scientists who talk about their successful experiments with cold fusion are subjected to such media attack that further research becomes difficult.

The animus from the science establishment, alluded to in all three of the interviews that follow, is astounding. The leading science journals—*Science* and *Nature,* to name two—have turned down manuscripts that describe positive results and have instead printed outrageous (and unscientific) allegations of "fraud"; for example, the charge that Texas A&M researchers spiked their cold fusion cells to produce tritium. One Nobel laureate resigned from the American Physical Society because of the manner in which his manuscript was rejected by a technical journal published by the society.

Much of the old "dirt" heaped on the cold fusion researchers has been swept into a new book by Dr. Frank Close, a physicist who works at the Rutherford Laboratory in Britain and the Oak Ridge National Laboratory in Oak Ridge, Tennessee. Scheduled to appear in May, Close's book *Too Hot to Handle* made the top of the front page of the *New York Times* March 17, in a nasty article titled "Cold-Fusion Claim Is Faulted on Ethics as Well as Science." The *New York Times*'s leading science reporter, William J. Broad, spends several hundred words discussing Fleischmann and Pons's alleged "false data." He makes no mention, however, of any actual news, such as the just-announced results of the Miles group or, for that matter, any results from the 90 or more laboratories in 12 countries that have successful cold fusion experiments.

'Fire from Ice'

The good news is that an honest account of the cold fusion battle is also scheduled to appear around the same time. The opposite of Close's warmed-over lies, *Fire from Ice: Searching for the Truth Behind the Cold Fusion Furor* is a *factual* account of cold fusion's first 18 months. Author Eugene F. Mallove, chief science writer at the Massachussetts Institute of Technology, reports on what happened after the March 23, 1989 announcement by Fleischmann and Pons, who did what research and what results they got. He doesn't omit the crucial positive information, and his book reflects the great potential of an emerging technology.

From the outset, Mallove starts with a point that most U.S. science writers (and readers) have yet to learn; namely, that science does not proceed by majority rule. As he says in his introduction, "It is a gross mistake to draw conclusions about the validity of reported findings by polling the membership of this or the other scientific organization or panel." Mallove offers more sound advice to all concerned, noting that one should "use extreme caution in dismissing experimental results just because theory suggests they are 'impossible.' Theory must guide science, but it should not be allowed to be in the driver's seat—especially when exploring the frontier."

Interview: Dr. Martin Fleischmann

Fusion can meet our future energy needs

Cold fusion pioneer Martin Fleischmann met with scientists in Milan, Italy, Feb. 12, 1991, to discuss the status of cold fusion and plan the second annual cold fusion conference, which will take place in Como, Italy, June 29-July 4. He was interviewed there by Evanthia Frangou. The interview, which we excerpt here, will appear in full in the summer issue of 21st Century Science & Technology *magazine.*

Q: What can you tell us generally about the perspective of cold fusion research today?

Fleischmann: It is now almost two years since the premature announcement of our experimental results. I would say that since then many people have got very interesting results, much more interesting than the results we had. There has been a lot of interest, of course, because underlying this research is the economic question. That is the question of how we are going to meet our energy needs of the future.

Now we have been very much criticized for making the social factors important in our work. Being in the field of electrochemistry, which has many industrial applications, it was very natural for us to take such a practical view. I know that here in Italy you are not too fond of nuclear energy. But my view and that of Stanley Pons is that in order to meet the future energy needs we will need the breeder reactor and then fusion reactors. So we have to push whatever program we have toward those objectives. And, of course, cold fusion enters into that perspective.

Q: Were you surprised by your results?

Fleischmann: Not surprised, astonished is the correct word. We did not expect to find what we found. This is one reason why we took so long in reporting it. We did not want to talk about it in 1989. Our optimistic target was 1990. This was due, as is well known, to the fact that our colleagues at Brigham Young University wanted to go ahead and publish their observations. Our difficulty was that we had results that looked technologically interesting. Although we were doing our work in secret, we then had to tell the university authorities what we were doing. And you can imagine, of course, they really were obliged to take patents.

So the driving force of the scientific publications became the patent consideration. There is nothing that you can do about it in retrospect. Should it happen again, I believe it would take more or less the same course. So now I am re-

stricted in what I can report to you. I cannot tell you what we have done since October 1989.

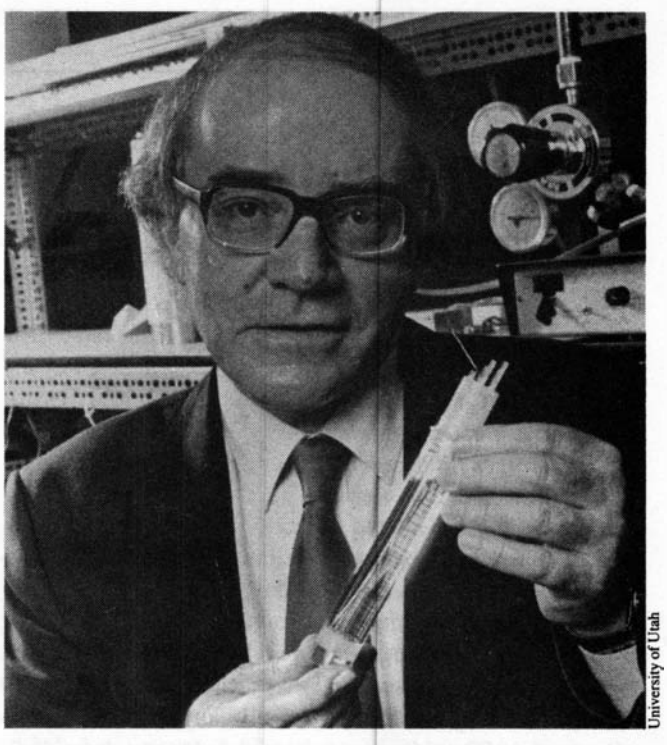
Q: How is the experimental situation now?
Fleischmann: . . . I can tell you that we have much better reproducibility now. We have sets of electrodes for which we could tell you more or less exactly when we will see what. Now that is based on sets of electrode materials. Until we get reproducibility, there are just too many variables to understand.

Q: How would you comment on the negative results of some groups?
Fleischmann: We knew that you had to do a very large number of experiments for a very long time. And we do know that the experiment can go wrong in many different ways. It is difficult to comment on those negative results where I do not have detailed access to what they did. I do know why some people's experiments went wrong.

There is a general comment I would like to make on negative results. When you do scientific research, especially in a new field, it is extremely easy to get zero results. Now if you believe that you should get zero results, you will be satisfied. It is only when you believe that you should not get negative results that you will try a little harder. There's been a lot of that going on. There have been some very strenuous efforts to "see nothing."

Q: Where else do you believe there is interesting work going on?
Fleischmann: There is interesting work going on in the military laboratories in the United States. Also in some national laboratories, particularly in India—I would say the work in India is very, very interesting. The Japanese work is very good. I would say that there is more liberty in doing scientific research in these countries, as opposed to the United States and Europe, where we have more political interference. . . . You see the attitude of the articles in the *New York Times* and the *Los Angeles Times*. And it is obviously orchestrated. Somebody starts it off, somebody who wants to cause a lot of damage, they leak a statement to the press. It takes them one minute and we have six months of trouble. The journalists do not check their facts. That is how it is. And that is why I think the way we have been working is not possible. People say science should not be done in secret, but that depends on people being reasonable. If people are unreasonable you have to say, well I'll pull the blinds down and work in a dark room. I satisfy myself whether it works or not. Unfortunately I still spend about 50% of my time on the terrible political problems. . . .

Q: How is the funding in other countries?
Fleischmann: The Japanese, for example, have taken a very pragmatic view of it. They took off 2% of their whole fusion budget and spent it on cold fusion. That is about $25 million a year. And that is about the level you would expect people to operate at. It is sensible, whereas in the United States and Europe, it has been seen as a competition between hot and cold fusion. It is not a competition—it is a piece of science, a piece of technology.


University of Utah

Martin Fleischmann, holding a model of one of the original cold fusion electrolytic cells. The basic apparatus consists of palladium and platinum electrodes placed in a glass tube with heavy water. A voltage applied across the electrodes splits the water into oxygen and deuterium, and the deuterium is then absorbed by the palladium. Excess heat at room temperature was measured, which Fleischmann and Pons attributed to a nuclear process—the fusing of deuterium atoms. The experiment occurs at room temperature, hence the name cold fusion.

I think the real problem now is that science has become too institutionalized, small science tends to be squeezed out. The project we are talking about starts as small science. We explained to a subcommittee of Congress that although we have got as far as we have got with $100,000, that did not mean that we could reach any satisfactory point with another $100,000. The problem is that this project will take substantial funds. It is no use disguising that. We are talking about tens of millions of dollars to go through the next phase. It is an intermediate-size project. It is not so small that you can do it on spare cash.

So scientific research has become very inflexible, it cannot accommodate the unexpected. We are in a situation where the progress is going to be restricted, I'm afraid, by the funding. So it becomes a political question.