'Cold fusion' is still generating plenty of heat

Nuclear engineer Ramtanu Maitra toured the U.S. labs, which are producing remarkable results. Maitra and Carol White tell what the 'science mafia' has blacked out.

If we were to be guided by the popular press or the hegemonic science journals, then it would seem like the excitement over the potentials of the Fleischmann-Pons cold fusion experiments was another flash in the pan, or just the product of media hype. However, as Maitra has learned from a tour through some U.S. research laboratories, this is far from the case.

The truth is that cold fusion research is still producing extremely exciting results, regardless of the decrees to the contrary from the science mafia, led by *Nature* magazine editor John Maddox and the gurus of the American Physical Society. They declared that the appearance of fusion taking place at room temperature must be an artifact of measurement errors; they are not interested in reviewing ongoing work which disproves their thesis.

The Japan story

This is not the case in Japan, where, to the contrary, there is top-level sponsorship for the research. Fortunately, cold fusion experiments do not require large infusions of money, even if they are in fact not the simple matter implied by University of Utah electrochemists Martin Fleischmann and Stanley Pons, who first announced their discovery on March 23. As the following report will make clear, cold fusion—whatever it really is—is here to stay. It may well be the case that power applications of the process will not be a reality in the near future, but the scientific implications of even the findings to date are so enormous, that there is no question but that the fallout from them will be equally great, however they are applied.

A Japanese symposium held on July 31 was not widely reported internationally; nonetheless the results reported were extremely exciting. Ten research teams announced results which included findings of tritium and excess neutrons and heat in their experiments. The conference, held in Tokyo and sponsored by the Electrochemical Society, found the deuterium-deuterium reaction to be definitely similar to that found in thermonuclear fusion.

Successful replications of the Fleischmann-Pons results had been found at the University of Tohoku, the University of Hokkaido, Aoyama-Gakuin University, and by a joint group from Tokyo University of Agriculture and Technology and the Japan Atomic Energy Research Institute.

This reversed a previous statement by the last group which had said that they found "no clear evidence" of tritium; now they announced that they had found both tritium and a vast amount of heat.

Previously the same doubts expressed in the United States and Western Europe had prevailed in Japan, but the results described in presentations at this symposium changed the situation. The earlier atmosphere of skepticism was such that when two researchers at the University of Hokkaido announced June 2 that they had succeeded in creating cold fusion, they did so with hesitation. Tadahiko Mizuno and Tadashi Akimoto, both assistant professors in the department of engineering, commented that they had not intended to conclude that cold fusion had taken place in their experiment. Such trepidation is now a thing of the past in Japan.

The Institute of Fusion Science announced on Aug. 1 that it has decided to begin joint research on cold fusion by assem-

bling three topical groups, involving 80 scientists from 25 institutes, colleges, and universities. The three groups are: 1) a group to detect neutrons in detail; 2) a chemistry group to find the most appropriate conditions in deuterium electrolysis; and 3) a physics group to conduct theoretical research on the reaction mechanism. The private sector is also involved in the research, although this is not being featured in public reports by the institute.

A variety of experiments

In the area of neutron production, Hokkaido researchers Mizuno and Akimoto constructed their experiment in a physics laboratory 5 meters underground, surrounded by a thick concrete wall, and separated from the outside by three sets of doors. They began their electrolysis experiment in late March, using palladium and platinum immersed in a solution of heavy water (D_2O) and lithium-deuteroxide (LiOD). The underground experiment lasted about 18 days. Neutrons were measured at 10 times above background on average, and 20 times above background (1,140 neutrons per hour) at peak. Mizuno said the experiment was a preliminary test to confirm the basic principle of cold fusion, and that now they have to accumulate more data.

At the University of Osaka, Akito Takahashi and his colleagues at the Department of Engineering announced July 30 that they had detected neutrons which they thought were produced by their cold fusion experiment. The number of neutrons detected was greater than that observed in nature and two to four times greater than what was reported in the experimental data from Stephen Jones at Brigham Young University in Utah. The Osaka electrolysis experiment, using a palladium electrode dipped in heavy water and lithium sulfate (1 mol/liter), lasted for about a week each time and was repeated five times. The researchers tried to detect neutrons at two different energy levels—fast neutrons and thermal neutrons. What they found was that the energy of fast neutrons was 2.4 million electron-volts (MeV), the same level as those of neutrons produced in deuterium-deuterium fusion reactions. The observed data of the fast neutrons and the thermal neutrons were consistent, and both levels were greater than the normal background level. Takahashi said they switched the electric current between 0.8 amps and 0.4 amps every 2.25 minutes. As a result, deuterium that is going out of the electrode in the current-drop phase tends to meet deuterium that is coming in. The deuterium atoms thus come close to each other, increasing the possibility of fusion reactions.

At the Bhabha Atomic Research Center in Trombay, India, one of the largest nuclear research centers in the world, the Fleischmann-Pons experiment was earlier confirmed. Dr. R. Chidambaram's physics group, equipped with a laboratory and staffed with scientists as good as the best in the world, observed neutron generation. "We have surely seen neutrons here, and some cold fusion is certainly going on," said Dr. Chidambaram, a renowned physicist. "The process seems to depend on so many poorly understood parameters—it is not a straightforward experiment. . . . If the process was simple and straightforward, we should have struck gold by now. We haven't. On the contrary, we are still trying to find out the basic parameters of the experiment. . . . But like ceramic superconductors, we may be onto something that may be a long way from practical use."

At the Tata Institute of Fundamental Research (TIFR) in Bombay, India, the cold fusion experimenters recorded a phenomenal temperature rise of 1° centigrade per minute. Dr. K.S.V. Santharam, head of the chemical physics department, said: "We detected the presence of neutrons and gamma rays at a level above that of normal background radiation. I estimated about 2 in every 50,000 deuterium atoms were fusing."

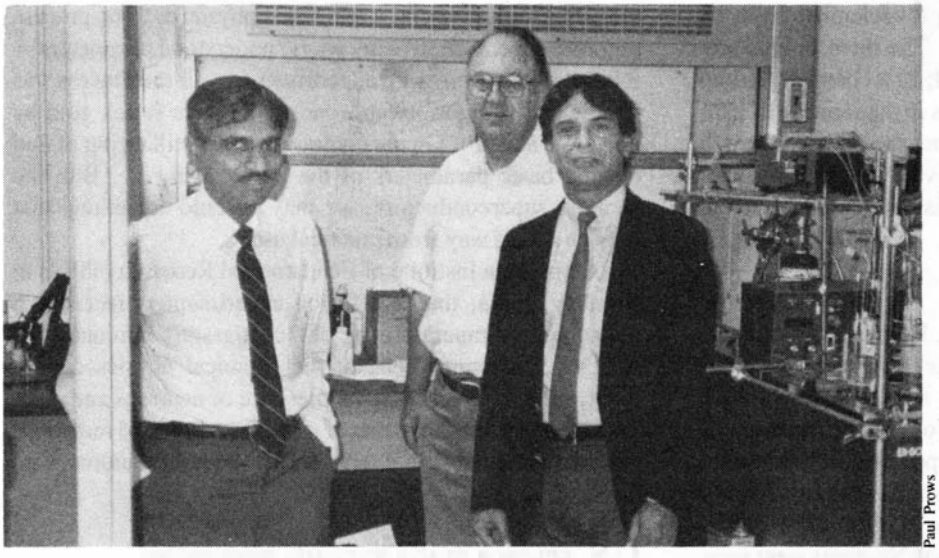
U.S. science mafia spreads pessimism

One can sympathize with the agitation of fusion scientists working on conventional experiments in thermonuclear fusion which are withering on the vine for lack of funding. As the Sept. 15 issue of *EIR* reported, they quite rightly fear for their very scientific lives. Not so those scientists at the large, prestigious laboratories who, without serious justification, have from the beginning pooh-poohed all experimental findings which went against their prejudices.

Besides demanding the proof, proof, and more proof that experimental findings were not errors of measurement, they demanded that these proofs be presented in record time. The charge was led by scientists from the Massachusetts Institute of Technology, Yale University, and California Institute of Technology, among others, where well-known experimentalists, using the latest diagnostic equipment, failed to duplicate what Fleischmann and Pons had done in a modest laboratory at the University of Utah. These well-heeled scientists reported failure to observe a significant amount of heat or generation of neutrons at a level which could justify calling the process fusion.

There are ample reasons why the experiment cannot be easily duplicated, and as Prof. Robert Huggins at Stanford University in California has explained, it's actually a difficult experiment. But the science establishment has been more interested in trying to spread skepticism about whatever experimental results the different groups working on cold fusion have already validated, rather than perfecting their own experiments.

It is not merely cold fusion which has generated exceptional heat: The discussion process about the experiments has unleashed a series of irrational statements from many prominent scientists. Some, like Dr. Moshe Gai of Yale University, took recourse to suppressing facts to justify their abrupt conclusions. Dr. Gai, whose experiment was published in *Nature* (Vol. 340) July 6, 1989, said categorically that "no statistically significant deviation from the background was



Paul Prows

Ramtanu Maitra (right), editor of Fusion Asia *magazine, visits the University of Utah Metallurgy Laboratory. Dr. Sivaraman Guruswamy (left) and Dr. Milton Wadsworth (center) have confirmed the surplus heat energy generation from cold fusion as reported by Drs. Fleischmann and Pons.*

observed in either gamma ray or neutron detectors." Yet, at least one scientist who knew what was going on with Dr. Gai's experiment has reported, through private communications, that Dr. Gai did observe neutron bursts, but chose to suppress this in his report.

Whether Dr. Moshe Gai was acting instinctively as an "establishment scientist" or was merely trying to publish his paper in a journal which does not want to publish anything positive about cold fusion experiments, is another question.

What, however, is clear is that *Nature,* like Dr. Gai, has few kind words to say about cold fusion. John Maddox, *Nature*'s editor, in the same July 6 issue, cited various experiments, including Dr. Gai's, to muster his own conclusion that "it seems the time has come to dismiss cold fusion as an illusion." The Yale group, Maddox stated, "has done its best to replicate the conditions of the original experiments, but has failed to replicate their results." The whole thing, Maddox declared, seems to have been "a brave leap of the imagination." The role of detractor is obviously a sympathetic one for Maddox, who last year tried to destroy the reputation of French biology researcher Jacques Benveniste, by similarly suppressing uncomfortable information.

New findings, new facts

At the University of Utah where the cold fusion findings were first announced, optimism runs high. In spite of the Energy Research Advisory Board's draft interim report, which most consider premature, stating that the evidence of cold fusion is unconvincing and, therefore, "no special programs to establish cold fusion research centers or to support new efforts to find cold fusion are justified at the present time," the state of Utah has allocated seed money of $5 million to set up a cold fusion research center at the University of Utah Research Park in Salt Lake City. The work of the center, as Dr. Hugo Rossi pointed out, is to replicate and validate the Fleischmann-Pons experiment and to work on the theoretical physics in order to explain the phenomenon. Dr. Rossi clearly stated that these are the present objectives and after these are achieved, things will continue from there.

At the Metallurgical Laboratory at the University of Utah, Dr. Milton Wadsworth and Dr. Sivaraman Guruswamy, perplexed by the assertive negativism of the establishment scientists, have noticed a significant amount of heat energy generation from palladium cells bathed in deuterium hydroxide. In certain cells they have witnessed energy bursts, in the form of sharp spikes, generating at least 1 million joules of energy at their peak.

One interesting result from this work is their discovery that the energy generation does not occur steadily. From the point of view of developing a new mode of power generation, this is obviously problematical, but scientifically it is of great interest.

In some experiments, Utah found sharp pulses, but the heat bursts were noticed only once over a seven- or eight-week period in these cells. More intriguing, perhaps, is the finding of the Wadsworth-Guruswamy team that 99.295% pure palladium rods function as better heat generators than the 99.5% pure palladium cathodes. This issue of materials, which both Dr. Wadsworth and Dr. Guruswamy are looking into, they have found to be excruciatingly puzzling. Nonetheless, there is no question that they have witnessed surplus heat energy generation from the Fleischmann-Pons set-up.

Findings at Texas A&M

At Texas A&M in College Station, Texas, the experimental findings are expected to exert a lot of pressure on the skeptics. The earlier work in this university by the Center for Electrochemical Systems and Hydrogen Research and the Department of Chemistry, presented at the Workshop on the Cold Fusion Phenomenon at Santa Fe, New Mexico, just two

months after Fleischmann and Pons had made their startling findings, indicated observation of excess heat generation. The electrolyte, which was a D_2O-LiOD solution, later showed the presence of tritium. The findings, which were significant to those working in this area, however, failed to make much impact on those who refused to believe.

Later, a team in the Department of Chemistry and the Cyclotron Institute at Texas A&M carried out an experiment using palladium electrode bathed in D_2O-LiOD (0.1 mol/liter). The objective was to generate tritium—the heaviest known isotope of hydrogen, which contains two neutrons and one proton in its nucleus—which does not exist in nature and is formed when the lithium present in the LiOD captures a free neutron released through nuclear reactions. The result turned out to be a stunner. The tritium produced during the experiments in 11 electrolysis cells under observation was 100 to 100,000 times more than that expected from the normal isotropic enrichment of electrolysis. The Texas researchers have sent their samples to such noted and established laboratories as Battelle, Argonne, Los Alamos, and General Motors. These laboratories came up with a tritium count that was no different from what the Texas researchers had found.

Looking at physics afresh at Brigham Young

At Brigham Young University in Provo, Utah, Dr. E. Paul Palmer, who worked with Dr. Stephen E. Jones on the low-level generation of neutrons with the Fleischmann-Pons set-up, is convinced that "something is surely happening" which physics must explain. Dr. Palmer, not a believer yet, does not expect that water will be able to be heated for commercial purposes through the cold fusion process in a decade or so, but he is aware that careful experimentalists have already reported findings which the present understanding of physics cannot explain. But as Dr. Jones points out, on the basis of the present conception of fusion, as developed to date by nuclear physics, it would be inaccurate to call the Fleischmann-Pons experiments "fusion."

While Dr. Jones is not ready to close the door on cold fusion, he, like Dr. Palmer, agrees that it is time to take a fresh look at the physics. He also points out that in order to do that, however, we need to do some very careful experiments and use the findings to set the basic parameters on which the new understanding of physics has to be based.

What do all these findings mean? It is too early to predict, because so little is known about a whole gamut of physics associated with the experiment. The tritium work, under Dr. Kevin Wolfe, Nigel Packham, and their team at Texas A&M, will be hard to ignore or dismiss as irrelevant. The work is thorough, and preventive measures were undertaken to protect the experiment from any contamination. Still, it would be naive to believe that finding of tritium factories will change the basic belief-structure of the science establishment. There are rumors that the allegation that the experiment was contaminated with tritium was leveled against the Texas A&M researchers as a ploy to discredit their findings.

But the Texas A&M work will open up a floodgate. Aleady the word is out—currently, private communication between scientists remains the most efficient way to pass information—that Glen Schessoff at the University of Florida, in Gainesville, has done closed calorimetry and has lit a glow lamp using the Fleischmann-Pons type of arrangements. At the Santa Fe Research Center in Columbia, Tennessee, Joe Champion has observed 40-600% surplus heat from a large single cell. At the University of Minnesota, Dr. Richard Oriani in the Chemical Engineering and Metallurgical Group has also observed a significant amount of surplus heat generation. Dr. Robert Huggins at Stanford University has duplicated the Fleischmann-Pons experiment and witnessed surplus heat. The list is growing longer every week.

Why such acrimony?

In order to answer this question, one has to look historically at various examples of groundbreaking research over the years. Establishment scientists, who made themselves acceptable by wearing blinders and who look only at what is considered as "accepted theories," will obstinately and arrogantly refuse to look at new findings. According to Dr. A. John Appleby and Dr. Supramaniam Srinivasan of Texas A&M, the problem with gaining broad credibility is that the cold fusion results emerged from the "Third World universities in the United States." What they meant is that the findings were not made at Princeton, Yale, MIT, or Caltech—the wealthy universities and research centers where the high priests of American science reside and from which citadels they make their pronouncements.

There is no doubt that the Texas team is partially right about the attitude toward non-Ivy League schools. But, there is more to it. Most important is the fact that the findings emerging from cold fusion experiments have begun seriously to bring into question the validity of many existing nuclear physics theories. The "well-established" quantum mechanics, which deals with the micro-universe, could very well also become a casualty. Such an upheaval within the scientific establishment is nerve-wracking to most "established scientists." It means they must get involved in new work, shedding the old beliefs and denouncing the old theories, whose mastery had won them fame and authority. It is anyone's guess at this point how many former Nobel Prize winners' work in these areas may turn out to be "also-rans" in the search for physical laws.

The announcement by Dr. Martin Fleischmann and Dr. B. Stanley Pons at the University of Utah last March claiming they had produced a fusion reaction in a simple electrochemical cell, consisting of a palladium and platinum electrode placed in a glass tube with heavy water, shocked the world. According to these two electrochemists, a voltage applied across the electrodes splits the water into oxygen and deuterium—a heavy isotope of hydrogen with one proton and one

neutron in the nucleus—and the deuterium released is absorbed by the palladium lattice.

So far, everything Fleischmann and Pons had said was acceptable to all scientists. But when the two electrochemists reported that the deuterium atoms inside the palladium crystal lattice underwent fusion, all hell broke loose within the "established scientific community." As proof, Fleischmann and Pons offered measurements of heat generated by the cell as well as the observation of a few neutrons, which are essential by-products of the fusion process. But these results came under heavy criticism from some of the "established scientists" and the two professors were accused of sloppy work.

Besides the threat to hegemonic—although in our opinion scientifically bankrupt—physics theory, there is also the nagging issue of malthusianism. During discussions with coauthor Maitra, Dr. Hugo Rossi, Dean of Science at the University of Utah, who was recently appointed director of its Cold Fusion Research Center, pointed to the "sinister" statement of Jeremy Rifkin. Rifkin, a hard-core malthusian masquerading as an environmentalist, had earlier said that if cold fusion becomes a reality then abundant energy will be available, which will cause a population explosion on Mother Earth. If Rifkin or his friends in the scientific community have their way, it would be safe to presume that they would try their best to shut down the development of such a potentially prolific energy source.

Moreover, those scientists who have dedicated their entire career to generating fusion energy in laboratories through the high-temperature, high-density route—such as nuclear physicist Harold Furth—are so obsessed with hanging onto what they would like to believe, that they are making a nuisance of themselves with their knee-jerk reactions. Associated with this obsession is the fear, understandable if irrational, that in the wake of the cold fusion wave, the high-energy fusion experiments will be further neglected by the funding agencies.

Clearly, as hundreds of millions of lives are threatened by the collapse of industry and agriculture, the crash effort to produce fusion energy—by all means—becomes a matter of urgency. To propose to cut funding one avenue of research for another would produce tragedy verging on criminality.

Fifty years ago, the possibilities of harnessing fission energy and fusion power were still in the future. Today, we seem to be on the verge of new experimental discoveries about the very essence of matter. Not only the work of Fleischmann and Pons, and their associates, but the past years' discoveries which have expanded our notion of electrical semiconductors as well, pose a whole new frontier not only of physics per se, but of biophysics as well.

The human body operates on the basis of advanced catalytic principles which must be analagous to *cold* fusion and *room temperature* superconductivity, since it can deploy huge energy flux densities without raising body temperature.

Perhaps the most upsetting feature of the Fleischmann-Pons experiments to the science establishment, has been their very simplicity. Today, physics and mathematics have followed the same path, relinquishing the only fruitful road to discovery through the methods of a constructive geometry, and replacing them by a dependence upon deductive logic, with its sterile axiomatic foundations. From the standpoint of deductive method to which the science establishment adheres, creative mental processes have no valid existence in our universe, nor are major scientific breathroughs predictable.

If a single, crucial physical experiment shows any strongly defended current theorem of a school of mathematical physics to be wrong, then its physical evidence must challenge both the whole deductive system and the axiomatic beliefs upon which it is based.

Ramtanu Maitra is editor-in-chief of Fusion Asia *magazine and an associate editor of* 21st Century Science & Technology *magazine. In August he toured cold fusion laboratories in Utah and Texas and held discussions with many cold fusion researchers. A full report of his findings and interviews will appear in the November-December 1989 issue of* 21st Century Science & Technology. *Fuller reports on the Japanese and Indian research appeared in the September-October issue.*