RETROSPECTIVE

Glenn Seaborg (1912–1999)

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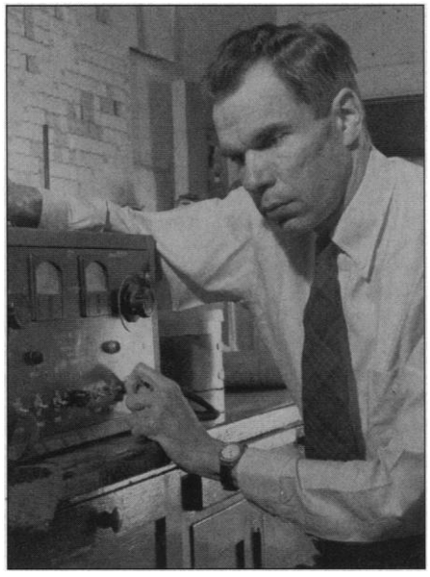
Glenn Seaborg had a career that few will emulate in any millennium. He discovered an element that ended a war and prevented more wars among the major powers for 50 years (and hopefully much longer). He was not only accorded many scientific honors but was also a special adviser to 10 Presidents of the United States, head of the Atomic Energy Commission for 10 years, professor at and Chancellor of the University of California, the faculty representative on the Athletic Commission of the Pacific 10 universities, a devoted husband and father of six, and a prominent leader in education reform. He was honored in 1997 by having element 106 of the periodic table, seaborgium, named after him.

Listing all of Seaborg's honors and achievements is impossible in a short article, but a selective list would be as follows. He was the discoverer or codiscoverer of elements 94, 95, 96, 98, 99, 100, 101, 102, 106, and 110. Seaborg suggested that the heaviest naturally occurring element and the first 11 synthetic elements after it form a transition series of actinide elements analogous to the rare Earth series of lanthanide elements. This concept helped elucidate the chemistry of the actinide elements, information that was key for isolating these unstable elements. He received the Nobel Prize in Chemistry in 1951 with E. M. McMillian "for their discoveries in the chemistry of the transuranium elements," as well as the National Medal of Science and the Nichols, Gibbs, Parsons, and Pure Chemistry Awards of the American Chemical Society. He authored over 500 scientific articles and 16 books and received 50 honorary degrees.

In 1941, Phil Abelson and McMillian discovered the first transuranic element Neptunium, element 93. Noting that it was a β-emitter with a short half-life and that its decay was followed by no further emission of radiation, Seaborg—a young assistant professor at the time—correctly deduced that neptunium must be followed in the periodic table by another element with a long half-life, element 94, later called plutonium. Because plutonium was chemically different from uranium but also fissionable, the wartime leaders of the Manhattan Project decided in 1941 that chemical separation (plutonium from uranium) might be easier to achieve than isotopic separation (^{235}U from ^{238}U). In the end, both were accomplished, but the great urgency (it was assumed that Hitler was also developing an "atomic bomb") dictated that alternate strategies be tried simultaneously. This meant that Seaborg had to isolate large quantities of a man-made element whose chemistry was unknown and separate it from a number of highly ra-



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dioactive fission products, also with largely unknown chemistry. Seaborg collected a group of young students fresh out of college (I was one of them) and some more mature scientists to embark on this formidable task and guided them with a genius that few could match. He not only had great chemical insight but also an organizational ability that made the plutonium project proceed with great speed and efficiency, resulting in the United States having two bombs, a crucial number for ending the war. The U.S. government decided that the use of two bombs in sequence was needed to create the illusion that we had many more to fulfill our threats if peace was not agreed upon. The records indicate that they were right and that it was the nuclear threat that led to the Japanese surrender. Because wars start by miscalculations (no one would start a war knowing that the outcome would be defeat), the existence of atomic weapons was a major factor in preventing a third World War during the Cold War period.

Seaborg's great genius for organization played a major role in his scientific career. On the plutonium project, Seaborg heard his chemists complain about the troubles they had completing their experiments. They would rush an experiment with an isotope with a short half-life into the general service counting facility for the Manhattan Project in Chicago, only to find that, frequently, all Geiger counters were nonoperational (this very new experimental tool was unreliable in those days). Seaborg decided that the physicists in charge of the counting facility were too concerned with highly accurate counting and so used precise but finicky machines. What his group needed was 24-hour operational reliability, not intermittent accuracy. So he developed a counting facility in our own small group that temporarily taxed our resources for plutonium chemistry but greatly accelerated the overall productivity because experiments no longer aborted because of faulty instruments.

Another example illustrates his ability to always keep his eye on the goal. A chemical group outside Seaborg's control was delegated to work out fission product chemistry, whereas Seaborg's task was to work out plutonium chemistry. These two big projects had to come together for the final separation of plutonium from fission products. Believing the other group to be proceeding too academically and too cautiously, Seaborg assigned two of his top researchers, Isadore Perlman and Bertram Goldschmidt, to try a dramatic shortcut procedure for separating plutonium from fission products. It worked, moving the Manhattan Project forward expeditiously.

His organizational skills and dedication to science education were also evident when he served as a key figure in forming the Lawrence Hall of Science, which has a major training role in science education in the United States. He was its chairman and mentor for many years. He also played a major role in a National Science Foundation study on high school and college education and was involved in organizing the Pacific 10 athletic consortium on the West Coast to deal with the problems of big college sports and academic standards.

Seaborg was enthusiastic about his contribution to nuclear medicine. He was also a strong advocate of the comprehensive test ban treaty on atomic weapons and a steadfast voice for scientific understanding and liberal pragmatism.

Glenn Seaborg lived the life of a legend, exemplifying the use of heart and mind for great benefits to humankind. He will always be remembered in ^{106}Sg.

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