Alan P. Lightman, Ph.D
Title: Professor of Science and Writing

***To Mom and Dad: I'm finally beginning to appreciate
your love and wisdom. Thanks.***

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Introduction



"Don't you remember? We were at Herb and Sally's, and Herb said he knew how to achieve fusion at room temperature, using only gin and vermouth."

Drawing by Handelman; ©1989 The New Yorker Magazine, Inc.

Science, as a process, is inherently full of disagreements and arguments. The scientific method depends on the hypothesis, a question to which the answer is not known or proven. Science promotes and encourages controversy, because without questions scientific knowledge would become static. However, this fundamental quality of science sometimes conflicts with the goal of journalism to inform and educate the public. Scientific controversies, while having great dramatic appeal, are difficult to report, because of the lack of consensus among the experts and the technical knowledge often required to understand the debate. This difficulty is reflected in the common opinion among scientists that journalists often report science and technology inaccurately. While most alleged errors are ones of omission, not actual mistakes, scientists have traditionally viewed reporters with great trepidation.

This uneasy relationship between the scientific community and the press has created a strong stigma against scientists going public with scientific information. Going public involves the release of experimental results and conclusions to the press before they have been through the traditional method of scientific disclosure: the peer-reviewed journals. The stigma is reinforced by the feeling within the scientific community that only peers, not journalists, can evaluate discoveries, and that the public needs to be protected from spurious scientific claims. Likewise, going public often is seen as a ploy to obtain funding for specific projects, an action which creates great resentment among fellow scientists.

The institution of peer-review journals is so strong that even journalists regard information released by alternative methods with great skepticism, and sometimes anger. Ironically, "science by press conference", which seems

to aid news gathering, is disliked by many reporters since coverage is forced on a topic before they, and the experts they use, can even gain a basic understanding of the complex issues involved. Yet, hot topics, like superconductivity and cold fusion which are examined here, have almost daily developments and their implications are so significant that the process of peer-review is too slow to accommodate the public interest. Additionally, patent pressures, Congressional "earmarking" of funds¹ (scientists and universities directly lobbying Congress for money), and professional rivalry have all made "science by press conference" an increasingly common occurrence, an occurrence that may force changes among scientists, the press, and the relationship between the two.

The announcement of cold fusion created a very difficult situation for the press. The potential impact on the world was so great that it forced coverage of the drama. However, the press was unable to poll their experts because the details of the science trickled out so slowly. When fusion experts are hesitant to comment on the situation, there is little chance that the press can form intelligent opinions. The only resort is to print all the information in very cautious and restrained language, a task that most journalists did.

The analysis of selected articles in this thesis suggests that the press in general handled the cold fusion episode responsibly, given the extremely difficult situation they had to work with. While the press handled cold fusion responsibly, the focus on science was often lost because of the strange circumstances of the situation and confusion surrounding any facts. Instead, the press latched onto things it, and the public, would understand. Issues like the BYU-Utah rivalry, the chemists-physicists civil war, the simplicity of the experiment, and the non-traditional method of announcement with its resulting furor. All these issues had great dramatic appeal but little

relevance to the conclusion on cold fusion.

Yet, while some of the focus may have been inappropriate, the majority of the articles properly conveyed the uncertainty within the scientific community and maintained restraint concerning extrapolations. The daily newspapers responded to the situation in excellent fashion, with thorough and relatively opinion-free news coverage of the developing debate. The weekly press, both within the scientific press as well as the popular, tended to summarize and interject opinions more. All in all, the press coverage of cold fusion, despite yells of "media circus", should serve as an excellent example of responsible science journalism in very trying times.

Interesting comparisons came from the press coverage of another fast-breaking science discovery with great implication: high-temperature superconductivity. Much of the superconductivity episode was also "science by press conference", a common and harsh criticism of the Pons and Fleischmann affair. Yet, there was little controversy because the initial research in Switzerland had been published traditionally in a scientific journal, and the new superconductors clearly worked. Additionally, superconductivity had a long history and a stable of experts from which the journalists could draw upon. This was reflected in the articles, which frequently recited the history of superconductivity and quoted the Nobel laureates who had won the prize for their theoretical explanation of superconductivity. The writers on cold fusion did not have a similar luxury; most of the "experts" were as confounded as the reporters, and cold fusion had no great heritage. Similar to the cold fusion press coverage, non-scientific issues, like competition with Japan, sometimes dominated the news. However, the science involved was rational and clear enough that the main focus of most pieces were the new developments in superconductivity.

Moreover, superconductivity already had scores of practical application which the articles emphasized. Cold fusion, although admittedly more important if true, was merely another source of energy and provided little ideas for concrete extrapolation, other than the abstract idea of solving our energy crisis.

The historical and theoretical background would appear to have made it easier for journalists to cover superconductivity responsibly. In fact, that is the popular opinion. However, considering the favorable circumstances, the articles on superconductivity do not support this belief. Whether the coverage can be deemed irresponsible is a difficult question, but there is little doubt that the press overemphasized the practical applications of superconductivity and misled the public as to feasibility. The articles clearly implied that room temperature superconductivity was around the corner, a prediction that has gone unrealized. Unlike the press coverage of cold fusion, which has been inappropriately labeled irresponsible by many, the coverage of superconductivity was inadequate. The skepticism and cautious language that should have been used on such an important development was sorely lacking.

This difference is not merely a matter of chance. By the time of the cold fusion story, science journalists had gained experience, and caution, in covering fast-breaking science through the superconductivity episode. This experience was desperately needed when cold fusion burst onto the scene. While the disappointment with superconductivity may have tilted cold fusion coverage towards the negative, the responsibility the press showed was worth it. Anyways, there was more than enough other doubts to warrant the highly skeptical tone most journalists took. In two years, journalists went from hot (superconductivity) to cold (fusion) and their

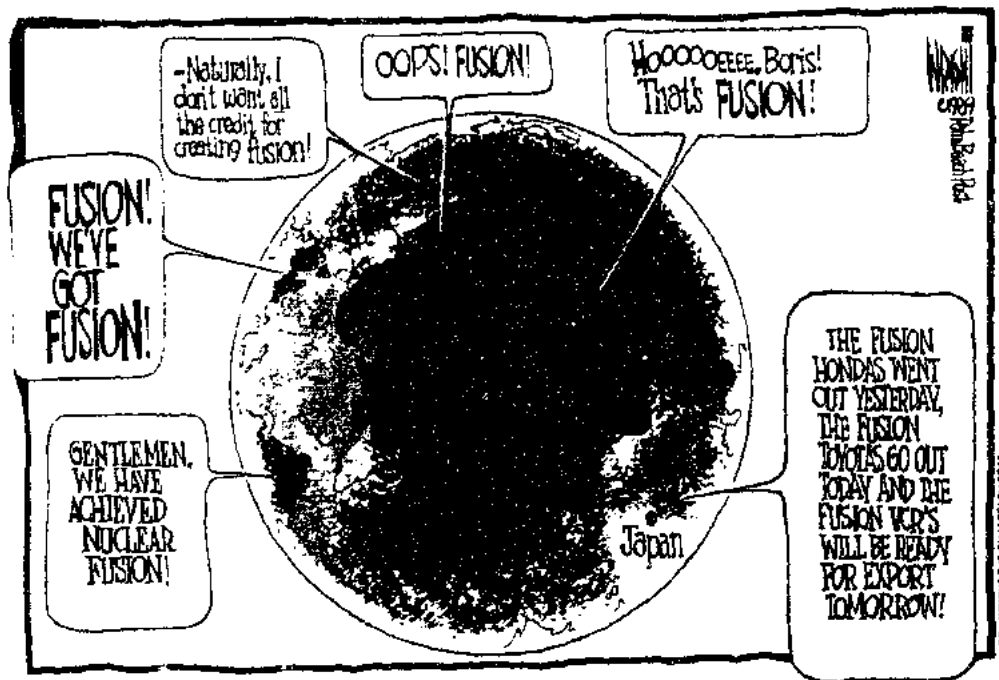
articles showed dramatic differences for that change.

In this thesis, I will analyze articles on superconductivity and cold fusion from a wide variety of sources. The "popular press" is often referred to and it consists primarily of the daily newspapers-*New York Times*, *Wall Street Journal*, *Boston Globe*, *Washington Post*, *London Times*, *Financial Times*, *Detroit News*, and weekly or monthly magazines whose focus is not purely scientific. These latter include *Time*, *Newsweek*, *The Economist*, *Fortune*, *Business Week*, *US News and World Report* as well as random articles in various other magazines. The "scientific press" - publications focusing on science or scientists - is represented by *Science*, *Physics Today*, *Nature*, *Scientist*, *New Scientist*, *Science News*, *Scientific American* among others. While this thesis does focus on these magazines, they were studied for any relevance to the popular press. Personal interviews and correspondence with science journalists, such as Jerry Bishop(*Wall Street Journal*), Ivan Amato (*Science News*), Robert Cooke(*Newsday*), and David Lindley(*Nature*), complement the archival research.

This thesis will show that the popular press was not uniform in its coverage of cold fusion. It will also show that while publications ranged from cynical or pessimistic to cautiously optimistic, the collective press did handle cold fusion as responsibly as the circumstances would permit. In contrast to overly optimistic speculation that occurred in the press coverage of superconductivity, journalists overcame the difficulties of the cold fusion episode and for the most part presented a balanced account of one of the most important science stories of the decade, cold fusion.

Chapter One

History of Cold Fusion



On March 23, 1989, Martin Fleischmann and B. Stanley Pons, two chemists from the University of Utah, hastily convened a press conference. Their brief announcement shocked the scientific community and the world. With an incredibly simple electrolysis experiment, they claimed to have achieved nuclear fusion at room temperatures and predicted an end to the world's energy problems. The furor created still exists today, as scientists continue their attempts to explain, verify, or debunk the extraordinary claim. And, more than any other scientific controversy, the fierce debate, described by the words of science journalists around the world, was played out in public.

Fusion, like its nuclear counterpart fission, is an atomic process which offers incredible energy rewards. In fission, a nucleus is split into smaller parts releasing energy. Fusion is the opposite. Two atomic nuclei merge, creating a larger atom and also releasing large amounts of energy, even greater than fission. The fusion of hydrogen into helium occurs in the sun's core and is the source of the sun's power. However, fusion usually requires large temperatures such as in the sun. These temperatures are needed to overcome the Coulomb force, a natural electrical repulsion between nuclei. Like magnets pushing away from each other, nuclei must be forced together. Normally, the high temperatures provide the necessary kinetic energy for the nuclei to crash together and fuse. However, the sun is our only practical source of fusion today. Fusion scientists have spent decades, and millions of dollars, trying to develop, without success, hot fusion reactors. Man-made devices still require us to input more energy than the resulting fusion creates, not a very efficient source of power. Cold fusion, as a source of

energy, has not been seriously studied for a variety of reasons. The primary one is that the rate of cold fusion, first calculated decades ago, has been orders of magnitudes below that necessary for a practical power supply. In the case of muon-catalyzed fusion, the short lifetime of the muon limited the number of fusion reactions that could occur per muon and thereby made the process inefficient for energy purposes.

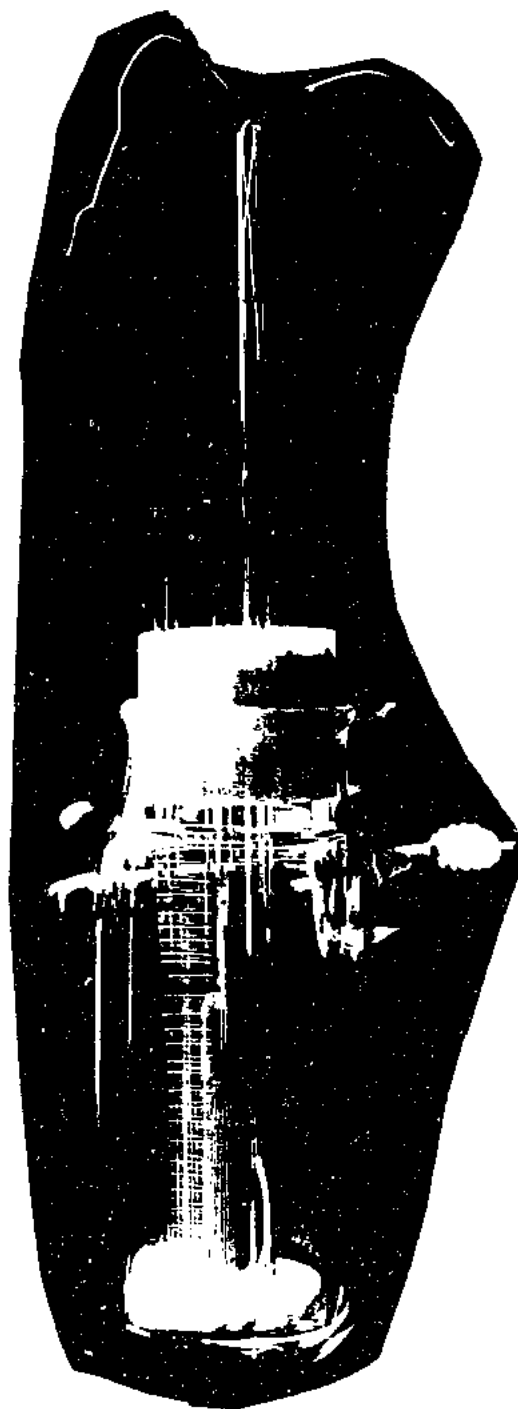
Cold fusion is an attempt to sneak around the Coulomb force, and consequently high temperatures are not needed. By packing nuclei together, there is a small probability that they may "tunnel" through the Coulomb barrier and fuse, regardless of the temperature. Such tunneling is described by the branch of physics called quantum mechanics. This process has been understood for some time, but the rate of fusion was never close to suggesting a practical energy source. Scientists can detect cold fusion in a number of ways. The first one is heat, which Pons and Fleischmann claim to have detected.. Through typical fusion reactions, neutrons are produced in large numbers as well as helium, the end product. Since the fusion cells were placed in water, gamma rays, which are often produced when neutrons meet water, can also be expected. In a newly proposed fusion path, neither helium nor neutrons would be created. Instead, tritium, another isotope of hydrogen containing two neutrons, would be created. So most experiments have been designed to detect heat, neutrons, gamma rays, helium, or tritium.

What Pons and Fleischmann have claimed is that their experiment somehow promotes fusion at a much greater rate than thought theoretically possible. In fact, they claim their system produces more energy than it consumes, something which past theories cannot explain. Pons and Fleischmann's experiment was similar to the electrolysis of water often done in high school. The primary differences were that the negative electrode was

palladium, a precious metal that is an excellent hydrogen absorber, and that heavy water was used in the cell. Heavy water is composed of two deuterium atoms, a naturally occurring isotope of hydrogen that has an extra neutron. The electrolysis splits the heavy water, and the deuterium is attracted to the palladium rod and absorbed into the crystal lattice. Locked into place, the deuterium nuclei are close enough to fuse. Pons and Fleischmann reported excess heat in these cells, so much in fact that they claimed only fusion could be the cause, not chemical reactions.

Martin Fleischmann and B. B. Stanley Pons are electrochemists at the University of Utah. Fleischmann, born in Czechoslovakia in 1927, was educated in England and still maintains an appointment at Harwell, Britain's nuclear research laboratory. In 1986, Fleischmann was elected a fellow of Britain's Royal Society, a high honor indicating his stature and respect among his peers. Born in 1943, Pons received his PhD in 1978 at the University of Southampton, where he met Fleischmann, who was a professor there. Pons eventually became the chairman of Utah's chemistry department and offered a position to his former teacher Fleischmann. From a student-teacher beginning, they have developed a close friendship and more equal working relationship. It was at Utah where they developed the cold fusion cells that were to shock an unsuspecting world.

Amazingly enough, another scientist in Utah was also exploring cold fusion. Thirty-five miles down the road, at Brigham Young University, Steven Jones experimented with slightly different electrolytic cells and produced significantly different claims. Jones, a physicist, had worked since the early eighties on cold fusion. At first examining another type of fusion called muon-catalyzed fusion, Jones even published a paper in *Scientific American* in 1987 entitled "Cold Nuclear Fusion". In recent years, he has used high



Pons and Fleischmann's cold fusion apparatus

pressure to achieve fusion in hopes of duplicating the conditions within the Earth's crust. His cell used a mixture of heavy water and various salts, as well as negative electrodes of both titanium and palladium. Jones claims to have detected neutrons in his electrolysis experiment, but no heat. He advances the more modest claim, that a significant amount of fusion is happening but not nearly enough for a practical energy source. In comparison to the University of Utah, Brigham Young's experiments suggested a fusion rate over a million times smaller than Pons and Fleischmann's experiments required.

The saga of Pons and Fleischmann and Jones had enough ups and downs to satisfy the most daring roller coaster fan. Science magazine graphed the "Cold Fusion Confidence Index" to demonstrate the volatility of the subject. The majority of events in the cold fusion episode happened in six weeks. This is an incredibly short amount of time in the normally cautious and restrained scientific world. On March 23rd, Pons and Fleischmann held a press conference at the University of Utah to announce their results. That same day, Jones, who had been in contact with Pons and Fleischmann and believed both groups would announce their results simultaneously, sent his paper to Nature because he felt betrayed. A week later, Jones publicly announced his results and fusion fever was in full swing. March 31st brought the first tentative confirmation from Hungary. Support for cold fusion grew on April 10th when Texas A&M announced it had detected heat (but no neutrons) and Georgia Tech claimed to have produced neutrons (but no heat). On April 12, Pons was hailed as a savior by his peers at a meeting of the American Chemical Society. The optimism quickly faded. Georgia Tech's claim proved to be one of cold fusion's great embarrassments. A couple of days after their press conference, Georgia Tech had to retract its statement

because their equipment had proved to be faulty. The skepticism grew as Nature announced that Jones' paper was accepted, but Pons and Fleischmann's paper required revision. Additionally, on April 14th, MIT announced that its cold fusion efforts had turned out negative.

Yet, cold fusion quickly rebounded when Pons announced further results on April 17. Robert Huggins, of Stanford, followed the next day with a description of his experiments which showed excess heat and appeared to rule out chemical reactions as the culprit. On April 26th, Pons and Fleischmann were in Washington, testifying before Congress on cold fusion and asking for money. Things then turned sour for their supporters. The April 27 issue of Nature contained a scathing editorial about Pons and Fleischmann, calling their experiments and conclusions sloppy. The May 1st meeting of the American Physical Society in Baltimore reinforced that impression. Physicists collectively ripped the cold fusion experiments of Pons and Fleischmann. They attacked and refuted the measurements of gamma rays, neutrons, and heat. Jones' more modest claims provoked grudging acceptance, or at least not outright disbelief.

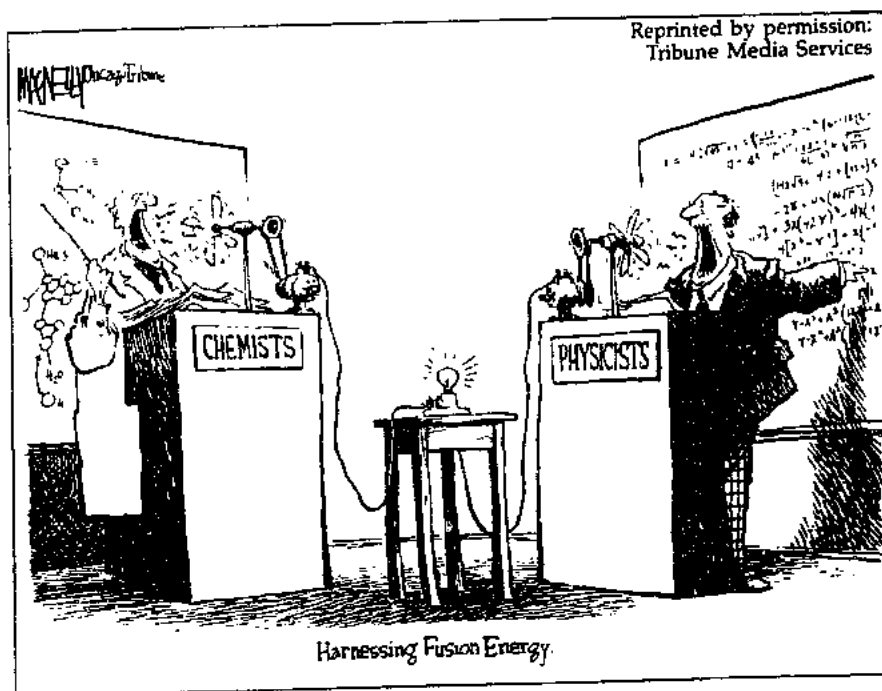
Pons and Fleischmann responded to their opponents at the May 8th meeting of the Electrochemical Society. Acknowledging the severe criticisms leveled in Baltimore, Pons and Fleischmann retreated on the measurements of neutrons and gamma rays, but steadfastly insisted that excess heat was still being detected; fusion fever had subsided considerably. Los Alamos held a Cold Fusion Workshop in late May, which did little but allow each side to restate its beliefs. A small band of scientists continued to support and study cold fusion, but the majority had written it off.

In late summer, the Department of Energy released a report that concluded there was little evidence for cold fusion and recommended that

the government should provide no further funding. Yet, throughout all these negative announcements, research continued. While skepticism is still dominant, national laboratories are still encountering abnormal results in further cold fusion experiments. Earlier this spring, tritium, a fusion product, was detected in numerous experiments at various labs and Huggins continues his claims of excess heat. The end of March saw the First Annual Cold Fusion Conference in Utah, suggesting that the controversy has not yet died. Jones research seems to be well-accepted, but dismissed as a scientific curiosity. However, Pons and Fleischmann's epitaph is yet to be written.

Chapter Two

The Articles



On the Wednesday morning of March 22nd, the day before Pons and Fleischmann's stunning press conference, Jerry Bishop of the *Wall Street Journal* received a very surprising phone call. Pamela W. Fogel, from the University of Utah's news office, informed him that the next day there would be a press conference where University scientists would announce a "sustained fusion reaction at room temperatures." Bishop remembers, "I thought it was a weird call. I asked for how many seconds. When she replied it was still continuing, I said you got to be kidding."¹ He then forgot about the matter until lunch, when a fellow science journalist reminded him of Steven Jones' 1987 paper on muon-catalyzed fusion. Intrigued, he made a few phone calls which established that two papers on fusion from Utah were being submitted to *Nature*. From that point on, Bishop was on the track of the year's biggest science story-cold fusion.

Three newspapers(*Wall Street Journal*, *London Times*, *Financial Times*) scooped everyone, and, on the day of the press conference, printed articles speculating on Utah's announcement. The *London Times* had a brief page two article whose sketchy details were dominated by the optimistic headline, "Scientists pursue endless power source." Page one of *The Financial Times* declared, "Test tube nuclear fusion claimed" in its headline. The final paragraph of the story summed up the possibilities of the unverified claim, "If the Utah research can be commercialized, small or even portable nuclear fusion cells may be feasible." The technology page carried a diagram of "Nuclear fusion in a test tube." This diagram was significant because of the sketchy details released at the press conference. Hundreds of attempts to duplicate Pons and Fleischmann's experiment were designed according to the

Development
In Atom Fusion
To Be Unveiled

Fuming physicists pour scorn on cold fusion claims

Physicists Debunk Claim
Of a New Kind of Fusion

2 CHEMISTS DEFEND
FUSION EXPERIMENT

Taming H-Bombs?
Two Scientists Claim
Breakthrough in Quest
For Fusion Energy

Fusion Illusion?

Significant Errors Reported
In Utah Fusion Experiments

Fusion Debate Turns Into Confusion

Test tube nuclear fusion claimed

Skepticism Grows Over Cold Fusion

Confusion, astonishment, physicists, and chemists dominated the headlines

simple newspaper graphic. The *Wall Street Journal* took a much more conservative approach in an article entitled, "Development in Atom Fusion to be Unveiled". Bishop's article documented Utah's pre-press conference phone call and the recent history of fusion research. No extrapolation based on a new fusion source was made, and Bishop accurately foreshadowed the future, writing "Any claims of a major breakthrough would stir considerable controversy and send physicists rushing to their labs to try to duplicate and confirm the Utah experiments."²

The Daily Newspapers

The daily newspapers would prove to be the primary source of information about this public and fast-paced scientific controversy. Developments occurred so rapidly that articles in weekly magazines were often out-dated. Thorough coverage of the cold fusion episode, regardless of tone or accuracy, is a an obvious area in which the national newspapers stood out. Most of the papers examined in this thesis could be considered national in scope. The two exceptions are the *Boston Globe* and *Detroit News*. The *Globe's* coverage of cold fusion was comparable to the national papers(*Wall Street Journal*, *New York Times*, *Washington Post*, *Financial Times*, and *London Times*), primarily because of MIT's role in the debate. The *Globe* is more conscious of science and technology issues than many local papers, because of the considerable number of colleges and universities in the area. The *Detroit News* does not have this expanded scope, and its coverage was significantly different from that of the other papers examined.

Detroit News

The attention given to cold fusion in the *Detroit News* can be termed both limited and Michigan-oriented. No space was given to the events in Utah until an April 8th editorial, which extolled the virtues of ideas and

imagination. An article detailing the University of Michigan's efforts to duplicate cold fusion followed the optimistic editorial a few days later. Between April 13th and May 1st, the only mention of cold fusion was a humorous op/ed piece comparing heavy water to wine coolers. The May 1st issue contained another locally oriented story, focusing primarily on KMS Fusion, Inc. and using the cold fusion excitement as a lead-in to a discussion of the company's efforts at achieving fusion.

A May 6th article documented UM's failure at duplicating the cold fusion experiments. The only national news was a list of other labs that were also unable to reproduce Pons and Fleischmann's results. The next article appeared on May 12th; no coverage had been given to the significant meetings the chemists and physicist had had in the previous week and a half. Once again, the theme was local, consisting of interviews with area scientists who had worked with or were friends of Pons and Fleischmann. The focus was whether Pons and Fleischmann were hiding data to protect patent rights. None of the science involved was discussed. The last mention of cold fusion in the period examined was a syndicated column on May 16th. This piece, by Daniel S. Greenberg(editor and publisher of *Science and Government Report*, a Washington newsletter), commented mainly on non-scientific matters such as the peer-review process, the division between chemists and physicists, and the unfortunate reality of money as a motive for scientists. A search of the *Detroit News* index did not uncover any articles on cold fusion from June to December, despite the fact the paper has a dedicated weekly science section. For the *Detroit News*, cold fusion was a story determined by its local relevance. The coverage was in no way irresponsible, but considering cold fusion's implications, the scant attention given to cold fusion seems short-sighted.

Boston Globe

The first two months of the cold fusion confusion were well-documented in the *Boston Globe*. The original press conference rated an optimistic page three article and was followed about ten days later with a longer feature story in the weekly science section. From that point on, a series of confirmations and supporting information of cold fusion grabbed the space in the *Globe*. Articles on April 5th, 10th, 11th, 13th, 14th, and 15th presented either theories to explain cold fusion or reports that labs had seen effects similar to Pons and Fleischmann. The Texas A&M and Georgia Tech announcements found their way onto the front page. Underlining the *Globe's* early optimism, Georgia Tech's retraction a few days later was given scant attention. Its only mention was a short paragraph in a feature story on cold fusion, a couple of days after Georgia Tech admitted its mistake. Peter Hagelstein's theoretical explanation of cold fusion was of great importance to the *Globe*. This was an understandable focus since he is a professor at MIT, a local school.

On April 21st, a front page article headlined "Researchers withdraw fusion paper from journal", introduced the first major hint of caution or skepticism into the story. Yet, the article de-emphasizes the action with a quote dismissing the withdrawal as not unusual and the mention of other experiments satisfying *Nature's* complaints.³ Four days later, another front page piece seriously discussed cold fusion as if it was a reality. The subheading was "Critics says process has risks, limitations", and the article addressed the problems or advantages of a world with available fusion power.⁴ Pons and Fleischmann's trip to Congress also warranted page one space.

Finally, on May 2nd, the opponents of cold fusion received some coverage.

Two stories, with a large picture of an MIT scientist and the words "Fusion study under heavy attack" over both, dominated the front page. The negative results of the Baltimore meeting were being prominently displayed; still, the *Boston Globe* refused to kill cold fusion.⁵ The articles were accompanied by an "explainer" which emphasized the difficulties in duplicating the experiment. A May 5th article on the top page expressed the outrage in the scientific community over an upcoming cold fusion forum that would only hear from supporters of the phenomena.⁶ An extremely long story on May 7th documented the growing evidence against cold fusion, but demonstrated no bitterness over the episode. The article ended excusing Pons and Fleischmann if they were wrong, and suggesting that the controversy benefited the public by increasing interest in science.⁷ For a negative article on cold fusion, the message was surprisingly buoyant.

A series of articles covering Pons and Fleischmann's response to leveled criticism and also reporting further positive results from Texas A&M and Los Alamos culminated in an editorial on May 28th. While not yet delivering a verdict on cold fusion, the editorial, entitled "The healthy fusion process" praised Pons and Fleischmann. The last paragraph comments, "The enormous benefit that would derive from successful cold fusion, economically and ecologically, fully justifies all the resources necessary to test and perhaps expand beyond Pons and Fleischmann's efforts. For having started the process, they deserve great thanks, whatever the outcome."⁸ The *Globe's* extended coverage of cold fusion ended in a June 5th feature article in the science section. "Fusion - back to the grindstone" topped the story. The focus was on how cold fusion fever has subsided and that practical fusion, hot or cold, was not something imminent

Like the *Detroit News*, and typical of all the newspapers, the *Boston*

Globe's coverage of cold fusion slowly dwindled as the summer months arrived. In a striking contrast to the almost daily articles in April, the *Globe* wrote nothing about cold fusion in the months of July, August, September, and October. November issues contained a single article covering the release of the Energy Department's final report which described the cold fusion claims as unsupported and weak. Overall, the *Globe's* coverage was thorough and balanced, although some events received spotty coverage. The paper's attitude, typified by the aforementioned editorial, was cautiously optimistic and good-natured, displaying no resentment of the cold fusion confusion.

New York Times

The *New York Times'* coverage of cold fusion differed significantly from that of the *Boston Globe's*. While even more complete than the *Globe*, the *Times* seemed to de-emphasize the story through the placement and focus of its articles. The *Times* is normally restrained, but articles detailing Pons and Fleischmann's discovery, as well as Jones' own results, did not make it past page two. It was only on April 11th, that reports of duplication by Georgia Tech and Texas A&M received front page treatment.

Unlike in the *Globe*, Georgia Tech's retraction a few days later warranted its own article.⁹ This was typical of the *Times*; negative or skeptical pieces equaled, if not exceeded, supporting articles. Cold fusion hit the front page only four more times, and in each case the content, as well as the tone, was decidedly negative. An April 21st story focused on Utah's rush to turn cold fusion into profits, and was followed three days later by another negative article on the fusion race. Subheaded "Caution Is Abandoned In a Frenzied Race To Come in First", the message was that the lure of money and prestige had warped the normal scientific process into something reckless and sloppy.¹⁰ On May 3rd, the upper left corner, a position of prominence in a

newspaper, featured a boxed story, "Physicists Debunk Claim Of a New Kind of Fusion." The front page treatment was surprising because much of the information had already been examined the day before in the *Times'* weekly science section. The earlier article bore a similar headline, "Physicist Challenge Cold Fusion Claims", and extensively covered the Baltimore attack on Pons and Fleischmann. The last front page article reported the Energy departments findings, "Panel Rejects Fusion Claim, Urging No Federal Spending." Of the twenty-two paragraphs, which quoted both the report and a panel member in a strong verdict against more funding, only the last three paragraphs contained any support for cold fusion.¹¹

The skepticism, and outright negativism, emerged in various other places as well. A vicious editorial, "The Utah Fusion Circus", attacked both Utah and Pons and Fleischmann. The *Times* writes, "None of this means the claim is wrong, just that at present [cold fusion] totally lacks the guarantees of reasonable credibility that attach to research claims published in refereed journals. Given such nakedness, the University of Utah should be embarrassed..."¹² The last line of the editorial continues the criticism, claiming that the University of Utah "May now claim credit for the artificial-heart horror show and the cold fusion circus, two milestones at least in the history of entertainment, if not science."¹³ Another opinion column comments "Apart from whatever it is that Dr. Pons and Fleischmann may or may not have discovered, their behavior is deplorable."¹⁴

While extremely negative, the *New York Times* did not hesitate to publish information favoring cold fusion. Despite a clear skepticism, the *Times* did not, as the *Globe* did, selectively cover the cold fusion story. All meetings and announcements were reported, both pro and con. All sides of the controversy were presented, though the placement of quotes, arguments, and the actual

stories obviously supported the *Times'* editorial position of emphatic disbelief. Their complete coverage was rivaled only by the *Wall Street Journal*, one of the newspapers which broke the story.

Wall Street Journal

The *Wall Street Journal* introduced cold fusion to the world, and the paper took great care not to kill its own creation. The articles, primarily written by Jerry Bishop, were restrained, but still consistently held out hope for the possibility of cold fusion. While the *Journal* was not blind to the problems that cropped up during the episode, the paper refused to jump on the physicists' bandwagon and write off Pons and Fleischmann. Bishop's articles emphasized the difficulties of accurate measurements and presence of scientific uncertainty despite the vehement opinions often expressed.

The *Wall Street Journal* placed great importance on the cold fusion story. This fact was established early by the placement of the article covering the press conference on the front page. Normally, feature articles, not breaking news, occupy the three columns not taken by regular daily sections.¹⁵ The Monday issue contained a biographical piece on Pons and Fleischmann, yet was not overly enthusiastic about their claims. The *Journal* wrote "the scientific community and much of the world's press is casting a serious if somewhat skeptical eye on the findings, yanking both men from relative obscurity."¹⁶

The optimism brought upon by the early confirmations, and Jones' similar work, was always stated in cautious and qualified wording. The headlines reflect this balance: *A Fusion Discovery Tentatively Confirmed; Two Hungarian Scientists Claim Success...but Results Are Unclear; Cold Fusion Experiment Is Reportedly Duplicated*(emphasis added). An April 4th article, "Fusion Findings in Utah May Take Months to Verify", was one of the few

places in the popular press that recognized and emphasized the slow process of scientific verification. It sensibly pointed out that it would take time to confirm Pons and Fleischmann's claim, and probably even more time to prove them wrong considering the complexity of electrochemistry and nuclear reactions.¹⁷

In a marked contrast from the *New York Times*, the *Wall Street Journal's* editorial was not a condemnation of Pons and Fleischmann or Utah. Rather, it was a commentary on the rare chance to see science played out in public. The paper seemed cheered and invigorated by the whole episode. The editorial ends on a very bright note:

It of course remains to be seen whether the Pons-Fleischmann fusion discovery will meet its promise of limitless energy supplies. But it is clear that we all happen to find ourselves living in an age of extraordinary dynamism and accomplishment. There is cause for optimism. The human enterprise is moving forward.¹⁸

It is difficult to believe that both newspapers are reporting the same story. The facts are essentially the same, but the interpretations are completely different.

The *Wall Street Journal* usually refrained from commentary, scene setting, or prediction in its articles. One particular example was the Dallas meeting of chemists. While most accounts emphasized the chemists' gloating and the image of a Woodstock of chemistry, the April 13th story merely detailed the events of the situation with little additional comment. The Baltimore meeting also produced balanced articles. Instead of the perjorative headlines that occurred in the *New York Times*, the *Journal* had "Physicists Cite Errors Behind Fusion Claim." Still completely covering what it termed a "broad and devastating attack on the credibility of [Pons and Fleischmann]", the *Journal* accurately concluded, "But while the attacks left cold fusion proponents on the defensive, they aren't likely to end the controversy."¹⁹

In an surprising departure from this level-headedness, a story appeared four days later, "Utah Fusion Experiment Is Springboard for Conjecture". The story asks the question "What if cold fusion is real?", while admitting that such a thought may be "premature". Even in this article of "blue-sky speculation" (the *Journal's* own words), hopes are grounded. The last paragraph states it will take six months to a year at least to "confirm and understand the Utah process, if it is a true breakthrough."²⁰

Yet, the *Journal's* coverage was more often based in reality. The *Journal* took great care to interview both chemists and physicists, something the *New York Times* was not as efficient at doing. Significant articles, ones that exposed important issues to the public, were written on the difficulty of calorimetry (measurement of heat), the crucial look for helium within the palladium rods, and importance of detecting tritium. Not only did the *Journal* cover the cold fusion thoroughly, it raised important questions that others had glossed over or not recognized.

Other Newspapers(*Financial Times*, *London Times*, *Washington Post*)

The *Financial Times*, after their initial optimistic article, took a relatively pessimistic outlook as the cold fusion drama unfolded. An April 15th article made the rash statement that "Some world-renowned centres of nuclear physics-Los Alamos and the Massachusetts Institute of Technology... - have already concluded that [cold fusion] does not work."²¹ Los Alamos is today one of the places still observing experimental abnormalities that may support Pons and Fleischmann. A May 4th article on the Baltimore meeting, "Fuming physicists pour scorn on cold fusion claims", was quite negative. The story suggested that Pons and Fleischmann were perhaps incompetent, as well as the more cynical idea that they "have deliberately withheld crucial

information to forestall competitors."²² The *Financial Times* often focused on the discord among scientists, especially between chemists and physicists, rather than the science itself.

The *London Times* coverage was very thorough and balanced, but the brief articles left little room for analysis of the situation. Skeptical, but not overly pessimistic, would be an accurate assessment of the articles examined. An editorial, "Wishing and Fusing", reflected this opinion, stating "there is all the difference in the world between scepticism and cynicism. The former simply asks for proof; the latter mocks. Until someone has disproved [cold fusion] he who mocks is on no safer ground than he who boasts."²³ The March 24th story did bring up an earlier British fusion fiasco, the Zeta machine, a comparison that implicitly urged caution for cold fusion. The coverage ultimately shifted in tone, writing off cold fusion when the results from Britain's national laboratory Harwell proved negative. Harwell's conclusion were given such credence that the *London Times* wrote, "The dream of a limitless source of cheap energy provided by cold fusion... died yesterday."²⁴ A June 30th "Science Report" written by John Maddox, editor of *Nature*, leads off "The nails are being driven into the coffin of cold fusion."²⁵ The concise and reasonable treatment of cold fusion turned into a possibly premature burial.

The *Washington Post* gave solid but unspectacular reporting on the Pons and Fleischmann affair. Cold fusion hit the front page three time, April 13, May 2, and May 10. The first story claimed that "overwhelming skepticism has give way to a suspicion that there might be something to it."²⁶ More than any other theme, the *Post* emphasized the confusion surrounding the controversy, and avoided picking sides in the debate. The *Post* refused to exaggerate, simply stating in the front page article on the Baltimore meeting,

"Claims of achieving cold fusion weakened substantially today."²⁷ The headline itself was sober and reasonable, "Significant Errors Reported in Utah Fusion Experiment". As the summer started, the mystery remained and the *Post* devoted little attention to cold fusion. No articles appeared on the topic from July to November.

None of the three newspapers demonstrated any significant irresponsibility in their coverage. Their coverage by no means matched the thoroughness of the *Times* and the *Journal*, but few papers are able to. This thesis has pointed out some flaws for each paper, yet overall there are no major criticisms for the manner in which these papers reported cold fusion.

The Weekly Magazines

The weekly newsmagazines slowly picked up the cold fusion story. Once they did, the magazines quickly magnified its importance, and just as quickly dropped the story. Business Week, Time, and Newsweek followed a remarkably similar path in their coverage, even though the content of the stories were markedly different, at least in structure. Business Week had a two-page article on April 10th, a follow-up on April 24th, a cover story on May 8th, and a final article on May 15th. Time and Newsweek both printed their first coverage of cold fusion on April 17th, continued on April 24th, (Newsweek had an article on May 1st as well), and climaxed on May 8th with cover stories. Articles in the May 15th issue of both publications served as the last exposure to cold fusion for readers of those magazines. The scientific developments in the following months were deemed too insignificant for these national magazines. Cold fusion was no longer hot; fusion fever had run its course.

Time

Time magazine was the extreme skeptic of the big three. At times,

opinion overshadowed the information and prevented the reader from forming his opinion. *Time's* initial article established the magazine's strong bias very quickly. The caption under the photos of Pons and Fleischmann read "heroes or blunderers", and the concluding paragraph asked if Pons and Fleischmann "have simply made an embarrassing blunder."²⁸ More significantly, *Time* does not present any quotes from Pons and Fleischmann, the only magazine examined not to do so. Steven Jones is quoted twice, asserting the modesty of his claims, but Pons and Fleischmann are given no chance to explain themselves or their more majestic beliefs. A reason for *Time's* discontentment may be inferred from their criticism of the announcement method - "[Pons and Fleischmann] had released their results in a manner that tended to cast suspicions on their claims, staging a press conference in Utah complete with television cameras."²⁹ The perjorative wording of the sentence is unmistakable and unfortunately bears little relevance to the accuracy of the scientific claims.

The next week's article continues the same bias. Pons and Fleischmann are still not quoted. Pons is mockingly described as "chemistry's new superstar", and *Time* claims fusion fever has caused "ordinarily cautious scientists to jabber", a deliberately negative verb choice.³⁰ *Time* even dismisses the recent experiments producing supporting evidence for cold fusion, not by factually attacking the methods involved, but by casually stating "Last week's results, while they seemed promising, had a hurried slapdash quality to them. The jury-rigged experiments..."³¹ In contrast, cold fusion skeptics were admired as "physicists who have labored for decades to achieve controlled fusion."³² While *Time's* reporting style is usually breezy and casual, it is significant to note the language is used to argue a cynical view, and not an open-minded one. *Time's* message, not the specific

language, deserves the criticism. The language merely emphasizes the bias.

Time's cover story reached the peak of extreme skepticism, if not outright prejudice. The entire structure and wording of the cover story presents a devastating condemnation of Utah, Pons and Fleischmann, and cold fusion. The opening paragraphs are vicious, sarcastically labeling the two "heroes, visionaries, and scientific superstars", as well as "the thermodynamic duo", and asserting that money is the primary motive for Pons and Fleischmann claims. *Time* advises Congress to "wait awhile before it starts pouring taxpayers' money into Utah's test tubes."³³ This warning is followed by a litany of negative evidence about cold fusion, concluding with Maddox's editorial in the April 27th issue of *Nature* denouncing Pons and Fleischmann's research. A brief paragraph mentions that Pons and Fleischmann stick to their claims, along with a few other researchers, but then returns to criticizing scientists as a group. *Time* wrote that researchers suffered "delusions of grandeur" and that "Scientific protocol went out the window as researchers called press conferences to trumpet the latest results before verifying them."³⁴ As in earlier articles, neither Pons and Fleischmann nor their supporters are quoted in response to these harsh words. *Time's* coverage shows little objectivity in this situation.

The unflattering portrayal of the cover story continues with an emphasis on the financial motive and patent claims. *Time* suggests jealousy and paranoia as possible reasons for Pons and Fleischmann's sketchy results.³⁵ The focus on distrust intensifies with paragraphs characterizing the dispute as chemists versus physicists, Utah versus East establishment, and the Utah-BYU conflict. Only after all this does the magazine return to discussing the scientific details of the controversy, and then only briefly. A history of Pons and Fleischmann and their experiments is presented, but an inset box

entitled "The Great Fusion Fizzles" dominates the page. Recalling past failures in science, *Time* writes "Pons and Fleischmann were not the first to suggest they had harnessed the fabled power of fusion. Disappointments in the past:" and proceeds to list other fusion fiascos.³⁶

The last page of the article reiterates criticism of Pons and Fleischmann with quotes attacking the quality of their paper. Robert Sachs, former director of Argonne National Laboratory, concludes a paragraph with "It's a shame. They obviously just got too excited about it to think straight."³⁷ Sarcasm appears again in response to Pons and Fleischmann claim of being too busy to correct their paper for *Nature*. *Time* finishes the story with sentiments, that although correct, have biased its coverage too negatively. The article finishes, "The solution to the world's energy crisis is not likely to be declared in a press conference. It must be slowly and carefully worked out, step by painstaking step."³⁸

Time's guilty verdict was finalized in their May 15th article, subtitled "Physicists dismiss claims of Pons and Fleischmann". Likening the meeting of the American Physical Society to a "unusually hot celebrity roast", *Time* included sarcastic poems about cold fusion and angry quotes calling Pons and Fleischmann incompetent.³⁹ Once again, supporters of cold fusion are given no space for rebuttal as *Time* continues its one-sided portrayal. Of the publications surveyed, *Time's* coverage was clearly the most one-sided and may even be labeled irresponsible. A reader of the magazine would not have received an accurate depiction of the cold fusion episode. Instead of the great uncertainty that was evident, *Time's* readers would conclude that cold fusion was a scientific fiasco, if not a fraud.

Newsweek

Newsweek painted a rosy picture in the majority of its articles on cold

fusion. The initial piece, on April 17th, was significantly different than most other publications. *Newsweek* was very optimistic, conveying the impression that there was little chance cold fusion was an error, and that it would just take time to scale up to a practical energy source. Visionaries is a term both *Time* and *Newsweek* use to describe Pons and Fleischmann, but *Newsweek* incorporates it in a respectful quote, earlier implying the two are geniuses. The article also speculates on plans for a cold fusion plant, despite the obvious prematurity of such conjecture. Like *Time*, *Newsweek* acknowledges past fusion failures but uses them to contrast with Pons and Fleischmann not to compare as other publications did. The final sentences are "The history of fusion is littered with breakthroughs that weren't. But as Pons and Fleischmann found, sometimes the long shots do pay off."⁴⁰ Clearly, *Newsweek* writers assume cold fusion is true.

Two interim articles, before the cover story, do document the growing skepticism, but were markedly different than *Time's* coverage. While reporting the negative results in the May 1st article, *Newsweek* chooses to begin the article with one of the few positive reports, Robert Huggins research at Stanford. In a dramatic change from *Time's* coverage, *Newsweek* proclaims that "the motivation is not money". Instead, "researchers are driven...by the almost magical lure of fusion."⁴¹ While this optimism is a refreshing change from *Time's* cynicism, it oversimplifies the situation - a pitfall *Newsweek* has trouble avoiding. The magazine even concludes the same article with the following-"Whether cold fusion is right or not hinges on one nagging question."⁴² One does not even need to know the question to realize the inaccuracy of that statement.

With its title and sub-heading, *Newsweek's* cover story demonstrates the optimism seen throughout the article. "The Race for Fusion: Whether a

breakthrough or a baby step, the scientific frenzy moves us closer to the fuel of the future" implies a number of things.⁴³ A race always has a conclusion, and *Newsweek* ignores the possibility that this may just be a huge mistake and no real science will emerge. Instead, visions of fusion fill our future. A main point of the article is that the cold fusion furor, whether justified or not, is beneficial to science because it has focused new attention on fusion and alternative methods of achieving it.⁴⁴ This a far cry from *Time* which found little of value in the controversy. Moreover, *Newsweek* is much more speculative than *Time* suggesting fusion would "be cheap and clean. And it would rewrite the international economic order."⁴⁵ Fusion is seen as a panacea, solving our energy crisis, political problems, the greenhouse affect, acid rain, radioactive waste, and even food production.

Scientists are portrayed favorably, not as money-grubbing, bickering rivals. *Newsweek* quotes one physicist, "We are humans, too, and need miracles, and hope they exist."⁴⁶ Little resentment is shown towards Utah's premature announcement, except to acknowledge that "Fusion scientists are talking to reporters so often that the press has become part of the process."⁴⁷ Instead of an inset box on fusion failures, *Newsweek* has "The Global Race for Second Place" summarizing all the confirming evidence. A brief paragraph establishes that "most researchers are throwing cold water on cold fusion", but the negative evidence is quickly excused. [Pons and Fleischmann] could be wrong, but there are other possibilities", warns *Newsweek*, suggesting that the difficulty of obtaining good calorimetry and neutron counts have prevented confirmation.⁴⁸ Ironically, these same problems are used by others to show that Pons and Fleischmann may have erred. However, *Newsweek* interprets the problems as support for Pons and Fleischmann.

Quickly moving from the negative evidence, *Newsweek* devotes a full page to various theories of cold fusion and the science involved. The presentation of reasonable explanations, by scientists from well-respected institutions like MIT, can only serve to bolster the credibility of Pons and Fleischmann's claims to the readers. *Time* literally ignored these theories in its cover story, a glaring omission. The only theories presented in *Time*'s articles were ones physicists used to discredit Pons and Fleischmann.

Finally, *Newsweek* acknowledges a main thrust of *Time*'s feature, that "the frenzy has distorted the usual careful pace of research, producing sloppy science."⁴⁹ However, unlike *Time*, *Newsweek* presents arguments countering those criticisms. The publicity has accelerated the process of verification and exposed the human side of science to the public("which can't hurt efforts to interest more school kids"). Lastly, *Newsweek* asks if there was any alternative-"And besides, the Utah pair would have been pilloried if they'd waited to publish their results."⁵⁰ The optimistic cover story concludes that cold fusion may even be an error, but one that still benefits science. The magazine believes "Pons and Fleischmann have unleashed a revolution in the way scientists think. That's not as significant as lighting the world, but ...that's cause for celebration."⁵¹

Even the final May 15th article refuses to bury cold fusion despite the widespread skepticism. While the optimism displayed earlier is gone, *Newsweek* maintains the possibility Pons and Fleischmann may still be correct. The lead reads "Cold fusion is dead! Long live cold fusion. Try as they might incredulous scientists can't seem to kill the amazing claim...". The last paragraph reaffirms that others support Utah and that "Right or wrong, cold fusion isn't out cold just yet."⁵² Contrast this with *Time*'s final sentence in its dismissive May 15th piece, a critical quote stating "Science is about knowing.

It's not about believing."⁵³ *Newsweek* perhaps wanted to believe in cold fusion. Yet, while it presented a rosier picture than most, *Newsweek* did show both sides of the cold fusion debate. The magazine's wish did not produce irresponsible reporting of reality.

Business Week

Neither pessimist nor optimist, *Business Week* presented a balanced, skeptical set of articles. However, that did not prevent the magazine from polarizing the cold fusion debate into simplified terms. Their April 24th article ends, "Everyone agrees there's no middle ground. Cold fusion is either the greatest discovery of the century-or its biggest scientific fiasco."⁵⁴ Like *Newsweek*, *Business Week* clearly felt the need to simplify the situation for its audience. This limited choice between two extremes is once again reflected on the May 8th cover which screams "Miracle or Mistake: Fusion in a Bottle".

Business Week's initial article, on April 10, was an extremely factual and balanced report of the present debate, emphasizing the uncertainties and skepticism within the scientific community. One item which stuck out however was the dependence on only physicists for quotes. This points out the predominance of physicists in the fusion field and is part of the reason the chemists/physicists division was played up.

For such an early article, the appearance of cold fusion history was a pleasant surprise and added an interesting perspective. It established a background for the topic and helped explain the skeptical reaction of most scientists, instead of merely quoting their anger. Nor did *Business Week* heatedly react to Utah's press conference. They termed it "unusual" and "unorthodox", and commented that it "drew heated-and highly skeptical-reactions"⁵⁵

One other image dominated the early articles, the opposition between Little and Big Science. References to the cold fusion experiment as high school chemistry were juxtaposed against an inset box titled "Big Science's Fusion Race is still at a Crawl". This image was prominent in most publications, and it is a significant reason for cold fusion's appeal to the public. The April 24th article was much more speculative, suggesting through quotes that our dependence on oil may end and that scaled down cold fusion plants may "be safely installed in homes, factories, and even cars".⁵⁶ Yet this conjecture was balanced with the possibility that cold fusion was "utter nonsense" and that Pons and Fleischmann had to be "certifiably nuts".⁵⁷ Once again, *Business Week* emphasized the either-or scenario.

Business Week's cover story focused on the characters involved and presented all sides of the debate. The magazine even acknowledged its own role in furor, calling it a "media circus that swept up scientists and the public alike."⁵⁸ It mentions the lure of patents, money, and Nobel prizes, but do not dwell on them. Following the who-dunit theme, the story gives us the background(history of other cold fusion claims), the characters (a description of how Pons and Fleischmann's experiments got to this point and Jones' story), and the witnesses(both negative and positive). The article alternates with evidence, first mentioning the quick "confirmations", then the negative backlash, followed by Pons and Fleischmann responding to the criticism. Theories for cold fusion are presented, but not asserted as truth. Instead, no opinion is given on their validity.

The cover story finishes with a paragraph reflecting *Business Week's* belief that any conclusions are premature. The last sentences are "The hope that cold fusion is the answer is understandable, but the doubts about it are reasonable. The scientific jury is still out."⁵⁹ The image of science as an

impartial judge is repeated in the May 15th article and earlier in the cover story. An inset, describing Jones' research and comparing it to Pons and Fleischmann, ends "Who is right? Science will soon decide."⁶⁰ This attitude was clearly the most responsible of the three weeklies. Opinions were contained in quotes, and were always balanced with an opposing viewpoint. While *Business Week* conveyed the skepticism and fading hope of the situation, it was also quite clear to the reader that cold fusion's death would be determined in the laboratory and not through the press or quotes.

The Rest of the Popular Press

US News and World Report

US News and World Report's primary article, on April 24th, displayed great skepticism, although the article was balanced. A clear separation was shown between chemists and physicists. Chemists were the ones "who gleefully see in the Utah work the triumph of 'small' chemistry over 'big' physics."⁶¹ Physicists urged caution. The article offered four possibilities for cold fusion: 1) "Bonanza" - called "least likely, though most exciting"; 2) Laboratory curiosity; 3) Nature's dirty trick - result of cosmic rays; 4) Oops-a mistake, although not implying incompetence.⁶² The magazine gives each equal billing, refrains from attacking Pons and Fleischmann, and follows a common trend of caution by quoting Jones in conclusion, "Don't sell your oil well yet."⁶³ A May 15th brief followup called the Baltimore meeting "likely the final chapter on the story", obviously putting cold fusion to rest. In fact, the short piece pontificates "The lesson of the episode are ones that scientists should not have to be reminded of. One is to beware of science by press release. The other lesson....is that even sober scientists can sometimes get carried away with their own enthusiasm."⁶⁴ This abrupt epitaph corresponded with the other weeklies who inscribed May 15 as the date of

death on cold fusion's tombstone. This action was a bit premature, but the story had lost its public appeal in the minds of the editors. Cold fusion had left the press podiums, and returned to the labs. Overall, the magazine was restrained in both the amount of coverage and its enthusiasm for cold fusion.

Fortune and Forbes

Since the story originally broke in financial newspapers, it is not surprising that the business implications of cold fusion intrigued these magazines. However, coverage was very limited. *Forbes'* effort was a single column which speculates on the correct metals to invest in if cold fusion is a reality. While the advice is couched in "ifs", the mere recommendation to buy metals because of cold fusion lends Pons and Fleischmann's claim credibility, at least in the eyes of the reader. The column even minimizes the surprise of cold fusion, with the puzzling statement that "cold fusion is commonly induced in laboratories and in industrial applications using particle accelerators."⁶⁵ The column is perhaps inappropriately speculative, but its purpose is to provide hot tips for investors' considerations, and so there is some justification.

Fortune published a four page article in June, long after the furor had subsided. The focus was on hot fusion in general, but also covered the topic of cold fusion. As usual, *Fortune* describes Jones' claims as credible, but says Pons and Fleischmann are being dismissed by the scientific establishment. Yet, *Fortune* does not close the door, writing "the cold fusion drama is still unfolding."⁶⁶ A cautiously optimistic paragraph tells us: "So don't give up on cold fusion yet. The furor over fusion-in-a-flask could just be the opening salvo in the battle to harness cold fusion for energy production. Whatever else they may have done, the University of Utah scientists have at least energized physicists and chemists everywhere."⁶⁷ Mentioning Alvarez's

similar discovery in 1956, *Fortune* asserts that "even the most skeptical physicist cannot argue that cold fusion is impossible in principle."⁶⁸ *Fortune* concludes that the Utah episode was worthwhile, calling the experiments "refreshingly modest" in comparison to Big Science.⁶⁹ *Fortune's* feature provided a balanced summary of cold fusion and put it into a context of other fusion efforts.

The Economist

The Economist took a much more leisurely approach to its coverage. Articles appeared on April 15, May 13, June 3, and concluded on September 30. The first piece is relatively short and merely summarizes the situation, while interjecting some subtle skepticism with phrases like "conjure up cold nuclear fusion" and "the greater outlandishness of the [Pons and Fleischmann] paper."⁷⁰ Yet, *The Economist* keeps an open mind alluding to Mark Twain's famous quote by entitling the May 13 article "Reports of my death..." and baldly stating "cold fusion is far from dead"⁷¹ even after the Baltimore meeting. The same article makes a strong distinction between the claims of physicists and chemists. Jones' results are referred to as "physicists' fusion", while Pons and Fleischmann discovered "chemists' fusion."⁷² The June 3rd article covers the Los Alamos cold fusion workshop and other developments. The first paragraph succinctly presents the situation, "Meanings change. A couple of weeks ago, cold fusion meant cheap, clean, and limitless energy. Now it means an increasingly convoluted puzzle for physicists."⁷³ Even at this late date, *The Economist*, unlike some publications, reserves judgement on the fate of Pons and Fleischmann's discovery. The last story, a more lengthy three pages, not only covers cold fusion but also its fall from public attention. Claiming that "the popular wisdom is that nothing was demonstrated except credulousness and sloppy experimental technique", *The*

Economist asserts instead that cold fusion lives and much still needs to be explained.⁷⁴ In a rare piece of media self-examination, as well as an accurate comment on the process of science, *The Economist* writes, "One of the problems the fusioneers have had is that their experiments last far longer than the media's attention span."⁷⁵ The article makes a number of important points that do not support cold fusion, but rather support keeping an open mind. Commenting on the difficulty of measuring the cold fusion affect, *The Economist* warns "But absence of evidence is not evidence of absence, and negative results are as open to doubt as any others."⁷⁶ Just as important, the article points out the experiment involves calorimetry, electrochemistry, and nuclear physics, and "no one can defend all three, since there has never before been any reason to master all three."⁷⁷ These intelligent realizations are almost unique in the survey of cold fusion articles and should serve as a lesson for journalists. *The Economist* does not ask for faith or scorn, merely time to scrutinize the mystery of cold fusion.

National Review

This conservative publication was comparatively slow in the formation of its opinions on cold fusion. A May 19th brief piece, after the criticism of the Baltimore meeting, still describes cold fusion as "increasingly believable" and speculates it "could be a major energy source within two decades."⁷⁸ Cold fusion delights the *National Review* because of the possibility of eliminating the Middle East's oil stranglehold, and achieving a "reduction of the cost of pollution control." Two weeks later, the magazine acknowledges the growing skepticism by writing, "For a few weeks there, we had cold fusion. Now it looks as if we don't have it."⁷⁹ Science is not a major focus. This is not irresponsible; it merely reflects the purpose of the magazine, social and political commentary, not science reporting.

Chapter Three

The Journalists Speak Out



Journalists, especially science writers, are an extremely heterogeneous group. Education, experience, and attitudes towards science vary widely. The cold fusion episode produced strong, and diverse, opinions from scientists, and it is no surprise that the journalists covering the story also developed differing views. A series of interviews and correspondence with writers that covered cold fusion was conducted in order to better understand what happened behind the scenes of the press coverage. What particular difficulties did the cold fusion story involve? What issues, themes, and images were considered important? What were the journalists' personal opinions, and were they reflected in their writing? In essence, the process of writing about cold fusion was examined to allow a more complete understanding of what was written. All quotes in this chapter are taken from my interviews and correspondence.

Jerry Bishop-*Wall Street Journal*

Jerry Bishop worked for the *Wall Street Journal*, and that fact had a great influence on his approach to the story. The financial implications of the announcement made it important to Bishop's readers. In fact, two financial papers, Bishop's *Wall St. Journal* and the *Financial Times* of London, are credited with breaking the story. The method of announcement, press conference rather than journal publication, did little to slow Bishop's research-"It didn't matter that it hadn't been published. It was a very competitive story." Furthermore, Bishop expressed the belief that what Pons and Fleischmann did, the press conference, was not that unusual. Mentioning the SLAC's(Stanford Linear Accelerator) recent announcement about the the Z boson, he pointed out that particle physicists have gone the media route

often. Some of the scientific community's outrage is hypocritical in Bishop's mind, because he claims "You can bet when one of the hot fusion groups [at MIT] reaches 'break-even', it will be announced quickly."

"Our readers want to know what Utah was announcing," Bishop said. Simple news interest justified the story, regardless of the claims validity. Bishop simply stated, "It was quite a major economic story. I'm no scientist, I can't judge the validity of their claims. Sometimes, science reporters get mixed up and want to judge the science, instead of judging whether it was news.. If the President gets up and lies, you still have to report the speech." The important thing in the cold fusion episode, to Bishop at least, was the necessity of covering what other scientists were saying. Through that, the confusion and doubt, which merely reporting a confirmation or negative result may ignore, could be expressed. Bishop dislikes the fact that many journalists judged Pons and Fleischmann as well as the science involved. He complains, "If you try to approach covering science as a scientist, you'll write what's importance to the scientist, not the reader."

Bishop admitted, "My first opinion was that [cold fusion] is really weird, but it's true. I got infected by what the scientists were saying." The initial coverage also exposed a problem many reporters had: Who to talk to. The first few days after the press conference, Bishop mainly consulted physicists, the normal fusion experts, and they focused on neutrons as the key to verification. Like many others, Bishop ignored Pons and Fleischmann peers, the chemists-"After two or three days, it dawned on me they were chemists. I talked to chemists then and found out that Pons and Fleischmann were respectable." More importantly, the chemists emphasized Pons and Fleischmann's excess heat as the important result to examine. In contrast to physicists who are concerned with sub-atomic particles, chemists focus on

more large scale features, such as heat. Bishop believes this is one place where the press was slow, "It took the papers a long time to realize heat measurements were important. The press was talking mainly to physicists."

This exchange reflects the dependence most science journalists have on a stable of experts. The writers can not be expected to be knowledgeable in every discipline, and therefore the opinions of other scientists often directs the tone and focus of the articles. The significant problem with the cold fusion episode was the "experts" knew as little as the journalists.

For one not irritated by "science by press conference", nor resentful of Pons and Fleischmann sketchy details, it is no surprise that Bishop feels the cold fusion drama was beneficial to the public. He argued, "It probably did science a a lot of good in the public image. It made scientists human to the public. The public could watch science happening day by day. Scientists making mistakes and arguing. It was the best insight the public has ever had." As for the differing coverage by the press, he attributes it to two reasons, the judgement of Pons and Fleischmann by some press, and the reaction against "science by press conference". Additionally, Bishop feels journalistic competitiveness entered into the story. Commenting on the *New York Times'* negative attitude towards cold fusion, Bishops said "If you get beat [on a story], you try to put it down. It's just a natural reaction. The paper that has the exclusive, ours in this case, plays it up in the long run."

Robert Cooke-*Newsday*

Robert Cooke has very different opinions about cold fusion. The method in which Utah and Pons and Fleischmann announced their results strongly affected him. Cooke is a traditionalist; he favors the peer review system, claiming it protects the public from spurious claims, and improves the quality of science. Cooke bluntly said, "*Newsday* ignored [cold fusion] because

the *Wall Street Journal* is not a scientific journal." Eventually, the magnitude of the story forced coverage, but the initial press conference immediately made him skeptical. "You learn that if a group of scientists come to you, you become suspicious," Cooke argued, pointing out that it was simply not the normal process. One of his goals as a journalist was not to lead his readers astray, and it was too early to say it was fusion.

In his opinion, the whole episode was overpublicized, but Cooke faulted Pons and Fleischmann rather than the press. The excitement and lack of concrete details created an optimistic outlook, and the press jumped on the bandwagon. A former member of the staff, Cooke complained that the *Boston Globe* wasn't skeptical enough, despite having one of the best fusion centers around. Yet, Cooke feels that journalists were forced to take Pons and Fleischmann at face value, because the confusion was so great. He commented, "It took two months before scientists figured out problems with the experiments, how can journalists be expected to do better." The difficulties of measuring heat, neutrons, and tritium were important issues that he felt deserved more attention, but few writers knew what questions to ask.

Cooke, like Bishop, mentions that the press is driven by competition, and that the story could not be ignored even if editors had wanted to. In Cooke's opinion, Pons and Fleischmann and Utah were irresponsible in their actions, and the press suffered for it. The early enthusiasm was unwarranted, and now Cooke feels that the press has reacted by being too skeptical. He is keeping an open mind and looking for "real results", but is very disturbed by the whole affair, "Utah has soured me." Little good has come out of the episode according to Cooke. He doesn't believe that it was an educational experience for the public, pointing out that the public's attention span is

brief and that few will remember the failure of cold fusion. Cooke's basic complaint is that the press was put into an extremely difficult situation by Pons and Fleischmann, and that the warning signs were ignored. His last comment was, "What I want to get across is we [journalists] do our job as honestly as possible, but we need to look out for red flags."

Ivan Amato-*Science News*

Ivan Amato looked at cold fusion in a much more philosophical light than the emotional reaction of Cooke. Amato dismisses the outrage provoked by the press conference, "That wasn't so terrible considering the importance of the discovery, if it was real. Nobody would be saying anything if [cold fusion] was real." The balance in his articles came from the belief that despite the strong statements being made, neither side could make a convincing claim. Amato found it necessary to stop listening to all those who were "certain", and realize that the data was simply insufficient for any definite claims. He strove to convey the idea that cold fusion was never a settled issue. Amato felt that most reporters were unable to achieve such distance. Even he felt at fault, admitting that Georgia Tech's retraction "made me realize that I would have to take more care about the measurements being made." He had approached the story skeptically, but with excitement. The thing which raised his eyebrows the most was that there was no existing physical theory backing up Pons and Fleischmann's claim.

Amato introduced the issue of Steven Jones' work as a complicating factor in the story. Jones' results were much more solidly based in science than Pons and Fleischmann's, and he made significantly different conclusions, but his work gave credence to Pons and Fleischmann's claim by merely supporting the possibility of alternative types of fusion. Amato emphasized that the hallmark of science is reproducibility, and while Jones technically

did not reproduce the experiments, the perception created by the second discovery produced a more accepting atmosphere towards the earlier, and more suspect, claim.

Amato considers the press coverage of cold fusion a slight aberration because of the attention given to negative results. He said, "Let's face it, negative results are just not as interesting. You see very little in the popular press about negative results." Because a lot of shoddy science was being done, cold fusion's negative news, more than other scientific stories, received great attention. In some ways, Amato feels this is confusing to the public, since a public debate is not the normal manner of scientific reporting.

Amato also encountered the schism between chemist and physicists. "There is a definite polarization between chemists and physicist," Amato maintained, "and physicists have a vested interest in [cold fusion] not working." In a novel solution to the problem, Amato depended on Glen Seaborg a nuclear chemist. A mixture of both fields, Amato felt a nuclear chemist would be able to give the most reasonable opinions. Amato feels that cold fusion has benefitted journalists by raising the degree of critical looking in reporting. Incidents, like that with Georgia Tech, demonstrate a problem science writer often have. Amato said, "We're all a little guilty of just reporting stuff, using single source stories."

David Lindley-*Nature*

As Associate Editor of *Nature*, David Lindley dealt with all the cold fusion papers, including the one from Pons and Fleischmann. He also wrote some news and editorials on cold fusion that appeared in *Nature*. In responding to a questionnaire I sent him, he addressed a number of facets of the cold fusion story and their affect on the press coverage. He emphasized the simplicity of the apparatus as contributing to the publicity. Calling it an

important part of the story, Lindley wrote that Pons and Fleischmann would have received attention if they had achieved fusion with an expensive and complex device, but because their apparatus was "simple and cheap, and because the scientific idea behind it was relatively straightforward, the notion that they were undercutting decades of work by conventional physicists was a hot ingredient of the story." He felt that *Nature* did not emphasize this ingredient, except in the beginning, because the simplicity was "fundamental and so widely understood."

Lindley also commented that the rivalry between chemists and physicists was an integral part of the story. He writes, "much of the appeal of the story was of two chemists - outsiders - making a lot of physicists look foolish." Yet, Lindley asserts that this rivalry was not created by the press, pointing out that Pons and Fleischmann mocked non-believers both in Dallas and at the Congressional hearing. He claims, "the question of rivalry between different groups of scientists was a genuine part of the story (not invented by the reporters)... It existed, and therefore it was reported as such." This remark is most interesting in that critics of the press coverage of cold fusion have claimed that the media was responsible for setting chemists against physicists; Lindley obviously does not subscribe to this belief.

Lindley wrote at length on the "science by press conference" issue, declaring "the manner in which the announcement was made took on great significance - not just because the rules of science were broken, but because the way in which they were broken suggested to most observers that something fishy was going on." Like Amato, Lindley realizes that proof would have allayed any suspicions. He wrote, "The University of Utah is free to conduct press conferences or not, as it chooses. What mattered here was that they made a big announcement and then repeatedly failed to back it up."

Concurring with Bishop, Lindley acknowledges that announcing scientific results to the press is becoming more common, and that it is a significant change from the past.

Regarding the competence of the press, Lindley believed it varied widely, but that most journalists quickly learned enough to write balanced stories. The good journalists, he remarked, were "quick to spot evasiveness and contradictions from scientists, both pro and anti-fusion." He characterized himself as skeptical on the story, and felt most writers shared this view. Lindley believes this skepticism is inherent in the job, since, as he writes, "It is in the nature of journalists, when they hear of some astounding discovery, to look for the bad news too." While perhaps accurate today, Lindley's belief was not always evident as the gee-whiz stories and incredible "breakthrough" articles of past eras demonstrate.

Responding to the criticism that Pons and Fleischmann were roasted in the papers, Lindley acknowledges that there was some delight in airing their dirty laundry; he claims there always is when journalists expose mistakes. However, Lindley asserts that Pons and Fleischmann were treated reasonably. He writes, "I think on the whole that Pons and Fleischmann got a pretty good press, even when they weren't widely believed - most coverage treated them as being guilty of overenthusiasm rather than incompetence or hypocrisy." Some stories were sensationalized, but this latitude is the price we pay for overall better reporting. Lindley argues that the "essential enthusiasm" that journalist need to do their jobs sometimes backfires, but is necessary because he "wouldn't want to desensationalize the press if it meant losing the scoops and investigative stories". Lindley's major complaint is that the press has a short memory. He found it sad that some cold fusion results from Japan late last year were reported with "no apparent attempt to

get comments from other scientists, or to explore how this experiment might have been similar to or differed from other cold fusion tests."

Finally, Lindley remarked that the science often took a back seat in the press. In response to my questionnaire, he wrote:

In a sense, cold fusion was only a science story right at the beginning; the focus quite rapidly shifted to the people involved and their motivations. This is largely why it was such a long-running story, because the science alone was not enough to hold people's attention, but squabbles and scandals are of much more durable interest.

While many, especially scientists, have complained that this focus was inappropriate, Lindley dismisses them. Asserting that Pons and Fleischmann dug their own grave, Lindley answers the critics, "Once it became clear that [Pons and Fleischmann] were not entirely open and honest in the way that scientists frequently are, they were fair game for muckraking journalists."

Chapter Four

A Comparative Case Study: Superconductivity



I think some of the scientific competence came from the high temperature superconductivity of a couple of years ago, during which journalists very quickly learned to be skeptical of claims of room-temperature superconductors and levitated trains.¹

High temperature superconductivity was the last science story to approach cold fusion in terms of public interest, fast-breaking news, and possible impact on the world. Superconductivity is the transmission of electrical current without the normal loss of energy due to resistance. Superconductors are materials that have this incredible property. Until recently, superconductivity was observed only at extremely low temperatures, near absolute zero. However, new materials first developed during 1987 have allowed superconductivity at much higher temperatures, and the race is on to create a practical room-temperature superconductor.

Cold fusion articles often alluded to the superconductivity race when searching for similar dramatic incidents in science. Consequently, a brief examination of the press coverage of this story may serve to highlight important issues in the reporting of cold fusion. Unlike cold fusion, there were seemingly few difficulties for the journalists covering high temperature superconductivity, but it remains a question whether that promoted more responsible journalism. A look at four newspapers (*New York Times*, *Wall Street Journal*, *Washington Post*, *Boston Globe*) and four magazines (*Time*, *Newsweek*, *Business Week*, *Fortune*) offers a surprising conclusion; the press coverage of high temperature superconductivity was not as responsible as could have been expected. The enthusiasm of the superconductivity race blinded journalists to engineering problems and resulted in a premature emphasis on practical applications.

One amazing aspect of the superconductivity coverage was how slow the rest of the popular press was to pick up on the *New York Times* front page article, "2 Groups Report a Breakthrough In Field Of Electrical Conductivity", of December 31, 1986. The first articles on high temperature superconductivity were quite spread out. The *Washington Post* published a gee-whiz UPI report on February 16th, but the first real article waited until April 5th. The *Wall Street Journal* picked up the story in mid-March, while the *Boston Globe* did not cover the superconductivity race until April 20th. The earliest magazine was *Time* with a March 2nd feature. *Newsweek* responded in May, two weeks after *Time* had a cover story on the new discovery. While events moved quickly, they did not occur at the daily rate characteristic of cold fusion, nor were they reported as frequently.

Most articles on high temperature superconductivity implied that practical applications were near. In fact, applications appeared to be the main selling point of the story. In the first story, before describing the breakthrough experiments, the *New York Times* emphasized the possible applications. Water Sullivan mentions that billions could be save in electrical transmission costs, and that this discovery would reduce the price of the superconducting collider. Skepticism was limited to the following, "Researchers cautioned, however, that it would take years before large scale commercial applications were perfected."² However, no doubt was expressed that they would be developed. "Physics Discovery May Lead to Superfast Airborne Trains" topped the article in which *Washington Post* readers were first exposed to the breakthroughs in superconductivity. Matching the headline, the UPI report glossed over the breakthrough itself to focus on the spectacular application of levitating trains.³

Continuing its enthusiasm, the *Post* reported that IBM had created a

The race for the ultimate superconductor

2 Groups Report a Breakthrough
In Field of Electrical Conductivity

**'OUR LIFE
HAS CHANGED'**

THE LIGHTBULB, THE TRANSISTOR—NOW THE SUPERCONDUCTOR REVOLUTION

RESEARCH RACE
It's frantic on superconductor frontier

New Superconductors Offer
Chance to Do the Impossible

Physicists Hail Breakthroughs
In Superconductor Research

Electricity Rushes Into a New Era of Discovery

TECHNOLOGY

**SUPERCONDUCTORS
GET INTO BUSINESS**

A New Electrical Revolution
Better living through superconductivity

**PUTTING SUPERCONDUCTORS
TO WORK—SUPERFAST**

Physics Discovery May Lead
To Superfast Airborne Trains

Headlines demonstrate the focus on a superconductivity research race and applications

superconducting wire that was able to handle a significant amount of current. The feat was hailed as "overcoming the greatest single technical barrier to a new generation of compact high-speed computers, new medical instruments, and efficient power generation and storage."⁴ Before the first practical high temperature superconductor had been manufactured, the *Post* had run a five part series on superconductivity and its implications. One article was devoted solely to applications.

The *Post* was not alone; the press in general hyped the applications. The *New York Times* ran another front page story titled "New Superconductors Offer Chance to Do the Impossible" (4/9/87) that listed benefits from computers to even nuclear fusion. The *Wall Street Journal* editorialized that electric cars would now be feasible, sea water would be fused for energy, and that our national security would be strengthened.⁵ *Newsweek* announced "A New Electrical Revolution: Better living through superconductivity." (5/25 p. 94) *Fortune* and *Business Week* also trumpeted the superconductor revolution. This paragraph in *Fortune* typifies the press' enthusiasm:

Relatively soon, perhaps in a few years, an array of promising electronic applications could ensue: superconducting computer chips, medical scanners, and ultra-sensitive detectors to probe the earth for minerals or transmit defense communications in deep space. Further along would come a world transformed by superconductors in almost unimaginable ways-ultrafast computers, hyperefficient power plants, 300-mph levitating trains, and ultimately, clean safe and plentiful energy from nuclear fusion.⁶

Business Week devoted a three page section of its cover story to the applications of high temperature superconductivity, writing that the scientists working on the new superconductors "are planting the seeds of an almost Utopian tomorrow."⁷

As with cold fusion, side-issues often dominated over science in the development of high temperature superconductivity. The primary one was the competition with Japan. The image of a superconductivity race was prominent; nationalism took hold of both the scientific community and the press. Almost every publication reminded the reader of Japan's success in stealing the color TV and VCR industries from American companies. The *Globe* called it "The race for superconductor supremacy" and the *Post* headlined an article, "Japan could win Superconductor Race with US, Scientists Warn". Scientists and the government created a confrontational position with Japan, and the press took delight in reporting it. *Time* quoted the Energy Secretary John Herrington as saying, "Superconductivity has become the test case of whether the U.S. has a technological future"⁸ Even the *Wall Street Journal* joined the national effort to warn us of the Japanese through its March 20th feature story, "Japan Is Racing to Commercialize New Superconductors".

High temperature superconductivity had established experts, Nobel laureates in fact, that the journalists could question, while cold fusion queries were usually directed to hot fusion people who found the whole idea improbable. Ironically, this difference promoted poor reporting of superconductivity. There was an unhesitating acceptance of scientific opinion. With cold fusion, it was clear from the start that most scientists knew little about the discovery, and consequently opinions and claims were taken with a grain of salt. However, superconductivity was a well-established discipline with reputable scientists that the journalists placed faith in. Whereas almost every superconductivity article had the obligatory history lesson, i.e. superconductivity's earlier developments, very few cold fusion articles mentioned past research in low temperature fusion,

primarily because it was so obscure. This tradition of superconductivity created an image that the new superconductors, while significantly improved, were merely the next step in a progression towards room-temperature ones and this impression eased the natural wariness of journalists.

The difficulties of high temperature superconductivity were better known than those of cold fusion, because they were mainly engineering problems encountered with earlier superconductors, ie. increasing the current in the wires and reducing the brittleness of the superconductors. Yet, this understanding did not emerge as caution in the articles. The problems were portrayed as a series of hurdles, that merely required some effort to overcome. The difficulties were not presented as possible roadblocks that might indefinitely limit the utility of these new superconductors, an approach that would have demonstrated more awareness and would have proved accurate. Furthermore, the current theory of superconductivity was inadequate to explain the new materials, and the importance of a complete theoretical understanding, before any phenomena can be truly utilized, was under-emphasized.

Three years later, the superconductor revolution has not yet arrived. Significant problems have greeted the development of room-temperature superconductors, and the majority of the amazing applications exist still only in dreams. Lost in the nationalistic fervor and unbridled optimism were the proper caution and restraint on the part of the press. A variety of items contributed to this relaxation of normal skepticism. Superconductivity had a long, well-documented history with a solid theoretical explanation of its working. Experts in the field were plentiful, including the scientists that won the Nobel prize for their theory of superconductors. Additionally, respected

names like IBM and AT&T were active in the research, giving any results an instant credibility that independent scientists could not provide. All these factors created a trusting atmosphere among science journalists, producing rose-colored articles that promised a vision of tomorrow but ignored the problems and limitations of today.

Chapter Five

Conclusions

WHILE PREPARING A TREAT FOR THE BRIDGE CLUB, MRS. EMILY TROODLE DISCOVERS...



Cold fusion was a discovery with three unique factors that caused its tremendous publicity: the non-traditional method of announcement and continuing promotion by Utah; the incredible potential to solve our energy problems; and lastly the human drama exhibited by a rare public controversy in science. Despite sketchy details and often sloppy science, cold fusion was a story that demanded to be told. Journalists dislike reporting confusion, and that is the most accurate description of the fusion furor, but responsibility and competition would not allow cold fusion to be ignored.

The confusion did produce coverage that often had little to say about science. Writers, and scientists, knew little about cold fusion. Rather than focus on the unknown of whether cold fusion actually worked, journalists latched onto and emphasized non-scientific issues such as the "civil war" between chemists and physicists and the fight over patent rights. Time's cover story is an example of where controversy and bickering overwhelmed actual scientific information. Yet, overall the press took care not to ignore the science involved despite a complexity that was not apparent at first.

One the reasons cold fusion exploded into our world was its ready-made media appeal. Two relatively unknown scientists, with claims of limitless energy from a simple table-top experiment, were battling the scientific community. It was a classic under-dog story with an effect on the world. This under-dog image of Pons and Fleischmann was continually emphasized, nowhere more than in the following passage:"...the two suddenly famous scientists had the look of the besieged defenders of the Alamo might have had - weary, aware there is little hope left but refusing to give up the fight."¹ The press was more than willing to emphasize this contest between Big Science, represented by physicists and their expensive machines, and

Little Science, Pons and Fleischmann table-top fusion in a jar. Additionally, a lively battle was being waged in the scientific community, as physicists and chemists bickered. While there was plenty of science involved, side issues tended to dominate the articles.

Throughout the whole episode, the press showed a clear division between physicists and chemists. Pons & Fleischmann were chemists intruding on the hallowed ground of nuclear physicists, and the reception of their ideas was quite cold. While chemists rallied around their peers, physicists were seen to be the skeptics. The media took full advantage of this conflict by emphasizing it in headlines and print. While there were individuals from each group with similar views, the readers primarily saw it as physicists trying to debunk the chemists. The words "chemists" and "physicists" appeared frequently in the headlines, often challenging each other. Some headlines highlight this battle:

- Fusion fever cools down; the Utah team, pilloried by physicists, stands firm.(May 15-*Newsweek*)

- Putting the heat on cold fusion; physicists dismiss the claims of Pons and Fleischmann(May 15-*Time*)

- Physics community strikes back in debate over cold fusion(May 6-*New Scientist*)

- Physicists challenge cold fusion claims...(May 7-*New York Times*)

- Chemists meeting fans the flames of fusion debate(April 22-*New Scientist*)

However, this civil war was not merely a fabrication of the press, it reflected important issues in the episode. Physicists were shocked, and leery, of Pons and Fleischmann. Furthermore, their education and experience did not allow the possibility of cold fusion, and consequently, their disbelief was understandable. Amato pointed out that differing world views on a situation

color one thoughts, and that was a significant barrier journalists had to be conscious of. Journalists did err early on in quoting, and giving consideration, only physicists. However, there was little alternative. They were the experts on fusion, although not this type of fusion as it turned out. Most writers recognized this schism and corrected very quickly. Bishop acknowledged his mistake and sought out chemist to balance his stories, and both Cooke and Amato consciously strove not to polarize the debate; yet, it was polarized and covered as such.

Money, patents, and the BYU-Utah dispute were other attractions that the press focused on to add some "pizzaz" to the story. Yet, they were part of the cold fusion drama. The second discovery by Jones was actually a separate story, but because of their similarities, the press was forced to group the two results. It was a confusing situation that made the journalist's job more difficult. Not only did he have two confusing and dramatic discoveries to cover, but he had to clearly show the difference between the two experiments and their different implications as well.

The press may have found gossip issues easier to report, but that does not eliminate their relevance to the episode. Too often the human side of science, a side which affects the course of science more than is thought, is ignored. Through the coverage of an admittedly unusual event, the press was able to convey more accurately the usual world of science and remove some of the public's idealized thoughts of scientists. Few articles on superconductivity focused on the sniping, bickering and jockeying for position that occurred as researchers worked for the Nobel prize. Instead, we encountered the savior scientist attempting to produce a new Utopia. The press coverage of cold fusion did not present that deception. Over all, he coverage presented the reader with reality, warts and all, and let the reader

make up his mind. There is no denying that publications had opinions, mainly cynical ones, but the collective press conveyed these views; they did not force them by irresponsible reporting.

One of the significant items noticed about the announcement of cold fusion was the relative restraint of the media in superlatives. The hyperbole was generally held back. When exaggerated phrases were used, they were often balanced against each other. *Business Week's* cover story was "Miracle of Mistake?" Miracle, like "breakthrough", is one of those words that science journalists tend to use because they attract readers. However, in this case, *Business Week* acted responsibly by also suggesting the possibility that cold fusion was a mistake.

This restraint reflects the media's attitude toward the discovery. In comparison to the "gee-whiz" journalism of the fifties and sixties and the cynical style of the seventies prompted by environmental concerns, most journalists chose the latter skepticism. "Gee-whiz" journalism created cancer cures out of everything and provide daily "breakthroughs" in almost every field of science. As mentioned earlier, the UPI report on levitating trains is an example of gee-whiz journalism that occurred during the superconductivity episode, but rarely during the cold fusion confusion. Because the discovery so went against common scientific knowledge, writers were even more cautious than normal

The writers of today are much more educated and scientifically literate than their counterparts from past decades, and consequently, they approached the discovery with the knowledge of its incredible significance if true. Whereas genetic engineering and the atomic bomb seemed to emerge from earlier knowledge, cold fusion flew in the face of it. Scientific discoveries seem to come in three categories: first, normal discoveries that

make up 99% of all discoveries, solid advances but uninteresting; second, ones that completely rewrite the textbooks(quantum physics/relativity); third, ones that tremendously impact our world(genetic engineering/the atomic bomb). Some may label the latter two categories Pure Science versus Technological Applications. Very rarely do both categories apply to a single discovery. Cold Fusion was such a rarity, and as such, its accuracy was questioned from the start. Neither pessimism nor optimism appear to be the correct characterization of the press coverage of cold fusion; highly skeptical is the more proper description.

One of the more interesting facets of this controversy is the media's examination of its own role. This self-consciousness has emerged from the dramatic increase in quantity and quality of science journalism of the last decade. A number of articles appeared during the cold fusion episode that had the media as its subject, not cold fusion. This shows a self-consciousness that may have prompted changes in reporting as the time wore on. This awareness demonstrates a responsibility that was not evident in the coverage of high temperature superconductivity. As Lindely suggested, the awareness may have been created by the earlier episode.

The popular press covered the cold fusion story as long as it remained "hot" and possible, if not probable. As cold fusion slowly became improbable, and withdrew into the labs and not press conferences, the popular press withdrew its coverage and allowed the scientific press the honor of bestowing the death blow on cold fusion. Cold fusion did not die in mid-May, but the public's interest did if the absence of coverage by the popular press is any indication. A story that had started out simple was becoming increasingly complex, especially in terms of the science involved. The simplicity of the story vanished, and with a large amount of cold fusion's

coverage in the popular press.

Some publications took an extremely skeptical approach to cold fusion and prematurely buried it. Some publications too often focused on issues other than the science involved. The press emphasized the division between chemists and physicists. The press had trouble separating the story of Jones versus that of Pons and Fleischmann. Yet, the press was not in control of the situation it reported. The majority of scientists dismissed cold fusion after the Baltimore meeting, and it was reported as such. Side issues such as money and professional rivalry were prominent in the drama, often influencing its progression, and it was reported as such. There is a division within the scientific community between chemists and physicists; this episode put it forth before the public, and it was reported as such. Jones' fusion claim did create confusion in the episode. Pons and Fleischmann released so few details that it was not clear what exactly they had done. Ignorance and confusion was common among scientists as the debate raged, and it was reported as such.

Cold fusion, unlike superconductivity, did not present ideal conditions for journalists. Scientists put forth claims that were extravagant and could not be backed up by solid evidence. The scientific community quickly split into vehement factions that shouted opinions, but little information. The experts, who journalists usually turn to, were as much in the dark as the writers and often more so. The experiments flew in the face of normal scientific theory. Additionally, the dramatic significance and possible impact of Pons and Fleischmann's claims necessitated coverage whether journalists were prepared or not. This was not true in the case of superconductivity, where experts, theory, and applications were all in evidence. Yet, this comfortable situation produced unrestrained prose focusing on Utopian applications;

prose that should have contained much more skepticism and less adulation of scientists. In contrast, the confusion and speed of the cold fusion episode, and perhaps the lessons learned from superconductivity, rang warning bells in the minds of most journalists. As a result, the press coverage of cold fusion did not catch the fusion fever sweeping Utah, demonstrating for the most part the responsible skepticism and open-mindedness that the situation warranted.

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NEW YORK, SATURDAY, DECEMBER 29, 1966.

Cold Fusion of Hydrogen Atoms

Inventors of a revolutionary way to find out in 48 hours whether a chemical reaction takes place without the million-degree temperatures required in the thermocouple method, the scientists, nuclear physicist Freda and chemist Joseph P. Kennedy, announced Friday at the annual meeting of the American Physical Society in New York, Calif., that they had developed a method by a team of twelve scientists at the University of California headed by Prof. Luis Alvarez.

Pulling Together
The discovery, it was pointed out, is at present of pure scientific interest only, as the process can now

One of the older ways is to increase a thermionic tube reaction, in which two nuclei of light elements, particularly hydrogen, are fused together into a heavier element with the aid, as well as the scarcity of the temperature is raised to about 100,000,000 degrees.

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Epilogue

How to write a thesis?

This chapter is supposed to be "How to write a thesis in 21 excruciating steps" or something along those lines. Well, the first step to any good thesis, perhaps I should just say any thesis, is the selection of a topic. Mine was cold fusion, and it was an excellent choice for a number of reasons. First, cold fusion is still a "hot" topic, and consequently any thesis about it would offer the opportunity to make a significant contribution to our understanding of the fusion furor. Second, a fortunate coincidence occurred. I was not the only one interested in cold fusion. My advisor, Alan Lightman, was also intrigued by the discovery and had compiled his own folder of material. So when I suggested cold fusion as my thesis topic, I had a thesis advisor already waiting for me. Third, while my thesis was non-technical, it did focus on a discovery in physics and therefore allowed me to satisfy my scientific interests. I am a XXI-S major in physics and science journalism, and although I decided not to become a physicist, I am still fascinated by physics. Following the cold fusion saga in the press was a perfect combination of my interests in writing, specifically science journalism, and physics.

Analyzing the press was also something I was familiar with. My freshman year, I UROPed with Professor Charles Weiner of the STS department. I collected and analyzed New York Times' articles of the sixties on genetic engineering. The purpose was to determine what the public perception was of this emerging technology. Was genetic engineering presented as a panacea, or were the ethical questions reported prominently. I enjoyed the archival research and was intrigued by the opportunity to judge the performance of journalists. In April of 1989, the *Boston Globe* ran an article commenting on the press' diverse reaction to cold fusion. I read the story with great interest and at that point first thought of analyzing the press coverage of cold fusion as a thesis topic.

A general topic had been selected, but now I needed to focus my efforts. My first inclination was to analyze the content and language of cold fusion articles in order to comment on the images and thoughts they conveyed. A number of these images were discussed in the thesis, Big and Little Science, physicists and chemists, are just two of them. However, such an analysis does not have a sharp focus. My work would have merely been a running commentary of what the journalists wrote. I thought that I had a thesis with cold fusion, but I had only a topic. I needed to argue and prove a point in my thesis. Past classwork and talks with my teachers have often raised the issue of responsibility in the press. My UROP also examined this issue, questioning if the press had exaggerated the benefits of genetic engineering and ignored the potential pitfalls. A question slowly emerged from this past experience: Did the press handle cold fusion responsibly? The images and content of the articles would not be ignored, but now there was a reason to examine them.

So, the research phase now started. Consulting with Alan pointed out the need for original research, not just copying old articles. We decided that documenting the journalists' experience during the cold fusion episode would be an important task. I proceeded to create a questionnaire which I sent to a number of writers. Unfortunately, none bothered to reply. (David Lindley did answer the letter I sent to John Maddox of Nature, but he waited three months). Exasperated and a bit worried, I attempted a phone interview with a writer at the *New York Times* only to be brushed off. Luckily, I went to talk to Eugene Mallove, a news writer for MIT, and he was able to facilitate my interviews. Not only did he provide me with phone numbers, but he was kind enough to call a couple of writers and ask them to spare a few minutes for me.

Throughout this, I was busy collecting stories from magazines and

newspapers. In addition to the popular press, I also gathered material from a variety of scientific publication. My original plan had been to contrast and compare the coverage of the popular and scientific press. Unfortunately, my efforts went to waste. The analysis of the popular press proved a daunting task, and a lengthy one, so I forgo writing about the science magazines. I do not feel the thesis is any weaker for this loss, primarily because the scientific press was relatively uniform and boring in its coverage of cold fusion. To no one's surprise, the focus was much more on the science, and little attention was given to all the side-issues. I felt resentful at times that my work had gone to waste, but an important part of writing a thesis is realizing what should not be include. It is a rare thesis that utilizes all the research that was done for it.

Now, the scary part was approaching. I had read hundreds of articles, and they had begun to blur together. It was time to start writing. At this point, I suffered the most intimidating experience of my academic career. I had no idea where to start. A writer's block had landed squarely on me. I had never been forced to organize such a vast amount of information, and I was scared. Writing is not to difficult if one has a plan or an outline, but I had neither. The deadline for my rough draft loomed, and I had not written anything. Finally, I forced myself to write, and ignored any coherence. Sometimes, you have to do this before your mind can see anything clearly. The rough draft was a disaster, but Alan recognized my problem and helped break the thesis down into manageable parts. Following his suggested seven chapter outline, I was able to work on small parts of the thesis at a time and not get lost in the total project. Eventually, I strayed from the outline, eliminating the final section, but I was well under way by then. The lesson to remember? Break your thesis into small parts, chapters, and work on them. Finishing one will

give you a sense of accomplishment, and there is plenty of time to unify the thesis, if the sections end up too unrelated.

I must warn the thesis writer to be prepared for surprises. At some point, you will realize you must completely change your thesis, or that your research isn't done, or that your outline is illogical. Be flexible. At the beginning of February, my thesis committee met and determined that a comparison case was an absolute necessity. So, the next weeks was spent gathering the material on superconductivity. It was a hectic time, and I was upset that this new piece had been thrown into the puzzle, but it was necessary. I was surprised by my examination of the superconductivity articles and it provided my thesis with the strength it needed. It would have been difficult to label the press coverage of cold fusion responsible, if I could not show what I felt was irresponsible reporting. Moreover, the comparison case added some excitement to the thesis, since I will wager most people don't hold the views my thesis argues. A casual opinion is probably that superconductivity was handled responsibly, but that cold fusion was a press circus.

The final point I wish to mention is about revision. During revision, one must sharply focus the whole paper towards the thesis that is being argued. When working on sections individually, it is sometimes easy to lose track of what points must be emphasized. Revision is when you hopefully correct these mistakes. It is the time when you delete material that does not promote your thesis, and elaborate on issues that bolster it.

I am not satisfied with this thesis; no writer should ever be content with his work. Further time and scrutiny would probably significantly improve the document, but time constraints is another lesson that writing a thesis teaches you. However, I am happy with the topic I chose and the research I

have done. Not only did I enjoy it, I learned from it. I am happy with the eventual thesis I arrived at, and the structure I used to argue for it. I would probably do much better a second time around. However, I hope I will not need to. Instead, I would rather take the lessons I learned from this thesis and use them when I graduate to different projects. I may not have told you how to write a thesis, but perhaps I prepared you a bit for the experience. It's not as bad as you think. However, I am done with mine and that may be influencing my opinion!

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Introduction

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