

## Tritium Discovered by Bockris at Texas A&M

(Excerpt from Chapter 22)

From *The Rebirth of Cold Fusion Real Science, Real Hope, Real Energy*

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No accounting of the history of cold fusion would be complete without an introduction to John Bockris. Famous as well as infamous, Bockris was second only to Fleischmann and Pons in attracting media attention in the early days of cold fusion research. His story may well be the most complex and misunderstood story in all of cold fusion's history. An entire book could be filled just with the cold fusion-related adventures and misadventures at Texas A&M.

Born in Johannesburg, South Africa, in 1923, Bockris earned his bachelor's degree in chemistry at the University of London in 1943 and his Ph.D. at London's Imperial College in 1945, at 22. At 23, he began teaching as a lecturer at Imperial and was responsible for leading a group of 10 graduate students.

Bockris is retired from his most recent appointment, at Texas A&M University as a Distinguished Professor in chemistry. Before that, he was chair of physical chemistry at Flinders University in South Australia, and before that, he was appointed professor of physical chemistry at the University of Pennsylvania. In the 1960s, he led the largest electrochemical research group in the Western Hemisphere.

Bockris' background and academic achievements are voluminous and include 750 scientific papers, a dozen books, and several commonly used college texts, among them his best-known book, *Modern Electrochemistry*, written with A.K. Reddy and published in 1970.

One graduate student who immensely enjoyed Bockris' lectures at Imperial College was none other than Martin Fleischmann, who was two years behind Bockris at the school. Although he was unable to squeeze into Bockris' full load of graduate students, Fleischmann found it irresistible to attend Bockris' groups and participate in after-school social activities with the more senior graduate students.

In the very serious-looking photograph in Figure 3-4, the lads are pulling a prank in honor of All Hallow's Eve, a holiday which is the United Kingdom's version of Halloween. The contraption in the photo, dubbed "The Geister-Phone," purportedly was able to tune in to the voices of ghosts from the spirit world. Bockris is at the far right of the photo, with Fleischmann just behind him and to Bockris' right.



Figure 3-4. The Geister Phone

Bockris enjoyed Fleischmann's company. He recalled with amusement that Fleischmann developed a unique way to encourage uninvited visitors in Bockris' office who had overstayed their welcome, to leave: he would write complex calculations on the blackboard. Most electrochemists were no match for Fleischmann's unusual proficiency at mathematics and would announce shortly thereafter that they had to be on their way, rather than face an embarrassing showdown with a junior student.

Bockris recounts the initial cold fusion news, carried on television:

I heard about it the day after "The McNeil/Lehrer Hour," but I did not see the show. I said to myself, "Oh, my God, that damn Martin Fleischmann!" You see, because I know Martin rather well and, um, [Bockris hesitates] I have to be very careful about what I say because I'm being recorded and you're probably going to put it in your book ... well, he's a very brilliant guy. There's no doubt about that. Let me make that very clear. But he has certain drawbacks. One is that of being "wooly." If you asked Martin a question, instead of saying "yes" or "no," he will say, "What a good question, John! That's something we really ought to discuss." Or, "That's a gas!" – a favorite thing he used to say. He'd go on and on and on, and you'd never get your question answered. So that's "being wooly."

But he's such a clever, inventive fellow with so much to give that I always took the attitude that, for God's sake, let's preserve this boy. I call him a boy, and he's two years younger than I.

So when I heard about this the next day, I called Martin. Martin at this time was being called about 10 times a minute, and he had to shut off the phone. But when he knew it was me, it was different. We had been friends for years, so he accepted my call.

Bockris recalls asking Fleischmann for details about the experiment. He remembers his answer clearly:

You go along at low current density for many hours, and then you jack it up! – 10 times, 100 times more current density, and then it happens!

As we found out later, that's not enough information, because the "go on for a long time" is a *very, very long time*, 500 hours or so. That is the essence of it, and then you see the [excess] heat.

Also, I asked Martin another question, which was, "How did you get the lithium hydroxide?" He told me that he had got it by putting lithium [a soft metal] in the solution and letting it dissolve to form lithium hydroxide. Those were the two bits of information that he gave me, and in that sense, I had a flying start, with all my graduate students [at Texas A&M]. I had 20 of them [working with me] at the time." <sup>6</sup>

Bockris, who was regarded as one of the world's top electrochemists, suffered a major political setback because of his pursuit of cold fusion, and especially his reports of tritium. Bockris claims that his group at Texas A&M was the first to observe tritium in cold fusion experiments.

As a scientist, Bockris has demonstrated consistently excellent integrity. Personally, few would regard him as a modest man. Beyond his pursuit of the highly controversial discovery of cold fusion, Bockris' overly confident and daring proposals in the realm of scientific experimentation, coupled with a lack of social and political deference, ignited hostility and doubt about his professional integrity. On two occasions, Bockris was charged with misconduct by his peers and was formally investigated by the Texas A&M administration. In both cases, investigations found no evidence to substantiate the allegations. Even though he was fully exonerated, this information never made the news, and his reputation remains tarnished.

In the view of Tom Passell, "Bockris can't be faulted beyond the fact that he tries things that most scientists would never be willing to try." Passell is a nuclear chemist who earned his degree while studying at the University of California, Berkeley, under Dr. Glenn T. Seaborg. Together with several program managers who worked for the Electric Power Research Institute, he oversaw the Texas A&M cold fusion research, which also was funded by the U.S. Naval Research Laboratory and by the CIA.<sup>7</sup> Passell provided the following assessment:

His extensive series of textbooks about electrochemistry is a solid contribution and highly regarded in that field, so he has a long history of conservative research that does not shake up accepted paradigms. Yet he doesn't mind taking risks to explore the world. Even some cold fusion researchers blanch at some of his ideas. Often, his proposals have been off-the-wall.

When Bockris gets into his salesman mode, he loses that conservative image. In a way, you could say some physicists have launched into that speculative salesman mode by pushing the nearly impossible task of hot fusion. So I forgive him for such forays as his attempt to convert mercury to gold using a thermite reaction, or trying to see if transmutation could occur in a carbon arc under water. These last two go well beyond what I found even remotely scientifically possible or worth trying to sell. However, his work on tritium in electrochemical cells I found within the realm of possibility and worthy of being defended.

I personally like him and think he made a positive contribution to the field. His critics can readily use his more outlandish ideas to try to discredit him and [unsuccessfully] attempt to do such things as to strip him of his academic title at Texas A&M.<sup>8</sup>



Figure 3-5. John O'Mara Bockris

As did many other scientists around the world, Bockris expected that it would be just a matter of weeks before his team would observe excess heat produced by their experiment. Bockris and his staff worked feverishly, night and day, to achieve what they thought would be a relatively easy replication of the discovery:

I organized a group of three. We worked eight hours each for 24-hour periods for about six weeks. We worked on many things, and then we looked for tritium.

The first time tritium was detected in our group came as a surprise. At this time, both Charles Martin and his co-workers, and my own co-workers, were taking our solutions (after electrolysis) to the Nuclear Engineering Department, because it was there that tritium-measuring capabilities were available. We had already made some half-dozen visits without seeing any tritium, and then [on April 24] 1989, the [surprised] technician who made the measurements exclaimed, "What have you done to this one?" He reported a very tritium-active cell for which a graduate student, Nigel Packham, along with others, had been responsible.

We took the solutions allegedly containing tritium to be measured at other places (outside Texas A&M), in particular to Los Alamos, and it was confirmed ... that it was indeed tritium that we had produced. The tritium in the electrolyzed solution was also confirmed at the General Motors Technical Center. The first published work was in the *Journal of Electroanalytical Chemistry* and [was] the earliest result published in a refereed journal.<sup>9</sup>

We found that, by working these cells of Fleischmann and Pons' that contained lithium hydroxide and deuterium oxide, we could produce this tritium in [relatively] great

abundance, let's say, 10,000 times more than ought to be there, as it were. And let me stress that we couldn't do it every time, but about one result in five or in four, and eventually we worked up to two results in three, we could produce tritium.<sup>10</sup>

Unfortunately, science journalists and the world's media in general were not to know of the tremendous achievement of tritium evidence until many years later, because news of the early findings was pre-empted by a vicious and slanderous article by Gary Taubes, published in *Science* magazine.

## Taubes Trashes Tritium

Bockris' priorities differed from those of others who were researching cold fusion. This did little to win him friends, even inside the cold fusion community, as Storms recalled:

John called me shortly after they had seen tritium and asked how my attempts were going. I told him, confidentially as one scientist to another, that I had several cells that indicated tritium production, but we still had much work to do. He promptly told the press that we also had seen tritium, which supported his claims. I soon received a call from a reporter asking about our work, which got me in considerable trouble at Los Alamos. The lab did not like people reporting their results to the press, especially in this subject. John was more interested in getting credit for being first than in being sure the observation was correct. This attitude seemed to be common at that time. Los Alamos did not play that game.<sup>11</sup>

Bockris' quest for attention drew to him a reporter, Gary Taubes, who was convinced not only that cold fusion was a worldwide blunder but also that some individuals were deliberately conspiring to produce false results. Mallove recalled being interviewed by Taubes:

Taubes was very aggressive in his pursuit of what he thought was true, that fraud at Texas A&M played a major role in keeping cold fusion alive. He had traveled to the university, collected over 50 hours of taped interviews, and had zeroed in on one or more possible tritium-adulterers. He had become deeply involved in an investigation of their personal lives in an effort to come up with a motive; in one case, he even traveled to England in search of details on the suspect's family life. Taubes was focusing on personal factors that may have led a certain graduate student into deliberate tritium tampering. This is the hallmark of skepticism run amok that has pervaded the entire cold fusion episode.<sup>12</sup>

On June 12, 1990, Taubes, writing for *Science* magazine, launched a historic media attack against cold fusion. A press release titled "Cold Fusion Revisited" proclaimed the following:

According to an investigative news report in the 15 June issue of *Science*, "suspicions were raised almost from the first that the tritium in the A&M cells was put there by human hands." Was this a fusion reaction, was it inadvertent contamination, or was it something more insidious?

Bockris submitted a rebuttal shortly after the *Science* magazine article ran, but the publication declined to print it. The following is an excerpt of the rejected letter followed by highlights from other documents:

It all began when Taubes came into my room one day, unannounced, without knocking. He's a great big chap; he looks like a football player. He was very nice and pleasant, and he was claiming he was a journalist. He wanted to write a book on cold fusion and wanted to know all about my results. I responded correspondingly; I showed him my notebooks and papers. He went away, and nothing happened, as far as I knew. But, in fact, lots of things were happening.<sup>13</sup>

Apparently, Mr. Taubes made a second visit to our university, but I knew nothing of this. Later on, it appeared that he had gotten a lot of information including confidential letters and memoranda which I had exchanged with Dean Fackler. How Taubes obtained these memos is not at the present time known.<sup>14</sup>

Then, about three months later, he came back again to my office. Now he was a changed man, extremely aggressive, and he was openly nasty.<sup>15</sup>

He said that he intended to attack cold fusion and to prove the work we had done was fraudulent!<sup>16</sup>

He started off by an amazing two-hour confrontation with my graduate student, Nigel Packham. ... Taubes accused him of spiking the [cold fusion cell] with tritium from a tracer-tritium solution as the basis for our successful cold fusion experiment. The only evidence for cold fusion [in the world], he averred, was the work of [my group at] Texas A&M on tritium, and this tritium work [must have] been faked by the graduate student to get a fast Ph.D. [He alleged that] we would never have seen any tritium except for the fact that Packham actually put it in the cells!!!<sup>17</sup>

I said, "Look, we're completely free and open here. Go and sit with Nigel Packham alone in his office, have a microphone there and ask him any question you want to." I remained calm and told [Packham] that all we can do is to show him our lab books and tell him the truth. What he does with the truth is his conscience and his journalism.<sup>18</sup>

Packham recalled some warning signs that trouble was on its way before Taubes arrived:

I was told of Gary's [forthcoming] visit, but I was also informed that it wasn't going to be a very pleasant visit, in that his message that he was going to bring to me was not one of belief in cold fusion but one of disbelief, because it went against all the natural laws of physics. It was much more going to be an aggressive interview about potential tampering of cells at Texas A&M University.

When Gary was on the record with the cassette running, he was actually fairly jovial, fairly approachable. Nothing that he said was very intimidating, nor did it have any implication involved in it. However, about 45 minutes into our discussion, he asked whether we could turn the cassette recorder off. I did tell him that at that point anything that I was going to say, I would certainly not mind being repeated anywhere or being quoted. After some going backward and forward, I said, "Okay, let's turn it off." It was then that the completely different side, ... Gary's intimidation, came out.<sup>19</sup>

Bockris recalled Packham's exasperated response after leaving the interview with Taubes:

He rushed into my room and said, "This man wants blood!"<sup>20</sup> Taubes had threatened Packham with a publication in the next day's *New York Times* reporting that his discovery of tritium was a fraud. If Packham confessed the fraud at the interview, he could avoid the article and perhaps find a job in Albania before the book Taubes was writing about the work came to be published.

Nigel Packham told me that he asked the journalist what else he could do but report the facts as he had found them. The experiment did not always work, but when it worked, the results were unmistakably strong.<sup>21</sup>

Russ George, chief scientist of Saturna Technologies and a specialist in both hot and cold fusion, expressed the opinion that "Taubes was just plain dishonest." George said he was "a real *National Enquirer* personality ... no care whatsoever for facts."<sup>22</sup>

Bockris shared his own thoughts about Taubes' "witch hunt":

Taubes' profession was two things. He wrote books about scientists, and he tried to denigrate them.<sup>23</sup> He has a history of writing books which are aggressively and negatively worded descriptions of famous professors. For example, he has attacked [Italian physicist and] Nobel laureate [Carlo] Rubbia in this way.<sup>24</sup> But he also wrote the text of novels in Hollywood. This is very remunerative. If you can get a job doing that, you've got several hundred thousand dollars a year. And he did this alternatively: six months writing in Hollywood, six months writing about scientists.

Well, he was on the novel thing at this time. He wanted to make a big novel about cold fusion, and what's the point about making a novel about cold fusion if you just tell the facts? You've got to have some zip in it! Right? You've got to have something that makes people say, "Auggghh!!" He wanted to have a fraud. He wanted to have a sensation, a disaster. That's how I see it.<sup>25</sup>

Taubes received assistance from an inside man at Texas A&M, Professor Kevin Wolf, a prominent nuclear chemist who conducted research in nuclear physics at the Cyclotron Institute at A&M. Wolf collaborated with Taubes to concoct a theory on how the tritium findings in Bockris' laboratory were not only artifacts but also fraudulently produced.

Wolf originally participated with Bockris' team on some of the cold fusion research that found tritium. He also performed his own research, which showed supportive evidence of tritium findings. At some point, for reasons on which one can only speculate, Wolf engaged in a broad campaign to distance himself from cold fusion. Some cold fusion researchers suspect that Wolf may have felt pressure from the nuclear physics community to preserve the status quo rather than break new ground in science.

Bockris reported that, on June 4, 1990, in a interdepartmental Texas A&M meeting, Wolf announced to all who had been working on cold fusion that *Science* magazine would be coming out shortly with an article that was very damaging to the Texas A&M chemistry department, and to Bockris in particular. The article, Wolf said, would explain that he was retracting his claims of tritium findings in his cold fusion experiments. Bockris reported that Wolf also announced at this meeting that the *Science* article would identify both Wolf's and Bockris' tritium findings as artifacts.<sup>26</sup>

Three days later, Wolf was featured in a *Wall Street Journal* article<sup>27</sup> in which he publicly retracted his supporting evidence of cold fusion. This came as a sigh of relief to the physics community which, until that point, had faced a severe political problem in that one of their most eminent members, Wolf, had supported the possibility of cold fusion. If tritium was just an artifact, on the other hand, then so was cold fusion, and the threats to prevailing science and hot fusion would vanish. In a one-two punch, Wolf simultaneously provided reasons to dismiss both his own tritium findings and Bockris': he alleged that the Bockris group findings resulted from the cell being spiked with tritiated water from a laboratory reference sample.

Wolf asserted that his own findings of tritium resulted from tritium impurities in the palladium. This theory later was disproved by Dr. Fritz Will, formerly president of the Electrochemical Society.<sup>28</sup>

The assertions by Taubes and Wolf in the June 15, 1990, *Science* article that the Bockris' tritium findings were artifacts made little sense to Los Alamos scientists. They proved that Wolf's concocted theories were also all wet. Storms, then at Los Alamos, stated the following in a letter to the editor of *Science* on June 25, 1990:

The accusation made by Gary Taubes that cold fusion cells at Texas A&M University were "spiked" with tritium can be easily tested. It is not even necessary to trust the people at Texas A&M or Mr. Taubes. All that is required is to add tritium to an electrolytic cell and see if it behaves like the tritium claimed to be produced from cold fusion. This has been done [at Los Alamos], and the results show that the tritium claimed to result from cold fusion cannot be caused, at least in some cases, by the addition of tritiated water. I sent the results described herein to Gary Taubes on April 9, 1990, [two months] before his article was published. Unfortunately, he chose to ignore this information.

A few days after the *Science* story was published, Bockris sent the magazine a note in which he stated the following:

The fair thing, of course, would have been [for Taubes] to write an article and for *Science* to send it to me and ask for comments. Then the editors could have decided to publish or not publish as they felt fit and with the use of other referees. In fact, nothing of this sort was done. So this, of course, was *unethical* and *unfair* and something which no decent magazine would ever do. It is also extremely damaging in respect to myself, my graduate student, and my university.

Now to the matter of fraud. This is very easy to answer in one sense. Unbeknown to Taubes, people have been getting tritium right, left and center. I enclose a partial list of the laboratories at which tritium had been obtained. But, of course, the idea that Taubes had, [that] we were the only boys on the block who had got it, has been blown to pieces, and, therefore, the pressure to explain the Bockris results is now passé. So much then for the spiking. It didn't occur.<sup>29</sup>

In a subsequent letter, Bockris asked these questions of the *Science* editor:

What was the purpose, then, of *Science* employing a journalist who is also a Hollywood screenwriter and a past contributor to *Playboy* to write a gossip-based account which, by strong innuendo, suggests that a graduate student faked results of some of the

observations made here? And why publish such a damaging account without first asking evaluatory comment on its contents by those directly concerned?<sup>30</sup>

As much as he felt surprised by the journalist's and publisher's behavior, Bockris was even more shocked and disappointed by the reaction of colleagues at the university and in the scientific community who acted as if he were guilty. He explained that, when the *Science* article ran, few people bothered to ask simple questions:

Every adviser knows his co-workers; I don't think that it is very likely that any of mine would do such a horribly dishonest thing. Why would they do it? Fifteen times?? For what purpose? With the danger of total ruin as a scientist upon discovery?<sup>31</sup>

Finally, in September 1991, Bockris and his team created a cell which evolved tritium for long periods. Bockris was thrilled that he might be able to show his colleagues the tritium results as they were occurring, yet, to his dismay, none cared to look:

During the long period (about one month) in which [the cell] evolved tritium, I invited several colleagues in the Department of Chemistry to come see a result so unexpected, so anomalous within the chemistry of 1991. One said that his son had a birthday party that day so that he could not come to see the remarkable experiment, and the other said that he was going to Germany to do some experiments in an institute there. I asked two other professors, telling them that, by staying with the cell for one hour, they could themselves use the scintillation equipment in the next room and become convinced that the tritium concentration in the solution was increasing without [as suggested by Taubes] the means of the addition of tritiated water by stealthy secret nightly visits by graduate student Packham. These two individuals also declined to come and see, which reminded me of Galileo and the cardinals who, in the 16th century, would not look through his telescope, because it showed an irregular mountainous moon, although at this time the moon was supposed to be, in the Ptolemaic view of the church, "Queen of Heaven" and "perfect."

On the other hand, when looked at psychosocially, rather than in terms of the spirit of scientific exploration, the attitude of these professors, as careerists rather than scientists, was rational. They had read the Taubes article in *Science*, they knew the production of tritium in the cold (according to current texts) was impossible, and they clearly preferred the quiet life rather than having to face a result which they could not explain and which would, in fact, put into doubt the basis on which billions of dollars [for hot fusion] was being spent.<sup>32</sup>

The media attention and fallout from the *Science* article took its toll on Packham, as well. At the time, Packham was finishing his Ph.D. thesis. It was a time of utter chaos for him. Normally, a thesis defense consists of a private meeting with committee members and perhaps a few additional attendees. Not this time. Because of the spotlight placed on him by Taubes' *Science* article, Packham's thesis defense was attended by several hundred spectators and members of the press. To top it off, his wife was two days away from giving birth to their first child.

Packham, who now works for NASA in Houston, summarized his experience at Texas A&M University:

It was traumatic. But if, in hindsight, I knew what I was going to go through, would I do it again? Knowing the character it developed in me, yes, I probably would. I think I grew

a lot. If Texas A&M had been the only group out there that said that they could produce excess heat effects, that would have been very different from the fact that there were people from, literally, all around the world - India, Japan - that were saying that they, too, were seeing something. Could they explain it? No. Did they necessarily need to at that point? In my opinion, and I think John would echo this, probably not. There are many things in this world that have unexplained reasoning behind them, and some of them are curious enough to investigate, and some will create a lot of problems.

Regarding Bockris, Packham added:

Bockris is a character. A lot of people don't understand him; a lot of people certainly don't like him. That's not John's fault. John does have some radical ideas, but sometimes radical ideas are the ones that move this crazy world we have along.<sup>33</sup>

Because of the pervasive misinformation spread by Taubes and *Science*, Bockris has lived these last 15 years with a tarnished reputation. Bockris contemplated whether to sue the magazine for defamation:

I took advice from seven different authorities on this issue. [The majority opinion] was that a suit would be impossibly expensive for me but of trivial financial concern to the publisher of Taubes' book and that what was really at stake was my scientific reputation. The only thing would be to wait and see. Would other people be able to replicate the results? If so, all would be well. If not, no suit would help.

This seemed good advice at the time; .... however, Taubes' article in *Science* spread throughout the world. The hundred independent replications of our original tritium work were known only to the few hundred researchers in the field.<sup>34</sup>

The June 12, 1990, *Science* "Cold Fusion Revisited" press release stated the following:

Through a series of exclusive in-depth interviews, *Science* reports on the events that amount to a case study in "the damage that can be done when questions of fraud, legitimately raised, are not seriously addressed by researchers or their institutions." The news article raises "crucial questions about how rumors and allegations of fraud should be investigated while ensuring academic freedom and protecting the reputations of scientists whose careers may be at stake."

The staff of *Science* magazine apparently believed that they were acting as guardians for the integrity of science; in fact, they violated their own professional integrity by reporting untruths and by causing harm to the subjects of their stories.

Bockris' rebuttal illuminated the political underbelly of science:

I think that the issue here in respect to the *Science* article is, How far do you go in publishing an investigative journalist's account of his gathering of gossip that a graduate student has been spiking solutions with tritium?

The allegations made are perhaps what a number of physicists would like as a solution to the puzzle of the anomalous behavior in Pd/D<sub>2</sub>O. Because they were not addressed to the several hundred people who have taken part in experiments giving positive results on cold fusion but were focused on me and Nigel Packham, it is difficult not to sense a

political element, clothed in talk of fraud and government investigation. Its publication wasn't good science. What the chairman of the board of directors of *Science* now has to decide is, Who takes the responsibility for the decision to publish such material, and was that decision truly good for *Science*?<sup>35</sup>

Miley, editor of *Fusion Technology* journal for 20 years, reflected on the matter:

Normally, we'd say someone's innocent until proven guilty, and you'd be given the opportunity to have a trial rather than having an article written about what you've done wrong and identifying you as being guilty in the press rather than due process. All these things were happening, and it just makes one sad.<sup>36</sup>

It may eventually come to light that the damage from the Taubes' *Science* article suppressed the truth of cold fusion and delayed its progress. If cold fusion does, in fact, turn out to be a significant answer to the world's energy problems, then the delay in recognizing tritium as nuclear evidence of cold fusion will be considered highly unfortunate.

Mike Epstein, an assistant professor in the department of science at Mount Saint Mary's College, adapted the Lizzie Borden playground song to express his views of this regrettable chapter in scientific journalism:

Gary Taubes took an axe  
Gave Pons and Fleischmann forty whacks  
And when he saw what he had done  
He gave John Bockris forty-one.<sup>37</sup>