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The Dilemma Of A Physics Teacher

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This presentation is dedicated to an unknown high school chemistry student who sent me an e-mail message last spring. She wrote:

“Help! My name is Maggie Johnson and I am a sophomore at Saratoga High School. In my chemistry class, I am doing a project on Cold Fusion. I was looking on the Internet for websites on Cold Fusion, and I came across links to your Cold Fusion items. I was wondering if you could give me some advice or information?”

1) A year ago I would have replied that cold fusion is pseudoscience. **But I am no longer comfortable with this kind of reply.** Why am I not comfortable? My first opinion was based on Huizenga’s famous ERAB report. I knew the author personally and I respected him. His criticism of cold fusion was convincing because it was based on the idea that cold fusion is a thermonuclear reaction between two colliding hydrogen ions. Experimental data certainly do not support such an idea. But who made this claim? Only the popular press and those who criticized cold fusion. Fleischmann and Pons, who discovered excess heat, speculated that some kind of nuclear processes might be responsible for what they observed. The very name “cold fusion” was highly unfortunate because it misled many scientists, including myself. Who invented this term? Was it introduced deliberately (as a straw man) to discredit the nascent field of research? I have no answers to such questions. But I suspect that this misleading term will survive the controversy; that is why I decided to use it here.

2) Two other factors helped to discredit the cold fusion field in many minds: the claim that experiments in this area are extremely simple, and that practical applications are going to be possible very soon. Again, I do not know who the authors of such claims were. Those who criticize cold fusion today, Park in the US and Kruglyakov in Russia, essentially repeat Huizenga’s arguments. **What was convincing in 1989 is no longer convincing today.** Why do they ignore the generation of helium? Why do they ignore more sophisticated calorimetry? Why do they ignore unnatural isotopic ratios? Why are they not at this conference listening to presentation of new data and defending their own

ideas? That is another set of questions that I am not able to answer. Ignoring experimental data is not an acceptable method of addressing a scientific controversy.

I am still not convinced that cold fusion is real. But I no longer say that cold fusion is voodoo science. I do read papers downloadable over the library of the Internet web site (www.lenr-canr.org) and I share what I understand with other physics teachers at

<http://blake.montclair.edu/~kowalskil/cf/>

Feel free to explore my short essays and to share them with others. **Why am I still puzzled?** Because everything I know about nuclear science goes against the idea that nuclear reactions can be induced by chemical processes at ordinary temperatures. I wish I had a chance to personally participate in experiments generating extraordinary results. But, like most teachers, I have no access to a sophisticated laboratory which would be needed to verify accumulation of helium and heavier reaction products. I read about such phenomena and I am impressed. But I would be more comfortable if the reported results were examined and officially confirmed by an appointed panel of experts.

3) I am also puzzled by the fact that **hundreds of sophisticated research scientists exploring cold fusion over the past 13 years have not yet developed a reliable demo for teachers**; windows of opportunity did exist in several countries. Teachers need experiments that can be performed with simple instruments available in schools, such as Geiger counters and gamma ray spectrometers. Excess heat generated at a rate of about one watt is not convincing unless one is able to deal quantitatively with all possible chemical reactions taking place in the apparatus. Reproducible generation of excess heat at the level of twenty watts, or higher, for a long period of time, would be much more convincing to a physics teacher, especially if it could be correlated with emission of nuclear particles or gamma rays. Even a 70% reproducible demo would be useful; teachers know that some experiments, for example in electrostatics, do not succeed when humidity is too high. Cold fusion seems to depend on factors which have not yet been identified. Abnormal isotopic ratios, reported by many independent researchers, are extremely convincing but a typical teacher can not verify such data.

4) That is why I would be more comfortable if the reported results were examined by an officially appointed panel of experts. **A second national evaluation of the entire cold fusion field is definitely needed to clarify the situation.** I am also disturbed by the fact that some cold fusion data are reported in journals which also publish papers dealing with hydrinos, antigravity, rotational fields, quantum healing devices, etc. etc. I know that leading journals do not accept articles devoted to cold fusion and that many scientists share their observations via channels available to them. It is better to use these channels, they think, than not to publish. That is natural. But it would be better if claims based on speculative extrapolations from exotic theories (and perhaps on wishful thinking) were not mixed in with cold fusion claims which are basically experimental. Therefore I strongly support the announced initiative of starting an electronic peer-reviewed journal devoted exclusively to cold fusion topics. Voodoo science does exist

and cold fusion researchers should separate themselves from it.

5) I am optimistic that the cold fusion controversy will be resolved, one way or another. The optimism is based on the following quotation from what John Huizenga, the author of the ERAB report, wrote in 1989. "**The scientific process is self-corrective.** This unique attribute sets science apart from most other activities. The scientific process may on some occasions move slowly, sometimes even along a circuitous path. The significant characteristic of the scientific method, however, is that in the end it can be relied upon to sort out the valid experimental results from background noise and error." And here is another quote from the panel of appointed scientists responsible for the first national investigation of cold fusion. "The Panel recommends against the establishment of special programs or research centers to develop cold fusion. However, there remain unresolved issues which may have interesting implications. The Panel is, therefore, sympathetic toward modest support for carefully focused and cooperative experiments within the present funding system." **Sympathetic attitude toward unresolved issues** is worth emphasizing.

6) What will be the verdict of history? Sooner or later, perhaps in 50 years, the cold fusion puzzle will be resolved (like the "puzzle of cybernetics," or the "puzzle of genetics," both in USSR). **Only two outcomes are possible:** (a) CF phenomena will finally be confirmed or (b) CF phenomena will not be confirmed. In each case one will have to deal with important social issues. Suppose that CF is confirmed. Then one would have to explain causes of a long-lasting conflict between scientists and administration. Suppose that CF is not confirmed. Then one would have to explain a phenomenon of massive self-deception involving hundreds of top scientists in many countries. In either case you will be recognized as participants of an important and **unique event in the history of science.**

Keep working to clarify the most intriguing scientific and social puzzle of the 20th century. I am certainly not the only physics teacher waiting for a consensus on cold fusion. Keep submitting good papers to traditional refereed journals, such as Physical Review, etc. **Do not be discouraged by frequently unjustified rejections** of your papers. Document such rejections and make them known to mainstream scientists. Deplorable confrontations with overly bureaucratic editors should also be exposed. Take advantage of the new electronic journal devoted to cold fusion. Dissociate yourself from voodoo scientists and openly criticize them. Keep bringing cold fusion topics to scientific conferences devoted to areas overlapping with your activities. My own interest in cold fusion was reawakened at such a conference one year ago. Try to seek contacts with students, and with the general public. But focus on puzzling scientific results; it is too early to speculate about practical applications.

7) Let me document **my personal encounter with the process of rejection.** About half a year ago I wrote a letter to the editor of Physics Today. In that letter I described my own dilemma in dealing with cold fusion and asked for help. Why was my short letter rejected? Why was I not allowed to see what the referees wrote about it? Ironically, that letter was triggered by the article entitled "New APS Ethics Guidelines Address

Research, Misconduct and Professional Responsibilities.” That article by Jim Dawson was published in the January 2003 issue of Physics Today. I welcomed the new guidelines and asked how a physics teacher can make sense of “cold fusion?” Was the research conducted in that area, in the last ten years, a “departure from the expected norms of scientific conduct” or did it “lead other scientists along fruitless paths?” I see no evidence that the data were “fabricated.” As a physics teacher I am confused by the situation. Some say it was “a fiasco” while others say it was an “important discovery.” How should teachers address this topic in the context of “public affairs between science and society,” or in the context of discussing “institutional support for new ideas and innovations?”

After waiting several months I sent an e-mail message asking about the status of my letter. On Thursday, June 12, 2003, I received a reply from Dr. Marty Hanna, Letters Editor at Physics Today. He wrote: “So far, **I have a split decision on the possible publication of your letter.** I expect soon to have a tie-breaking input from a third reviewer. I will let you know as soon as I have a firm decision. Thank you for your patience.” On Thursday, July 3 Dr. Hanna wrote “ We have completed our review of your letter commenting on the APS ethics guidelines story in our January 2003 issue. Our decision, after some valuable discussion, is not to publish your letter. Thank you for writing and for your interest in Physics Today.” Unhappy about this I wrote “I would very much appreciate if you could send me the reports of the referees evaluating my letter to the editor.” The immediate reply was “Please let me explain. I know that scientists who submit articles to peer-reviewed scientific journals expect reviewers to give them a critique of their letters. Physics Today is not, in the strictest sense, a peer-reviewed scientific journal; it is, instead, a **special-interest magazine** for physicists. Generally, my reviewers are staff writers and editors (all physicists) who may give me little more than ‘thumbs up’ or ‘thumbs down’ on a letter. As a rule, we do not give out the specific comments of the reviewers, because we consider them to be internal business. Thank you for your inquiry. I hope my explanation has helped.”

The input from three qualified referees would be very useful to me. I am a member of APS and I expected a better treatment from my journal. This is not a healthy situation. Here is how it was described by Dr. E. Storms: “Serious scientists rejected ‘cold fusion’ in the past for good reason. These reasons no longer apply. **If science cannot correct a past rejection, then what good is the scientific method?**” Physics Today should promote exchanges of information among recognized physicists from different disciplines. It is an ideal place to ask the question formulated in my letter. Why did Dr. Hanna reject the letter after one of the referees recommended it? Which special interest is he protecting by not publishing the letter? What is wrong with asking for another evaluation of new cold fusion claims by an appointed panel?

8) Fortunately, not all special interest journals are categorically opposed to anything connected with cold fusion. **I am happy to report that my letter to the editor of The Physics Teacher has been published** two month ago (Volume 41, June 2003, page L1). After quoting the above message from Maggie Johnson I wrote: “ How should a physics teacher answer questions about cold fusion? I am no longer comfortable saying

that 'cold fusion is voodoo science.' Can a nuclear reaction be triggered by a chemical process? The answer, based on what we know about nuclear phenomena, is negative. On the other hand many experiments seem to indicate the opposite. Some of these experiments have been described in refereed journals, others are available over the Internet. I am referring to papers published long after the first evaluation of 'cold fusion' made in 1989 by a board of experts appointed by our Department of Energy. Their authoritative report¹ was based on data available nine months after the initial announcement by Fleischmann and Pons.

Many objections found in the report are still valid but some are at odds with new data. Accumulation of helium, for example, confirmed by several investigators, was not known when the report was released. How can progressive accumulation of helium be explained? New findings about 'cold fusion' phenomena are available to students over the Internet, for example, at <http://www.lenr-canr.org>. Many articles downloadable from that site were published by scientists associated with prestigious institutions. What should a physics teacher tell students about phenomena reported by these scientists?"