New York Times

April 30, 1989

The Utah Fusion Circus

For the last month, scientists around the world have been poised between deepest doubt and highest hope. The University of Utah claimed on March 23 that two researchers had learned how to fuse atomic nuclei at room temperature. Yet despite a month of attempts to repeat the Utah experiment, no one yet knows if the claim will evaporate in smoke and recrimination or prove the first step to a revolutionary new source of energy.

Conventional attempts to attain fusion rely on multimillion-dollar machines working at enormous temperatures. So it was thrilling to hear that Stanley Pons and Martin Fleischmann, with simple equipment and a mere $100,000 of their own money, had apparently attained fusion at room temperature by passing electric current through heavy water and a palladium electrode.

But the two apparently neglected a basic caution that scientists have learned to impose on themselves for fear of being carried away - a control experiment, like repeating the test with ordinary water instead of heavy water. The University of Utah encouraged them to hold a press conference when the report of their results had been submitted to Nature, a leading scientific journal, but not yet accepted by its editors. When the journal's referees raised criticisms, the authors said they were too busy to respond and withdrew the paper.

None of this means the claim is wrong, just that at present it 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 indeed that many competent laboratories have been unable to repeat the Pons-Fleischmann experiment. Two teams that at first reported having done so later withdrew their claims. A rival group, at Brigham Young University in Utah, has now published a similar claim, but the few neutrons it reports as evidence of fusion may not greatly exceed those that occur naturally.

The claims of cold fusion could still turn out to be correct. And even if not, they have sparked scrutiny and theorizing that could lead others to a fruitful attack. But it's equally possible that some subtle experimental error or self-deception will prove to be the explanation. It's just such errors that the procedural safeguards of science are designed to catch. Imperfect though the safeguards are, they have saved many from the pitfalls of wishful thinking and overenthusiasm.

Last week Chase Peterson, president of the University of Utah, appeared before a House committee to drum up Federal funds. Asked how much, he replied, "The figure that comes to mind is $25 million." Given the present state of evidence for cold fusion, the Government would do better to put the money on a horse.

For Mr. Pons and Mr. Fleischmann, the best bet is to disappear into their laboratory and devise a clearly defined, well-understood experiment that others can reproduce. Until they have that, they

have nothing. As for the University of Utah, it 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 of science.

Opinion

Concord Nit Monitor 3/27/89

Reaction to fusion

the *Monitor's* view, written by its editors

Editorials

Maybe there is such a thing as a free lunch after all. Late last week, two scientists, one from the University of Utah and the other from the University of Southampton, England, announced that they have achieved the energy equivalent of a perpetual motion machine.

What the scientists claim to have achieved has eluded a generation of researchers: a sustained fusion reaction at room temperature. Fusion reactions normally take place only at temperatures of millions of degrees Fahrenheit.

Fusion is the source of power of the sun and the hydrogen bomb. In a fusion reaction, two atoms of "heavy" hydrogen combine to form an atom of helium. The fusion yields a great deal more energy than it takes to initiate the reaction. It also yields a spare neutron that goes on to smash into other atoms, continuing the chain. One of the scientists claims their "cold fusion" reaction went on for hundreds of hours.

If true, the sustained fusion reaction was achieved Gyro Gearloose fashion. The two scientists thought their experiment so unlikely to succeed that they financed it themselves for a mere $100,000. Their equipment consisted not of atom smashers, magnetic bottles and lasers, the normal stuff of fusion research, but of car batteries, a test tube, a thin rod of palladium metal and some platinum wire.

At the press conference announcing their discovery, the scientists said they were fortunate because between them they shared a rare combination of knowledge that allowed them to create the experiment. Both men had noticed similar oddities in the results from their research. The old friends discussed those anomalies while hiking. That discussion led to the experiment they said had a one in a billion chance of success.

If the findings of Utah chemistry professor B. Stanley Pons and British electro-chemist Martin Fleischmann can be duplicated, they will become scientific immortals. Since seawater is the fuel of fusion reactions, their experiment could lead to an age of limitless, cheap, pollution-free energy and a vastly cleaner world.

Both men have impeccable scientific credentials. Between them, they have published hundreds of scientific articles and won many prestigious awards.

Given the world's environmental crisis, we fervently hope that their findings are accurate, that science will come to the rescue.

But the last year has been hard on scientific findings. The Shroud of Turin was proved to be a medieval forgery. An experiment by a noted French scientist proved that water possessed the ability to remember the nature of substances that passed through it long ago, but this result was found to be nothing more than the result of sloppy lab conditions. That experiment was used to explain how naturopathic medicine allegedly succeeds in curing disease.

So we are going to wait for news that this latest experiment has been repeated by others before buying an all-electric home. We also have another reason for suspicion. Pons, the name of the Utah professor, is also the name of a portion of the human brain. Perhaps we will soon learn that the pons is the seat of practical jokes.

The Salt Lake Tribune

Wednesday, May 3, 1989

Section A Page 10

Carping On Cold Fusion Story Becoming Mostly Irrelevant

What follows is mostly quotations from other publications, accounts or commentary either directly related to or having a contextual bearing on the present furor caused by the University of Utah's "cold fusion" announcement. In particular, the reprints respond to the contention that chemists B. Stanley Pons and Martin Fleischmann prematurely publicized their discovery, before the details were accepted for disclosure in a certifiably scientific setting.

On that specific point, one which has been made repeatedly by those who also openly doubt the "cold fusion" theory, The Economist, a prestigious British magazine, said in its April 22 issue:

"Dr. Pons and Dr. Fleischmann upset the establishment in more ways than one. They had a bright idea, and in all good faith they tried it out. Critics moan that they should have submitted their work to a learned journal, to be reviewed languidly by a few of their peers." Answering such carping, The Economist observes:

"By their brashness they are getting something better: the eager scrutiny of thousands of colleagues. Critics of the Pons-Fleischmann approach should remember that reviews in journals are a surrogate for the acclamation of peers, not a precondition of it."

Preceding these comments, The Economist noted that, "There was indignant opposition to the slow-burning revolution that stretched from Copernicus to Newton, and to the comparatively brief putsches in which Lavoisier rewrote the rules of chemistry and Darwin deposed man from specially created grace." Further:

"Science has another side — the slow and steady side, in which revolutions are unwelcome disturbances that interrupt the painstaking accretion of facts. Both the conservatives and revolutionaries are necessary, and there is always tension between them. The stolid side occupies most scientists for most of the time, and so tends to become the voice of the establishment. When the unusual happens, it is distrusted and forced to prove itself. Good. Although a scientific establishment is needed — to shore up the findings of past revolutionaries, for example — upsetting it is not a bad thing."

But did the March 23 news conference at the U. of U. really represent such a shocking precedent? Consider this excerpt from "The Story of the *New York Times*, 1851-1951," the official history of that highly regarded metropolitan daily newspaper, written by Meyer Berger:

"Bill Lawrence . . . was forever poring over medical journals and chemists' reports or haunting scientific conventions. . . . He had written for *The Times* of Jan. 31, 1939: . . . 'The splitting of a uranium atom into two parts, each consisting of a gigantic "canon ball" of the tremendous energy of 100,000,000 electron volts, the greatest amount of atomic energy so far liberated on earth, was announced' " — now get this — " 'here yesterday by the *Columbia University Department of Physics.*' " Emphasis added for obvious reasons.

Moreover, according to historian Berger: "Another story in *The Times* on May 5, 1940, disclosed that the physicists at Columbia had proved that one pound of U-235, a uranium derivative, yielded power equal to that released by 5,000,000 pounds of coal, or by 3,000,000 pounds of gasoline. The same account told how German physicists were working night and day on converting this incredible power into offensive weapons."

Mr. Berger suggests these and subsequent disclosures, made in a major newspaper, with complicity from those scientists most intimately involved, helped alert the U.S. military to the danger of atomic power becoming a monstrous weapon acquired first by this nation's foes in a war which ultimately materialized.

That in turn validates what The Economist writers contend — There are times and instances when a particular discovery or experimental result is so significant that making it public can't wait for ponderous, establishment-imposed rumination and disquisition. Surely the Pons-Fleischmann findings fit in such a category and arguing with the way they were made public becomes increasingly irrelevant and rejectable.

News Office
TULSA TRIBUNE

TULSA, OK
DAILY 75,710

FRIDAY
DEC 8 1989

224 KD

Fusion flap

EDITORIAL

E 7407K

Cold fusion is still a hot topic on campus, and it has reached the boiling point at the Massachusetts Institute of Technology. MIT physicist Peter Hagelstein, who defends claims of a Utah researcher and a British colleague that they fused hydrogen atoms at low temperatures, may be granted tenure. Other MIT physicists ridicule the idea of cold fusion and Hagelstein's defense, thus confirming Henry Kissinger's observation about campus politics: It is so vicious because so little is at stake.

Globe 5/31/89

T.G.I.W.

BY ALEX BEAM

Cold fusion, we hardly knew ye

For some people, March 23 was just another news day. Fawn Hall put in a tearful appearance at the Oliver North trial. The Red Sox beat the Houston Astros in an exhibition game. But for me, March 23 was *the* news day of 1989, possibly of the decade – no, make that the millennium. It was the day that Stanley Pons and Martin Fleischmann, the inventors of "cold fusion," first strode onto the world stage.

I liked them the minute I saw them. These were no grant-grubbing drones in white coats who putter around the lab, checking and rechecking bothersome piles of data; Pons and Fleischmann were marching to their own drum. Peer review? Why bother. Share data just so caviling colleagues can tear down your discoveries? No need. We're not talking about some ordinary discovery here, we're talking about a scientific *revolution*.

I liked their style. Others did too.

MIT, for instance. Hot on the heels of the Pons-Fleischmann announcement from the University of Utah, the World's Greatest Scientific Institution trotted out the Tom Swift of Cambridge, Star Warrior Peter Hagelstein, who had purportedly been working around the clock to produce calculations that support low-temperature fusion. MIT gleefully announced that it had already applied for patents on four technological applications of Hagelstein's work. Hagelstein, a brilliant researcher who stopped working on military projects at the Lawrence Livermore Laboratories for reasons of conscience, apparently has no similar pangs about scientific grandstanding.

The same day that Hagelstein came forward, MIT Provost John Deutch, who as a former director of the Energy Department's Office of Energy Research should know better, issued a statement trumpeting Hagelstein's work. Deutch ended his ill-timed paean by noting, "We are encouraging investigators both here and and at other research institutions to continue their work on this most surprising phenomenon."

Maybe Ronald Parker, director of MIT's Plasma Fusion Center, misunderstood Deutch's marching orders. The surprising phenomenon, Parker told reporters earlier this week, is that Pons and Fleischmann weren't laughed out of academe weeks ago. Parker charged that the Utah researchers – who coincidentally would put Parker's vast "hot fusion" research complex on Albany Street out of business if their experiments stand up – "may have misinterpreted their data." Coming from a physicist, that's a polite way of saying these bumbling chemists screwed up.

Otherwise respectable scientists aren't the only group falling for fusion. "Competitiveness" gurus, suffering from headline withdrawal as US manufacturing employment increases, have also seized on fusion as a promotional tool.

Ira Magaziner, for instance, who once had the quixotic notion that Rhode Island could become a technological "greenhouse" for new industries (an enthusiasm not shared by the state's voters, who soundly defeated Magaziner's proposal), has signed on as a business strategy "consultant" with the deficit-plagued University of Utah. In a hearing before the House Committee on Science, Space and Technology – the same venue in which business-savvy University of Utah president Chase Peterson casually asked for $25 million worth of taxpayers' dollars to support Pons and Fleischmann – Magaziner warned that 100 Japanese companies were examining low-temperature fusion, adding ominously that the mighty Ministry of International Trade and Industry "is already in the process of forming a committee to implement its plan." Like Peterson, Magaziner asked for federal dollars "to match the competition in Europe and Japan."

Pretty sneaky, these Americans. First we let our industrial competitors bankrupt themselves by bankrolling this bogus technology. Next we'll swoop in and buy up all *their* skyscrapers and investment firms. Then they can nurture their own cadre of theory-spinning "competitiveness" specialists.

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I'm sorry. I'll miss it.

MORNING NEWS TRIBUNE

TACOMA, WA
DAILY & SAT 104,100

THURSDAY
MAY 4 1989
BURRELLE'S

168 HC

R.I.P., cold fusion, we hardly knew ye

By Alex Beam 74028

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"Henderson, you moron! I said we need heavy water — not heavy metal!"

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Alex Beam is a business columnist for The Boston Globe.

KEENE SENTINEL
KEENE, NH
D. 15,046

News Office

MAY 09 1989

NEW ENGLAND NEWSCLIP AGENCY, INC.

Editorial

Pondering fusion

Last week, just as we were beginning to understand what cold nuclear fusion is, we found out that it probably doesn't exist. Now, after feeling bad about that for a few days, we read the Donella Meadows column on this page and discover that we're probably better off without fusion.

Sometimes things work out for the better after all. Science is wonderful.

It all started March 23, when scientists at the University of Utah said they had achieved cold fusion in a table-top experiment. If true, it would be the equivalent of the discovery of a perpetual motion machine. Fusion of nuclei at room temperature could generate almost unlimited amounts of clean, safe energy. As Meadows notes, that would mean no more industrial pollution, no more oil spills, no more nuclear accidents, no more petroleum wars, no more Third World misery.

All this optimism may sound familiar to anyone old enough to remember the claims made 40 years ago, shortly after the atom was split, as opposed to fused. Nuclear *fission* was going to give the world a clean, abundant form of electricity that, in the PR phrase of the day, would be "too cheap to meter." Many people bought electrically heated homes in anticipation.

Things didn't work out as planned – although at least nuclear fission did work. The debunking of cold fusion didn't take 40 years, only 40 days. Last week, scientists from some of the country's most prestigious universities concluded that the Utah researchers were probably confused by faulty calculations that lead to faulty measurements of the energy they had generated.

Teams of researchers from the California Institute of Technology and the Massachusetts Institute of Technology independently tried to duplicate the Utah experiment, and found that no fusion took place. The energy produced, they said, was actually less than the energy put into the reaction. Back to the drawing board.

Predictably, a University of Utah official attributed the MIT and Caltech conclusions to professional jealousy. "Valid objections are welcome," he said. "If it's out of pique, then I don't think it's helpful."

Columnist Meadows, who has a doctorate in biophysics, agrees that pique may play a role in other scientists' reaction to the Utah claims but, she says, she doesn't believe table-top fusion has been achieved. She also hopes it hasn't been. Unlimited cheap energy, she reasons, could easily lead to unlimited folly. She makes a very good case that humankind is not yet wise enough to be entrusted with the key to the stars.

Untrained observers are ill-prepared to participate in the scientific dispute over cold fusion. But, when you take a look at today's world leaders, Meadows' philosophical argument is easily appreciated. So, having gotten over our disappointment at the apparent demise of cold fusion, we may now breathe a sigh of relief.

News Office

PROVIDENCE JOURNAL

PROVIDENCE, RI
DAILY 94,220

SATURDAY
MAY 6 1989
NEW ENGLAND NEWSCLIP AGENCY, INC.

36 AM

Hot stuff over cold fusion

Alex Beam

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News Office

KENTUCKY ENQUIRER

CINCINNATI, OH
DAILY 17,830

WEDNESDAY
MAY 17 1989

399 BURRELLE'S RH

Energy

Experiments in nuclear fusion warrant careful examination

E7402B

The nuclear fusion a University of Utah scientist claims he and his partner achieved could be Earth's ultimate energy supplier. It could end U.S. dependence on the whims and monopolistic pricing of the international oil cartel.

But it's far too soon to assume the experiments of Stanley Pons, professor of chemistry, and his British colleague, Martin Fleischmann, have ended the urgency for fuel conservation and further domestic oil exploration. For one thing, some experts dispute their claims.

Keith Johnson of the Massachusetts Institute of Technology, for example, says the experiments were mainly chemical, rather than nuclear, reactions and offered scant hope for a new energy supply. More experiments will have to be run to prove that the Pons-Fleischmann team did fuse two hydrogen atoms and thus find the key to the process powering the sun. Professor Pons contends that he and his colleague produced neutrons and high heat with their experiment. Neutrons are a prime sign of fusion.

Most scientists are by nature skeptics. So it's not surprising that the scientific community hasn't accepted the reported fusion discovery with universal acclaim. Many scientists have tried and still try to achieve similar results.

But clearly the U.S. Department of Energy should investigate the Pons-Fleischmann claims thoroughly. If they turn out to be accurate, if the two scientists have, in fact, unlocked a vast new power source, they would have made a breakthrough second to few this century. It would alter how the United States looks at the rest of the world.

Nuclear fusion could end, once and for all, the power of the Organization of Petroleum Exporting Countries to shape global energy policies.

Desperately Seeking Fusion in Laboratories

May 10 '89

By Robert C. Cowen
Staff writer of The Christian Science Monitor

BOSTON

A MONTH and a half after the original report of its "discovery," the outlook is unfavorable for fusion.

Many experiments have been run in laboratories around the world seeking to confirm that hydrogen fusion — the power source of the stars — can be made to run at room temperature in a small jar to produce useful amounts of energy.

None of the experimenters has fully confirmed this phenomenon, although a few have reported some signs of fusion or of a net energy output. A number of experimenters, however, have failed to find the phenomenon at all.

The spotlight again returned to the original claimants — B. Stanley Pons of the University of Utah and Martin Fleischmann of the University of Southampton (England). They presented the results of further research to bolster their case Monday night at a meeting of the Electrochemical Society in Los Angeles.

During the meeting they claimed that their latest experiments generated even more excess heat than previous ones.

Drs. Pons and Fleischmann have been experimenting with battery-powered electrolytic cells.

In these cells, two electrodes — one of which is palladium — are immersed in water that has deuterium (doubly heavy hydrogen) in its molecules. The palladium absorbs the deuterium. Then, the Utah researchers claim, deuterium fusion takes place.

Since their March 23 press conference, they haven't released enough details of their work for other scientists to know exactly what they have done. This has left that work open to charges of substantial experimenter error. It also leaves the pair's critics vulnerable to charges that they didn't conduct their experiments properly: During Monday's meeting, Pons said that researchers are not duplicating the Utah results because their palladium electrodes are too small.


B. STANLEY PONS

B. Stanley Pons

Some of the most careful attempts to confirm the Utah claims have been made at the California Institute of Technology and the Massachusetts Institute of Technology. Members of these research teams told an American Physical Society meeting last week that they could find no sign either of fusion or of a net energy output from their electrolytic cells.

They raise several questions. Did Pons and Fleischmann measure energy output correctly? Did they ensure the heat was evenly distributed or did they just detect a local "hot spot" near the palladium electrode? Did they measure the voltage difference between the electrodes accurately? A difference of a few tenths of a volt could make the difference between net energy gain and energy loss in the Utah experimenters' calculations.

Did they really detect fusion neutrons or were the neutrons from other processes, such as the action of cosmic rays whose effect is as large as that expected from the claimed fusion reactions? This means researchers are looking for a very slight excess of neutrons that might be because of fusion. Even then, experimenters have to make sure they actually count neutrons. Pons and Fleischmann observed gamma rays, which they think were due to neutrons. Skeptics dispute that. Fleischmann said Monday night that he and Pons were working to get better measurements on this aspect of their experiment.

So far, there have been no answers to such questions.

Not even a rival research team led by Steven E. Jones of Brigham Young University in Utah believes in cold fusion as an energy source. It published a detailed paper in the April 27 issue of Nature explaining that team members believe they have detected fusion in electrolytic cells but with energy releases billions of times less than the Utah workers claim. Dr. Jones later said he expects this kind of fusion, even if it is real, will not be a practical source of energy.

News Office

LA GRANGE DAILY NEWS

LA GRANGE, GA
DAILY 14,900

MONDAY
MAY 1 1989
BURRELLE'S

154 UB

LIMITLESS ENERGY?

7402B

Many people probably remember a little about fusion from their high school physics classes, but its amazing potential to mankind really was brought home last month when two chemists at the University of Utah made the astonishing announcment that they had created it in a test tube.

Since then the worlds of physics and chemistry have been in an uproar over the possibility that fusion has been achieved.

What it's all about is the ultimate in scientific breakthrough, literally transforming one kind of matter into another. If the two chemists, Stanley Pons and Martin Fleischmann, have truly achieved what they say they have, the discovery is akin to electricity in its significance.

Nuclear fusion sounds like magic--getting more energy out than you put in--but the Pons and Fleischmann results are being duplicated elsewhere, so it may be a shattering breakthrough.

If it is, not only will oil spills be history, so will OPEC, air pollution, coal mining accidents, the Greenhouse effect (if it really exists), and the radioactive waste created by conventional nuclear reactors.

Fuel for practically every energy need would be extracted from simple water. One ounce would provide as much energy as 80,000 gallons of gasoline. The top layer of water in Lake Michigan would supply all of the electricity for the United States for 15,000 years.

All of our current nuclear energy comes from fission, releasing the energy of the atom by splitting it apart. It's the power that explodes an atomic bomb and the force generating conventional nuclear reactors.

Fusion, by contrast, is the joining of two atoms. In a controlled fusion reaction, the only waste is the creation of harmless helium atoms and stray neutrons which are easily controlled.

But has it arrived? The researchers who claim to have created what has come to be called "cold fusion" are chemists, not physicists, and that has given rise to skepticism in some quarters. A physicist at MIT dismissed the possibility. But even as he was speaking, MIT colleagues were in the labs trying to duplicate the results and one, Peter Hegelstein, was even sending papers to professional journals providing a theory for why the experiment works and seeking a patent on the process.

It probably will be months before we know whether the day will arrive to dry dock our tankers and seal off our coal mines.

But even if the Utah experiment proves to be a disappointment, it has taught scientists enough to ensure that a time of limitless energy is coming, and maybe sooner than we think.

SEDALIA DEMOCRAT
SEDALIA, MO
DAILY 14,403
FRIDAY
APR 14 1989
BURRELLE'S
296 GU

Fusion experiment shakes up science

Has a relatively simple table-top experiment in Utah revolutionized the field of energy, not to mention particle physics itself?

Two chemists working at the University of Utah turned the physics world on its ear three weeks ago when they reported they had achieved the world's first sustained fusion reaction.

The so-called "cold fusion" process produced more energy that it consumed, according to Stanley Pons and Martin Fleischmann. This has been the dream of fusion researchers for decades.

In the better-known fission nuclear reactions, atoms are split to produce energy. But in fusion they are joined together. Not only does this produce a great deal more energy than does fission, but it is cleaner. Radioactivity, for example, is a minor consideration in fusion reactions.

Since the announcement of the Utah experiment, physicists around the world have been scrambling to duplicate it. Some report they have succeeded, while others remain skeptical. Scientists at the Massachusetts Institute of Technology say the Utah findings may indicate that past theories of the fusion process are wrong, and need to be changed. In short, it is a time of great ferment in the whole area of fusion physics.

If a sustained fusion reaction has indeed been accomplished — and it may be premature to definitely say at this point — the implications are vast. One ounce of deuterium (available from plain water), for example, will produce the energy equivalent of 70,000 gallons of gasoline.

One writer has likened achieving fusion to the discovery of fire. It may not be a far-fetched comparison.

The healthy fusion process

Globe 5/28/89

In the two months since B. Stanley Pons and Martin Fleischmann electrified the world with their announcement that they had achieved cold fusion, the world has had scant encouragement that their process was actually doing what they though it was. Despite the dwindling of hope that a simple source of boundless energy had been uncovered, Pons and Fleischmann may ultimately deserve credit for having kindled new directions of inquiry, even if their own system is disproved.

Cold fusion – the room-temperature nuclear bonding of commonplace isotopes of hydrogen to produce helium and heat – represented a radical shift away from longstanding efforts to achieve fusion through a high-temperature system of enormous complexity. If valid, cold fusion might also have avoided the production of an intense neutron bombardment that critics of hot-fusion systems believe will make them ultimately inoperable.

Pons and Fleischmann have unquestionably generated heat on one front. Their scientific colleagues have unleashed a storm of comment based in large part on their general failure to duplicate the process described, only in part, by the two University of Utah scientists. They, in turn, have for the most part buried themselves in the laboratory, testing for further evidence of the process they do not fully understand themselves.

The process is a healthy one. Although Pons and Fleischmann may have erred in judgment by making their announcement prematurely, and have raised some negative comment because they have not taken the scientific world fully into their confidence, they have encouraged the widest possible efforts by well-qualified persons to prove or disprove their process. Some scientists believe that the much less spectacular claims of another physicist, Steven Jones of Brigham Young University, may come closer to actually achieving cold fusion, though at rates so low as to have no economic significance.

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.

F - FUSION

WSJ 4/12/89

Fusing the Impossible

Rutherford was a perfect man for the time, a hard-working, hardheaded scientist who was impatient with mathematical abstraction and complicated equipment. He declaimed that he liked to discover facts the reliable way, through experiments, without a lot of theoretical pettifogging. The experiments themselves should be quick, simple and performed on equipment scavenged from the basement of the laboratory. . . . The object was to find good, solid facts—did X happen or not?—to find them first, and to let other people clean up decimal places. He said, "There is always someone, somewhere, without ideas of his own, who will measure that accurately."

The world does not yet know conclusively whether Stanley Pons and Martin Fleischmann will enter science's pantheon with Ernest Rutherford, one of the giants of 20th-century physics. The world, however, is getting a rare look at the clash between science and the politics of science—a clash between human curiosity's innate optimism and the compulsive naysaying of the current national mood.

Pons and Fleischmann, of course, are chemists who with a simple experiment appear to have solved one of the great riddles of human knowledge—how to create energy through the fusion of two atoms. The fusing of two heavy hydrogen atoms was done, as Mr. Pons has said, "with equipment that could be found in any freshman chemistry lab." This announcement was not met with hosannas, but with a fair measure of boos and catcalls. Writer Robert Bazell was not much worse than most in the current New Republic, sniffing that the two had "defied the conventions that are supposed to ensure the reliability of scientific information."

"How does it feel to be accused by some pretty eminent physicists of being a bungler, of not knowing what you're doing or what you've done?" an interviewer asked Mr. Pons on the public-television show "Science Journal." His reply would have warmed Rutherford's heart: "Well, if they keep it up, they're going to hurt my feelings."

On Monday, researchers at Texas A&M confirmed that they had produced surplus energy with the Pons-Fleischmann technique. And scientists at Georgia Tech reported neutron production from their duplication of the experiment, confirming that fusion indeed occurs. Many questions remain, of course, not least the admittedly not-yet-understood process by which the experiment generates energy far in excess of the amount of fusion indicated by the neutron emissions. But clearly, scientists have once again discovered something new under the sun.

Ernest Rutherford's cavalier attitude toward the decimal counters, quoted above, appears in Robert P. Crease and Charles C. Mann's "The Second Creation," a remarkable history of the men who made 20th-century physics. In the two decades running up to World War I, physicists and mathematicians such as Bohr, Heisenberg, Planck, Einstein and Dirac made an astonishing series of discoveries about the world's basic building block, the atom. While the Crease and Mann history makes palpable the physicists' enthusiasm for their work, mostly this great revolution occurred out of public view.

Today, in an age of rapid telecommunication, the public can if it chooses bear almost simultaneous witness to the accomplishments of science and technology. Avid readers of this paper's daily Technology page, for instance, are not only ahead of the pack on the cold fusion story, but also would have read of the initial breakthroughs in labs around the world in achieving superconductivity. They would have learned more recently of Intel's and Motorola's ability to place 1.2 million transistors on one microprocessor, of AT&T Bell Laboratories' ability to make semiconductors so small that their activity has to be described in terms of quantum mechanics, of a system of safe hydrogen storage developed at Syracuse University, of fiber-optic devices that will let engineers "see" the internal workings of an internal-combustion engine.

The pace of scientific advance is sometimes hard to discern amid the unending wail about trade deficits, food chemicals, the ozone layer, the greenhouse effect, animal rights or political ethics. Even within the scientific enterprise, the creative impulse of a Fleischmann and Pons must contend today with what might be called the "Academy mentality."

Among the first members of the Academy to toss cold water on the Utah experiment were scientists at MIT in Cambridge. "We see no physical basis at the moment for thinking that nuclear fusion is going to occur," said an MIT scientist, "and we certainly have no evidence that there's a big effect." Of course, the two chemists for their part didn't even bother to ask the federal funding-source academy to support their work.

As Rutherford might have said, people with serious ideas find ways to push them toward the future; that leaves plenty of people to stand around worrying about the present. 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.

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BURRELLE'S

Hoopla Over Fusion

The excitement over two Utah chemists' report of achieving "cold" nuclear fusion is getting serious. Researchers at the Lawrence Livermore Laboratory and MIT cast heavy doubts over the claims by B. Stanley Pons of the University of Utah and Martin Fleishmann of the University of Southampton of room-temperature fusion, but scientists at other institutions say they can verify the claims.

Researchers at Hungary's Lajos Kossuth University reported the first success in reproducing the Utah experiment. Others at Texas A&M measured excess heat from the reaction. A Georgia Tech group has detected excess neutrons, proof of a nuclear reaction.

Controlled fusion has been a scientific Holy Grail nearly 40 years. During the heady 1950s, Americans expected soon to trap the sun's power in reactors as small as matchboxes to drive automobiles, homes, personal aircraft, even spacecraft. There would be no radioactivity to worry about and no hard-to-handle waste, and there was no end to promises of things to come.

One reason the promises went so long unfulfilled is that protons in the hydrogen nucleus carry positive electrical charges. It takes great force to push these like-charged particles together, either with the intense electromagnetic fields of the Princeton Tokamak, or with awesome lasers. Until now, no one has claimed a repeatable success.

The Utah researchers, modifying an old electrolysis experiment, think deuterium, double-heavy hydrogen, is fusing inside a palladium electrode's crystal lattice. Brigham Young University's Steven E. Jones, using a slightly different technique, claims a similar success.

The Georgia Tech team worked from sketchy TV and computer bulletin board reports to verify the results. One step, toasting electrodes in a vacuum oven, seems to have boosted their results by clearing the lattice of excess hydrogen.

The fusion experiments will be Topic A next month at the American Physical Society's meeting in Baltimore, even after a going-over by an earlier Dallas parley. Scientists are burning the midnight oil in the search for answers; so far, some of the results are downright electrifying.

what Reuters news agency called "one of the most ferocious barrages of the 14 years of periodic civil strife in Lebanon." The lack of interest on the part of Jennings and others in the media, including the prestige press, can be traced to the fact that Jews are not the ones doing the killing. When that happens it provides opportunities for sustained and somewhat hysterical attention and accompanying high-dudgeon outrage, the stuff of morality plays. On these occasions Jennings musters a peculiarly haughty sneer, much in evidence since the *intifada* began in December 1987 and, of course, throughout the 1982 Lebanon war. Some observers sympathetically explained Jennings's relentless and unprofessional hectoring of the Israelis at that time as an expression of the fidelity he felt for Beirut, where he had lived for several years. But his neglect of that city's recent agonies rather undercuts this interpretation. He is as intrinsically interested in the Beirutis as he is in the Aborigines. His interest, his hostile interest, like that of others in the trade, is in Israel. Which is why when Arabs rain high-explosive death on other Arabs, even in mind-numbing numbers, no one seems to take much notice, certainly not Peter Jennings. Right now it is the Syrian occupation army and its allied Druze militia that, without even the pretense of military targeting, have been bombarding schools, hospitals, apartment houses, and factories in an effort to terrorize Christian East Beirut into submission to Damascus. Early last month two warring Christian factions put the same neighborhoods through an only marginally less intensive fratricide. Maybe Arabs murdering Arabs is boring, if only because it is so routine. But the innocent dead demand some respect: in these two Arab slaughters in one month in one part of Beirut surely more innocents have died than during the entire 16 months of the uprising in the West Bank and Gaza. There may, moreover, be an American interest or two at stake. But none of this cuts much ice with the 7 o'clock people. There is only so much time that television news can dedicate to the Middle East. Sorry, Mr. Jennings and the others have already reserved that slot for the brutal Israeli soldier who can be counted on to shoot back at a Palestinian mob that is trying to kill him with rocks and gasoline bombs.

TAKING LIBERTIES:

Bennett says he'd defend civil liberties

—*Houston Chronicle*, March 2

Bennett sees limiting liberties in drug war

—same paper, next day

(thanks to Chiarizio & Brewton, Houston, Texas)

CARROT AND STICK:

Eastern chief pleads for pilots to return

—*Denver Post*, March 6

Eastern tells striking pilots: Return or else

—*Boulder Daily Camera*, same day

(thanks to Michael Parker, Nederland, Colorado)

SCIENCE AND SOCIETY

HYPE-ENERGY PHYSICS

By Robert Bazell

"We don't know that it is fusion," Dr. Stanley Pons admitted. That was a week after the University of Utah's press release had unequivocally proclaimed that Pons and a colleague, Dr. Martin Fleischmann, had "created a sustained nuclear fusion reaction at room temperature." The breakthrough, continued the release with full sense of the historic moment, "means the world may someday rely on fusion for a clean, virtually inexhaustible source of energy."

If the experiment did indeed produce large amounts of fusion energy, the press release wasn't exaggerating its importance. But Fleischmann and Pons may in the end turn out to have produced a whimper, not a bang. In any event, the university and the scientists released the experimental results in a way that maximized publicity but defied the conventions that are supposed to ensure the reliability of scientific information. Apparently eager to gain recognition, they didn't take the simplest steps to try to determine whether what they were saying was true. And University of Utah officials, imbued with that state's unique blend of chauvinism and xenophobia, were not only happy to play along but encouraged them.

It's not impossible that Fleischmann and Pons are right. Fleischmann, after all, is a world-renowned chemist at the University of Southampton, England. Pons, on the Utah faculty, is his former student. Most other scientists doubt the two men have done what they claim, but no scientist will reject it out of hand until the actual work is available for review.

At first that was impossible. While Pons and Fleischmann trumpeted their results to a crowd of reporters, they were coy about telling colleagues what they had done. They put off scientists who telephoned. Those who appeared in Salt Lake City were allowed to look briefly at an unpublished paper, but not to copy it. Asked about this secretiveness, Pons says there was a need to protect pending patents. It was, however, necessary to talk to the popular press, he says, because word of the experiments was about to appear in the *Financial Times* of London and the *Wall Street Journal*, and he saw the need to "clarify" what he had done. It was also necessary, he said, to use the media to warn other scientists that the experiment could be dangerous. (Kids, don't try this at home!)

Dr. Chase Peterson, president of the University of Utah and the official who ultimately decided to hold the press conference, gave me one other reason: the need to establish Utah's "primacy." Peterson, a former faculty

member of the Harvard Medical School, clearly hopes that the experiment will enhance the image of both his native state and his university, an image he says is distorted by the "insularity of the coastal regions." The world "doesn't see this as Berkeley or Stanford or MIT," Peterson correctly noted. As for the state, "The world's view of Utah is a funny one. What do you think of when you hear Oregon? Douglas fir trees, I guess. Maine? Probably lobsters or the coastline. But the views of Utah have been kind of bizarre lately," he said, referring to events involving the Mormon Church. "Murders, thefts of forged documents."

The jury is still out on the announcement's effect on Utah's image, but it certainly lifted local pride. A *Deseret News* headline said the experiment could rank as "the century's greatest achievement." The newspaper predicted Pons could take a place in history alongside Newton, Einstein, and Edison. On a more temporal plane, Utah governor Norm Bangerter summoned the legislature into special session to allocate $5 million for fusion research. And Utah native James Fletcher, who is retiring as NASA administrator, announced he will head a new Fusion Research Institute at the university.

Eight days after the press conference, fax machines in laboratories around the world spewed out details of the experiment. Someone had gotten hold of a paper submitted by Pons and Fleischmann to the *Journal of Electroanalytical Chemistry and Interfacial Electrochemistry* (an obscure periodical even by academic standards) and quickly disseminated it. With the details in hand, the scientists renewed their efforts to duplicate the Utah results. As of this writing, there has been no clear-cut success. The experiment looks amazingly simple, especially compared with the multimillion-dollar machines physicists have been using to try to produce fusion in the laboratory. (The assumption has been that heating things up to an enormous temperature—as in the sun, the big fusion reactor in the sky—was essential for a sustained fusion reaction, whereas the Utah scientists worked at room temperature.) In glass tubes about a foot tall and an inch in diameter, Pons and Fleischmann have inserted two wires, one made of platinum, the other of palladium. The tubes are filled with "heavy" water containing a form of hydrogen called deuterium, or "heavy" hydrogen. The scientists ran an electric current through the wires, causing the water to bubble. Their theory is that the current also causes hydrogen atoms to pack into the palladium so tightly that they fuse together inside the metal.

In Pons's laboratory, the untrained eye can see that some of the tubes are producing heat. But is it fusion? One hallmark of a fusion reaction is the release of neutrons. Pons says he has detected neutrons, but there are a billion times too few to account for the heat. He said it "may be some type of thermonuclear reaction we don't understand." Dr. Ron Parker, head of MIT's fusion lab, says, "If there is a thermonuclear reaction, it will release some signature—neutrons, gamma rays, something which can be measured." He says it would take a few days or at most weeks to take such measurements with the right equipment. Several major labs have the equipment and would have been (and still are) willing to help take the measurements. Pons, Fleischmann, and the University of Utah could have made the measurements and found out what, if anything, their experiment proves, before proclaiming that they had accomplished the 20th-century equivalent of turning lead into gold. The glory that awaits them if they are correct would still have been theirs. And they would have avoided the ridicule that surely will follow if they are wrong.

WHITE HOUSE WATCH

NEWTERED

By Fred Barnes

One of President Bush's recent soirees didn't turn out quite like he had planned. He had gathered a dozen Republican senators and House members in the Cabinet Room for a private unveiling of the administration's child-care proposal. Without applying any pressure, he got several Republicans to sign on as co-sponsors of the bill. But that didn't end the conversation. Bush sat between Senator Pete Domenici of New Mexico and Representative Tom Tauke of Iowa, and they gave him the bad news. His approach—tax credits for parents, whether or not they work—has all the right principles, they told Bush, but it won't fly in Congress. It's too cheap. So Domenici and Tauke would be offering a bill of their own. It would cost $2.5 billion the first year, compared with the $500 million proposed by Bush. The president spoke up. His bill was better, he said, partly because it won't bloat the deficit. Richard Darman, Bush's budget chief, echoed the president. But in the end, Bush all but acquiesced. He didn't sign off on the Domenici-Tauke bill, but he didn't protest too loudly either.

That session gives a pretty good picture of how legislative strategy is made at the Bush White House. There's give-and-take with congressional Republicans, especially take. It's not like it was back in Ronald Reagan's era. In Reagan's first term, a group of senior White House aides (Darman was the moving force) plotted legislative strategy with a single goal in mind, prevailing over congressional Democrats to enact conservative programs. Details changed from bill to bill, but the strategy was invariably to put together a conservative majority of Republicans and right-wing Democrats. White House aides spent their time scheming to build that majority. If they got input from congressional Republicans, fine. If not, that was fine, too. The White House was firmly in charge.

No more. Bush is desperate for advice from Republicans on Capitol Hill (he also listens to advice from Democrats, but this is diplomacy, not strategy). And no wonder. His situation is a lot more difficult than Reagan's. He lacks a broad agenda with popular support,

Oak Ridge and the fusion confusion

So far, the annoucement by University of Utah scientists that they have found a new, relatively simple method of producing nuclear fusion has produced mostly confusion.

If true, it could revolutionize power production, yielding a steady supply of cheap, clean electricity. Indeed, as one Oak Ridge scientist points out, we could be driving fusion-powered cars by the end of the century if the process pans out. Oak Ridge scientists, as detailed in our cover story today, are busy trying to duplicate the process announced two weeks ago by University of Utah chemist B. Stanley Pons and Martin Fleischmann of England's University of Southampton.

Pons and Fleischmann said they produced nuclear fusion in a table-top experiment using ordinary lab equipment.

Scientists initially greeted the Utah announcement with skepticism. Then reports started coming in that other scientists around the country and in the Soviet Union had duplicated the experiments successfully. A Georgia Tech team announced it had failed to duplicate the experiment, then reported that its effort had been flawed.

At the Massachusetts Institute of Technology, chemist Mark S. Wrighton said his experiment using technical details from the Utah experiment had been going on continuously since March 27 with no evidence of nuclear fusion and MIT Provost John Deutch pooh-poohed the Utah claim. Then MIT officials turned around and filed for patents involving cold nuclear fusion based on the theoretical work of Peter L. Hagelstein, a university researcher who a decade ago pioneered what eventually became the world's first X-ray laser.

Utah officials wasted no time backing up Pons and Fleischmann. The state Legislature immediately went into special session and quickly appropriated $5 million to speed up further research. The idea is that, if the claims turn out to be valid, Utah would have a front row seat on one of the most sensational discoveries in many years.

Since Oak Ridge has been in the forefront of nuclear fusion development by the more traditional methods, the reports of the experiments have been watched with more than casual interest here. The technology and resources available here could undoubtedly play an important role in developing this new process if it is proved feasible.

However, it could still be a long time before the process is proved or disproved and we learn whether it has significant practical application in producing large amounts of electricity.

The nation's news media, sensing the stupendous implications in such a breakthrough, have jumped on the story with uncommon enthusiasm, proving that "good" science news also can grab headlines and time on TV news shows.

Even if the so-called low-tech fusion fizzles, focusing attention on the concept of fusion as an energy source could lead to more research dollars for traditional fusion research, thus speeding up the day when fusion will actually be a major new source of clean, cheap power.

PARK RECORD

PARK CITY, UT
WEEKLY 4,900

APR 6 1989
BURRELLE'S

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MISC
OLD EDITORIALS

Can we - should we - contact some of these folks with new info?

And So It Goes...

7402B

I got fusion

BY TOM CLYDE

Last week a couple of chemists at the University of Utah made the announcement that they have discovered a process they think is controlled nuclear fusion. I don't understand it very well. Frankly, I never have believed in atoms, let alone sub-atomic particles. But the claim is that they can zap "heavy water" with something, and shake an extra neutron loose. The freed neutron blows town in such a hurry that it leaves a patch of rubber on the road behind it. They tap that heat to generate electricity. The neutron, after it skips town, joins up with something else and makes helium, which is perfectly safe and clean. The only possible side effect from a fusion-powered world is that we will all talk like Mickey Mouse because of all the helium in the air.

In the past, scientists have always assumed that fusion could only occur at extremely high temperatures, like those found on the surface of the sun. The Utah scientists managed to make fusion at low temperatures. In fact, right there on television, they were making fusion in a Rubbermaid dish pan that didn't even melt. I'm not sure whether the major scientific breakthrough was nuclear fusion or non-melting plastic, but it is a major advance either way.

Needless to say, the University of Utah was very happy to have this discovery made on their campus. All universities like to have that kind of prestige, and they may have rushed the announcement a little bit. Not to be outdone, the scientists at BYU also called a press conference to say that, "Our fusion's bigger than your fusion," but they backed off when it was confirmed their fusion melts the Rubbermaid washtub. News organizations all around treated it as a big story. NBC mostly ignored it until late in the week, then did one of those stories about how Dan Rather at CBS had reported the story, but that old Dan would fall for most anything.

Scientists at other colleges around the nation were very skeptical. They all felt that this process was both too simple and straightforward, and also that nothing of any merit could possibly happen this far inland. In the past, the great advances in nuclear physics have been the province of people with heavy accents and German-sounding names working at schools on the coasts. You know, folks like Openheimer, Von Braun and Einstein.

The Park Record's science consultant, Otto Schwartz, professor of cosmetology at Roger's College of Beauty near the campus of MIT expressed doubts typical of those heard elsewhere. "I just don't believe they have discovered anything," he said. "It lacks credibility. I mean we've got this WASP working at a college in Utah, of all places, claiming to have discovered cool temperature fusion. It just doesn't add up. The last WASP physicist was Isaac Newton, and Einstein proved him to be mostly wrong."

Pons' partner on the project has been Dr. Martin Fleischmann. That is a good German-sounding name, but Schwartz said it hardly helped. "Fleischmann is British. He has an accent right off 'Masterpiece Theater.' His real name is probably something like Wainwright. Next thing you know, they'll be claiming that the Great Salt Lake is as salty as the ocean."

Famous public television chef, Julia Child, was even more critical of the announcement. "I paid close attention to the process they discussed. They claimed to be able to get four watts of heat for every one watt of energy put into the process. Big deal. I have students do that all the time right here in the kitchen. It's not fusion, it's just a bad batch of chili."

Whether the discovery is the key to an endless supply of cheap energy or bad chili, it is exactly the kind of clean, high-tech business venture that Utah's economic development people have been trying to attract for years. The state people are excited, and Governor Bangerter has called a special session of the Legislature to address the issue. The governor wants a special appropriation of $5 million for the fusion project. Most of the $5 million will be spent printing stock certificates to be offered on the penny stock market. "This offers ten times the speculative opportunity we had in the uranium boom," said one source. "It's better than gold mines in Chile."

The penny stock market has been soft for several years in the wake of stronger Federal securities regulations. This is an opportunity to put one of the state's basic industries back together. I understand that the whole Osmond family has signed up to buy shares. Promoters, who have had to busy themselves with time-share condos for the last several years, are now getting their stock brokerages back in business.

The other item on the agenda for the Special Session is the adoption of a new state song. Utah's current state song, "Utah, We Love Thee," has never been a very popular tune. Noboby ever tapped a toe to that one, let alone danced. In honor of the fusion discovery, legislators propose to change the song to somethign a little more catchy. The new state song will be that Gershwin favorite, "I Got Fusion." I overheard the traders at the Intermountain Stock Exchange in Salt Lake practicing it the other day, and it sounded pretty good. It goes like this:

"We got protons, we got neutrons,
We got fusion, who could ask for anything more."

Of course, the governor's interest runs deeper than just the possibility of a Utah-based research project discovering the key to an endless supply of nearly free energy. He is even looking beyond the resurgence of the penny stock market. He hopes they can get the test project under way soon enough for fusion to power the Great Salt Lake pumps for this year's spring run-off.

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Assertions of fusion

MIT

Scientists have spent decades trying to develop large reactors in which nuclear fusion can occur under conditions of high temperature and pressure.

Among them are scientists at the Massachusetts Institute Of Technology, where millions have been spent on hot fusion research. Not surprisingly, the announcement last March that two scientists had achieved nuclear fusion at room temperature was greeted with little enthusiasm at MIT.

Peter Hagelstein was an exception. At a news conference in April, the MIT physicist theorized that a previously unknown nuclear phenomenon was involved in cold fusion. By doing so he twice alienated his colleagues — by defending cold fusion, and by doing so at a press conference rather than submitting his theory for scientific review.

Now Hagelstein may have the last laugh. Asahi News Service reports that two groups of Japanese scientists have successfully achieved nuclear fusion at room temperature.

On Dec. 1, scientists at Osaka University announced that cold fusion had been achieved on five occasions over a period of five months. The team said they used a method similar to that used by Martin Fleischmann of the University of Southampton in England and Stanley Pons of the University of Utah, the two scientists who launched the cold fusion debate last March.

Several days before the Osaka University team announced its findings, two scientists at Nagoya University published a report describing their successful achievement of cold fusion using a technique simpler than that used by Fleischmann and Pons. Their findings were published in the Japanese Journal of Applied Physics.

Given Japan's technological and scientific successes of recent years, only the reckless would dismiss the Japanese researchers' cold fusion claims. If their findings stand up, then visions of a cheap, safe and virtually unlimited supply of energy may indeed come to pass — to say nothing of proving Fleischmann, Pons and Hagelstein correct.

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faithfully for their victory. The size of the second faction made the first, smaller faction marginally decisive. So American policy on Nicaragua remained in chaotic stasis.

Why couldn't the White House change Congress's mind? It tried, of course. There was something heroic about the hours of lobbying, on the Hill and at the grassroots. And yet . . . and yet it always fell short of the full-court press. Two elections occurred while Colonel North was laboring at his NSC desk, the Reagan-Mondale wipeout, and the off-year election two years later. If the Republicans had told voters that, for the first time in history, there was a Communist government on the American mainland, a two days' drive from Texas; if the rest of Central America goes, Mexico goes, and if Mexico goes we will have fifty million refugees; here are the congressmen (Faction Two) who desire this result, and here are the congressmen (Faction One) who are making it possible; and if they succeed and we fail, we guarantee years of (that dread post-Vietnam word) recriminations—would the voters have responded?

We'll never know. (Though we do know all about North's tin box.)

Education Doldrums

THE EDUCATION PRESIDENT has struck again. Having decided to put practically all his eggs in the federal-program basket, rather than pounding on states and localities to shape up, he found himself obliged to disclose some specifics. This occurred in early April, when the White House sent Congress a 39-page bill called the Educational Excellence Act of 1989. It consists of seven new programs, for which Mr. Bush seeks to add $423 million to the fiscal-1990 education budget.

The initiatives, as far as they go, are pleasant enough. They embody such sensible ideas as rewards for outstanding schools and teachers, "magnet schools" that need not necessarily be part of integration plans, extra help for drug-infested urban schools, "alternative certification" for teachers and principals (meaning that well-educated adults who don't have degrees in education can nonetheless land classroom jobs), and college scholarships for math and science superstars.

Yet even if these were all enacted and funded exactly as the White House has suggested (which congressional critics instantly said will never happen), barely 2 per cent of the Education Department's present budget would be affected. In other words, business as usual in 98 per cent of that lackluster agency's doings. More than 120 current programs will be untouched, programs that range from the useless (vocational education) to the needless (library subsidies) to the well-meaning but feckless (compensatory education for poor youngsters) to the harmful (Women's Education Equity Act, National Diffusion Network) to the scandalous (the default-plagued multi-billion-dollar guaranteed-loan program for college students).

What happens in Washington has at most a marginal impact on what happens in the nation's schools and colleges. What George Bush has proposed, despite all the White House hoopla, will have at most a marginal impact on what happens in Washington. Operating on the margin of the margin, he cannot accomplish much. Even the educators know this. A long, biting article in the April 19 issue of *The Chronicle of Higher Education* bears this headline: "High hopes for Bush and Cavazos have evaporated, many say."

The President has recently trotted out one important idea, though. Picking up a suggestion from a Rochester think-tank chaired by Apple Computer's John Sculley, Bush announced that he would like "to waive some regulations for poorer communities, allowing them to pool state and federal funds in exchange for higher accountability and performance—a kind of performance-driven, partial deregulation of education."

Nice. But that means getting the Education Department to uncoil some of its notorious red tape. Not even William Bennett could accomplish that. And look who's sitting in the Secretary's office now.

Energy from Seawater?

THE INITIAL REACTION was understandably skeptical. Yet it seems increasingly believable that two entrepreneurial scientists on a low budget may have turned the Middle East's hoarded petroleum into a mere curiosity of the future—something to bottle for museums, to show our grandchildren. Stanley Pons of the University of Utah and Martin Fleischmann of Southampton University in Britain managed to generate energy (heat) by simply inserting a palladium rod into a bottle of hydrogen-laden "heavy water." Their experiments suggest that one gallon of seawater may contain as much usable energy as thousands of gallons of gasoline. The crucial factor is that the process does not appear to require intense heat (since the purpose is defeated if the process requires more energy than it generates); hence the name "cold fusion."

To find that something is possible is not, of course, to prove that it is economically feasible. If it works, though, cold fusion could be a major energy source within two decades, surely for electricity and possibly even for automobiles. As such technology came within sight, oil-producing countries would obviously have a strong incentive to pump all they could before Vaseline became the main remaining use of petroleum. Important products that use substantial energy in their production, such as paper and aluminum, would become much less expensive. The gradual historical process of replacing the physical effort of human beings with machines would be greatly accelerated.

The environmental implications are equally staggering, since cold fusion generates relatively little radiation and no air pollution. The reduction of the cost of pollution control, which has absorbed a huge share of investment outlays in recent years, would release capital for even more rapid improvements in the quantity and quality of goods, housing, and services worldwide.

In a mere decade, the supply-side vision of entrepreneurial capitalism has already uprooted the foundations of egalitarian, centralized regimentation in such unlikely places as India, Israel, China, the Soviet Union, and, most recently, Vietnam. Part of the lesson is that the spark of ambitious genius does not merely create well-deserved fame and fortune for a few bold entrepreneurs, but also tremendous benefits for the entire world. The recently unleashed energies of innovation in China may have provided the clue, from a derivative of a Chinese cucumber, that leads to a cure for AIDS. That same spirit, from an unlikely pair of innovators in Utah and Britain, may likewise have begun a process that will create forms of energy in the twenty-first century that seem as unimaginable today as petroleum was in the seventeenth century or uranium in the nineteenth.

Afghan Follow-Through

WHEN 15,000 CORPSES of the British Army of the Indus were freezing on the Hindu Kush passes in January 1842, Shah Soojah, the puppet Afghan king whom the British had installed in 1839, continued to rule in Kabul. As soon as the British were defeated, the Afghan coalition disintegrated, and no faction was strong enough to dislodge Shah Soojah from his Bala Hissar citadel.

Afghanistan is in a similar situation now. The Kabul Communists are supported by only a small minority of the Afghan population, and their foreign patrons have departed. But they are still entrenched in most of Afghanistan's provincial cities; they enjoy the Soviet Union's unqualified military, diplomatic, and economic backing; and, faced with defeat and revenge, they are determined to fight to the last.

Having mistakenly expected that the Najibullah regime would disintegrate soon after the Soviet departure, the Western media are now offended that the guerrillas have failed to provide the theatrical Fall of Kabul story and retaliate by disparaging them. "I would put even money on Najibullah's still ruling in Kabul in five years' time," pontificates Professor Fred Halliday of the London School of Economics. But to overrate Najibullah's strength now is as silly as it once was to exaggerate his weakness.

The *mujahedin* have not won yet because they are not trained soldiers; because, like their ancestors confronting Shah Soojah, they bicker; and because Pakistan and the United States have induced them into foolish enterprises such as the failed assault on Jalalabad. As Radek Sikorski reported in these pages recently, the *mujahedin* never *planned* to attack Kabul the moment the Soviets left. Only this summer will we see how strong they really are. If the guerrillas succeed in blocking the Salang highway, which is the only land supply route from the Soviet Union to Kabul, and if they match the attack on Kabul with a coup within the gates, then Najibullah would do well to keep a gunship ready for evacuation.

The Afghan *jihad* is unlikely to peter out. The Communist rule of terror and the horrors of Soviet invasion have unleashed passions that can only be appeased by the elimination of the Najibullah regime. It might take time. The Afghans, unlike our media, are not in a hurry. Most have relatives in the Communist-occupied cities and want to avoid hurting civilians. Reasonably, they prefer to wear the Communists down and dislodge them by bargaining and stratagem rather than by conventional battle, for which their enemies are better prepared.

Historical portents favor them. Shah Soojah survived the British defeat by a few months but was assassinated in April 1842, when he ventured out of the Bala Hissar to "his social bases," as Najibullah might put it today, in Stalinist jargon. Professor Halliday's new prediction is likely to prove as accurate as those he made in 1986 when he asserted that the Soviet army would never quit.

Let the Ordeal Commence

I've ordered in potato chips
  And tidied up the couch;
My vertebrae are limber, so
  I'm set to sit or slouch;
The beer is at the ready and
  The TV's been repaired,
Which postures me for pleasure as
  The Wright affair is aired.

W. H. VON DREELE

From Tragedy to Prejudice

THE TRAGIC DEATH of a large number of soccer fans crushed at the stadium in Sheffield, England, has once again focused American attention on the British soccer hooligan. American liberals have been quick to blame the tragedy on a favorite scapegoat: the English class system.

They could not be more wrong. Soccer hooliganism is, if anything, a manifestation of Britain's shift *away* from a strongly hierarchical society and toward a

THE NEW YORK TIMES, SUNDAY, MARCH 31, 1991

Dr. Baltimore's Experiment in Hubris

By John Maddox

LONDON

Dr. David Baltimore, president of the Rockefeller University for the past six months, is among the cleverest scientists of his generation. He was awarded the 1975 Nobel Prize for Medicine for research on molecular biology published in 1970, when he was only 32. Now in his early 50's, he still thinks much faster than most people. Why should it matter that he has now disowned a recondite and obscure scientific article published in 1986?

Because the authenticity of the article has been disputed for the last four years, because Dr. Baltimore chose needlessly to be its champion, because at least one person has been seriously damaged by his defense of the article, because the dispute has corroded the civility of the scientific community — and because Dr. Baltimore is a man of such distinction.

The circumstances are well known. In 1986, Dr. Baltimore, Dr. Thereza Imanishi-Kari of Tufts University and others published a research article about genetic influences on the immune system.

After publication, Dr. Margot O'Toole, an untenured researcher at Tufts, told Dr. Imanishi-Kari that she believed repeat measurements for the experiment had not been carried out. A Tufts investigation rejected Dr. O'Toole's complaint, which she then took to Dr. Baltimore. He dismissed her charges as, later, did a M.I.T. panel (where Dr. Baltimore was the director of the Whitehead Institute). Dr. O'Toole lost her job.

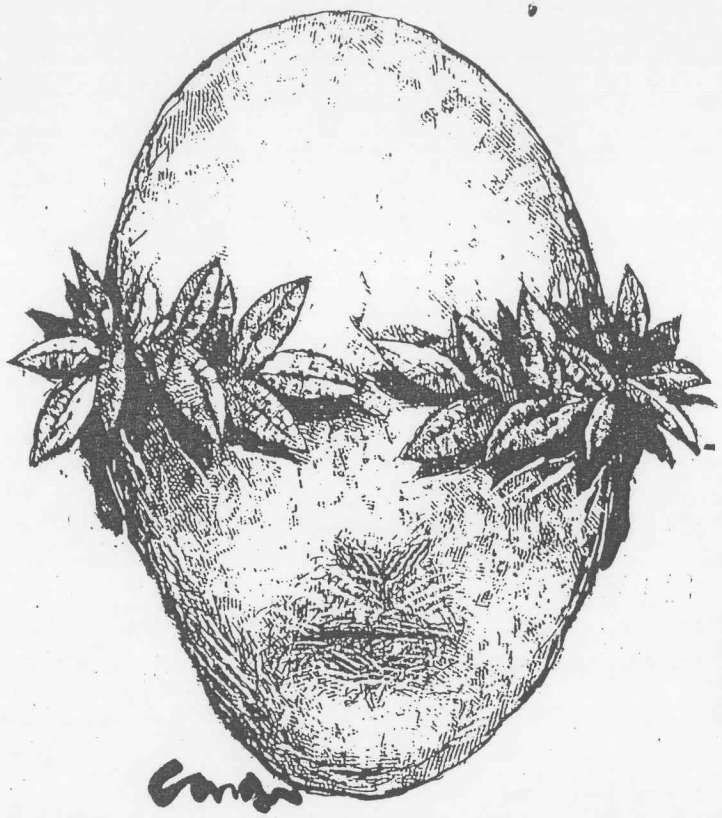
The case was then taken up by two researchers at the National Institutes of Health and eventually by Representative John Dingell's subcommittee on Oversight and Investigations. Notebooks were subpoenaed and pored over by the Secret Service.

A 1989 N.I.H. investigation concluded that there was no evidence of "fraud, conscious misrepresentation or manipulation of data." But now the draft of a second N.I.H. report says that the disputed data were indeed "fabricated." Those concerned have 30 days in which to rebut the charges. Dr. Baltimore has asked that the article be retracted.

I first met Dr. Baltimore in 1962, when he was a graduate student at what was then the Rockefeller Institute. I have been in contact with him off and on ever since. For a man in his position, he is unostentatious.

So what went wrong? At the end of 1986, Dr. Baltimore rejected overhaughtily a request from the N.I.H. investigators for further information. Then, as at the earlier meeting with Dr. O'Toole, he defended the article even though it had never been suggested that he had gathered the data.

John Maddox is editor of Nature.



Loyalty to one's colleagues is admirable, but the ferocity of Dr. Baltimore's defense has been arrogant. He angrily rejected suggestions from friends (myself included) that he should publicly allow the possibility of error. When the Dingell inquiry was announced, he circulated a letter to the scientific community warning of the dangers of Congressional interference in science.

That danger is one dark consequence. Another is the damage to Dr. O'Toole, who behaved properly throughout. She was without a job for three years. Those who have carried out the investigations at Tufts, M.I.T. and the N.I.H. have been made to look foolish, dupes of Dr. Baltimore's glittering reputation. It has taken the Secret Service to show that the disputed data were fabricated.

The damage to the scientific community's reputation will also be considerable, after a decade's anxiety about laboratory fraud. It is no surprise that fabricated data and false conclusions can find their way into print; the unpaid scientific peers who review articles before publication cannot emulate the Secret Service.

But this case will seem proof that the scientific community can cover up the errors of eminent insiders at the expense of unestablished whistleblowers. The disputed article would not have survived had not Dr. Baltimore been its champion.

The chief victim, however, will be Dr. Baltimore himself. He has brushed aside valid criticism, as much from overconfidence as from loyalty. His call against the Dingell committee sounds hollow now.

But the chief casualty is perhaps Dr. Baltimore's pride. The outcome is like that of a morality play with an admonitory ending. Dr. Baltimore has lived through two rotten years. The sooner he can return to what he does most excellently, the better for science. □

the presence of man-produced radionuclides in the environment. For the general public it is important to get the message across that today there is a sound basis for proliferation of nuclear power; there are no insurmountable scientific problems in the disposal of waste products to the sea or land. There are risks associated with all technologies, but there are also considerable advantages — hence a balance has to be achieved very soon.

Lambert provides the scientific framework upon which evaluations and judgements can be made by those with limited knowledge of nuclear matters, by contrast to Gould and Goldman who present areas of concern which are not based upon proven scientific evidence, but rather the extrapolation of controversial findings well beyond any reasonable level of acceptance. Nevertheless, there are some facts in the fiction — but of course this is common to many areas of controversy, especially when evaluating man's impact on the environment in relation to technological and social evolution.

In the short to medium term, there are no viable alternatives to the generation of electricity by nuclear means, neither are there any serious technological difficulties involved in the process. To expect a no-effect relation between technology, man and the environment is not reasonable. Overall, the benefits of accepted technology outweigh the disadvantages. It is to be hoped that the nuclear debate will become more open and informed so that the advantages and disadvantages can be properly evaluated. □

E. I. Hamilton is an environmental consultant and Director of Phoenix Research Laboratory, Penglebe, Milton Abbot, Dunterton, Tavistock, Devon PL19 0QJ, UK.

Cold fusion and other matters

FOR many years, trenchant observations on the affairs of science in the United States have been provided by the legendary Grant Swinger, director of the Mythical Center for the Absorption of Federal Funds. Here Dr Swinger converses with Daniel S. Greenberg of *Science & Government Report*, on 1 June 1989.

Q. How do you see the Bush Administration shaping up in the science-policy area?

A. That's best judged after they take office.

Q. They've been in for over four months.

A. Four months? As long as that. It is difficult to keep track of time in the absence of activity. But I can say that the general atmosphere in the country and in Washington is favourable to innovative approaches.

Q. Example.

A. Cold fusion. An exemplary case in the best tradition of the Center for the Absorption of Federal Funds. If I have any concerns, they're directed at my own institution for not doing it first. Think of it: no publication, just a press conference. And they get $5 million from the Utah legislature. Jim Fletcher, the ex-chief of NASA, joins up with them, and over a hundred corporations line up and plead for a piece of the action. It's on the covers of *Time* and *Newsweek*, and Congress invites them in to talk about $25 million. And if there's anything there, no one can find it! This is a triumph. We've worked for years to get the Congress, the press, and the public to this stage.

Q. Very unusual events.

A. Actually, we've pulled this off in medical research many, many times. There's almost nothing that hasn't been reported cured or on the brink of a cure. But this has hardly ever been done in the physical sciences. The closest thing now going is the search for extra-terrestrial life, but that's never got beyond a small scale.

Q. On cold fusion, there was some scepticism at the outset.

A. That's bound to happen when you try to undercut other researchers in a field. The main opposition came from the hot-fusion tokamak crowd — very innovative people when it comes to protecting their territory. After the first report about cold fusion came out, they advised Congress not to put any money into it until it's proven.

Q. That seems to be a prudent approach.

A. Prudent to wait until it's proven? Hot fusion has been running for 30 years without anything proven. And they're now at $400 million a year.

Q. They feared competition?

A. It was potentially very embarrassing, very threatening, this tabletop stuff for a mere $100,000. But do you know the worst of it?

Q. What?

A. The worst of it was that these fusion researchers shouted that they used their own money. As far as I'm concerned, that's unforgivable. They're cannibals. Whether or not cold fusion works is a minor matter. But using their own money. The precedent, I mean —

Q. Please, calm down, Dr Swinger. What are you planning at your centre?

A. We have a number of activities. Inspired by recent events, we're working on an alternative to the superconducting super collider.

Q. What will that be?

A. Table-top particle acceleration. Our motto is: "Fifty-three inches is better than 53 miles. One in each state." The politics are sound, even better than our old proposal for a transcontinental linear accelerator that would run across a dozen or so states. That would have brought in 24 senators and maybe a hundred congressmen.

Q. Is table-top particle accleration feasible?

A. We're going about this in the right way to find out. First, we're setting up a task force to plan a workshop preliminary to holding a conference. Next comes a call for papers. Then we'll circulate the proceedings for comment and issue a draft report. A small conference will follow to oversee preparation of the final report. This is the standard way of approaching these things. We'd be criticized if we went about it in any other fashion.

Q. If I may say so, table-top particle acceleration does seem too far-fetched to warrant all that effort.

A. This is an open-ended business. Opportunities can be anyplace. A lot of people thought Star Wars was too far-fetched to get a nickel. But there it is. And what about the manned space station?

Q. What about it?

A. It's terrific. No one knows how much it will cost or what it's supposed to do. But it's going ahead. That's an ideal project, in our view.

Q. What do you foresee as new growth areas?

A. There's a lot of talent out there working up new possibilities. We were worried about the Department of Energy losing that old entrepreneurial spirit, but they reassured us all by cooking up the mapping of the human genome. It's not really their business, but that lit a fire under NIH and they've moved into the genome trade. Of course, it also took a little nudging about the Japanese rushing into this before Congress came across with the money. But bless the Japanese. They've arrived just as the steam was going out of the warnings about how we have to beat the Russians in this or that. What would we do without the Japanese? Without them, superconductivity research would be in the poor house.

Q. What else do you see ahead for growth in science and technology?

A. The greenhouse effect is bound to be a gold mine. And we see a lot of forthcoming activity devoted to agonizing over scientific priorities: conferences, white papers, congressional hearings, and all the usual stuff. It's a small industry all by itself.

Q. In this period of economic challenge, well-chosen scientific priorities are very important for making the best use of valuable scarce resources, aren't they?

A. What?

Q. I was noting the importance of well-chosen scientific priorities.

A. I see. Excuse me, I'm late for a meeting. □

The Grant Swinger Papers. 2nd edn. *Science & Government Report, 6226 Northwest Station, Washington, DC 20015: 1990. Pp. 40. $8.95 ($10.95 overseas orders).*

mos seemingly buttressing cold fusion, and once again the spirits of chemists soar.

The gloating and sulking will go on for a few more weeks until either Fleischmann and Pons (and their red-faced allies) manage to pull a rabbit from the test tube or tabletop fusion simply fizzles. In the latter case, chemists will skulk back to their labs, to their plastic dish pans and cook books. The physicists will offer condolences (a smirk carefully hidden by the hand) and ask the Feds for more megabucks to stoke their monstrous hot fusion reactors.

Sad, really. History has not been kind to chemists. Every time a chemist discovers something significant, physicists jump in and steal the show. Think of Robert Boyle and his gas law. Or Dalton and his atoms. Mendeleev and his periodic table of the elements. Marie Curie and her new element radium.

That's all *our* business, snort the physicists. Boyle, Dalton, Mendeleev, and Curie were really physicists. Chemists don't *understand* anything; they just muck about with recipes. If you *really* want to understand gases, or atoms, or elements, or radioactivity, you've got to put away the test tubes and pipettes and do some hard-nosed statistical physics or quantum mechanics. And if you want to do fusion, you don't do it in a jar.

But wait! Don't put away the jars yet. Let's take a closer look at fusion.

In every molecule of water there are two hydrogen atoms. Out of every million hydrogen atoms, 150 have a nucleus with an extra neutron. These heavier hydrogen atoms are called deuterium, and water made with deuterium is called heavy water. If two deuterium nuclei (deuterons) fuse to form helium, about 0.1 percent of the mass turns into energy. Lots of energy. It's the old Einstein formula: Energy equals mass times the speed of light squared. Fuse all the deuterons in a cup of heavy water and you can run your car for a lifetime. There's enough heavy water in the sea to answer our energy needs forever.

So what's the problem? Deuterons have a positive electrical charge. Two deuterons vigorously repel each other. To make them fuse you've got to get them very close, overcoming the electrical repulsion. One way to do it is to heat them up to tens of millions of degrees. Then they are moving so fast they slam together and fuse. That's what happens at the cores of stars. And in hydrogen bomb explosions. And that's what physicists are trying to do with their hot fusion reactors. Fusion by brute force.

Strange things do happen

But there's another way. Put two deuterium atoms in close proximity and there's a statistical probability that the nuclei will fuse, not by overcoming the electrical repulsion but by "tunneling" through it. It's the crazy magic of the quantum world that these things happen, like Casper the Ghost passing through a closed door. But in all circumstances so far considered by physicists, the probability of tunneling – cold fusion – is so hopelessly remote as to render the process useless as a practical source of energy.

It is the dream of the electrochemists that something is happening inside their palladium electrodes that dramatically boosts the chances of tunneling. And who knows, strange things do happen in the interiors of crystalline substances; high-temperature superconductivity is a case in point.

Even if the experiments of Fleischmann and Pons turn out to be a bust, which seems likely to me, they've got a lot of people thinking about new approaches toward fusion. So don't pack away the dish pans and test tubes prematurely. Chemists may have the last laugh after all. It would be nice to think that Nature could be teased and tickled into admitting fusion rather than blasted into submission by the big bucks and monster machines of the physicists.

Chet Raymo is a professor of physics at Stonehill College and author of several books on science.

SCIENCE MUSINGS/CHET RAYMO

Cinderellas of science

There is more at stake in the cold fusion story than the discovery of a cheap, safe source of unlimited energy. There is also a chance for chemists to have their day in the sun at the physicists' expense.

No sooner had electrochemists Martin Fleischmann and Stanley Pons announced their claim of fusion in a test tube than the battle lines were drawn.

On the one side were the physicists, armed with the heavy artillery of quantum mechanical calculations, who pooh-poohed the whole thing. They, after all, are the proprietors of huge hot-fusion research schemes, funded by massive government grants. If the claims of Fleischmann and Pons were correct, the river of federal money for hot fusion projects could be expected to dry up.

On the other side were the chemists, the Cinderellas of science, always bridesmaids and never brides, who saw in the palladium electrodes of Fleischmann and Pons the magic wands that would transform their lackluster discipline into a glittering Princess.

First the chemists, 7,000 strong, met at Dallas for the regular convention of the American Chemical Society. President Clayton Callis introduced a special session on cold fusion by saying, "Now it appears chemists may have come to the rescue," and the audience broke into laughter and applause.

Then the physicists gathered at Baltimore and gleefully marshalled evidence to suggest that the cold fusion experiments were flawed and irreproducible. Words like "incompetence" and "delusion" flew through the air like neutrinos from the hot core of the sun. The upstart chemists needed to be put in their place.

Gloating and sulking continue

A week later, the electrochemists met at Los Angeles for a self-congratulatory Woodstock, inviting only those who had good things to report about cold fusion. By all reports, the mood of hopeful ebullience sagged when "confirming" experiments turned out to be something less than convincing.

And now come new reports from Texas A&M and Los Alamos seemingly buttressing cold fusion, and once again the spirits of chemists soar.

The gloating and sulking will go on for a few more weeks until either Fleischmann and Pons (and their red-faced allies) manage to pull a rabbit from the test tube or tabletop fusion simply fizzles. In the latter case, chemists will skulk back to their labs, to their plastic dish pans and cook books. The physicists will offer condolences (a smirk carefully hidden by the hand) and ask the Feds for more megabucks to stoke their monstrous hot fusion reactors.

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But wait! Don't put away the jars yet. Let's take a closer look at fusion.

Debate continuing on cold fusion

One of the most interesting aspects of the issue of cold fusion is the struggle that is going on in the scientific community over the validity of the claim by University of Utah researchers.

In formal terms contained in papers delivered in scientific circles, the battle rages. You can almost hear the test tubes clinking as first one side and then the other advances a position.

There have been supportive responses from other researchers who claim to have duplicated the cold fusion experiment, and there have been criticisms from other scientists.

The latest skirmish was produced by two Massachusetts Institute of Technology scientists this week who suggested that the Utah researchers misinterpreted the number of neutrons emitted during their experiment, and fusion really didn't take place.

But with the caution characteristic of scientists, the men summarized their critical assessment of the experiment and concluded that the facts lessen the posibility that fusion took place in Utah, but they added that their argument "doesn't completely rule it out."

So the hope for a clean and inexpensive source of energy is still alive — and so is the argument over whether cold fusion is fact or fancy.

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Cold Eyes on Fusion

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EDITORIAL

No one yet knows what B. Stanley Pons and Martin Fleischmann actually discovered in a test tube in Utah March 23, but the energy released among scientists has powered 'round-the-clock discussions 'round the world. Mr. Pons, of the University of Utah, and his former teacher from the University of Southampton shook the chemistry world and roiled tempers in the world of physics with their March 23 announcement of cold fusion via electrolytic breakdown of heavy water.

This week at the American Physical Society meeting in Baltimore, the physicists struck back. Most of the speakers denounced the claims as erroneous interpretation of data. Researchers in [illegible] versity thought they could verify parts of the Utah claims, but the physicists say they haven't been able to duplicate the feat. MIT plasma fusion chief Ronald R. Parker has questioned the reported level of neutrons, and others say there is "no evidence for anything other than conventional chemistry." That hasn't stopped MIT's Peter Hagelstein from coming up with a theory that could explain how cold fusion *might* work, just for the record.

It had seemed to be going so well. A Georgia Tech team got unexplained neutrons from the Utah experiment, duplicated from televised reports and notes on a computer bulletin board. That group later backed off, after finding its neutron measuring gear temperature-sensitive. Others at the University of Washington saw no neutrons or heat, but fusion byproducts. Now Texas A&M has backed off, too, and the physicists say the verifications are mere wishful thinking.

Scientists say the press-release-facsimile-computer message style of presentation hurts good research and wish Messrs. Pons and Fleischmann had gone the traditional route. Yet the debate has produced at least one salutary result: a worldwide, 24-hour symposium on fusion, involving chemists and theorists as well as experimental physicists and prompting new looks at a body of knowledge that had been sacrosanct.

Even if the Utah nuclear fusion results turn out to be mere chemistry, that could prove useful, too. Some scientists think the experiment will help unravel the mysteries of catalysis, which itself could spark a whole new round of discoveries. Physicists will no doubt have much to say about that, so stay tuned.

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Confusion in a jar

Researchers are still divided over claims by two scientists to have discovered how to produce room-temperature fusion. Over the weekend, for example, it was reported that attempts to replicate the Utah experiment at the Brookhaven National Laboratory, at Cal Tech and at Yale had not succeeded; and now from MIT comes the news that a physicist has demonstrated why the experiment only seemed to create fusion.

Of course, it is disheartening to learn that a process which could open the door to unlimited energy supplies has been cast in comparative doubt. Energy panaceas have a way of disappointing us. But bleak as these recent tidings may be, research will continue, and the prospect of fusion is still very much with us. Unlike the researchers examining the Utah experiment, we need not restrain our desire that fusion be achieved, and we trust that efforts to find the truth will adhere to methodologies aimed at ensuring objectivity.

As so often happens in these circumstances, the science of fusion is immersed in the politics of science. The competition is under way to determine who will win the recognition, who will gain commercial rights — and who will look foolish for spending billions to no end. In such an environment, scientists, as well as the academic, industrial, and governmental institutions that support them, may be assumed to have reasons to avoid publicity about their progress, or lack thereof. Reputations are on the line, and so are the fortunes of industries providing energy from coal, oil, natural gas, and nuclear fission.

The forces at play — institutional, financial, professional, political — are considerable indeed. Like most Americans, we can only wait and see how this recent controversy plays itself out, and whether fusion research might truly yield results.

But one way or another, the world will eventually learn whether fusion in a jar is a tempest in a teapot — or the real thing at last.