Cold Fusion, the Titanic Disaster Aftermath, and the Internet

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"News is the first rough draft of history."
—Newspaper publisher Philip L. Graham (1915-1963)

Newspapers are indeed the first draft of history and, in many cases, the last draft as well. This has been one of the reasons behind cold fusion's bad press over the years. Researchers made initial assessments of the phenomenon back in April 1989 and offered up their gut-reaction opinions to the media. Many of these erroneous, off-the-cuff ramblings are still widely quoted today. The three famous "negative" experiments at Caltech, MIT, and Harwell are often cited as proof that cold fusion does not exist, although careful reexaminations have subsequently shown that the tests conducted at all three establishments did, in fact, yield positive results. Reporters, commentators, and historians seldom look beyond immediate impressions formed in the earliest days of a major event, when confusion is rampant and detailed investigations have not yet begun. This is the pattern with many controversial events, particularly crises that upset people, flummoxed the experts, and aroused passionate, snap judgments. Perhaps the most infamous example was the 1912 Titanic disaster. In many respects, it bears striking similarities to the events surrounding the introduction of cold fusion in 1989.

Titanic, Southhampton pier, April 10, 1912
Photo courtesy of Titanic Incorporated Limited.

The Titanic disaster is one of the most closely documented incidents in history. It was the focus of a Congressional investigation in the United States, and a Board of Trade investigation in England. It dominated the news for weeks. It has been the subject of thousands of articles, books, and movies. Minute-by-minute chronologies have been compiled. Historical societies in England, the United States, France, and elsewhere are devoted to the Titanic. On the Internet many extensive web pages can be found, including an *Encyclopedia Titanica*[1] with thousands of photographs and biographies, and dozens of scholarly essays on subjects ranging from "Biodeterioration of the RMS Titanic" to the life story of the maid who accompanied Mrs. John Jacob Astor.

Despite this close attention, in many accounts crucial facts are confused, misrepresented, distorted, or covered up. In the weeks following the disaster, erroneous statements were published in the newspapers, and many are repeated today. Here is a good example, from a four-page article in a popular history book:

> The Titanic was traveling at twenty-two miles per hour through ice-dotted waters in an attempt to break the record for a trans-Atlantic crossing.[2]
> —M. Hirsh Goldberg

The Titanic could not have broken the record for a trans-Atlantic crossing. It was designed for comfort and fuel economy, not speed. It was equipped with two oscillating steam engines and one turbine, whereas by 1912 the record-holding ships used pure turbine propulsion, which is faster. Goldberg would have discovered this fact in most introductory articles about the Titanic. If he had dug a little more, he would have learned that the Titanic's sister-ship Olympic was launched a year earlier, but it did not break the speed record. Furthermore, steamships were seldom pushed to top speed on their maiden voyage, because that was not good for the engines.[3] This rumor about a speed record appeared in many newspapers following the disaster. It has been copied ever since. Goldberg repeated other egregious mistakes:

"The ship's designers had reinforced the bow . . . But there was not much they could do with the sides of the ship below the waterline." The Titanic was double-hulled, an important innovation still missing from some modern ships, including the Exxon Valdez.

"Its designers thought of one other attribute that would set the Titanic apart from all other ships: It was built to be unsinkable." The implication here is that watertight subdivided compartments were innovative or unique to the Titanic. All British steamships built after 1894 had to have watertight compartments, by law, and the first large ship with a double-hull was the Great Eastern in 1858. Goldberg notes correctly that technical journals called it "practically unsinkable," but after the accident, the public forgot that caveat and accused the shipowners of saying it was absolutely unsinkable.

"[Regulations] called for ships . . . to have a minimum of 16 lifeboats, but in a classic Catch-22 of error, no one thought to increase the minimum number of lifeboats for the 46,000 ton Titanic." The designer, Alexander Carlisle, originally proposed forty-eight lifeboats, which was enough for all passengers and crew.[4] After well-documented exchanges between the designer, owners, and builders, the number was whittled down to twenty, including four collapsibles. The deck and davits were built as originally planned, with the capacity for forty-eight boats. Immediately after the accident, the crew of the sister ship Olympic went on strike and refused to leave port until enough boats were installed, which was easily done.

The ship was traveling at 22.5 nautical miles per hour, or 26 miles per hour. Contrary to many accounts, this was not quite top speed, which was about 24 knots, but it was too fast for an area where icebergs had been reported. Other ships in the area had slowed or stopped for the night.

Where These Mistakes Originated

It is understandable that facts about the disaster were garbled at first. People who expect to drown in a dark night at sea do not make careful, objective observations or keep notebooks. The ship sank, most expert witnesses died, the evidence vanished. The details brought out during the investigation were astonishing and appalling, such as the fact that many lifeboats were only partially loaded, and the fact that another ship, the Californian, stood ten miles from the disaster and did nothing. The captain and crew saw the distress rockets, yet they did not even wake up the radio operator. While responsible reporters did their best to print the facts, yellow journalists invented sensational stories and passed them off as news. The truth was as lurid as the invented stories, so it is no wonder people could not tell them apart. News of the sinking was a worldwide sensation. Rumors flew. Crowds of reporters and terrified relatives besieged distraught officials. This was not an environment in which you could expect carefully thought out, accurate fact-finding. The 1989 mass media brouhaha that erupted around cold fusion, although far smaller in scale, engendered similar confusion, which has also remained uncorrected in the popular imagination.

Confusion about the condition of the ship itself remained until the wreck was discovered. Most experts

thought that a large gash had been torn in the side. Some eyewitnesses reported that the ship broke apart as it sank, but most shipbuilders dismissed that as impossible. The wreckage revealed that the ship did break apart, and there does not seem to be a gash after all, only small holes. In the absence of evidence, such mistakes are understandable. Similar confusion about the cold fusion effect lingered until 1991, when careful replications were published.

Mistaken impressions, hysteria, and distortion in the heat of passion back in 1912 are understandable. By 1984, when Goldberg wrote his book, the facts were reliably established. He should have spent a little more time at a public library. By the early 1990s, facts about the Titanic were available on the Internet, but not in much detail, because the cost of on-line storage was high. The Internet was "an ocean a thousand miles wide and one inch deep." Today, you can find hundreds of detailed articles about the Titanic. You can find original sources, and accounts of historical events written by the people who experienced them. In a few minutes you can pull up the entire text of the U.S. and British official investigations.[5] In the past, a single copy of an unpublished memoir, letter, or testimony was often buried in a dusty library stack. Such material is gradually being scanned and placed on the Internet for all to see. In the future we hope that original papers and unpublished data from cold fusion experiments will be made available. When the information you want is not available on-line, the Internet can still help. Online bookstores list nearly two hundred books about the Titanic. The Internet is a marvelous research tool, unprecedented in scope, speed, and ease of use.

It would seem that authors like Goldberg no longer have an excuse for making egregious mistakes. Unfortunately, although the Internet is a treasure trove of accurate information, it is also a junkyard of mistakes, misinformation, propaganda, and urban myths. It is an uncensored, uncontrolled free-for-all. A search for Titanic may turn up a thoughtful, accurate article, or one filled with nonsense. The two may look equally authoritative and professionally formatted. Where does this leave an author like Goldberg? He wants to write a three hundred-page book in a reasonable amount of time. He cannot afford to spend days researching every topic. How can he distinguish good information from bad? People often make three suggestions:

First, use your best judgment; go with what sounds reasonable. The problem is that truth sometimes sounds unreasonable, and defies the judgment of experts. This advice is unfair to Goldberg, because he probably does not have much judgment when it comes to marine technology in 1912. Like a reporter, he must act as a generalist, and describe subjects with which he is unfamiliar. Perhaps we should advise authors to "stick to a narrow range of subjects you know about." This would make history books dull, and newspapers impossible.

Second, stick to Internet pages from mainstream, authoritative publishers such as *Britannica*, the *New York Times*, and *Scientific American*. The authors at these sites are usually diligent, intelligent, and well-paid. They have high standards, and large libraries to draw on. But they are human beings, with prejudices and limitations. They sometimes despise, ignore, shortchange, or misrepresent a topic, such as they have with cold fusion.

Third, go with the most popular site. The latest Internet search tools automatically rank web pages by the number of links from other pages. Even so, the majority opinion is not always correct.

These techniques are not foolproof. In the end, you must depend upon your own judgment. If you cannot tell a reciprocating engine from a turbine, perhaps you should refrain from writing about the Titanic. Reporters, historians, and scientists who know nothing about electrochemistry and calorimetry should refrain from writing about cold fusion. If a reporter must write about cold fusion, he should search the Internet for articles about it. We are pleased to note that many search tools bring up our web site, **www.infinite-energy.com**, at the top of the list. A reporter starting there need not trust our judgment. We

include a list of original sources: peer-reviewed scientific papers available at university libraries. A reporter who does not understand these papers must do his best with summaries written for the layman, and admit to his readers that he does not fully grasp the technical issues.

When a scientist writes about cold fusion, he should be held to more exacting standards. He must not dismiss or condemn cold fusion without reading the journal papers, and without presenting a credible, technical reason for doubting those papers. Society relies upon scientists, lawyers, ship captains, and other professionals to make unbiased, informed statements about their areas of expertise. It is unethical for a scientist to endorse or condemn a claim he has not carefully analyzed.

In rare cases, a few scientists have been guilty of even more unethical behavior. McKubre and other prominent cold fusion scientists have given copies of journal papers to prominent critics, including Douglas Morrison, Robert Park, and John Huizenga. The papers directly contradict assertions made by the critics regarding matters of fact, not opinion, such as the amount of energy produced by cells in continuous bursts, the percent of input versus output, or the amount of chemical energy that a mass 0.5 grams of palladium deuteride will release as it degasses. Morrison often claims the degassing can account for the heat produced during an experiment performed by Fleischmann and Pons. Fleischmann gave him a paper showing conclusively that he is mistaken by a factor of 1,700.[6] Morrison has been told about this mistake countless times, at conferences, in writing, and in a formal reply published in *Physics Letters A*. Yet he recently contacted a Nobel laureate and repeated the same misinformation. Fortunately, the Nobel scientist contacted me, and I was able to give him the correct numbers.

Gary Taubes is another prominent critic. He made many misinformed claims in his book, on the radio, and in the mass media. He may not be qualified to read journal papers, because he does not appear to understand basic concepts such as electricity. He claims people sometimes measure electrolysis amperage alone and not voltage, and he thinks that regulated power supplies put out more electricity over the weekend because factories use less power. He thinks some researchers measure tritium once, after the experiment, without establishing a baseline or taking periodic samples. His book is filled with hundreds of similar errors. Perhaps the most mind-boggling one was his statement that a cell might have huge temperature gradients, "say fifty degrees hotter on one side than the other."[7] This is like asserting that you might stir a cup of coffee, drink from the right side and find it tepid, but when you turn the cup around and drink from the left side, it will be steaming hot.

Taubes wrote his book using the same methods employed by sensation-mongering reporters in 1912: he pieced together second-hand rumors and made wild guesses about a subject he does not understand. He described his methods in the introduction, footnotes, and appendices. The book is based upon interviews and telephone conversations with 257 people, listed in an appendix. He spoke with seventeen people who actually performed experiments. Four of the seventeen are implacable enemies of cold fusion, including the authors of the three famous "negative" experiments. Most of the remaining 240 are critics like Frank Close and William Happer, who deplore cold fusion, and have staked their reputations on its demise. They have attacked it in the mass media, the ERAB report, and in books. Although more than a thousand peer-reviewed papers were published by the time Taubes wrote the book, he did not reference a single one of them in the footnotes. His descriptions of the experiments are wildly at variance with the facts, in major and minor details, so it seems unlikely that he read a paper. Describing an experiment is an exacting task, even when you understand electricity, you read the paper, visit the lab, and ask the experimenter to review your description. When a scientifically illiterate person tries to imagine how an experiment works based on allegations made by people who despise the research, indescribable confusion and distortion result.

Taubes' book was recommended in enthusiastic blurbs by four Nobel laureates and the chairman of the American Association of the Advancement of Science. These people could not have actually read the

book, or if they did, their judgment was skewed by animosity. This shows how easy it is to spread false information, and how careless distinguished scientists can be. It takes only a small group of people to poison the well of public opinion. There may be a few other active critics in the mass media, but most attacks originate from these four: Morrison, Park, Huizenga, and Taubes. They are not famous or influential. They succeed because many scientists bear a grudge against cold fusion, and are willing to believe the worst about it. When Robert Park attacked it with inflammatory *ad hominem* rhetoric, a room packed with hundreds of members of the American Physical Society (APS) applauded and cheered.

Mistakes Caused by Culture, Denial, and Psychology

One way to learn how to separate fact from fiction is to study the ways mistakes and disagreements arose in the first place, and why they remain in the historical record, seemingly impervious to correction.

What caused people to distort the Titanic story? Trauma, at first. People could not bring themselves to believe the news. An accident was bad enough, but it must have been heartbreaking and infuriating to read about the "millionaires' special" lifeboat No. 1, with a capacity for forty people, which was launched holding only "Sir Cosmo, Lady Duff Gordon and ten other people," leaving twenty-eight others to die in agony for no reason. Many distortions were caused by a spooky romanticism characteristic of the times. The truth was sickening; the romantic myth was comforting. People searched for meaning and inspiration in a seemingly random event. Two-thirds of the first class male passengers sacrificed themselves to rescue women and children, and they were celebrated as heroes.[8] Some surviving officers testified that the men stood back bravely and the crowds were orderly. Other witnesses said there was chaos, violence, and disorganization and that the crowds were quiet at first only because no one told them the ship was doomed. The treacly version has dominated most movies and the popular imagination. In 1912, George Bernard Shaw wrote:

> Why is it that the effect of a sensational catastrophe on a modern nation is to cast it into transports, not of weeping, not of prayer . . . not of poetic expression of soul purified by pity and terror, but of wild defiance of inexorable fate and of undeniable fact by an explosion of outrageous romantic lying? . . . What is the use of all this ghastly, blasphemous, inhuman, braggartly lying? Here is a calamity which might well make the proudest man humble and the wildest joker serious. It makes us vainglorious, insolent, mendacious. The effect on me was one of profound disgust, almost of national dishonor. Am I mad? [9]

Sea captain and author Joseph Conrad said, "There's nothing more heroic in being drowned very much against your will, off a holed, helpless, big tank in which you bought your passage, than in quietly dying of colic caused by the imperfect salmon in the tin you bought from your grocer."[10]

Some mistaken ideas about the disaster have more sinister origins. Reporters were looking for lurid "scoops." While some were inventing romantic myths, other demonized the capitalist ship owners, or invented horror stories. They invented tales and passed them off as news, the way Taubes invents magic temperature gradients. The American press described the survivors as they came aboard the rescue ship Carpathia as hysterical, suicidal, and "lunatic," when in fact the captain of the Carpathia said they were "magnificent . . . Calm and perfectly orderly." False rumors were published that workmen were still finishing up construction on the lower decks, and the water-tight doors could not be closed.[11]

When the story broke, outrage erupted all over America and Europe. The U.S. blamed the British government for lax regulations, and the British newspapers blamed the Americans for lurid misrepresentations and spreading false hopes with bogus radio messages. The owner of the ship, J. Bruce Ismay, had been on board and he survived. Many people blamed him for the disaster. They assumed he ordered the captain to break the speed record. Perhaps the worst error to come out of this stew of

confusion, anger, and grief was the calumny heaped upon the principal American investigator of the disaster, Senator William Alden Smith. These attacks were not honest misunderstandings; they were politically motivated. The portrayal of Smith's role is repeated in many modern accounts. I have read several books about the disaster, but I know of only one, by W.C. Wade, that tells the full story and gives Smith the credit he deserves.[12]

Senator William Alden Smith, principal American investigator of the Titanic Disaster.

Smith dug out the causes of the disaster, and then he pushed through new safety regulations. Other members of the investigating committee helped, but it was mainly Smith who vigorously fought against "stupendous opposition" (Senator Vandenberg) from the steamship companies, conservative newspapers, the British Board of Trade, the surviving officers of the Titanic (some of whom never forgave him for revealing their ineptitude), the Marconi company, and the New York Times Co., which had a sweetheart deal with Marconi to monopolize news of the disaster. These powerful interests fought to hide the facts and derail reform. They did not want to be held liable. They feared having to pay millions of dollars in restitution to the families of the victims. They did not want to pay to hire additional radio operators, or equip ships with enough lifeboats. Above all, they did not want a landlubber like Smith telling them how to run their business.

Opposition began within hours of the accident. The U.S. Navy intercepted confidential White Star line telegrams sent by Ismay from the Carpathia, and handed them over to Smith.[13] Ismay and other company officials planned to bundle off the surviving officers and crew back to England the moment they arrived in New York, to keep them from testifying. Smith and his deputies boarded the Carpathia when it docked and served subpoenas on the witnesses, forcing them to stay in the U.S. When the investigation got underway and Smith began revealing the ugly truth, the vested interests launched a propaganda campaign against him. Some newspapers, especially in England, were happy to go along. (Many other newspapers came to his defense.) His opponents made Smith look like a fool, with tactics similar to those used against cold fusion scientists, especially quoting out of context, oversimplifying, and ridiculing a person because he knows more than you do. One of the most famous attacks on Smith, often reprinted today,[14] came after this exchange during the testimony of a surviving officer, Harold Lowe:

Senator Smith: Do you know what an iceberg is composed of?
Mr. Lowe: Ice, I suppose, sir.
This response "convulsed the audience with laughter," and it was reported in many newspapers as proof that Smith was an ignoramus. Here is what followed:
Senator Smith: Have you ever heard of an iceberg being composed not only of ice but of rock and earth and other substances?
Mr. Lowe: No, sir; never.
Senator Smith: Did you hear the testimony of your fellow officer, Boxhall?
Mr. Lowe: No, sir.
Senator Smith: You did not hear him describe what composed an iceberg?
Mr. Lowe: No, sir.
Senator Smith: But you labor under the impression that they are composed entirely of ice?
Mr. Lowe: Absolutely, sir.

The reporters should have latched on to the implications of the exchange. They did not ask what was the true meaning of this exchange, and the circumstances behind it. At least they could have asked Boxhall or one of the Navy experts present at the hearings what icebergs are made of. Here is the story behind this

question. On the morning the news of the disaster hit, Smith began energetic steps to arrange a Congressional investigation. He consulted with leading experts on North Atlantic navigation and arctic conditions. Weeks later, when he questioned Boxhall and Lowe, Smith knew that icebergs in that part of the ocean, at that time of year, often contain "rock, earth and other substances." Boxhall was an experienced North Atlantic seaman, so he also knew this. The other surviving officers and men had no idea what icebergs are composed of. Smith asked this question to screen Lowe's knowledge. The question was brilliant; it seemed ignorant only to those who were themselves ignorant. Smith asked many other incisive questions about the North Atlantic, such as why sailors were ordered to keep a log of water temperature, and what it means when the water or air temperature drops suddenly, as it did a few hours before the accident. He knew that a sudden drop in water or air temperature indicates the presence of ice floes. Most of the surviving Titanic officers and men did not know this.

To the critics, ice was ice, and that is all you need to know about it. Smith understood that an iceberg is a complex object, and its appearance tells of weather, geology, and massive forces that move megatons of materials over land and sea. Pathological skeptics often view the world in simple, black-and-white terms. When they are not aware of complexity, they are sure it cannot exist. They never thought that an iceberg might have internal structure, history or contamination. By coincidence, cold fusion critics often make the same mistake about palladium. Richard Blue and others ridicule cold fusion scientists for saying there is "good palladium" and "bad palladium." Blue thinks that when you describe a sample as 99.999% pure palladium, that's all there is to it. He does not know that the remaining 0.001% trace elements might include catalysts that enhance or poison the reaction. He never imagines that the crystalline structure of the metal, the voids and cracks, and microscopic surface roughness might affect conventional electrochemical reactions, hydride formation, and cold fusion. He does not know that a sample of palladium has a history of temperatures, pressures, cover gas composition, and cooling, rolling, and cleaning. This history affects performance. Anyone who studies electrochemistry, metallurgy, surface catalysis, material science, or the history of semiconductors would know these things, but the skeptics resolutely refuse to study any pertinent field. They insist that a metal lattice is simple and fully understood, and that "pure palladium" is a complete description down to the last atom, and all samples of pure palladium must perform the same way in all experiments. Some skeptics go to extremes, lumping together branches of the periodic table. During ICCF-3, Morrison objected to the claim that palladium reacts with deuterium, but nickel reacts with hydrogen. He said, "metal is metal: nickel or palladium, it's the same thing." He added later: "If these effects are real, why don't we see them in heavy-water ice?" The skeptics cannot imagine that a featureless polished metal sample may be as unique as a snowflake on the microscopic scale, and on the atomic scale, it may be as complex and mysterious as a star.

Smith's dogged, low-key style gave reporters the impression he was stupid. An experienced prosecutor, he was in the habit of asking the same questions over and over again, politely but forcefully wearing down the resistance of a hostile witness.[15] Thanks to Smith's tenacity we learned, for example, that the lookouts on the Titanic's mast had been issued binoculars on the first leg of the voyage, but when the ship left Queenstown, an officer took the binoculars away. Although the lookouts repeatedly complained and requested binoculars, the officers did nothing. The surviving lookout, Frederick Fleet, testified that if he had had binoculars he would have seen the iceberg in time to save the ship. Experts like Admiral Peary said that binoculars are essential in calm conditions at night in ice floes. Smith reached a clear-cut, commonsense conclusion: a regulation must ensure that lookouts will be issued binoculars.

Charles Lightoller

The man who opposed Smith most vociferously in public was Charles Lightoller, the senior surviving officer of the Titanic. The history books have treated him too kindly. This is a nuanced story. It would not be fair to portray Lightoller as a stereotyped villain. He was a brave man, a skilled mariner, and a hero at sea in both World War I and World War II. The captain of the Titanic was to blame for the disaster. But the officers failed to stay alert, be aware of iceberg warnings, and make sound

recommendations to the captain. Lightoller played a prominent role in the investigations, and he spoke with authority and self-confidence. He personifies the tragedy. His supercilious attitude, his refusal to admit mistakes, and his blind refusal to accept commonsense safety measures—especially ones proposed by landlubbers—are symptomatic of the problems that led to the disaster. He and his captain made the worst mistake in nautical history, but he could not bring himself to admit it. When asked why they did not slow down, he testified:

Lightoller (L): You see we were making for a vicinity where ice had been reported as you say year after year, and time and again, and I do not think for the last two or three years I have seen an iceberg although ships ahead of us have reported ice time and time again. There was no absolute certainty that we were running into an ice-field or running amongst icebergs or anything else, and it might have been as it has been in years before ice reported inside a certain longitude.
(In other words, if you cannot prove with absolute certainty you will enter a danger zone, you should not slow down.)
Commissioner (C): I can understand that; it does not follow that because ice is reported you are going to have a collision with an iceberg.
L: That is what I wish to convey.
C: I take it then that your position is to justify the conduct of the Captain and those who were navigating the Titanic from 11 o'clock till the collision?
L: Yes.
C: In going ahead at 211/2 knots, although you all knew that you were in the presence of ice?
L: Well, you hardly state it correctly when you say we knew we were in the presence of ice. We did not, we only had reports to go on.
C: You had no reason to disbelieve those reports.
L: On the contrary we had, having so many years gone across and never seen ice though it is repeatedly reported.
C: I suggest to you it would have been a much safer thing to have believed the reports which you had from a number of sources as to the presence of ice, than to have acted in disregard of the warnings you had received from other ships, and gone ahead at the rate of 21.5 knots an hour until the collision occurred.
L: In the view of after events, of course, we form a totally different opinion. It would naturally have been safer, we can see now, not to have gone ahead at all.
C: And that is what, at all events, in the light of your present knowledge, good seamanship would have dictated?
L: Not necessarily good seamanship.
C: Extra good seamanship?
L: No, not seamanship at all.
C: In the light of the experience you have had, it is what you would do now?
L: In the view of our reports we have had in other voyages, if I say in the light of good seamanship or extra good seamanship, we should have stopped, the thousands of ships that have crossed the Atlantic would likewise have stopped, and then you come to the end of your tether.
C: I do not say they would have stopped.
L: Well, or slowed down. . .

In other words, slowing down to avoid ice would render North Atlantic navigation untenable and impossible. Any step to improve safety must end with all the ships at sea paralyzed and motionless, "at the end of your tether." Lightoller takes a practical, commonsense suggestion, postulates that it must be carried to irrational extremes, and from that he demonstrates that the suggestion cannot be implemented at all. This sort of illogic is rampant in debates about cold fusion, particularly when experts respond to irritating, unwelcome suggestions made by amateurs. They start out cautioning the amateur that instruments such as calorimeters have a margin of error, and calorimeters frequently malfunction with

leaking cooling fluid and other problems. When the expert senses the message is not getting through, and the amateur still believes that cold fusion calorimetry indicates real excess heat, the frustrated expert may resort to extreme, untenable claims, such as a statement that no calorimeter has an error less than 10%, when in fact the error margin for top-quality conventional instruments is on the order of 0.1%. Or he may wave his hands and say calorimeters are so undependable that you cannot run one for more than a few days without recalibrating, when in fact a good one will run reliably for months.

Lightoller's quibbling and evasions went to eerie extremes:

C: You said something a moment ago, "As you know now" or "in view of what has happened." May I take it with the knowledge that you have now, and in view of this accident, what you would do now would be to slacken speed, or stop?
L: In view of what has occurred naturally we shall take every precaution that suggests itself to our minds in the future to avoid a repetition of such an accident.
C: Would not one of the precautions be what Captain Smith said to you on the bridge between nine and ten, "we should have to go very slowly"?
L: He was speaking about haze.
C: I know he was speaking about haze, but is not that what you should have done in adopting precautions?
L: No, I do not see it. It would have cleared the accident, I quite agree with you, had we been going very slowly, but we have to take in view the experience of years, what we have always done. . .
C: . . . you said that since the accident with the knowledge that you now have, you would have adopted extra precautions, I mean, at all events, from half-past nine onwards. Would not one of those precautions be going very slowly— diminishing speed?
L: I am afraid I cannot give you any definite answer to that. . .
C: What I want to suggest to you is that it was recklessness, utter recklessness, in view of the conditions which you have described as abnormal, and in view of the knowledge you had from various sources that ice was in your immediate vicinity, to proceed at 21.5 knots.
L: Then all I can say is that recklessness applies to practically every commander and every ship crossing the Atlantic Ocean.
C: I am not disputing that with you, but can you describe it yourself as other than recklessness?
L: Yes.
C: Is it careful navigation in your view?
L: It is ordinary navigation, which embodies careful navigation.
C: Is this your position, then: that even with the experience of the Titanic disaster, if you were coming within the near vicinity of a place which was reported to you to be abounding in ice, you would proceed with a ship like the Titanic at 21.5 knots?
L: I do not say I should . . .
C: At nighttime, and at a time when the conditions were what you have described as very abnormal, surely you would not go on at 21.5 knots?
L: The conditions were not apparent to us in the first place; the conditions of an absolutely flat sea were not apparent to us till afterwards. Naturally I should take precautions against such an occurrence.
C: And what precautions would you take if you would not slow up or slow down?
L: I did not say I would not slow up.
C: Cannot you say whether you would or not?
L: No, I am afraid I could not say right here what I should do. I should take every precaution whatever appealed to me. . .

In the end, the Board ignored Lightoller, and ordered ships to slow down or alter course in ice floes.

These dithering discussions, the horrifying mistakes made by the Titanic crew, and the rules that allowed

steamships to go to sea without enough lifeboats combine to give the impression that British seafaring was in crisis and the Board of Trade was run by idiots. This was not the case. Most sailors were skilled, and most ships arrived safely despite the myriad dangers of the sea. The Board performed badly in the hearings because it was under duress. Like many conservative organizations, it functioned well enough under normal circumstances, but badly in a crisis when the public demanded swift change. We should not exaggerate the Board's negligence, or the surviving officers' intransigence. The testimony was not all as infuriating as the sections quoted above. Board members asked many sharp questions. In the end, the Board pulled itself together and made sensible recommendations, including enough lifeboats for all passengers and crew, and a twenty-four hour radio watch, although it neglected other important steps. Today, institutions like the APS are competent, although perhaps plodding and conservative. They make incremental scientific progress, which is a vital contribution to society. The APS has failed to respond to the challenge of cold fusion, because cold fusion is very different from conventional breakthroughs like high-temperature superconductivity or the discovery of planets circling distant stars.

For many years before the disaster, the Board of Trade knowingly allowed ships to sail without enough lifeboats. After the disaster, some steamship companies fought proposed regulations to increase the number of lifeboats. From our perspective, this seems like self-destructive behavior, as if they wanted to murder passengers and incur ruinous liability. Yet shipowners were not ignorant, or blinded by avarice. The weight of lifeboats reduced the payload and fuel economy; companies that did not carry enough gained a competitive advantage. Titanic designer Carlisle said, "Until the Board of Trade and governments of other countries require sufficient lifeboats to be carried, shipowners cannot afford such extra top weight."[16] In 1912, experts pointed out, correctly, that in most emergencies such as storms, lifeboats would be useless. The boats were open, with oars, and in bad weather they would be swamped, capsized, or lost in fog. (Advanced modern lifeboats are much more survivable, being enclosed, motorized, self-righting, equipped with radios, and so on.)[17] The experts in 1912 thought of lifeboats the way we would think of a plan to supply parachutes to all passengers in a jumbo jet. It is not practical or cost-effective.

Cover-up, Denial, Whitewash, Blaming the Messenger

How did people behave after they made the worst mistake in history and accidentally killed 1,400 people? Some, like Captain E.J. Smith, refused to put on a life jacket, and deliberately went down with the ship. Some tried to learn from the experience, and worked to prevent similar mistakes. Some, including Lightoller, seemed to learn nothing, and admit no regrets. For the rest of his life, Lightoller blamed the messenger, Senator Smith. He said the hearings were "Nothing but a complete farce, wherein all the traditions and customs of the sea were continuously and persistently flouted."[18] If it ever becomes generally known that cold fusion is real, how will the scientists who opposed it react? A few may take responsibility and go down with the ship, retiring from academic life. I hope that most will regret their actions, and try to prevent such a thing from occurring again. Some will react the way Lightoller did, blaming Pons and Fleischmann. They may say the traditions and customs of science are more important than experimental results. Lightoller, in effect, put traditions and customs ahead of the lives of passengers. To him, "the experience of years" and "what we have always done" outweighed all practical suggestions as to what we might do instead, to avoid killing thousands of people. It seems that many scientists believe the processes and niceties of doing science are more important than exploring a discovery which might benefit millions of people.

Some institutions react to trauma by reforming. Others go extinct. Even those which reform may pretend nothing has happened. They hide a scandal in plain view. The Board did this by focusing on a narrow set of questions framed in advance of the hearings, to which they supplied reassuring answers. Here are some examples:

"Was the Titanic supplied with proper charts?" The Board said Yes.

"Was the Titanic sufficiently and efficiently officered and manned?" Yes.

"Before leaving Queenstown on or about 11th April last did the Titanic comply with the requirements of the Merchant Shipping Acts, 1894-1906, and the rules and regulations made thereunder with regard to the safety and otherwise of 'passenger steamers' and 'emigrant ships'?" The board answered Yes, which was technically correct. It did not say this proves the requirements were inadequate, obsolete, and a major contributing factor to the disaster.

Elsewhere the Board reached absurd conclusions:

"(a) Were binoculars provided for and used by the look-out men? (b) Is the use of them necessary or usual in such circumstances?" After pages of meandering discussion, and after hearing Lightoller testify he would "much prefer" not to give the lookouts binoculars, the board answered No, and No. The Titanic's designers must have thought otherwise, since they included a box in the lookout station to store binoculars. The surviving lookout, Frederic Fleet, said he could have saved the ship with them, and U.S. experts agreed with him, but the Board thought not.

"Was proper discipline maintained on board after the casualty occurred?" Yes.

"Were the boats swung out, filled, lowered, or otherwise put into the water and got away under proper superintendence?" The Board said Yes. Everyone else said No, boats launched half-empty were not "under proper superintendence." One wonders how sparsely loaded the boats would have to be before the Board would call it "improper supervision." Perhaps it would have objected to boats set adrift empty?

"Were the boats sent away in seaworthy condition and properly manned, equipped, and provisioned?" "Manned" here means the boats had the requisite number of sailors in charge; the Board did not dispute the fact that the boats did not carry enough passengers. The Board concluded, "The fourteen lifeboats, two emergency boats, and C and D collapsible boats were sent away in a seaworthy condition, but some of them were possibly undermanned. The evidence on this point was unsatisfactory." This was a flat-out falsehood. Testimony proved beyond doubt that the boats were ill-equipped and that many were manned by untrained crew members, in some cases stewards instead of sailors. (See the Smith quote, below.) One of the collapsible boats was sent away capsized, because the launching equipment was inadequate. Perhaps it was in good condition, but surely not in a seaworthy state.

"Did each boat carry its full load; and if not, why not?" The answer was No. The Board explained:

1. Many people did not realize the danger or care to leave the ship at first.
2. Some boats were ordered to be lowered with an idea of their coming round to the gangway doors to complete loading.
3. The officers were not certain of the strength and capacity of the boats in all cases.

People did not realize the danger because Captain E.J. Smith did not tell them the ship was doomed, even though he knew it ten minutes after the accident. The captain told a few top officers and ordered them to keep it a secret to prevent panic, as if it could have been kept secret indefinitely. Someone may have had the "the idea" of coming around to the gangway doors, but no orders were issued, the maneuver was not carried out, and some experts doubt it could have been carried out. The comment about "strength and capacity" refers to the testimony of the officers in charge of loading lifeboats. They said they thought the boats might buckle in the middle while being lowered fully loaded with their rated capacity of sixty people. They quibbled about this at great length during the hearings. Their objection makes no sense. They should have known that in 1912, engineering was advanced enough to ensure that a brand-new lifeboat would not break in half when fully loaded. The Titanic was the most expensive and best-

equipped ship ever made, not an old tub with rotting lifeboats. When they realized the ship was sinking, the officers loaded the lifeboats fully. They were untrained, unprepared, and unfamiliar with the lifeboats and other equipment. Most British crews were much better. During his investigation, Senator Smith went aboard the Olympic while it was docked in New York. He asked the captain to perform an impromptu lifeboat drill. Within fifteen minutes, a boat had been prepared, loaded with sixty crewmen, and lowered into the water in perfect order.[19]

Senator Smith's report was the unvarnished truth. Smith drafted and pushed through effective reforms, ensuring enough lifeboats, regular lifeboat drills, a radio operator on duty twenty-four hours a day, improved watertight construction, better pumps, and much else.

Men have not grown wiser since 1912. The arguments made today in debates about cold fusion and the California power crisis are as misguided as those made by the Titanic officers. We are blind to irrationality in present debates because the issues are not settled yet, the facts are not in, standards have not been set. We see the mistakes made by Titanic officers because we are the beneficiaries of Smith's reforms, which raised our expectations. No officer or passenger on a ship today would have cause to imagine that a lifeboat, when properly manned and lowered, might break in half!
In contrast to the Board's anodyne assurances Smith wrote:

> The Titanic boats were only partially loaded and in all instances unprovided with compasses and only three of them had lamps. They were manned so badly that, in the absence of prompt relief, they would have fallen easy victims to the advancing ice floe . . . One witness swore that two of the three stewards in her boat admitted that they had never had an oar in their hands before and did not even know what the oarlock was for. The lifeboats were filled so indifferently and lowered so quickly that, according to the uncontradicted evidence, nearly 500 people were needlessly sacrificed to want of orderly discipline in loading the few that were provided. There were 1,324 passengers on the ship. The lifeboats would have easily cared for 1,176 and only contained 704, 12 of whom were taken into the boats from the water, while the weather conditions were favorable and the sea perfectly calm. And yet it is said by some well-meaning persons that the best of discipline prevailed. If this is discipline, what would have been disorder?

What would have happened if Smith had not investigated? Critical facts would have been concealed, and lost forever. Naturally, there would have been reforms, but they would have been half-hearted, incremental, and ineffective compared to the sweeping changes Smith pushed through. The larger impact of the disaster would have been blunted. Society's hubris would not have been so effectively punctured. It was largely thanks to Smith that society fulfilled the pledge he proposed:

> . . . the sea is the place permanently to honor our dead; this should be the occasion for a new birth of vigilance, and future generations must accord to this event a crowning motive for better things.

We want a new birth of vigilance in physics today. The quiet catastrophe we have lived through with cold fusion has been nothing like the Titanic disaster. No one has drowned, or been hurt. At worst, people's careers have been derailed and their reputations sullied. Yet if it turns out that cold fusion can be made into a practical source of cheap energy, then the consequences of the twelve-year delay in launching serious, large scale research will turn out to be worse than the Titanic disaster. During the twelve-year hiatus, more people may have perished for lack of energy and clean water than ever drowned in

shipwrecks.

If we prevail in this fight for cold fusion, we must strive to prevent this sort of thing from happening again, at least for a few generations, until the shock wears off. Perhaps the greatest danger in studying the Titanic is that you may be lulled into a false sense of superiority. We must not imagine that we are immune to suicidal mistakes. We will not run a ship into an iceberg at high speed, thanks to regulations and radar. But we will discover many new ways to commit mayhem. Look at the damage we do to the environment, the Chernobyl accident, our stockpiles of nuclear weapons. Look at a crowd of physicists cheering and applauding derisive attacks on cold fusion at the APS. Let us hope our descendants do not look back at the cold fusion debate, read the statements by Taubes—which are more wrongheaded and reckless than anything Lightoller said—and conclude that they will never be so stupid.

Perhaps the most disturbing aspect of the Titanic aftermath was that so much depended upon Smith. A haunting question confronts us in our predicament: Why must society so often depend upon a lone, crusading hero: a William Alden Smith, Margaret Sanger, or Medgar Evers? What will happen to cold fusion if a hero does not arrive in time? What other breakthroughs have been forgotten, how many other opportunities were squandered, because no champion stepped forth?

References and Sources

A note on sources: Because the disaster is so copiously documented and controversial, nearly every statement in this essay is backed by several sources, and probably contradicted by others. Items of common knowledge, such as the fact that no large gash has been found in the wreckage, are not documented. Most assertions here are backed by what I consider the three most reliable sources: Wade, the Senate transcript, and Board of Trade transcript. I apologize if I have not footnoted every assertion the reader doubts or wishes to follow up on. The statements by Dick Blue were repeated on the Internet many times. The APS members' applause for Park and Morrison's comments at ICCF-3 are my own recollections.

References

1. http://www.encyclopedia-Titanica.org
2. Goldberg, M.H. 1984. *The Blunder Book: Colossal Errors, Minor Mistakes, and Surprising Slipups That Have Changed the Course of History*, Quill.
3. Board of Trade investigation. C. Lightoller testified that White Star Line ships were not run at top speed during the first year of operation.
4. Wade, W.C. 1986. *The Titanic: End of a Dream*, Penguin Books, p. 41, and Board of Trade. Carlisle also contacted the Board of Trade, the Merchant Shipping Advisory Committee and other authorities during the design phase of the Olympic and Titanic, recommending more lifeboats. Carlisle was browbeaten and treated as a hostile witness by the Board, proving that no good deed goes unpunished.
5. http://www.Titanicinquiry.org/index.html. "Titanic" Disaster, Report of the Committee on Commerce, United States Senate, Report No. 806, May 28, 1912. Report on the Loss of the "Titanic" (s.s.), Board of Trade investigation, July 30, 1912
6. Fleischmann, M. "Response to Douglas Morrison," published on the Internet and in another version in *Physics Letters A*.
7. Taubes, G. 1993. *Bad Science*, Random House. The statements about electricity are on page 229 and an interview on National Public Radio. The statements about tritium are repeated in several descriptions, and he seems to be unaware of the use of baseline, reserved samples and before-and-after comparisons of other products as well. The quote about thermal gradients

appears on page 271. Taubes must not be well-acquainted with the seventeen scientists, since he listed Edmund Storms as "Ed Talcott" (mixing him up with Carol Talcott).
8. Two-thirds of the third class children also died, but they were not proclaimed heroes. The exact numbers were 57 out of 174 first class men rescued, 27 out of 79 third class children rescued.
All 30 first and second class children survived. Statistics are from the U.S. Senate and Board of Trade reports.
9. Wade, p. 311.
10. Wade, p. 63.
11. The rumors were described in the U.S. Senate hearings, testimony of survivor Catherine Crosby, and elsewhere. She said, "I have read it in the papers, but I personally know nothing about it." There is no evidence that any of these stories are true.
12. Wade, see footnote 4.
13. Wade, pp. 47-48.
14. For example, Lord, W. 1986. *The Night Lives On*, Morrow; and Baldwin, H.W. 1955. *Sea Fights and Shipwrecks*, Doubleday. Both quote the exchange verbatim. Baldwin writes ". . . the Senate investigating committee . . . brought out numerous pertinent facts, though its proceedings verged at times on the farcical. Senator Smith was ridiculed for his lack of knowledge of the sea when he asked witnesses, 'Of what is an iceberg composed . . .'" Baldwin should have wondered how Smith could have "brought out the pertinent facts" if he was such a dunce. Critics assumed Senate staff members or the Navy wrote the report, but Smith wrote it himself.
15. Wade, p. 312.
16. Wade, p. 41. Carlisle also said he never believed "there was such a thing as an unsinkable ship."
17. http://www.mulderrijke.nl/
18. Wade, p. 313. Wade comments: "Indeed they were. Among the traditions flouted was the habit of driving full speed into known ice-floe areas. Among the customs was that of sailing with an insufficient number of lifeboats."
19. Wade, p. 279.
20. According to the World Health Organization (WHO), water-bourn bacteria causes 4 billion cases of diarrhea per year, resulting in 2.2 million deaths, or 4.3 Titanic disasters every day. Most of the victims are children under age five. Extremely cheap energy used to pump, filter, or boil water would prevent most of these deaths. WHO estimates one-third would be saved with conventional sanitation measures, but I doubt they have made projections based on ultra-low cost energy. The toll comes to 26 million in 12 years. Source: http://www.who.int/water_sanitation_health/Globassessment/Global1.htm#1.1 It is difficult to estimate total deaths in shipwrecks. Ships have been in existence for roughly 5,000 years. Taking into account the low human population in ancient times, and restricted navigation before 1500, I estimate 5 million deaths before 1500 (1,000 per year), and another 5 million since then (10,000 per year). There is some evidence that seafaring began much earlier, perhaps hundreds of thousand of years ago, so perhaps I should say "shipwrecks in recorded history."