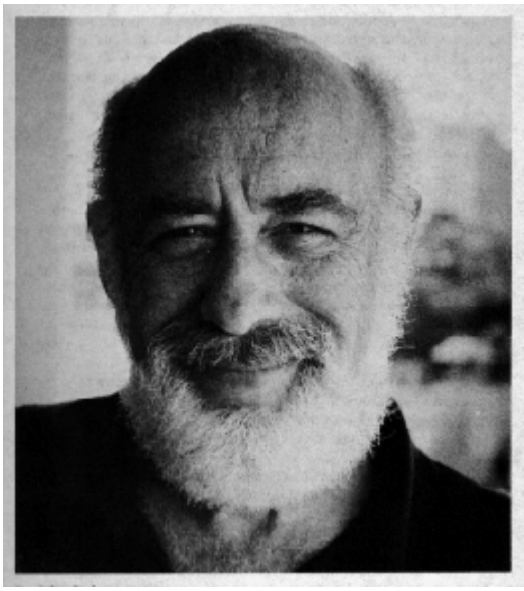


Dr. John W. Gofman, M.D., Ph.D.

John William Gofman was Professor Emeritus of Molecular and Cell Biology in the University of California at Berkeley, and Lecturer at the Department of Medicine, University of California School of Medicine at San Francisco.

He is the author of several books and more than a hundred scientific papers in peer-review journals in the fields of nuclear / physical chemistry, coronary heart disease, ultracentrifugal analysis of the serum lipoproteins, the relationship of human chromosomes to cancer, and the biological effects of radiation, with especial reference to causation of cancer and hereditary injury.

A Narrative Chronology

While a graduate student at Berkeley, Gofman co-discovered protactinium-232, uranium-232, protactinium-233, and uranium-233, and proved the slow and fast neutron fissionability of U-233.

Post-doctorally, he continued work related to the chemistry of plutonium and the atomic bomb development. At that early period, less than a quarter of a milligram of plutonium-239 existed, but a half-milligram was urgently needed for physical measurements in the Manhattan Project. At the request of J. Robert Oppenheimer, Gofman and Robert Connick irradiated a ton of uranyl nitrate by placing it around the Berkeley cyclotron (to capture neutrons), for a total exposure period of six weeks, with operation night and day. In 110 Gilman Hall, they scaled up Gofman's previous test-tube-sized sodium uranyl acetate process for the plutonium's chemical extraction. Dissolving 10-pound batches of the "hot" ton in big Pyrex jars, and working around the clock with the help of eight or ten others, they reduced the ton to a half cc of liquid containing 1.2 milligrams of plutonium (twice as much as expected).

After the plutonium work, Gofman completed medical school. In 1947, he began his research on coronary heart disease and, by developing special flotation ultracentrifugal techniques, he and his colleagues demonstrated the existence of diverse low-density lipoproteins (LDL) and high-density lipoproteins (HDL). Their work on lipoprotein chemistry and health consequences included the first prospective studies demonstrating that high LDL levels represent a risk-factor for coronary heart disease and that low HDL levels represent a risk-factor for coronary heart disease. His principal book on the heart disease research is *Coronary Heart Disease* (1959, Charles C. Thomas, Publisher).

In the early 1960s, the Atomic Energy Commission (AEC) asked him if he would establish a Biomedical Research Division at the Lawrence Livermore National Laboratory, for the purpose of evaluating the health effects of all types of nuclear activities. From 1963-1965, he served as the division's first director, concurrently with service as an Associate Director of the entire Laboratory, for Biomedicine. Later he stepped down from these administrative activities in order to have more time for his own laboratory research in cancer, chromosomes, and radiation, as well as his analytical work on the data from the Japanese atomic-bomb survivors and other irradiated human populations.

In 1965, Dr. Ian MacKenzie published an elegant report entitled "Breast Cancer Following Multiple Fluoroscopies" (*British J. of Cancer* 19: 1-8) and in 1968, Wanebo and co-workers, stimulated by MacKenzie's work, reported on "Breast Cancer after Exposure to the Atomic Bombings of Hiroshima and Nagasaki" (*New England J. of Medicine* 279:667-671), but few were willing to concede that breast-cancer could be induced by low-LET radiation.

Gofman and his colleague, Dr. Arthur Tamplin, quantified the breast-cancer risk (1970, *The Lancet* 1:297), looked at the other available evidence, and concluded overall that *human exposure to ionizing radiation was much more serious than previously recognized* (Gofman 1969; Gofman 1971).

Because of this finding, Gofman and Tamplin spoke out publicly in favor of re-examining two programs which they had previously accepted. One was the AEC's "Project Plowshare," a program to use hundreds or thousands of nuclear explosions to liberate natural gas in the Rocky Mountains and to excavate harbors and canals. Experimental shots had already been done, for example, in Colorado and Nevada. The second program was the AEC's plan to license about 1,000 nuclear power plants as quickly as possible and to build a "plutonium economy" based on breeder reactors. In 1970, Gofman and Tamplin proposed a five-year moratorium on licensing of commercial nuclear power plants.

For Gofman and Tamplin, the public health was the issue of prime importance. The Atomic Energy Commission was not pleased. In 1973, Gofman returned to full-time teaching at the University of California at Berkeley, until choosing an early and active "retirement" --- a retirement to full-time research on radiation health-effects. This research led to publication of four scientific books, and to the current work, *Preventing Breast Cancer.* The previous books included the following:

1. *Radiation And Human Health*, 908 pages (1981).
2. *X-Rays: Health Effects of Common Exams* (with Egan O'Connor), 439 pages (1985).
3. *Radiation-Induced Cancer From Low-Dose Exposure: A Independent Analysis*, 480 pages (1990).
4. *Chernobyl Accident: Radiation Consequences for This and Future Generations*, 574 pages (1994). It is in the Russian language. An English-language edition will be published in the future.

Recent Honors and Awards

December 1992, in Stockholm, Sweden: The Right Livelihood Award of the Right Livelihood Foundation. Dr. Jakob von Uexkull's statement, in presenting the award for John Gofman's "pioneering work in exposing the health effects of low-level radiation," was:

"The Right Livelihood Award for vision and work forming an essential contribution to making life more whole, healing our planet, and uplifting humanity."

November 1993, in Atlanta, Georgia: Selection as Honored Speaker for the 1993 Meeting of the Arteriosclerosis Section of the American Heart Association, in recognition of work described by Donald S. Fredrickson in *Circulation* (Suppl., Vol.87, No.4: 1-59, April 1993).

Curriculum Vitae

Birth: September 21, 1918 in Cleveland, Ohio.

Education:

- Grade and high school in Cleveland. A.B. in Chemistry from Oberlin College, 1939.
- Ph.D. in Nuclear/Physical Chemistry from the University of California at Berkeley, 1943. Dissertation: Discovery of Pa-232, U-232, Pa-233, and U-233. Proof of the slow and fast neutron fissionability of U-233. Discovery of the 4n + 1 radioactive series.
- M.D. from the School of Medicine, University of California at San Francisco, 1946. Internship in internal medicine at the University of California Hospital, San Francisco, 1946-1947.

Positions:

- Academic appointment in 1947 in the Division of Medical Physics, Department of Physics, University of California at Berkeley. Advancement in 1954 to the full professorship, a position held to the present time, with shift to Emeritus status in December, 1973. Under recent University reorganization, the affiliation is now the Division of Biochemistry, Department of Molecular and Cell Biology.
- Concurrent appointment since 1947 as either Instructor or Lecturer in Medicine in the Department of Medicine, University of California, San Francisco.

Additional appointments held:

- Associate Director, Lawrence Livermore National Laboratory, 1963-1968. Resigned this post to gain more time for research and teaching. Remained as Research Associate at Livermore through February, 1973.
- Founder and first Director of the Biomedical Research Division of the Lawrence Livermore Laboratory, 1963-1964. This work was done at the request of the Atomic Energy Commission.
- Member, Advisory Board for NERVA (Nuclear Engine Rocket Vehicle Application), approximately 1963-1966. Member of the Reactor Safeguard Committees University of California, Berkeley, approximately 1955-1960.
- Group Co-Leader of the Plutonium Project (for the Manhattan Project) at the University of California, Berkeley, 1941-1943. This work included meetings at Chicago and Oak Ridge to exchange information and to help DuPont engineers prepare for the reprocessing operations at Hanford, Washington.
- Physician in Radioisotope Therapy, Donner Clinic, University of California, Berkeley, 1947-1951.
- Medical Director, Lawrence Radiation Laboratory (Livermore), 1954-1957.
- Medical consultant to the Aerojet-General Nucleonics Corporation, with special emphasis on the hazards of ionizing radiation, for approximately eight years during the 1960s.

- Consultant to the Research Division of the Lederle Laboratories, American Cyanamid, 1952-1955.
- Consultant to the Research Division of Riker Laboratories, approximately 1962-1966.
- Scientific consultant to Vida Medical Systems, 197O-1974; co-invented the VIDA heart monitor, a pocket-worn computer to detect and announce the occurrence of serious cardiac arrhythmias; invented a skin cardiographic electrode subsequently used widely throughout the USA.
- Chairman of the Committee for Nuclear Responsibility, 1971 to the present; pro-bono work; no book-royalties or compensation of any type has ever bean accepted.

Patents:

- # 3,123,535 (Glenn T. Seaborg, John W. Gofman, Raymond W. Stoughton): The slow and fast neutron fissionability of uranium-233, with its application to production of nuclear power or nuclear weapons.
- # 2,671,251 (John W. Gofman, Robert E. Connick, Arthur C. Wahl): The sodium uranyl acetate process for the separation of plutonium in irradiated fuel from uranium and fission products.
- # 2,912,302 (Robert E. Connick, John W. Gofman, George C. Pimentel): The columbium oxide process for the separation of plutonium in irradiated fuel from uranium and fission products.

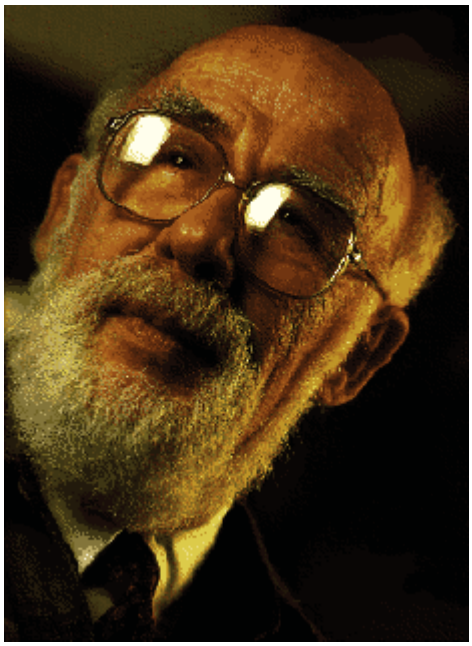
Earlier honors and awards:

- Gold-Headed Cane Award, University of California Medical School, 1946, presented to the graduating senior who most fully personifies the qualities of a "true physician."
- Modern Medicine Award, 1954, for outstanding contributions to heart disease research.
- The Lyman Duff Lectureship Award of the American Heart Association in 1965, for research in atherosclerosis and coronary heart disease; lecture published in 1966 as "Ischemic Heart Disease, Atherosclerosis, and Longevity," in *Circulation* 34: 679-697.
- The Stouffer Prize (shared) 1972, for outstanding contributions to research in arterioslerosis.
- American College of Cardiology, 1974; selection as one of twenty-five leading researchers in cardiology of the past quarter-century.
- University of California, Berkeley, Bancroft Library, 1988; announcement of the "Gofman Papers" established in the History of Science and Technology Special Collection (October 1988, *Bancroftiana*, No. 97: 10-11).

Other References:

- Gofman on the health effects of radiation:
  `There is no safe threshold', and `Challenging The Nuclear Establishment'
- A Conversation with John Gofman, Ph.D. '43,
- The Plowboy Interview: Dr. John W. Gofman, Nuclear And Antinuclear Scientist
- *Nuclear Witnesses, Insiders Speak Out*: John W. Gofman, Medical Physicist

What follows,
is one of the last interviews of Dr. Gofman
by Russell Schoch



California Q&A: A Conversation with John Gofman, Ph.D. '43

By Russell Schoch

A conversation with the Berkeley scientist who helped to build the atomic bomb and to unbuild this country's nuclear energy program.

A man filled with a passion for truth and justice, or a crank who once did good science but now tilts at nuclear-powered windmills?

Both opinions have been voiced about John W. Gofman, Ph.D. '43, M.D. '46, professor emeritus of molecular and cell biology at Berkeley. One thing is certain: When Gofman has felt ill-treated by the establishment, he has raised hell about it.

Tangles with the establishment have come as result of Gofman's unsparing evaluations of the health effects of radiation. For example, in 1969, when Gofman and his colleague Arthur Tamplin '53, Ph.D. '59, first began to write papers assessing nuclear energy's effects on the cancer rate, officials at Livermore Laboratory -- which employed Gofman and Tamplin -- stepped in and demanded that certain critical statements be taken out. Gofman promptly wrote a letter to the American Association for the Advancement of Science calling Livermore a "scientific whorehouse." The lab backed off before the letter became public.

Although Gofman today says he has never heard of the Berkeley slogan/bumper sticker "Subvert the Dominant Paradigm," he in fact has spent the last quarter century doing just that, even though, as he says, "I sure didn't set out to do it."

Gofman was born in Cleveland, Ohio in 1918, the son of Russian Jewish immigrants. (His father attempted to subvert the dominant paradigm directly: he took part in the aborted coup against the Czar in 1905 and was forced to flee his Russian homeland.) Gofman graduated from Oberlin College in 1939; after a year at Western Reserve medical school he decided he needed to know more about chemistry.

A teacher told him: "There's only one place in the world to study physical chemistry, and that's Berkeley." In 1940, Gofman, who had just married Helen Fahl, set out for graduate study at Cal. He was impressed by what he found. "All the giants were here," he recalls. "Latimer, Giauque, G.N. Lewis, Pitzer, Seaborg, Melvin Calvin, Joel Hildebrand. What a break to come and study in that atmosphere!" Gofman was a teaching assistant for William Giauque's freshman chemistry section in the large lecture course taught by Joel Hildebrand. Told to get his research started, Gofman quickly chose a young faculty member named Glenn Seaborg as his mentor.

When the Manhattan Project was launched in 1941, Gofman was pulled into the exciting and exhausting work of helping the United States construct an atomic bomb. Working in Gilman Hall, Gofman played a major role in extracting the plutonium desperately needed by Robert Oppenheimer at Los Alamos. While he was still a graduate student, Gofman co-discovered uranium-232 and -233 and helped to prove the slow amd fast neutron fissionability of uranium-233.

In 1944, he left the Manhattan Project and entered medical school at UCSF, earning his M.D. in 1946 and an award as the senior medical student "who most fully personifies the qualities of a `true physician.'" But Gofman had never wanted to be a doctor; he was always interested in medical research. After completing his medical internship, he joined the Berkeley faculty as an assistant professor of medical physics in 1947.

For the next 25 years he conducted important research on cholesterol, arteriosclerosis, and heart disease, work that won wide recognition and received major awards. He developed techniques that demonstrated for the first time the existence of low-density lipoproteins (LDL) and high-density lipoproteins (HDL). His work was the first to show something we are intimately familiar with in the 1990s: High LDL levels and low HDL levels are risk-factors for coronary heart disease.

Since the late 1960s, John Gofman has written, spoken out, and served as an expert witness in the field of radiation and human health. He has become a widely known -- and often officially scorned -- critic of nuclear power. In his latest subject of study, Gofman has written three books -- including the monumental *Health Effects of Radiation* (1981) -- and is just now completing his fourth, "Radiation and Chernobyl: This Generation and Beyond" -- which will appear in both English and Russian later this year. His work on the health effects of radiation led him to Stockholm last December to receive the Right Livelihood Award -- considered an "alternative Nobel Prize."

The effect of the efforts by Gofman and those who followed in his footsteps can be gauged very clearly: Before he started his critiques, the nuclear power movement in the United States was relatively unchallenged and was aiming for the construction and use of one thousand nuclear power plants by the year 2000. Instead, in 1993 there are only 110 nuclear plants licensed to operate in this country. Public opinion has turned around as well: In the 1950s and 1960s, close to 70 percent of the public favored nuclear power, while 30 percent were opposed; today those percentages have been reversed.

Since 1971, Gofman has been chairman of the Committee for Nuclear Responsibility, which has been the center and a publisher for his work in the field of radiation and health.

He and his wife have lived in the Upper Haight in San Francisco since 1947, in a house built by Guy S. Millberry, professor and dean of the College of Dentistry at UCSF for whom Millberry Hall is named.

Our interview took place in a room used earlier in this century as Millberry's dental office.

Q: *How did you, as a Berkeley professor with a medical degree, become involved with the weapons lab at Livermore?*

A: That had a lot to do with my friendship with Ernest Lawrence. In 1952, soon after they established the lab at Livermore, Ernest called me up and said, "Jack, I'm worried about the work they're doing out there." Many people don't know this, but Ernest Lawrence was an absolute bear on safety. If people handled radioactivity carelessly, he wouldn't tolerate it.

He asked if I would go out to Livermore one or two days a week as his personal representative and see that things were being done safely. "If you find anybody who isn't working according to standards you think are important to health," he said, "let them know what my wishes are. You'll be speaking for me."

Q: *He didn't give you a list of safety precautions?*

A: No, he just trusted me to do it. I had to have a base out there, so I set up the Industrial Medical Department for the Livermore Lab and became its medical director. While I was there, I began research that later enabled us to say something about the "good" and "bad" cholesterol -- low-density and high-density lipoproteins.

Anyway, I got to know the weaponeers, raised some hell about sloppy procedures -- the chemists were the worst -- and did this for about a year, when I returned to the Berkeley campus full time.

Q: *And you never became an opponent of nuclear weapons research?*

A: No. I have never opposed nuclear weapons. Because we live in a dangerous world, I think the only thing you have is the deterrence value of the nuclear weapons. And I certainly think that, in the jungle we call civilization, people who believe in human rights have to stay strong.

Q: *Your position has not changed with the collapse of the Soviet Union?*

A: No. If anything, I think the world is more dangerous as a result of that collapse.

Q: *Let's talk about how you started to worry about nuclear power even though you loved the bomb.*

A: Well, I had known the people at Livermore as a result of the work I did there in the 1950s. In the early 1960s, I got a call from John Forster, who was then director of the Livermore Lab. He said that the Atomic Energy Commission had asked him to set up a biomedical division at Livermore.

He was persuasive, and I agreed to investigate the health effects of all atomic energy programs. So, around the beginning of 1963, I became head of the Biomedical Division of Lawrence Lab and stayed on in various capacities until 1969.

Q: *And you gave a report on your findings in 1969?*

A: Yes. My colleague Art Tamplin and I had been trying to put together just exactly what we thought were the health effects per unit of radiation. In the fall of 1969, I was asked to address the Institute of Electrical Engineers. I thought this was a good place to summarize our findings.

Q: *And this is what stirred up a lot of trouble?*

A: It sure did. I never thought it was going to be such a big deal. What we said was this: based on the information we had, if everybody got what was then the allowable dose of radiation, there would be at least 16,000 extra cancer deaths per year. We soon raised that figure to 32,000.

Q: *Isn't there a difference of opinion on the effects of radiation and on the hazards associated with various doses? Isn't this a scientific question?*

A: It is a scientific question -- or it would be if you could say that all scientists approached the question as a strictly scientific one, in no way influenced by their salary or position.

Q: *Aren't we being irradiated by natural background radiation in amounts equal to what the nuclear power industry proposes as safe levels?*

A: Yes we are. And the nuclear proponents would therefore say, Why worry about it? But the point is this: Natural background radiation is just as harmful as any other radiation. Unfortunately, we have genetic diseases; unfortunately, we have in utero diseases; and unfortunately, we have cancer.

Q: *Which are caused by background radiation?*

A: I think there's no doubt about it, and therefore the argument your question implies falls on its own weight.

Q: *Is there such a thing as a safe amount of radiation?*

A: The *claim* has been made that there's evidence for a safe dose. As an analyst in this field, I have regarded this as one of the very serious questions I have to try and answer. In working on material right after the Chernobyl accident, which turned into the book I wrote in 1990 [*Radiation-Induced Cancer from Low-Dose Exposure: An Independent Analysis*], I used a method called nuclear track analysis. I was led to the conclusion that the lowest possible dose is producing cancer. Therefore, there is no safe dose and cannot be.

Q: *Is there any way to know that deaths from cancer and leukemia are actually caused by ionizing radiation?*

A: You know such things in the same way you know that smoking causes lung cancer. But you're never able to say: *This person*'s cancer was caused by radiation. You cannot do that.

Q: *You yourself were exposed to a great deal of radiation during your work on the bomb during World War II. That was 50 years ago. Aren't you living proof that your theories are incorrect?*

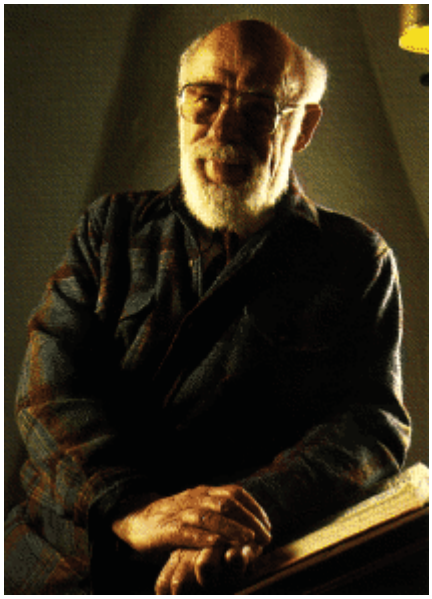
A: That's a very interesting question. But if you look at the calculations that we've made, you'll find that even at such doses as mine -- 100 rads, say -- more people escape the effect than get the effect. But all around me, I have seen deaths. Joe Kennedy, a brilliant man who was head of Oppenheimer's Los Alamos group, died at 38 of a carcinoma of the stomach. Bert Lowbeer, who was working in the 60-inch cyclotron building in Berkeley with Joe Hamilton -- both of these men died of leukemia in their early 40s.

Q: *So you consider yourself lucky.* **A:** Darned lucky.

Q: *Let me confront you with some of your critics. Philip Boffey wrote in* **Science** *magazine in 1970, following your initial claims about radiation and human health, that you were "indulging in verbal overkill" and alienating your peers and undermining your credibility.*

A: Well, he's entitled to his opinion. How I express myself is one thing that I really can't defend. But what I would like to say to such critics is this: Can they cite a single instance in which I said something of scientific merit on what radiation does, on how many cancers result, on what the mechanisms are -- can they cite something I said on those matters that could be construed as overkill or false?

Q: *Glenn Seaborg, the Nobel laureate and former head of the Atomic Energy Commission who was your mentor at Cal, remembers you as "one of his most brilliant students." But he also told me recently that you have been "misleading" and have "exaggerated" the dangers of nuclear power.*



Following Chernobyl,

Gofman's analysis led
---
him to conclude that
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there is no safe dose of
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radiation.

A: That's interesting, because back in the early 1970s when Glenn was head of the Atomic Energy Commission I wrote him a letter saying I thought his staff was misleading *him.*

I would like to say this. I have a lot of respect for Glenn; his record of accomplishments is amazing. But I don't think he knows a damn thing about the health effects of radiation. And I'll say something further. If *anybody* -- Glenn or anyone now high in the nuclear establishment -- really thinks they have found something I don't know, or am misusing, I would very much appreciate it if they would show me. And if they can show me, I would like to say publicly that I was wrong.

Q: *Hoping they would do the same?*

A: That would be a very good quid pro quo.

Q: *Could you briefly describe the accepted beliefs -- the dominant paradigm -- about radiation and human health?*

A: The dominant paradigm comes in three parts: **1)** There may be a cutoff threshold for the dangers of radiation; **2)** slow doses don't hurt; and **3)** it may be good for you.

Q: *It may be good for you?*

A: Yes, this is called "hormesis."

Q: *What does the word mean?*

A: It's from the Greek, and it has something to do with low doses of a toxic substance being favorable while higher doses are unfavorable. Probably the way it works -- according to the paradigm -- is that the jolt of toxins kicks your system into resisting disease even better than it would without the jolt.

Q: *How seriously is hormesis taken?*

A: Very seriously. They're very careful not to come out and say, publicly, "Hey, we're ready to start this new treatment of radiation-deficiency disease...." But make no mistake about it -- they're planning to introduce this notion to the public.

Q: *Radiation deficiency?*

A: Radiation deficiency.

Q: *That sounds crazy.*

A: It does to me too. I find that not one of these three points is credible. And in my books I've tried to give what I think is conclusive evidence about why they are not credible.

Q: *How would you assess the impact of your criticisms and those of others on the nuclear power movement in the United States?*

A: I think we changed the scene completely. After we came out with our calculations about cancer deaths in 1969-70 and gave public testimony about it, the government set up an Advisory Committee on the Biological Effects of Ionizing Radiation. Their report said, "We calculate about 6,000 deaths from cancer, while Gofman and Tamplin say from 16,000 to 32,000."

Q: *You forced them to make their own estimates?*

A: That was the key. They had never made such estimates before. They were forced to respond to our calculations.

Q: *Isn't it true that you wouldn't have been taken seriously if you hadn't been employed by an AEC-funded lab?*

A: I think that had just about everything to do with it. They wouldn't have taken us seriously otherwise. The Atomic Energy Commission had gotten away with just a totally arrogant approach before that. Atomic energy had a two-fold aura: First, it was going to be safe, clean, and cheap -- a cornucopia of good; second, it was part of the weapons program, and you couldn't attack the weapons program at that time.

`Every puff, every squirt,
----
every spill, every

Three Mile Island,
----
every Chernobyl makes

"clean" an odd adjective
----
for nuclear power.'

Q: *We've talked about the safety. What about the claims that nuclear power is cheap and clean?*

A: It hasn't turned out to be cheap, despite the initial claims. The other forms of power generation, even some of the solar methods, are about the same. In fact, the costs of decommissioning reactors and disposing of wastes in a safe manner are not even known. So we really don't even know the true cost per kilowatt hour of nuclear power.

Q: *Isn't it clean?*

A: It would be true that nuclear power is clean *if* at every stage along the path from the mining and milling of uranium through to its final sequestration -- if that's possible -- into some secure place there were no leaks into the environment. But every puff, every squirt, every spill, every Three Mile Island, every Chernobyl makes "clean" an odd adjective for nuclear power.

Q: *What are the usual responses to a critic like you?*

A: The major response is just to ignore me.

Q: *And hope you'll go away?*

A: You can't last forever. They do. You don't. You don't stay working in atomic energy in any of its installations with the wrong opinion on scientific matters. No one survives in that atmosphere who doesn't say the right thing.

Q: *And this is worldwide?*

A: Oh, yes. The club is worldwide. France is probably worse in its pressures than the United States. They're just gung-ho about nuclear power.

Q: *The former Soviet Union?*

A: Dr. Adamov, head of the Soviet Atomic Energy Program, says, "Our reactors are first class. The Chernobyl is first class. We're going to build *many more* Chernobyl-type reactors."

Q: *What would be the motivation for saying this?*

A: Adamov's the head man; that's his life and work. Yeltsin favors nuclear power too. They don't see a viable source of energy outside of nuclear. They don't believe solar energy efficiency could possibly come along in time.

Q: *And you do?*

A: I do. Reagan cut off all the funds for solar development. If solar got one-fourth of the attention and funding from the government that nuclear power has gotten in the past 20 years, we'd have a functioning, viable solar energy program in place today.

Q: *Is that what you'd wish for in the next 20 years?* **A:** That's correct.

Q: *More generally, what would you hope for in the years ahead?*

A: I think that the idea of an independent second opinion on all pollution matters has been long, long overdue.

Q: *All pollution?*

A: Yes. If you're going to talk about dioxin, I don't want to trust the EPA or any government agency which may feel it has to cater to some industrial interest. I think this is very important. If you're going to say you're concerned about an evaluation of whether people should or should not be exposed to such things, then you should have an independent group, responsible to citizens, doing the evaluations. Watchdog scientists -- this is a crucial idea. It seems to me that if society is going to defeat the pollution problem, nuclear or any other, the most important thing is a public demand that watchdogging becomes an honored profession.

Q: *In closing, let me ask what it is about the people like you, people who wind up opposing dominant paradigms. What motivates you?*

A: I don't know, and I have given this some thought. I'm not a moralist or a crusader. I don't consider myself a martyr. I haven't been hurt badly. The AEC did cut off my research funds, and therefore I was not been able to do lab work I might have preferred for a longer part of my life. And I haye been insulted. But it's not been too bad.

Q: *And now?*

A: And now, at age 74, what do I have left to look forward to?

I'm not going to be famous. I don't think I'm going to get noticed for my recent books, particularly. But I do want to have them in the library. Because somehow I feel that we have an obligation to our children and to their children, to leave the generations to come with a legacy of truth about the health effects of radiation.

* * *