LETTERS TO THE EDITOR

FACTS BEING DISTORTED IN COLD FUSION CONTROVERSY

We have to be reminded occasionally that in science, difference of opinion or controversy requires a balanced and honest statement of fact by both sides. When this rule is not followed, which is increasingly the case these days, we all lose by a cheapening of the scientific method and a loss of respect toward our profession.

The so-called "cold fusion" controversy is a particularly good example of facts being distorted by many who are skeptical of the claims. As a result, I am saddened to say, the situation has degenerated from useful debate about how experimental data should be interpreted to an issue of intellectual honesty.

Several examples of this deterioration can be given starting with the recent book by Hoffman.[1] This book contains a variety of examples; however, for the sake of brevity, I will address only two. Hoffman tries to explain why claims for tritium production are false because they are based on a misinterpretation of normal phenomenon. He first explores the possibility that heavy water used in claimed successful tritium-producing experiments contains used heavy water from nuclear reactors containing leaking nuclear fuel. Consequently, the water would, he claims, contain ^{238}U and ^{210}Pb, a minor decay product of ^{238}U. This ^{210}Pb has a β emission that might be mistaken for tritium during a careless measurement. The reader is left with the impression that this scenario actually has merit. In fact, a person learns after a simple inquiry to the supplier of heavy water that such mixing is not done, would be completely impractical, and would result in a dangerous product. A simple check of the decay chain of ^{238}U shows that at most, 3 atom/min would result if the sample contained 1 g of uranium, an impossibly large amount. Because of the 21-yr half-life of ^{210}Pb, only a small fraction of this accumulated isotope would actually decay during a measurement and be mistaken for tritium. Thus, the maximum decay rate of this material is smaller than 10^{-15} times the observed tritium decay rate. No mention of such facts that would completely nullify the scenario are to be found in Hoffman's dialogue. Hoffman next makes a similar assumption about commercial palladium. Contaminated palladium resulting from the nuclear weapons program is proposed to be mixed with palladium used in cold fusion experiments. A simple inquiry to the manufacturers of palladium would reveal that this possibility simply does not exist. Furthermore, hundreds of pieces of palladium from many sources have failed to show significant tritium. To be on the safe side, people frequently prepurify or preanalyze the studied palladium. Published studies demonstrate that even if tritium were present, it would not appear in the electrolyte, where anomalous tritium is found, but in the evolving gas. None of these facts are to be found in the book. I believe that giving a false impression based on data demonstrated to be false is intellectually dishonest and should be censured by any competent scientist, no matter how he or she stands on an issue.

Other skeptics of the effect show a tendency to use logic in very careless ways. For example, Jones et al.[2] (of Brigham Young University) found, as others have, that recombination can occur between the evolving gases within an open, light water-Ni/Pt electrolytic cell. Such recombination makes heat measurements uncertain. From this single experience, they state, "failure to rule out prosaic explanations probably invalidates all currently available reports of excess heat in both light water Ni/Pt and heavy water Pd/Pt cells." They go one step further by proposing that reports of excess heat result from using "bad" calorimeters, and negative results, like theirs, result from using "good" calorimeters. No mention is made of over 10 studies using closed cells and 9 studies showing no recombination to which the "prosaic" explanation does not apply. No mention is made of the studies using calorimetric techniques at least as good as theirs. No mention is made of the fact that failure to observe the effect can be attributed to known defects in the experimental method or materials, factors having nothing to do with the kind of calorimeter used, nor do they mention that so much power has been produced on several occasions to completely overwhelm any "prosaic" explanation. Such omissions, I believe, are not in the spirit of proper scientific debate.

Morrison (of CERN) has been especially outspoken and careless with information in a regular series of newsletters. His main theme is that the large number of failed experiments nullifies the positive results. He does not acknowledge that these negative studies frequently failed to follow the known procedures required to achieve a positive result. Furthermore, simple logic known even to college freshmen shows that a negative result demonstrates neither the presence nor absence of a phenomenon. Of course, reproducibility is required to study an effect, but it is not a necessary requirement to accept its existence. Many obvious examples can be found in nature.

If skeptics wish to make a contribution, they should explore rational explanations; otherwise, they should just remain quiet while letting the rest of us find ways to explain the effect.

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October 11, 1995

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2. J. E. JONES, L. D. HANSEN, S. E. JONES, D. S. SHELTON, and J. M. THORNE, "Faradaive Efficiencies Less Than 100% During Electrolysis of Water Can Account for Reports of Excess Heat in 'Cold Fusion' Cells," *J. Phys. Chem.*, **99**, 6973 (1995).

RESPONSE TO "FACTS BEING DISTORTED IN COLD FUSION CONTROVERSY"

Storms falls prey to exactly the same fault he finds in others; i.e., he defines anyone who is skeptical of "cold fusion" claims as someone who distorts the facts, is dishonest, or is careless with logic. We did not derive our conclusion that "failure to rule out prosaic explanations probably invalidates all currently available reports of excess heat in both light water Ni/Pt and heavy water Pd/Pt cells" from a "single experience" as Storms asserts, but rather from a careful review of all of the literature available at the time we wrote the article. Our conclusion was and is consistent with the results of several experiments reported in our paper. We did not propose that "reports of excess heat result from using 'bad' calorimeters and negative results . . . from using 'good' calorimeters." Rather, we pointed out that "bad" calorimetry (which can be done with a "good" calorimeter) definitely accounted for some of the claims of excess heat. It is also certainly true that most claims of excess heat, including those of Pons and Fleischmann, come from studies using calorimeters of unproven design and with minimal calibration and verification. The measurement of heat, i.e., calorimetry, can be subject to many errors and is not something that should be assumed to give correct answers without careful and thorough verification of the results. Storms does not give any references to the "10 studies using closed cells and 9 studies showing no recombination to which the prosaic explanation does not apply," so we cannot respond. Indeed, which "prosaic" explanation does he refer to, recombination or bad calorimetry? No references are given to support his assertion of work that used "calorimetric studies as good as theirs."

One of the requirements for a phenomenon to be accepted as scientifically valid is that it be reproducible. Storms argues that we cannot criticize a result just because it is not reproducible. To what experiments does Storms refer in which "so much power has been produced on several occasions to completely overwhelm any 'prosaic' explanation?" We devoted a paper to the claims of Miles et al. showing that neither excess heat nor ^{4}He production had been established by their work.[1] Storms fails to mention this paper although it was published together with his reference.[2] Such omissions are definitely "not in the spirit of proper scientific debate."

The challenge for Storms is to prove that cold fusion does exist. In our opinion, work done to date does not provide compelling evidence for cold fusion. We suggest that Storms study the history of genetics research in Russia during the period of Lysenko if he really wants to know what happens to science when the skeptics follow his dangerous request to "just remain quiet."

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November 27, 1995

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2. J. E. JONES, L. D. HANSEN, S. E. JONES, D. S. SHELTON, and J. M. THORNE, "Faradaic Efficiencies Less Than 100% During Electrolysis of Water Can Account for Reports of Excess Heat in Cold Fusion Cells," *J. Phys. Chem.*, **99**, 6973 (1995).

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When I was asked to write this summary of "cold fusion," I knew I would receive enormous flak because both sides of this controversial subject have turned to bitter rhetoric when discussing the scientific capability of anyone who disagrees with them. I thought that my book would especially draw the ire of the "anti-cold-fusion" establishment because I maintained that the workers in cold fusion were competent indeed and doing interesting, scientific work. Much to my surprise, almost all the bitter attacks came from the "pro-cold-fusion" faction.

One point in particular has been raised again and again. We found that the surface of palladium cathodes often showed a surface, some hundreds of angstroms thick, highly enriched in mass 106. Auger analyses showed this layer to be ZrO^+ producing (90 + 16) and not palladium isotope 106. The question then arose, "Why such widespread contamination by zirconium in the pH 13 LiOD electrolyte?" The tritium/deuterium (T/D) ratios of solutions that deposited out zirconium were higher than literature values for heavy water. Because heavy water reactors often use zirconium cladding for fuel rods (and all cladding have measurable fuel contamination on the outer surface of the cladding), a hypothesis was put forward by one character in the dialogue that the high T/D ratio, the presence of zirconium, and a possible slight increase of suspended particles with alpha-emitting surfaces could all be explained by "spiking" of natural heavy water with slight amounts of used moderator water from a heavy water reactor. The second character in the dialogue asks