

Alvin Weinberg: Oak Ridge's visionary lab director and intellectual leader, part 1

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Carolyn Krause draws upon an Oral History interview Steve Stow conducted with Alvin Weinberg and also the *ORNL Review* article she wrote after Weinberg died in October 2006.

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Alvin Weinberg (1915-2006), the internationally known director of Oak Ridge National Laboratory from 1955 to 1973, once aspired to be a great scientist like his mentor Eugene Wigner, an ORNL research director who received the Nobel Prize in physics in 1963.

In an Oak Ridge National Laboratory oral history interview in 2003, Steve Stow asked Weinberg what his greatest regret was. "I'd like to have been a great scientist – something I'm not," Weinberg replied. "It's just that I don't have the right genes to be a great scientist, in the sense that Wigner was a great scientist."

Of the eight books Weinberg authored or co-authored, he was most proud of the work he wrote with Wigner, entitled "The Physical Theory of Nuclear Chain Reactors." "That's probably my most important contribution to science," he once told the editor of the *ORNL Review*, the research magazine he founded in 1967.

But to many people in and outside Oak Ridge, Weinberg possessed a unique combination of talents and attributes that made him highly influential in many arenas.

He built, rescued and personified ORNL. As the lab's visionary director and the intellectual leader of an energy policy think tank he founded in 1975 at Oak Ridge Associated Universities, he influenced U.S. government energy and science policy as well as research funding priorities—from reactor design and nuclear safety to renewable energy and the impact on climate of increased carbon dioxide emissions from coal-fired power plants.

Weinberg was known on six continents. In Oak Ridge, this citizen of the world and Renaissance man was also a valued friend and neighbor. A lover of music and a musician, Weinberg played Bach preludes and fugues, as well as Christmas carols, on his Steinway grand piano and occasionally gave public concerts.

Until his mid-80s he was a competitive tennis player with his backhand slice. He always had a great sense of humor. During the celebration of his 90th birthday in the lobby of the auditorium named after his friend William Pollard, Weinberg told his many admirers, "The first 90 years are the hardest."

He delivered numerous speeches and wrote 541 scientific papers. He was a nuclear energy pioneer and prophet. He advocated the peaceful use of nuclear energy for producing electricity and medical radioisotopes. He also made accurate long-term predictions about energy technologies and the possibility of climate change if the world depended much more heavily on fossil fuels than on nuclear energy for base-load electricity.

He was an innovative scientific administrator who believed his most important and original contribution was the development of criteria for measuring the value of competing scientific ventures. The National Science Foundation uses many of these criteria to guide funding decisions on research proposals.

Weinberg was a thought-provoking communicator, coiner of phrases and a man of conscience and social responsibility who cared intensely about the welfare of humankind.

His niece Judith Goleman called him "a worrywort for the human race." In his last papers, authored in his late 80s, Weinberg was concerned about threats to humankind's survival—

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asteroids, nuclear waste, global warming and thermonuclear war—and capitalism's lack of compassion.

In 1946-47, when Wigner was research director at Clinton Laboratories, Weinberg developed his administrative skills, first as the physics division director and then as ORNL's research director in 1948, replacing Wigner. Weinberg is credited with saving the Laboratory from shutdown, convincing the federal government that ORNL had reactor development capabilities vital to the nation.

(Note: The name of Clinton Laboratories was changed to Oak Ridge National Laboratory in March 1948. Weinberg, in collaboration with William Pollard and others, including University of Tennessee professors and representatives of 14 universities accomplished this tremendous feat against political desires to prevent a "national laboratory" from being located in the South! – Ray)

In 1946 Captain Hyman Rickover and four other Navy officers came to Oak Ridge to explore the possibility of using nuclear power to propel submarines. Rickover had asked the General Electric Company to work on a liquid-metal-cooled reactor while he examined the pressurized water reactor concept that Weinberg was promoted.

Rickover told Weinberg that the thermal efficiency of his concept was too low. Weinberg argued that thermal efficiency is not nearly as important in a submarine as are reliability, simplicity and small size – criteria a PWR can meet. The PWR became the energy source for U.S. nuclear submarines and the dominant reactor design in commercial nuclear power plants, which today provide 16 percent of the world's electricity.

Freeman Dyson, renowned physicist with the Institute for Advanced Studies at Princeton University, wrote in a 2006 letter that Weinberg 50 years earlier taught him and others at General Atomic Company the particulars of nuclear reactor function and design.

Dyson said: "Weinberg made ORNL the best place in the world for designing and building nuclear reactors. Oak Ridge developed the basic technology for scientific research reactors, electric power reactors and Navy submarine propulsion reactors.

Dyson concluded, "He was the only nuclear pioneer who supported the wide universe of reactor designs, going beyond the conventional solid-fueled reactors. He built liquid-fueled reactors with highly original designs."

Of Weinberg's broader influence at the laboratory, Dyson wrote: "His vision for Oak Ridge went far beyond nuclear reactors. He made ORNL an outstanding international center for research in pure physics, chemistry and biology, as well as ecology and environmental science. He was interested in all kinds of energy technology and the effects of technology on the environment."

Dyson also wrote, "Long before the subject of global warming became fashionable, he set up a research program in Oak Ridge [in 1975] to study the effects of carbon dioxide emissions on climate. This program trained many people who became leaders in climate studies at other institutions."

Dyson was referring to the Institute for Energy Analysis at ORAU, an idea proposed to Weinberg by Bill Baker, eminent scientist with the Nixon administration. IEA was the first organization to receive significant funding from the Department of Energy for climate studies.

A popular speaker and bold thinker, Weinberg coined new phrases to explain his groundbreaking ideas about energy and science to lay audiences. Examples are "burning the sea" (fusion),

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"burning the rocks" (fission), "nuclear-powered agro-industrial complex," "nuclear priesthood," "technological fix" and "Big Science" (e.g., the moon mission).

He told Stow that he first used the "Faustian bargain" for nuclear power in his article "Social Implications of Nuclear Energy" in which he stated that nuclear energy is special because of its potentially adverse side effects – radioactivity, waste disposal issues and nuclear proliferation (the spread of hazardous, bomb-grade nuclear material to terrorist groups and hostile nations).

Weinberg frequently quoted Enrico Fermi, who in 1944 said to his fellow scientists: "Look, this is a great new energy source that we're creating, but there is no a priori reason to believe that the public will accept a new energy source that is encumbered by huge amounts of radioactivity and has a possibility of proliferation."

Weinberg said to Stow, "If I examine what my career has been all about, it's been to prove that Fermi was unduly pessimistic because, as you know, nuclear energy does account for something like 20 percent of our nation's electricity now."

A brilliant but (in his words) not great scientist, Weinberg envisioned ways that teams of researchers could help overcome the challenges facing the nation and the world.

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Thank you Carolyn for insight into Alvin Weinberg. Next week Carolyn will bring us the second part of this series.

There has been an effort to recognize Alvin Weinberg that has already resulted in plaques commemorating Weinberg at the American Museum of Science and Energy, the Oak Ridge Associated Universities, and the Graphite Reactor at ORNL. The group has plans to produce a film of his life. Fundraising to complete the film and other planned commemorative actions is underway now. If you would like to help, please contact Steve Stow or Tom Row.



Massachusetts Senator John F. Kennedy and Jacqueline Kennedy visiting the Homogeneous Reactor Experiment No. 2 during a campaign visit at ORNL (Photo courtesy of ORNL)

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ORNL Director Alvin Weinberg shows a model of Building 4500-North to Queen Frederika of Greece, November 7, 1958 (DOE Photo courtesy of ORNL)



Alvin Weinberg, 1948 (Photo courtesy of ORNL)

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Alvin Weinberg and Eugene Wigner (Photo courtesy of ORNL)