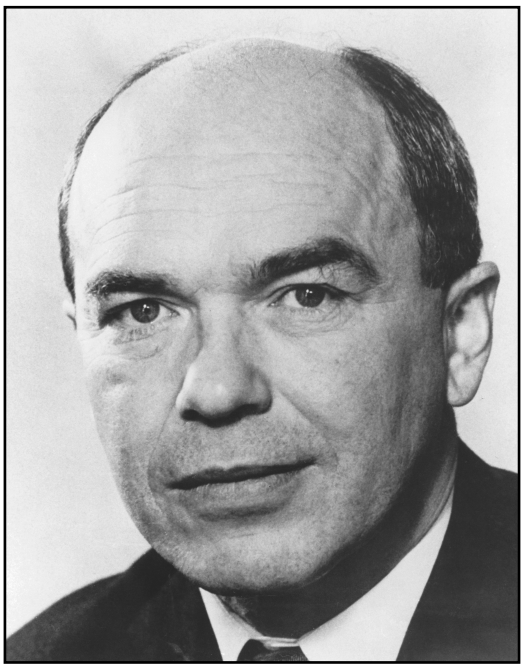
DONALD FREDERICK HORNIG



17 MARCH 1920 · 21 JANUARY 2013

DONALD HORNIG led a multifaceted life, which included a highly productive career as a physical chemist and that of an elder statesman of science and government. In the latter role, he served as president of Brown University and science advisor to President Lyndon Johnson, and at 23 years old, he was a key scientist in the Manhattan Project during World War II. A member of the National Academy of Sciences, he participated in numerous activities and studies over many years; he was a member of the American Philosophical Society, to which he was elected in 1967. Late in his career, he served for 13 years as director of Interdisciplinary Programs in Health at the Harvard School of Public Health. He was a faculty member at Brown and Princeton for almost 20 years before taking on government and academic administrative positions. These singular achievements will be described, recalling Hornig first as a brilliant research scientist.

Hornig was born in Milwaukee, Wisconsin, and received his early education there. Demonstrating his ability at a young age, he received an undergraduate scholarship to Harvard and went on to obtain a Ph.D. there. It should be mentioned at the outset that Hornig had a rich personal life. He married Lilli Schwenk, a chemist in her own right, in 1943. It was a marriage that lasted until his death. He had four accomplished children: Joanna Hornig Fox; Ellen; Christopher; and Leslie, who died of cancer in 2012.

Hornig's roots, as with many high achievers in science statesmanship, lay in his early career in the laboratory. The work he performed for his Ph.D. at Harvard gave him his start. His thesis, performed during the height of World War II under E. Bright Wilson, was "an investigation of the shock wave produced by an explosion in air." This theme informed much of his later research activities, which also led to his recruitment to Los Alamos. After receiving his Ph.D. in 1943 and serving as a post-doc at Woods Hole Oceanographic Institution (also working with explosives), he was singled out by George Kistiakowsky to move to the Manhattan Project at Los Alamos, where his work on shock waves and explosives both at Harvard and Woods Hole were to come in handy. At Los Alamos, his successful leadership in developing triggers for the plutonium implosion bomb earned him both high praise and visibility.

Before describing his life-altering experience of helping to develop the atomic bomb, followed eventually by his service as presidential science advisor to Lyndon Johnson, his career as a physical chemist at Brown and Princeton must be discussed. When the war ended, he joined the faculty at Brown University, where he established a research program mainly in the use of spectroscopy to study properties of molecules and molecular ions mostly in crystalline solids, although he

kept his hand in shock research primarily to study chemical reactions in the shock front. During his roughly 10 years as a Brown University faculty member, Hornig published more than 40 research articles, mostly in the *Journal of Chemical Physics*. Among these works was an extraordinary 10-part series of articles on vibrational structure, which started with a landmark paper in 1948 presenting the general theory of vibrational spectra of complex ions in crystals, followed by nine experimental papers applying the theory to a variety of applications to important molecules. Eventually, he was recruited away from Brown by Princeton, although his scientific productivity continued unabated. His publication record just about doubled during his Princeton tenure, stretching long past his academic residences into his governmental era and ending only when he became president of Brown.[1]

When Don Hornig died, on 21 January 2013, newspapers from coast to coast published his obituaries, almost invariably emphasizing in headlines the role he played in assembling and arming the first atomic explosion in Alamogordo, New Mexico, on 16 July 1945.[2] Although he did play a dramatic role in the assembly of the test bomb, his more significant accomplishment was his leadership in the design and construction of the ignition triggers required to successfully compress the spherical ring of explosives that surrounded the plutonium core, which were necessary to develop a fast, symmetric chain reaction. Recall that it was his earlier shock wave research leading to his Ph.D. thesis, followed by similar work at Woods Hole, that led to a phone call from George Kistiakowsky, who essentially ordered him to get post-haste to Los Alamos, where he landed that job as leader of the trigger mechanism development.

Hornig arrived at Los Alamos, along with his new bride, Lilli, at the beginning of 1944. His job was to design and develop those essential triggers, and this, as he has stated, was before the plutonium core even existed. He assembled a small team of researchers for this purpose.[3] The job was to develop a large number of triggers—32, it turned out—which were to sit on the apexes of conically shaped explosive lenses, and which were to ignite these explosives essentially simultaneously (in this case meaning within a tiny number of microseconds). The triggers were designed, fabricated, and tested, and they eventually ended up on that bomb on a tower in Alamogordo, where Hornig

1 A partial list of journals in which Hornig published research articles during his research years include: *Transactions of the Faraday Society, Physics of Fluids, Canadian Journal of Physics, Journal of the Optical Society of America, Molecular Physics, Electrical World, Science, Journal of Physical Chemistry,* and *Physics Today*.

2 For a sampling of these obituaries, see http://philosophyofscienceportal.blogspot.com/search?q=hornig

3 The current author was one such researcher.

famously "baby-sat" history's first atomic bomb the night before its ignition. These triggers were finally used on the Nagasaki bomb.

Hornig was among the vast majority of Manhattan Project scientists and engineers who remained convinced long after the end of World War II that the use of the two atomic bombs on Japan hastened the war's end and resulted in the saving of many American and Japanese lives. The reader is referred to an oral interview that Hornig gave in 1968 when he was still science advisor to President Johnson. In it, Hornig describes the fateful time when he was at Alamogordo, responsible for arming the implosion test. This interview also presents a thorough picture of his time as member of the President's Science Advisory Committee during the Eisenhower administration, and then as Special Assistant to the President (i.e., science advisor) to President Johnson.[4]

Hornig was first appointed by Eisenhower to the President's Science Advisory Committee in 1959. His appointment continued under President Kennedy, and shortly after the president's assassination, Hornig became Chairman under Johnson, a position he kept until Johnson left office in 1969. During those years, he was deeply involved in many of the most important problems our country was faced with involving science both directly or indirectly. These included such matters as arms control, space exploration and the founding of NASA, the intense competition with the Soviet Union over space and weaponry, education, basic research, and public health. He was a key contributor to establishing the Korea Institute of Science and Technology. As presidential advisor, he was a leading supporter of science development in other Asian and Eastern European countries. He contributed his research skills and diplomatic prowess to the heat-seeking/infrared detection capacities that made the Sidewinder missile such a valuable component of America's defense arsenal.

This brief biography cannot do justice to all of these matters; the reader should refer to Hornig's oral history for a deeper view of his involvements with these issues, which were so vital to America's health at the time.

The late '60s to the early '70s was a period of great turmoil and dissent in America, notably at its universities, primarily, though not exclusively, because of the war in Vietnam. Brown University was no exception, although it was not as deeply involved as other major universities during the heyday of student troubles in the late 1960s. One of the casualties at Brown at that time was an able and talented

4 Transcript. *Donald F. Hornig Oral History Interview, 12/4/68*, by David G. McComb, Lyndon Baines Johnson Oral History Collection, LBJ Library, 2313 Red River St., Austin, TX 78705.

scholar, Ray L. Heffner (1925–2012), who served as president for only a few years. He resigned in 1969, admitting that he wasn't too enthralled with the presidency. Hornig was a natural replacement. With his impeccable credentials, he was a popular choice, and it was a natural step for him to take in his career. In fact, despite the continuing conflicts that arose out of both the student troubles and a serious financial crisis that faced the university, his achievements during his 7-year tenure starting in1976 were considerable. During his term as president, a number of significant developments occurred at Brown. Among these were: (1) the unification of Brown with its all-women sister affiliate, Pembroke; (2) the creation of a medical school; and (3) perhaps most importantly, his success in achieving control over the ballooning budget deficit that posed a real threat to Brown's stability. He was also instrumental in obtaining better student and faculty input for university governance. However, these achievements, important as they were, did not come without a price. There were student protests, a building occupation by black students, a faculty willingness to bend over somewhat excessive student demands, and, perhaps most importantly, his unpopular creation of an austerity budget calling for significant cutbacks in both faculty and student aid.

Hornig resigned as president in 1976. At his death, Brown President Christina Paxson stated, "Much of Brown University's success over the last three decades had its roots in these decisions, for which we remain grateful." Hornig himself characterized his presidency as "bittersweet."

For a decade and a half, Hornig had devoted himself to government and academic service at the highest level. It was a time for decompression and a time to return to his scientific and cultural roots. It is no surprise, therefore, that after taking a temporary position at Harvard, nominally in applied physics, he accepted a faculty appointment at the Harvard School of Public Health, where he remained until retirement in 1990. While there, he served in various capacities, first as professor of Chemistry, then as director of the Interdisciplinary Programs in Health, and finally as chairman of the Department of Environmental Science and Physiology. Hornig's decompression would be any mortal individual's feverish activity. During this period, he continued his involvement with the National Academy of Sciences, serving on many of its committees; for example, he was chair of the Academy's Board of Environmental Studies and Toxicology.

This biography omits discussion of his many additional activities over the years, such as his involvement with private enterprises and his innumerable committee services at various government, academic, and

private institutions. Perhaps only one of these will be noted here: From 1986–98, he was president of the Cambridge Water Board!

Hornig's eldest daughter, Joanna Hornig Fox, offers a personal comment on two of Hornig's most distinguished teachers at Harvard and several of his earlier teachers who greatly influenced his career[5]:

> Both Bright Wilson and George Kistiakowsky remained influential figures in his life for a very long time, both mentors, both in terms of science and also in terms of civic and public responsibilities of scientists, and I think that he was mentored so well by them, both as an undergraduate and graduate student, because in some way he attracted mentors. Both his chemistry teacher at Milwaukee Country Day who was just a few years older than he was, and an earlier middle school teacher in the Milwaukee Public Schools (who, rumor had it, said, "Donny, if you want to make anything of yourself, you have to get out of here") stuck with him for a long time. I remember meeting the chemistry teacher at our summer home sometimes in the 70s or 80s . . . . [This] was an outstanding characteristic of his final professorship at Harvard—he mentored others, and in fact, he did that all his life. We had innumerable stray grad students to Thanksgiving dinner, and several of his post-docs were practically members of the family.

According to Douglas W. Dockery, chair of the Department of Environmental Health and Physiology at the Harvard School of Public Health: "Don valued using the combined brainpower of many disciplines in addressing emergent public health problems. He instilled that approach in us through his wisdom, wit, and warmth . . . . He was instrumental in establishing the culture of multidisciplinary approaches to addressing complex environmental health problems . . . . "

Hornig was an unusually skilled, wise, and caring person when it came to his work, and the same could have been said for Don Hornig's entire life.

I wish to thank Hornig's daughter Joanna Hornig Fox for reading this manuscript and supplying personal details that were unknown to me.

Elected 1967

Benjamin Bederson
Editor-in-Chief Emeritus, American Physical Society
Professor Emeritus of Physics, New York University

5 Personal correspondence to the author.