Cold fusion revolution marks its fourth year

Cold fusion researchers used to think of themselves as a "resistance" movement against unfounded attacks; today, they are deepening their understanding of this new field. An interview with Carol White.

On Feb. 9, 21st Century Science & Technology *editor Carol White was interviewed for the cable television series "The LaRouche Connection," on the subject of cold fusion, which has granted* EIR *permission to publish a transcript edited by Mrs. White. She was interviewed by Paul Gallagher.*

Gallagher: Good evening, and welcome to "The LaRouche Connection." Our topic this evening is the extraordinary reactions discovered four years ago, known as "cold fusion." The media, both in this country and abroad, and also the scientific establishment, have been trying to convince you that cold fusion, in fact, does not work, or that the very idea of cold fusion reactions is a hoax. Many of you may know that that is not the case, and that, in fact, the most fascinating developments in science are taking place in these experiments.

Our guest tonight is Carol White, who is the editor of *21st Century Science & Technology* magazine, and who is constantly in touch with and circulating the work of virtually all of the people who are important in this extraordinary field of experimentation.

Carol, let me ask you first, what has *21st Century Science* done in the field of cold fusion? You can start, if you like, with the first announcements which were in 1989.

White: Well, we covered it from the very beginning, because we've always been interested in fusion energy, and this seemed quite extraordinary; normally with fusion energy you need huge machines, and it's a very elaborate setup. And here were two scientists, saying that with test tubes on a table, they could cause nuclei to come together and to fuse, and we thought this was really, incredibly exciting. We wondered if it was true, but we were very interested, and we just followed it from Day One. And of course, after not too long, we realized that this was a very extraordinary, and very serious experiment, and we've been writing about it ever since.

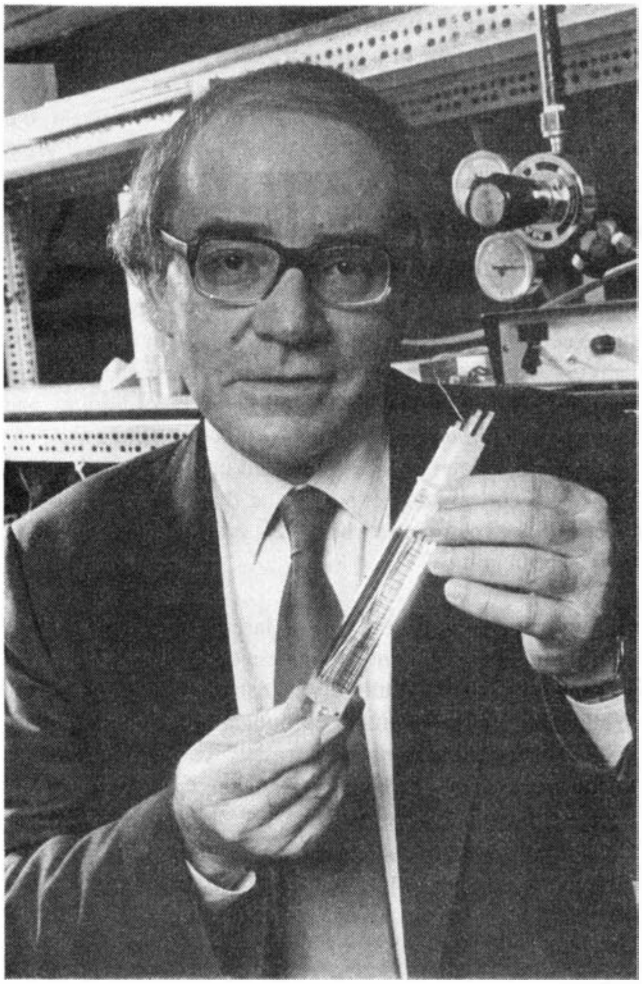
Gallagher: Here you have one issue of your magazine, in which the subject was a conference, the Como conference in Italy. You were there with *21st Century*. Tell us about that conference.

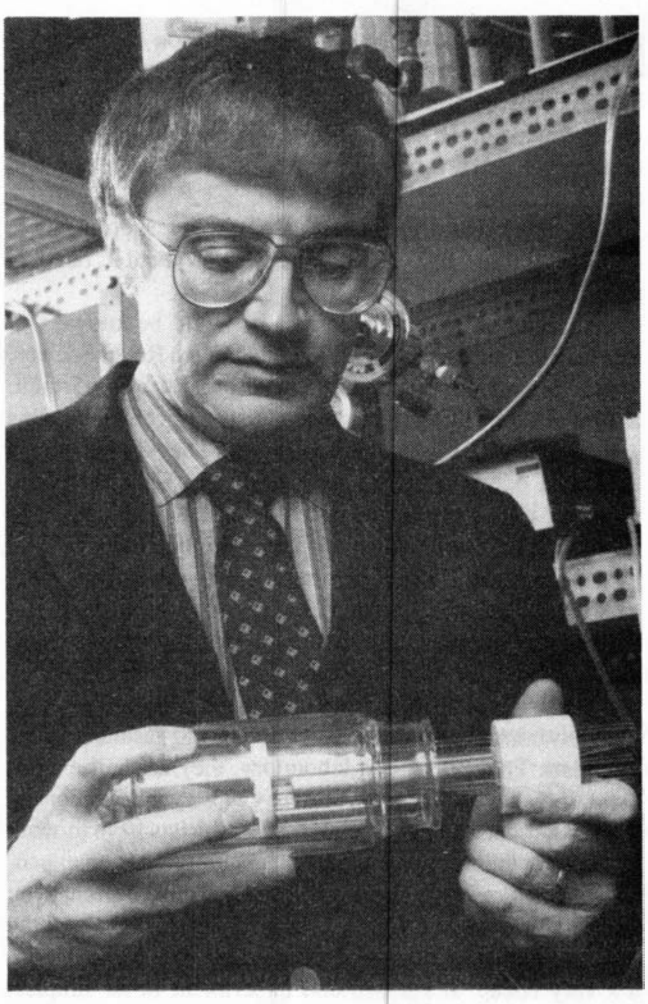
White: The conference was open to all journalists, and we were the only scientific magazine in the world that came. There were two other publications there, but one was a technical journal put out by the American Nuclear Society by George Miley, and one was Hal Fox's *Fusion Facts,* which is a newsletter; but we were the only mass-circulation popular magazine which chose to come. *Scientific American* didn't choose to come, or *Nature* magazine, or *Science;* and they never chose to cover any of the positive results, and haven't to this day in any detail on cold fusion. Mainly they have panned it or they have been sarcastic. Now, most recently with the large Japanese program and the enormous positive results, they haven't been able to totally black it out, but they have yet to give any serious scientific coverage to cold fusion.

Gallagher: What was the Como conference? When was it, and what was established?

White: It was a year and a half ago on July 4 [1991]; it was the second annual conference on cold fusion.

From the beginning, Fleischmann and Pons demonstrated that—using electrochemical means—they could, with chemistry, elicit a nuclear response. They could do it in a controlled, if not repeatable, fashion—that is, you didn't have an uncontrolled explosion—and they had announced that on March 23, 1989. Many people tried to repeat the





Coldfusion pioneers Martin Fleischmann (left) and Stanley Pons (right).

experiment, and a lot were successful and some were not. The unsuccessful results were played up, and the successful results were debunked and slandered.

This conference was really an extraordinary gathering, in that it was a collection of scientists from around the world—from Russia, from Japan, from the U.S., Italy, one Frenchman, one German—who stood up for the fact that they had themselves, in different ways, proven the phenomenon to be true, and they were refusing to take the easy road of saying: "Well, probably it's artifact," or "It's not real," or just shutting up about what they did. These were very conscientious, brave scientists, and they were standing out for the truth [see box]. They were threatened, they found it very uncomfortable in their campuses, these professors, to be pursuing cold fusion, because the scientific establishment had said it was merely a hoax, or it was bad science; it was called "pathological science."

First it got enormous headlines—oh, cold fusion is going to solve all our energy problems in two days—and then after about three weeks, it began getting a very bad press.

Gallagher: And this was why your magazine was among the very few that were even present at the conference?

White: Well, I wouldn't put it that way. I would say that the magazines that gave it a bad press, did it deliberately, because they just didn't like the idea of somebody going around the edges of approved procedures, and going out to the public as Fleischmann and Pons did in Utah, with a press conference, saying, "We have done this magnificent thing, that stands science on its head, and gives us a whole new perspective on what can be done"; and they just didn't like this, and they decided to teach a lesson to any scientist who wasn't going to go through established channels.

Now, it's ironic, because Fleischmann and Pons didn't really want to do the press conference, but they were forced to do it by the University of Utah, where Stanley Pons was the head of the Chemistry Department; and the university arranged the press conference, because they were afraid that, if they didn't, the magnificent experiment would be taken by other people. There were a lot of patent claims in this, because there's a mint of money, when it gets proven. The university had patent shares, because it was done on the campus, and they wanted to establish this thing very quickly, because they were afraid that the Department of Energy had circulated too much information about the experiment to other scientists and that other people would take the patent, and the university wouldn't get it.

So, they jumped the gun with a massive press conference. Fleischmann and Pons were a little worried about it, but they went along with it.

And then they were pilloried. It should be known that Martin Fleischmann is a fellow of the British Royal Society, which is a very prestigious thing to be. He was 65 then, and he was one of the famous scientists and chemists of his generation, and he was just *pilloried*. They called him a fraud. At one point, they were saying in Utah that there might be criminal charges raised against him, because the university collected $4 million to set up the National Cold Fusion Institute. They spent it mostly on overhead; then they tried to control Fleischmann and Pons, and tell them just what to do, and how they should develop their experiment, and so forth. And there was a lot of bad blood, because they brought in a lot of people from outside.

Fleischmann and Pons are two very old-fashioned-type scientists: They sit in their laboratory, they do their experiment, they have their ideas, and they're very independent.

In fact, chemists are wonderful. Physicists have to work in very big teams now, because the equipment is so expensive—if you're going to have a tokamak, it costs billions, you know. You can't be an independent person in most scientific experimenting today, certainly in physics. But in cold fusion, it's very cheap: It's a $10,000 experiment in its simplest form, and actually Stanley Pons had financed their work through his own private income (he had a cotton mill in the family, and so forth); and they were very independent. Most chemists are that way: They're very independent, sort of old-fashioned scientists.

Gallagher: Can you tell us what actually is going on in these electrolysis experiments?
White: You have a positive electrode made of platinum, which is a coil. Inside it you have a negative electrode, made of palladium. Now, both platinum and palladium look to the eye very similar to a gold wedding ring, not in color, but in composition: The difference is that hydrogen, or deuterium—which is hydrogen with an extra neutron in the nucleus, or a heavier hydrogen—they are absorbed readily into palladium; it just seems to suck out hydrogen or deuterium from the atmosphere and compact it in. So you can get 1,000 times more compressed hydrogen or deuterium in a bit of palladium than you would get free in the atmosphere. That gives you a kind of density. In the palladium, the hydrogen ceases to be an atom. The electrons separate from the nucleus, so you have protons—the single proton in the nucleus of the hydrogen, or the proton and the neutron in the nucleus of deuterium—and these nuclei can fuse together to form a new atom, or a different isotope of hydrogen. That's fusion.

Gallagher: You're saying not only that it *can* happen, but that it appears to *be* happening. What is the evidence? What made these experiments extraordinary in the first place?
White: When Pons and Fleischmann were experimenting with the hydrogen they noticed that they were getting a good deal more heat energy out of their electrolytic cell. They noticed that they were heating up the water. You have these two electrodes, and they're in water; they're in what's called heavy water, that is, water which is not made with hydrogen, H_2O, but with deuterium, D_2O, and with a bit of lithium, and there's a salt. And you have electrolysis occurring.

Now, the water was being heated up, way beyond what you could conceivably expect to be the case simply by an electrolysis experiment, where you get a certain amount of resistance heating.

Gallagher: So, apparently some large amount of heat was coming from a non-chemical process of some sort?
White: Yes. So, they said, "What could it be coming from?" Well, there must be something nuclear going on. It's very extraordinary: In chemistry, normally you get compounds interacting because the electrons outside of the nucleus bond together. That's a chemical reaction. Here, what was occurring was the bonding of the nuclei. And, of course, to *do* that, using simple chemistry—it's an extraordinary window of opportunity for us to solve all of our potential energy problems, and with a very clean energy source.

Gallagher: We all know that, after the first few weeks, all of the science magazines turned around and said that this really didn't happen, or can't be replicated by anybody else, or that none of the labs could make it happen, and so on. But what has actually happened? Your experience here is not simply from reading literature, but from talking to many of the people who are engaged in cold fusion experimentation.
White: Yes. In this experiment, Fleischmann and Pons would spend about three months on one experiment; so, they didn't get heat within a week, or two weeks, or three weeks. They had been working on this experiment for five years, before 1989. At the point that it became very clear to them that they had something very unique, they told the university, because they needed to get some more funding to do this thing on a more systematic scale. They had developed techniques for doing it; they had expertise.

They didn't know all the things that were making it work: For example, if you do it in a Pyrex glass cell, that favors the experiment; if you do it in a Teflon cell, which would seem to be much more clean, the experiment doesn't work as well at all, because from the Pyrex, you get silicon which coats the electrodes; and that's very beneficial for keeping the deuterium inside of the negative electrode, so that the concentration is maintained, and then the fusion can take place. Things like that.

Other people came on the scene, some of them not even chemists; they tried to do the experiment one week, two weeks, three weeks, and they didn't get anywhere. Many chemists, for example, a guy named Huggins, who is now heading a laboratory in the German state of Baden-Württemberg, which is one of the premier hydrogen laboratories in the world today, got high heat. He was at Stanford University at that time. John Bockris, at Texas A & M, another one of the most eminent chemists in the world, a teacher of Martin Fleischmann, not only got excess heat, but he produced tritium; in other words, he had a nuclear ash, and you could have only gotten tritium if nuclear fusion had taken place. And he got high tritium.

Then, in Stanford Research Institute, Michael McKubre's group has a systematic program. They have the only big program now going on in the United States. . . . He has done three years of experiments, and he has gotten up to 50% excess heat—in four instances he got bursts of three times as much power output as he put into the cell—and he's gotten them over protracted periods of time—weeks, and so forth. He has many, many, many experiments which document this; and it's probably, in some ways, the most rigorous work that's ever been done on this, because he uses, not an open cell, but a closed cell, and he has expert diagnostics.

Gallagher: So, this is the production of a large amount of excess heat from a simple electrolysis, but one in which there are special materials being used, and in which the deuterium and palladium are fusing, or packing each other in some way. Is there a range of results, where some are better than others? And how many places in the world has this been shown so far?

White: Well, the best results were Fleischmann and Pons, and they have sometimes gotten 15 times as much output as input, which is quite extraordinary. And they are able to get their cells to boil off; and they can get a cell to boil off under some kind of nuclear reaction which is taking place—some form of fusion reaction—and it will boil off in 11 minutes; where, if electrolysis had been going on with the same input of electricity and so forth, you would have expected it to take 40 minutes for that cell water to evaporate.

I've seen a film of that, and it went in 11 minutes, and that's very classy.

Now, there is someone in the United States, whose name I'm not able to use because he wants to make sure his results are repeatable, who's recently gotten a boiloff, which seems very exciting.

The next highest results were in Japan. You have a picture of Akito Takahashi there—

Gallagher: Here he is with a blown up photograph of *Time* magazine.

White: That's a very funny story. He's a very well known physicist who works in the area of neutron detection. He works for the IEAA and so forth in Japan. In 1989, he was supposed to be doing a program coordinated between the United States, Japan, and China, on neutron detection and corrosion studies, and Tiananmen Square occurred, and that program was suspended. (It's now started again.) He had the time then to check out the results from the Fleischmann-Pons experiment to see if any neutrons were emitted, which would have been another sign of a nuclear reaction taking place. If you look at this *Time* magazine cover, it says, "Fusion, Or Illusion" and shows Fleischmann and Pons, and on top it says "China's Angry Students."

Akito Takahashi was here last year on a tour, this is him at MIT showing a slide of this and explaining how he got into the work to this large audience at MIT.

He got 100% excess power in his experiment, using a plate of his design last winter. He got 70% excess heat over two months.

Gallagher: Where are the largest efforts going on?

White: In Japan, you had two things occurring.

You had Michael McKubre in the United States, and in Japan, Keiji Kunimatsu, and they're both chemists. Both of them had worked in 1976 in Martin Fleischmann's laboratory in Southampton on some very advanced electrochemical ex-

Japanese physicist Akito Takahashi, pointing to Time *magazine's cover story on cold fusion. When a project he was supposed to work on with the Chinese was postponed because of Tiananmen Square, he took advantage of the time to investigate the Fleischmann-Pons findings.*

periments, with him and Stanley Pons, and a group of people working there. So, when Fleischmann gave his announcement, both of them took it very seriously—Mike, who was in California, and Keiji, who in Japan. Keiji had just left a university position to go work with a firm—Aisin A.W., which makes transmission parts and is part of a conglomerate associated with Toyota. So when Keiji went to work at Aisin A.W., that was just when Pons made his announcement, he said, "Oh, I've just done the wrong thing"—he was going to work on fuel cells, and he was terribly depressed, because he thought he couldn't do the experiment.

But he told his boss, Mr. Moroto—someone I met, a wonderful person, who's an engineer who is the chairman of the company, but is an engineer by profession. He was very excited by it, and he went up the ladder to the honorary chairman of the group Mr. Minoru Toyoda, who just died. . . . He was very, very excited about this.

Keiji briefed him on Fleischmann and Pons and the experiment, and he said, "Well, we've got to do what we can to support this effort." He gave Keiji the ability to work on cold fusion. He set him up to do it, and he invited Fleischmann to give a speech to a group of people in Japan. . . . He went and spoke; he met with Mr. Toyoda, and they became friendly, and when things became very bad at the National Cold Fusion Institute in Utah, Fleischmann asked if he could get some support. Mr. Toyoda offered him and Pons a chance to work in France, and set up a laboratory where they could just work, and do what they wanted. That's really what has saved cold fusion.

Gallagher: So, you're saying the pioneers were almost driven out of this country by the scandalization?
White: It was such an unpleasant environment.

The Japanese gave them a place to work in France, in a laboratory in Nice, and at the same time, they sponsored Keiji Kunimatsu—Fleischmann's former student—to replicate the experiments which he did in Japan, and he did his own version of them with a unique fuel cell anode.

In the universities program, you had another input from Hideo Ikegami, who coordinated the universities program independently of the Toyodas. He's a plasma physicist, which is really unique, because in this country the hot fusion scientists really dismissed cold fusion.

There are, by the way, many reasons why scientists don't believe in the reality they see before their eyes. It's because a cold fusion reaction would seem to be very improbable by the theory which guides current physics today. First of all, it would seem improbable that even at the concentrations that are achieved, you would get a fusion reaction, and overcome the Coulomb barrier, the repulsion between like-charged nuclei. Secondly, from the reaction, while you get a lot of heat, you don't get the nuclear ash that you would expect; you don't get the production in sufficient quantity of either tritium, the heaviest isotope of hydrogen, or the next highest element, helium; and we haven't identified enough so far to account for the heat. Also, the balance between the production of the helium-3 and the tritium is not one to one, as in a hot fusion reaction, but it's very unbalanced; it's 100,000 or a million to 1 in favor of the tritium, depending on the experiment.

Fusion in the solid state, or whatever nuclear reaction is occurring in the solid state, is a new kind of nuclear reaction. It needs new theory. Most of these physicists were unwilling to look that straight in the eye, and Hideo Ikegami's a different kind of guy. He saw the challenge as extraordinary and something that he thought the Japanese should immerse themselves in, for the reason that it was a scientific challenge, and he's very eager for the Japanese to go into fundamental scientific experimental work, not just technological development.

So, he was an adviser to the ministry that coordinates university science programs, which is called the Ministry of Education, but it's the university science program. Instead of simply coordinating hot fusion work for them, he also took some of the money and he got a group together, with people like Takahashi, and they worked on cold fusion. That was a parallel effort.

Things came together, where Ikegami and the Toyodas, of course, got together, and you've got a very strong group of people. Then they began to organize a climate in Japan amongst the broader scientific community and industrial community, and now the Ministry of International Trade and Industry (MITI) is supporting this effort to the tune of $30 billion over four years, with industry contributions added to this. It's going to be a very, very big program there, and very impressive.

Gallagher: You recently visited Japan and met with some of the people doing these experiments there. Here's a photograph of you with Dr. Takahashi [not shown here].
White: I went to a conference last January in Japan, but then my husband and I went back to Japan in April. I visited Dr. Takahashi's laboratory, and was able to look at some of his results. This was a repeat of his classic experiment, where he got the 100% heat, and, on one occasion, he also got boiloff. Here he's getting about 20-30% excess heat, in the second run of the experiment, which is still very impressive.

Gallagher: And now, we evidently have labs in the United States which are re-doing the experiments that have been done in Japan.
White: Yes. Takahashi did a tour of the United States, and Tanaka Metals Co. has provided free palladium for all the scientists in Japan who want to work on this; and they offered the same thing to American researchers, so they could all work on the same palladium and repeat the Takahashi experiment. The importance of this is that the quality of the palladium makes a very big difference in whether the experiment succeeds or not: If it's too cracked, then the hydrogen drifts

out, and you don't get an activation center and you don't get the cold fusion occurring. So, there are many problems in controlling the quality of the material.

Ed Storms, who works at Los Alamos, repeated Takahashi's experiment and he got 20-30% excess heat. There are some other people, who have also repeated the experiment, but again, they want to publish, they want to be peer reviewed, they don't want to go through being pilloried as Fleischmann and Pons have been; so they want to get peer review before they release their experiment to the public, but there have been several.

In Japan, there have been repeats, and there have been at least two or three—John Bockris (I think he wouldn't mind my talking about him) has gotten 18% excess heat. Another experimenter got that in Italy. Francesco Celani got 10% excess heat in an experiment that he did.

Gallagher: So, in other words, this supposedly impossible experiment has, in fact, been replicated scores of times, by large numbers of groups of scientists in various places.

White: Oh, yes. And then, in Russia, they've done different kind of experiments, but they have shown similar solid state fusion taking place, and producing different kinds of particles as a result. They have one experiment with tungsten and bronze, which is very exciting, where they load it, and all kinds of similar but different experiments have also been going on. In China, they've done experiments showing neutron emissions and helium-4.

But in Japan they have had several people who have gotten excess heat—but not all with the Takahashi configuration. People are doing their own experiments and broadening the field.

Gallagher: Here you are with another scientist [not shown here]. Who is that?

White: This is Dr. Okomoto. He was a co-chairman with Ikegami, whose picture you saw before, as co-chairman of the Third International Conference on Cold Fusion, which was held in October in Nagoya, Japan.

Gallagher: What was the change between the second conference, the one in Como, and the third conference in Nagoya?

White: Enemies used to say the second conference was the "true believers," because it had this wonderful quality of people who got together, and said, "We're standing up for the truth against anything"; and there was a kind of solid support for Fleischmann and Pons.

We had an interview here with Hideo Ikegami; it was an interview that Ikegami did in a magazine in Japan called *Aera*, and they interviewed me, too, and some other people in the United States—Gene Mallove, and so forth. All of us independently had the same idea, in a sense—I guess, because we all knew each other—but I said that the cold fusion scientists were like a resistance army in the French *maquis* in the Second World War. And Ikegami said, well, it's like the hidden Christians; in Japan in the 17th century, Christianity was outlawed, and many people practiced it, but they had to do it secretly, and they were the hidden Christians. And he says the cold fusion community is like the hidden Christians.

Gallagher: Were there not cases where scientists in this field actually hid the fact that they were working on cold fusion?

White: Oh, yeah! Well, they had to, or they would lose their jobs.

So the second conference was rather like the hidden Christians, or the underground, coming together, and people who were just brave enough to come out and say, "We're going to keep the flag waving."

But the third conference was different, because by then it had been established. And really, the interest of the third conference was the direction of this now, to not prove it, but to establish the scientific parameters: Why is it working? What happens in the surface of the palladium? What are quantum reactions? What is the loading? What is the science of this? And it's a much more broad-based, serious scientific effort that's going on now. And, of course, there were very exciting, odd things that occurred. There are people who say they can get it, not with heavy water, but with light water, using nickel.

Gallagher: Have the establishment magazines and so forth stopped denying that cold fusion results occur? Or are you saying that any competent scientist now looking at this can say, "It's been confirmed."

White: The hegemonic view is still that it's not confirmed, but there's a lot of disquiet, because the Japanese have put so much resource into it. So, you've got the *New York Times*, which covered it in their science review, and they said, "Well, y'know, the Japanese are doing it. Hmm." Or the *Wall Street Journal* covered it, and said, "Hmm." And there was a spread in the *Financial Times* in England, in which they said, we think that England and America missed the boat. So, there's beginning to be real nervousness, which is being covered in the following way: They're saying, "Well look, the Japanese are energy-short. They will take a flyer and go for a risk, where the United States and Britain don't feel that need, that pressure, to do it." So, they're saying that the Japanese have taken a real risky chance, but *maybe* something is there.

So, there's going to have to be a shift. But what's happened now is a kind of an opening up; *Business Week* has written articles which are raising the possibility that this is true. There have been brief notices in *Nature* magazine, but no serious coverage as of yet in either *Nature* or *Science*.

Another thing that occurred was that *Scientific American* in Japan covered Takahashi's results honestly in their local

Japanese edition. And in their local Japanese page, they gave a big spread last spring to Takahashi. In the United States, in the English-language edition, it did not appear.

Gallagher: If these experiments are further developed, what are the technological possibilities?
White: Fleischmann and Pons are getting power densities of about 4 kilowatts (kW) per cm^3, which is on the same level as the breeder nuclear reactor. They're doing it for less than a half-hour; they don't have a prolonged burn. But the advantage of the cold fusion reaction appears that you get very little contamination, you get much, much more heat than neutron flux or tritium, which is what you want, because you don't want the tritium and you don't want the neutrons. The same things that make it a terrific scientific puzzle—why don't you get the radioactive contaminants?—is really a very big plus from the point of view of a realizable technology. So, they believe that they could make some form of boiler out of this, and therefore, that you could have small generators; and you could have localized power generation possibly. They see that as a potentially feasible thing in three, five, or ten years, that you would get some demonstration capability like that.

It's possible that it could also be used for desalination, but we haven't established that. It's simply the hope, that we would have this very controllable, very inexpensive generator; and you could have relative decentralization of your generation, so that you wouldn't have to have the overhead of the power-transmitting lines—you wouldn't have to transmit over such huge areas. Obviously, if we could do it, we could begin to use fusion power technologically for generation.

And, of course, if we can establish what's going on, then who knows what we could do? You don't really want to boil water and run a turbine to generate electricity; it would be much better if you could get positive and negative currents generated from the cells, so that you could capture it, and make your energy directly. But, whether that's a possibility, we're nowhere near that at this point.

But, you're just at the very beginning of a whole new branch of science, and we don't know what that's going to tell us. We don't know what it'll tell us about materials, and maybe many different things will come from it that we don't even consider today, just as with lasers or transistors, or any other new, unfolding branch.

Let me say that the implications of cold fusion are much bigger than superconducting, even high-temperature superconducting, or transistors, or semiconductors. If we can't unleash the energy of the nucleus in this safe way—

Gallagher: Such an easy way—
White: It's enormous. It's an enormous potential. Therefore, it's worth whatever the risk to see what's happening.

And if it turns out that this is some unique chemistry, or unique electronic effect that no one had known before, but not nuclear fusion, it's still going to be a tremendous discovery.

Gallagher: That brings up another question. Do the experimenters that you have interviewed and talked with and so forth, the public knows the name "cold fusion," but do they consider that they understand that this is fusion? Or are they still open to other explanations?
White: Well, there are many people with many different explanations: Some people feel that neutrons are travelling from the deuterium into the palladium, or into the lithium, and that you have a neutron transfer reaction, which is not a real fusion, but is a nuclear reaction.

There is undoubtedly an interaction between the lattice structure of the metal, the crystal lattice structure and its vibrations, and the implanted deuterium atoms.

Gallagher: Can you explain? You have a metal lattice and its vibrations. What metal are you talking about?
White: Palladium.

Every metal has a structure; it's a solid, and that solid structure vibrates and has a kind of vibrational motion. There are many theories that suggest that that creates a climate favorable to allow fusion to take place, even though you would not normally think that it could occur.

Gallagher: It's vibrating under conditions where it is the negative pole?

Cold fusion, courage, and a passion for truth

In September 1992, 21st Century *editor Carol White interviewed Martin Fleischmann and Giuliano Preparata in southern France. The following is excerpted from that interview in the Winter 1992 issue of* 21st Century.

Fleischmann . . . remarked rather wryly on the moral predicament that his and Stanley Pons's discovery of this extraordinary phenomenon had created for them. "If this had just been some normal science and I had so much flak thrown at me, I might well have given it up," he said. "It just was not worthwhile to take that amount of abuse. But this is not a normal piece of science. If it turns out to be useful, it will be of such consequence that it cannot be regarded as normal science. Therefore, it brings in its train the antagonism, and the political element, and all of the other factors that have so bedeviled us. But Stan Pons and I decided that we could not back down, that to do so would be irresponsible."

Preparata interrupted to underscore the importance of courage to a scientist—to be willing to stand up for the

White: Well, no. Inside the palladium, which is the negative electrode, is where you would be getting some kind of an oscillation, which would encourage the possibility of the deuterium to be accelerated and fused together; so, you get some form of collective interaction of the host metal, the palladium, which creates electron clouds and somehow accelerates these nuclei of hydrogen, the deuterium nuclei, in such a way that they can come together and mesh. Or maybe, they're in clusters and they come together in some geometrical way to actually have a nuclear interaction.

But what that nuclear interaction is, is a very big question, and there are many different theories of that.

Gallagher: You are talking about a context in which deuterium—this is a gas—is getting inside a metal—palladium—and apparently a great deal of the deuterium is getting inside the metal. Is that unique? In other words, the absorption of a large amount of gas into a metal, is this a field of chemistry? Is this unique to these materials? Or is this something these people were working on before that?

White: People were working on the absorption of deuterium in palladium, for example, to build detectors for nuclear reactors. Also, palladium can simply be used to store hydrogen. Working with deuterium in palladium is something that people have done for other reasons; it wasn't something unique to the experiment. The study of hydrogen and its flow in palladium has gone on since the 1920s, and there are many people who worked on that: Paneth, Alfred Coen in Germany, and there have been many studies of that.

Gallagher: And is it this which makes the cold fusion occur? this packing of the deuterium inside this? is this what leads to excess heat, and so forth?

White: I believe so. I believe that what actually occurs is that, in the surface of the palladium is where the activity happens, or at least, where a lot of the activity goes on in a surface layer, or near-surface layer, where you get very dense concentrations. And it's in these dense concentrations that the initial fusion is, at least, or the initial nuclear reactions, take place. Then, you may have diffusion into the center of the volume of the palladium, or—it's not really clear what's occurring.

Gallagher: There have been reports of explosions of one or two of these experiments. Are they characterized by very rapidly increasing amounts of energy and heat?

White: There was one. You're talking about the explosion that killed Dr. Andrew Riley on Jan. 2, at SRI last year. But it was not a mini-bomb explosion. Possibly, you got a lot of excess heat from fusion taking place, but the explosion

---

truth no matter what the opposition. He pointed to the situation of Pons, who had been the chairman of the Chemistry Department at the University of Utah, but had his tenure removed after the attacks on him and Fleischmann from the press and the majority of the scientific community.

Laughing, Fleischmann responded: "Yes, that is perfectly true that Stan and I were courageous, but I did have the good sense to make the announcement about cold fusion after I had retired. I had no illusions about the kind of attack we would face. Stanley Pons and I discussed the kind of problems that could emerge, and I asked him, 'Stan, are you really sure at this stage in your career that you can take this on, because it is going to be bad,' and he said, 'yes.' "

Fleischmann described Stanley Pons as a man of absolute integrity, willing to pursue and fight for the truth at all costs. . . .

Preparata emphasized in this regard that the approach that he and Fleischmann were adopting was, in fact, the Platonic method of hypothesis. One must have the courage to ask "why?" not just "how?" For Aristotle and his followers, it was enough to ask how.

Fleischmann agreed, pointing out that this method, posing "how" rather than "why," always leads to a complicated patchwork in which an incorrect theory is "fixed up" rather than discarded and replaced by a more truthful, more comprehensive theory. He stated, "In the end you always have to go back to Plato, and really this is how science most efficiently answers the question of 'how,' by understanding 'why.' The universe is governed by reason and simplicity. If we think it is complicated, almost certainly we are wrong.". . .

In other words, the question of "why or what if" leads in the final analysis to the most fundamental questions of the creation, the possibility of the very existence of the universe as we know it. If it were not for constants such as the fine structure constant and the speed of light, then our universe would not exist.

For Preparata, this is a question of God's generosity to man in allowing man to understand how reason governs nature. "It is an act of generosity toward man," he said, "to make him understand. I am a religious person and according to my metaphysics, the ability to understand nature is a great gift to us."

Fleischmann concurred. . . . "I believe that the moral sense must be ingrown. . . . It has to be in there. I see it as a total part of the universe. In this it is like a scientific idea. The universe is there for us to discover, and the moral principles are there for us to discover. . . .'

occurred, because it was a closed cell, and the pressure wasn't vented, and it went up too rapidly. The recombiner, which is ground platinum and carbon, which allows the recombination of hydrogen and oxygen to be going on all the time, had stopped working; so, what you got, is an explosive combination of hydrogen and oxygen, and an explosion of hydrogen-oxygen recombination shattered the cell and a piece of shrapnel penetrated his forehead and he died.

Gallagher: But you are talking about a lot of heat being produced in these simple table top experiments. You said it was comparable to the density of energy in a breeder reactor.
White: Yes, but the electrodes used are very small—maybe one one-hundredth of a cubic inch or less. Fleischmann and Pons get that; no one else does. They get much less. The boiloff that I was talking about with the breeder densities, they were getting 600% more heat output than the energy input into the electrolysis cell. In SRI, they get, maybe, 20% output compared to the input. Twenty percent is 20%—that's non-chemical output heat, but it's not on the scale that Pons and Fleischmann get.

We know why. We have many reasons why we think that's the case. McKubre at SRI was testing to see how he could get the loading most effectively, and get repeatability of the experiment; so, he was not striving for the high heats, but repeatability under certain parameters which he could identify.

What he identified was that, if you added aluminum to the cell, that would work to create a surface that held the deuterium concentrated into the palladium and enhance the reaction. So he was doing a great deal of experimental work with what they call the "loading" of the hydrogen or the deuterium into the palladium. It was not an explosion of the sort that Fleischmann and Pons would worry about, when they do their experiment.

Gallagher: This is, then, like other fundamentally new fields, where a large number of experiments of many different kinds have to be done in order to surround the problem.
White: Absolutely.

Gallagher: Among these people who are doing the experiments, have they begun to agree at all on theory?
White: No.

Gallagher: What are the leading ideas, or who are people, other than the experimenters, who are trying to come up with a totally new physical hypotheses?
White: There is Giuliano Preparata, who writes a good deal for our magazine. He's an Italian, a professor in Italy. He's a particle physicist, very well known in his field. He believes that a kind of lasing takes place, only that you don't need a population inversion, as you do in a normal laser—that is, you don't have to excite the electrons and then have them release simultaneously or sequentially, but that you get a kind of lasing effect, which he calls "superradiance," in the palladium. It is that superradiant effect, which is caused by very small electromagnetic radiation fields, which is actually creating the conditions for cold fusion to occur.

Gallagher: In other words, like a laser which does not require a great amount of energy to get it going.
White: Right. He has worked to develop a theory with Martin Fleischmann. In our December 1992 issue of the magazine, we have an interview with him and Martin Fleischmann about how they think that cold fusion is going to actually transform the whole way people look at quantum physics; that what you have to do is look for this kind of collective activation which gives you energy enhancement. This is like a second field theory, second quantization. They take off from the work off from the work of Richard Feynman, and they are trying to develop their own theory on that.

Gallagher: What do you think is going to happen next in the experiments in this field?
White: I think that there's going to be a lot of work in exploring what's going on in the solid state, that it's going to go back into solid state physics, and there's going to be a great deal of diagnostic work, and they're going to try to find out how plasmas inside solids actually behave. It's just going to open up a whole new field of research. In that way, it's very exciting.

Gallagher: You're talking about the deuterium gas inside the solid palladium?
White: Yes, but you don't think of it really as a gas—in that sense, it's not a gas. It's really a plasma inside a solid. So it's not a gas: A gas outside in the atmosphere does not have coherent behavior in the same way, although I do believe in plasmas you do develop coherent geometries. But, that's the essential quality of something that happens in the solid state, that it's impacted together; and you have to get collective activation.

Gallagher: At the same time, are they going to try some kind of technological demonstration in the future?
White: Well, Martin Fleischmann says that he sees nothing that stops them yet. He's hoping to do that, and he sees nothing in his way.

I would like to mention one thing: This is a picture [not shown here] of Eiichi Yamaguchi in Japan, he works for Nippon Telegraph and Telephone, and behind him is Professor Tsarev from Russia, who coordinates the program in the former Soviet Union.

Yamaguchi loaded an actual deuterium gas and a palladium plate, and he was able to get helium-4 from it, which is a stunning confirmation that a nuclear reaction took place.

That was the big news at this conference in Nagoya. He is a solid state physicist, and I think it's a very definitive experiment that he did, because he was able to get this helium-4, which may be the secret that accounts for the excess heat or one of the secrets as to why we're getting the excess heat, and we couldn't measure it before, because helium-4 is very hard to measure.

Gallagher: Other than the fact that there is not a theory to explain what's going on, what else do you think accounts for the extraordinary resistance—one would almost say, downright insistence that this was a fraud, in 1990-91?

White: I think that, from the days when President Kennedy said we Americans were going to put a man on the Moon, and the whole country was mobilized in that effort, we have gotten to a position in which there is a priesthood who control science, who are scrambling to get any money to continue their researches. And this priesthood has become sort of embattled, and they're seeing only the maintenance of their position, that they can work as scientists in any way, in a very hostile environment.

And the general public has become against science; they have become yuppies and they want immediate gratification, and you've got the idea of pleasure being primary—the "Dallas" mentality—in place of a culture in which people believe that life is about working and accomplishing something, and building for the future. From when we had a work ethic in this country and a sense of pride in science and accomplishment, you have a general population—now suffering an economic depression, so they're getting kind of enraged—but who believe their birthright is pleasure and not accomplishment.

You have children being raised in the most pessimistic way possible to believe that man is the enemy of the planet, and science is the enemy of life.

I *totally* reject that. I think all true scientists reject that, because they see what could be more beautiful for man than to understand the creation, to understand the universe, to understand the earth, to make it more beautiful; to provide, in a beautiful, safe, non-polluted way—as cold fusion can, perhaps, do—enough energy, enough resources to support all children to become whatever they want to be; and so that you don't have starvation in Africa, or war and the kind of horror that we're seeing all around the globe.

I think people are getting pessimistic, and they're getting narrow in their vision, and they've lost *hope;* and therefore, it has been easy to organize a climate against this magnificent discovery. And instead of saying, even if proved wrong in the end, it was *absolutely* worth the effort. I believe it's a monument to the human spirit that this has been done.

Americans are always saying, "Japan: They stole this, they did that," but in Japan, you had some people with extraordinary vision—Mr. Toyoda. He said in a beautiful speech [see *EIR*, Dec. 11, 1992, p. 20], that Toyota was a business, but he saw that he wanted to end his life giving something to all of humanity, and that's why he backed Fleischmann and Pons. He saw cold fusion as a gift that he could make to all humanity.

Fleischmann and Pons *knew* they'd be pilloried, because they were saying something so extraordinary, but Fleischmann said, "I couldn't not do it. It was too important. I knew I was going to take it on the chin, but I had to do it."

Gallagher: And Mr. Toyoda was the one who came to their rescue.

White: He came to their rescue and supported the effort. He just died in December: I think he was a wonderful, wonderful man.

Hideo Ikegami, Kukujiro Namba, who is the president of Technova, which was the corporation that is actually sponsoring Fleischmann and Pons. These are people with great vision—Ed Storms, who's working against opposition in Los Alamos; Mike McKubre; John Bockris. I mean, each of these are individuals whom our grandchildren, our great-grandchildren will remember with great pride and will wonder what kind of a nation we were, and what happened to us, that these people weren't being celebrated, but were being castigated.

Gallagher: What is *21st Century* doing next in this field?

White: I'm going to write up the implications of all the experiments from the point of view of where it's going to go in solid state physics, and where I think the direction of the work over the next year will be in our April issue. . . . We cover a broad array of science—biology and we're on the scientific frontiers in many areas.

Gallagher: Your objective with the magazine, by bringing together these scientists in print and getting their work out, is to get this breakthrough made in theory as well as in science, which obviously has to be made.

White: Well, I think my efforts are modest in sharing information, insofar as I can help in the organization of the international effort; but, my main hope is to create for people in the United States, Europe, and Japan who read our magazine, a renewed excitement, so that they can follow this.

It's a spiritual adventure! You're doing something that's totally new, totally against what people would have expected from the point of view of existing theory; it's unknown; it's risky; it's tremendously exciting; and we have the chance of watching it day by day. It's as if you were there in Einstein's brain when he was thinking about special relativity: It's a tremendous, great moment! And we have the chance to have a window on it, because we know all these people.

I think if Americans, if Europeans, if everybody immersed themselves in this, then we would see a transformation in their attitude about what we can do, what we accomplish, what we can build. I believe in optimism.