

Ernest O. Lawrence and Y-12 Calutrons

“August 8 is the birthday of physicist Ernest O. Lawrence, born in Canton, South Dakota in 1901. He was a curious child — at age two, he tried to figure out how matches worked and ended up lighting his clothes on fire. His best friend in Canton was a boy named Merle Tuve, who would go on to become a famous geophysicist. The boys built gliders together and constructed a crude radio transmitting station.

“Lawrence worked his way through college — he received an undergraduate degree from the University of South Dakota and graduate degrees from the University of Minnesota and Yale. He accepted a position at the University of California, Berkeley, and in 1930 he became the youngest full professor there.

“Lawrence put in 70-hour weeks at the Berkeley Radiation Lab, and he expected everyone else to do the same. The Lab was open 24 hours a day, seven days a week.

“It was there that he invented a machine that he called a “proton merry-go-round,” better known as the cyclotron. Lawrence’s first version of the cyclotron was very makeshift — it involved a kitchen chair, clothes racks, and a pie pan — but eventually he produced a more sophisticated device.

“The cyclotron was a machine that could accelerate particles and then hurl them at atoms to smash the atoms open. This allowed scientists to discover radioactive isotopes of elements and sometimes new elements. In 1940, Lawrence won the Nobel Prize for his invention.”

The above information came from the August 8, 2011, edition of the *Writer’s Almanac* by Garrison Keillor. The *Writer’s Almanac* is produced by Prairie Home Productions and presented by [American Public Media](#).

The following quote reflects the fact that Lawrence was known as the “father of big science,” being the first scientist to advance the idea of doing research with multidisciplinary teams of scientists and engineers. This was unheard of at the time, but is commonplace today.

“Lawrence will always be remembered as the inventor of the cyclotron, but more importantly, he should be remembered as the inventor of the modern way of doing science.” —Luis Alvarez, winner of the 1968 Nobel Prize for Physics.

Lynn Yarris, writing *Ernest Orlando Lawrence – The Man, His Lab, His Legacy*, says “Lawrence was also the legal inventor of the Calutron isotope separator – but he assigned the patent rights to the U.S. government for a fee of one dollar.” This “**CAL**ifornia **U**niversity **Cyclo**TRON” invention is what Y-12 used during the Manhattan Project to separate the uranium 235 needed for Little Boy, the world’s first atomic bomb ever used in warfare.

Some of these same calutrons continued to operate at Y-12 until 1998, separating all of the known elements in the periodic table at the time. Some of the stable isotopes separated by the calutrons were used to produce medical isotopes in the Graphite Reactor at the Oak Ridge National Laboratory.

Lawrence visited Y-12 often during the early years when his invention was just beginning to operate at full production. He assigned scientists and engineers from his Radiation Laboratory in Berkeley to work in Building 9731, the “Pilot Plant,” and to make improvements in the calutron design. There is a story told that on one such visit, he noted that the calutrons were not being operated at full power and proceeded to turn the power up significantly.

This increase in power resulted in substantially higher levels of product and Lawrence, said, “See, I told you it could produce more...” However, he had not been gone from the building but about five minutes when an arc inside the vacuum chamber created sparks and a small explosion inside the calutron.

Yet, his demonstration caused the staff who witnessed what he had done to have the confidence to increase the power at which the calutrons operated, and thus, increase their output. They just did not take the power up as high as Lawrence had done.

Lawrence helped win World War II through his invention of the calutron. He continued to work toward the winning of the Cold War, and eventually, he contributed to the ban on testing of nuclear weapons.

Lynn Yarris also writes, "After the Soviet Union exploded its first nuclear device in 1948, Lawrence was drawn into President Truman's decision to build a thermonuclear or 'H' bomb. By 1952, concerned that a lack of competition for Los Alamos was hampering scientific progress, Lawrence lobbied for and won approval to establish a second national weapons laboratory at Livermore. At the same time, he took up a 'hobby' and invented a type of color television tube that is still in use today." (This was written 10 years ago...before widespread use of flat screen monitors – Ray)

"By 1958, Lawrence, having been a key figure in releasing the nuclear genie from the bottle, became a key figure in trying to put it back. Despite suffering from a serious flare-up of his chronic colitis, he traveled to Geneva to participate, at the request of President Eisenhower, in negotiations with the Soviet Union on a proposed treaty that would ban the testing of nuclear weapons. The strain proved too much, and Lawrence was rushed back to a hospital at Stanford for surgery. During his final days, he confided to his wife, Molly, "I wish I'd taken more time off. I would have liked to, you know, but my conscience wouldn't let me."

Lawrence died on August 27, 1958, at age 57.

"This laboratory is his legacy. There is no other laboratory quite like this anywhere. And it is really because it was created by the science, the inspiration, the strength of Ernest Lawrence." —Charles V. Shank, Director, Ernest O. Lawrence Berkeley National Laboratory

On August 8, 1901, a child was born with a brilliant, inquisitive mind. His mother, Gunda Jacobson Lawrence, a daughter of Norwegian immigrants, married to Carl Lawrence, also born of Norwegian immigrants, said of her first born son, "He was 'born grown up,' yet he never lost his boyish enthusiasm. Ernest was always of a happy disposition and life to him seemed to be one thrill after another, but he was also always persistent and insistent!"

Such men as Ernest Orlando Lawrence succeeded in releasing the power of the atom and also wrestled with the proper control of that tremendous power. Today, the struggle continues. While nuclear weapons have kept the world from a third World War for over 65 years, the special nuclear materials needed for nuclear weapons must still be controlled. The Y-12 National Security Complex continues today to provide key functions to help ensure the safety of the world.