

Waldo Cohn: Revelations in a DOE oral history

(As published in *The Oak Ridger's Historically Speaking* column on September 15, 2014)

This second in the series of article documenting the extraordinary scientist and community leader, Waldo Cohn, is being brought to us by Carolyn Krause. She has uncovered some amazing insights into such subjects as “human radiation experimentation” and has found information from Waldo that flies in the face of the all too often held preconceived concept that such experimentation was rampant in the early years of the Nuclear Age. You will find Waldo’s reaction to the accusation precise and blunt. Enjoy the read!

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On Jan. 18, 1995, Thomas Fisher and Michael Yuffee from the Department of Energy’s Office of Human Radiation Experiments arrived in Oak Ridge with a list of questions. They were authorized to conduct an oral history interview with Waldo E. Cohn, who earlier had told someone on the telephone that “tying me in with human experimentation is misleading.”

The retired biochemist from Oak Ridge National Laboratory had been selected for three reasons. He had investigated the radiotoxicity of fission products. He was the architect of the U.S. postwar isotope production and distribution policy.

And he developed ion-exchange chromatography, a technique that proved invaluable in the study of the nucleic acids DNA and RNA. By 1995 the technique had been used in most biochemical and chemical laboratories and in chemical manufacture throughout the world.

In 1993, U.S. Secretary of Energy Hazel R. O’Leary announced her Openness Initiative under which DOE sought to identify and catalog historical documents on radiation experiments in which human subjects had been used. Some documents were missing and others were scattered or disorganized. The oral history project was started to provide missing information and enrich the documentary record.

From the interview with Cohn, some interesting information emerged. For example, his college advisor at Berkeley wanted him to major in French, but his father insisted that he major in chemistry—and he did. His first wife was a scientist who died of cancer after an operation and treatment with radiation from radioactive phosphorus. Charmian, who was well known in Oak Ridge, was his second wife.

For his Ph.D. thesis research Cohn used as tracers in biochemical and biological experiments the artificial radioactive isotopes produced from elements bombarded by protons in Ernest O. Lawrence’s cyclotron at the University of California at Berkeley. Because of his expertise, Cohn was asked to leave his position at Harvard University in late 1942 and join the Manhattan Project at the University of Chicago.

He was placed in charge of the radiobiological aspects of the plutonium project including assessments of the biological and biochemical hazards that might be induced by the fission products of Enrico Fermi’s chain reactor after it went critical. Cohn and his colleagues at the Metallurgical Lab planned on paper what experiments could be done with fission products on animals. Half stayed in Chicago and the other half moved to Oak Ridge once the Graphite Reactor was operating.

“I elected to go to Oak Ridge, where we would actually prepare the fission products and send them back to the half I would leave at Chicago, where they would do the biological experimentation,” Cohn said. “So, I became a nuclear chemist involved with isolating the fission products from the neutron-exposed uranium.”

Cohn said the Chicago experiments looked at the toxic effects of fission products on animals but not on humans. He acknowledged that some radioisotopes were later used as tracers in humans, explaining that a tracer dose is a million times smaller than a therapeutic dose.

In fact, Cohn said that in his studies to “trace” human metabolic pathways at Berkeley, he had used himself as a subject. He measured how fast blood flowed from one arm to the other by injecting a tiny bit of radioactive sodium and following it with a Geiger counter.

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No human radiation experiments were performed in ORNL's Biology Division, Cohn said. As for the total-body irradiation of patients at the hospital of the Oak Ridge Institute of Nuclear Studies (ORINS), which later became Oak Ridge Associated Universities, Cohn said, "My impression of those is that they were all cancer treatments."

Cohn expressed anger that Secretary O'Leary released documents that gave rise to the incorrect perception that uses of tracer amounts of radioisotopes for diagnoses and radiation to treat cancer patients are types of radiation experiments on humans.

Both ORINS and Vanderbilt Hospital in Nashville, where harmless radioactive iron tracer studies were conducted on pregnant women, received negative publicity because the media presented their work as examples of human radiation experiments.

A 1946 paper by a scientist at Vanderbilt suggested that the radioactive iron came from Oak Ridge, but Cohn testified at a litigation hearing that the iron radioisotope used was produced at a cyclotron. At that time Oak Ridge had a reactor but no cyclotron.

General Leslie Groves, who had headed the Manhattan Project, proposed charging a high price for carbon-14 and other radioisotopes to help amortize the construction of the Graphite Reactor. Cohn called him up and said, "Look, General, if you put that price on carbon-14, you won't sell a microcurie of it."

It has to be priced so researchers can afford it. You will have to write off the Graphite Reactor as part of the war project." The general agreed. "There was an element of reasonableness in his dictatorship," Cohn told his interviewers.

They also asked Cohn about his development and application of ion-exchange chromatography to separate the nucleic acids DNA and RNA. This technique uses a column with a resin that selectively binds nucleic acids, allowing rapid separation of DNA from contaminating RNA, proteins, carbohydrates, and metabolites.

Cohn was the first to use ion-exchange chromatography to separate and isolate the four chemical bases, or nucleotides, of DNA and RNA molecules. Because DNA and RNA are organic molecules with pentose-phosphate backbones, Cohn and Elliot "Ken" Volkin incorporated radioactive carbon and phosphorus into these molecules to help determine their structure.

Use of Cohn's ion-exchange chromatography and the radioactive phosphorus Cohn produced in the Graphite Reactor led to Volkin and Larry Astrachan's discovery in 1956 of what is now known as messenger RNA, the substance produced directly by DNA in the cell's nucleus. This "DNA-like RNA," as Volkin called it, carries a message from the DNA to the cell's cytoplasm, instructing it to make a protein with a specified structure and function.

French scientists François Jacob and Jacques Monod, who were aware of the ORNL work before they published their seminal paper, received a Nobel Prize for the discovery of messenger RNA. Paul Berg, winner of the 1980 Nobel Prize for chemistry, calls the ORNL research an "unsung but momentous discovery of a fundamental mechanism in genetic chemistry" and a "seminal discovery [that] has never received its proper due."

Cohn has left his mark as a Renaissance man. He helped name new biochemicals, he founded and conducted a symphony orchestra in Oak Ridge and he was a fellow of the American Academy of Arts and Sciences.

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So, there you have yet another example of an Oak Ridge Scientist, Waldo Cohn, who was extraordinary but who likely was overlooked in that selection process that awards Nobel Prizes. Cohn was comfortable

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enough with his knowledge of using trace amounts of radionuclides to actually inject them into his own bloodstream and monitor their movement.

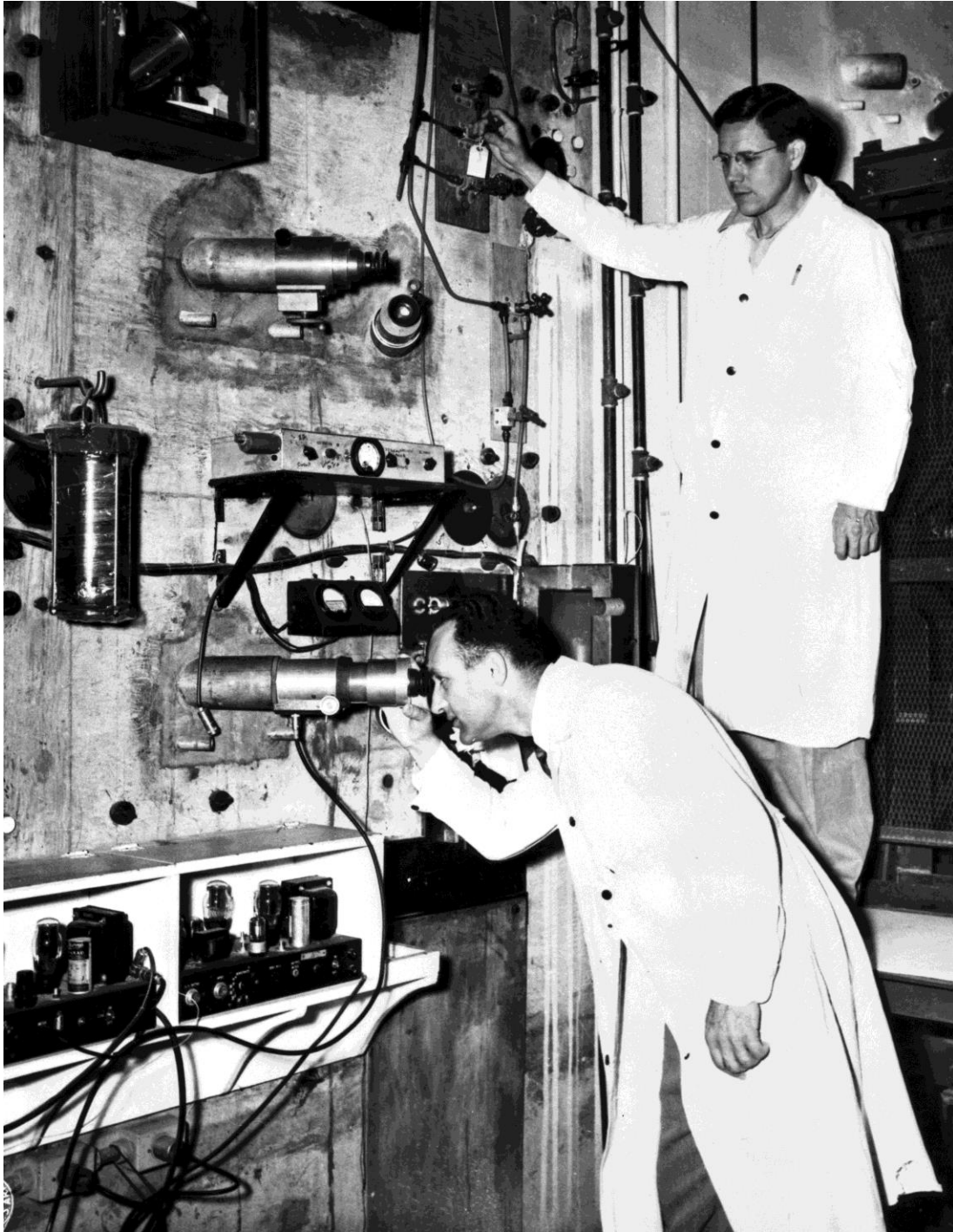
He was bold enough to speak the truth to the person who was in charge of the entire Manhattan Project, General Groves, and he was effective. Waldo Cohn stands among the great ones who made Oak Ridge their home. Thanks Carolyn for another excellent treatment of one of our local heroes.



Waldo Cohn and a piano player (anyone know him?)

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Waldo Cohn shown working with another scientist as they create isotopes

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A young Waldo Cohn conducts experiments with isotopes