A Tribute to the Life and Scientific Accomplishments of Lauriston Sale Taylor

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We meet this morning to honor the memory of and to pay tribute to Lauriston Sale Taylor, the beloved founder of this organization and its predecessors.

Here is a photograph of Laurie Taylor, presiding at the organizational meeting of the new NCRP on August 3, 1964.

The Council came into existence as a federal corporation chartered by an Act of Congress and signed into law on July 14, 1964. That date marks the most important milestone in the long history of the National Council on Radiation Protection and Measurements (NCRP), namely its recognition by the Congress of the United States as being the only national private organization competent to recommend standards for radiation protection.

I am indeed most honored for having been invited to present this tribute. I have many cherished memories of Laurie since I first met him in January 1953 when I served as a proxy for Dr. Pendergrass on NCRP Committee 10, the Regulation of Radiation Exposure, chaired by Laurie. One of my earliest memories was taking this photo of Laurie a year later receiving the Janeway Medal from Edith Quimby at the American Radium Society meeting in Hot Springs, Virginia on March 16, 1954, over a half century ago.

In the time allotted to me, I can touch only on some of the more important highlights of Laurie's very long and distinguished career. As Laurie himself said, he was lucky to be at the right place at the right time on many occasions during his life. Even more important, he recognized the great needs of the time and he took advantage of the opportunities presented to him to fill those needs. Laurie was never shy about taking the initiative and accepting responsibility. His job was to get the job done; and this he did many times over, even into his 90s. At the same time he was a skilled and artful administrator and diplomat, most effective in persuading scientists from many disciplines to freely volunteer their time and effort to NCRP and many other organizations.

Laurie Taylor was born on June 1, 1902 in Brooklyn, New York but he grew up in Maplewood, New Jersey. Shown here is the house in which his family lived, only a few miles from Thomas Edison's laboratories.

This is a photograph of Laurie at age three, looking forward to confronting the challenges of the future.

This photo shows Laurie with his kindergarten class. You can see him waving the flag of the country he will help defend in World War II.

Here is Laurie (right) with his two brothers and their mother around 1910. Their father was a metallurgist and minerals assayer with broad training in physics, chemistry, geology, engineering and botany. His mother had a good background in French and music, and played the church organ. Laurie was a good student, but he had his mischievous moments. He once told me with a big grin that he managed to be expelled only twice. I will relate briefly two episodes. Laurie had a great fondness for hand tools. While in the second grade, he decided to try out a fancy new screw driver his uncle had given him by unscrewing from the floor all of the desks in one row in his class-room. When the students marched in and sat down on the teacher's command, the whole row of desks slide across the floor, much to the delight of the students and the consternation on the teacher. The second episode occurred in the fifth grade. He and several classmates took strings of black liquorice candy and laced them with red pepper by inserting the pepper down the hollow tubing. The strings of candy were cut into 3 inch lengths, sealed off at the ends with a hot soldering iron and then distributed them to his classmates just before class. By the time general assembly was called to order, half of the class was in tears from coughing, choking and sneezing. For his part, Laurie had to appear before the Board of Education. But that gave him a chance to use his developing diplomatic skills by negotiating permission for his co-conspirators and himself to return to school 3 d later.

Laurie's parents provided 20¢ a day for car fare for the train and bus (a nickel for each) to high school 3½ miles away. To save money to buy the tools he was so fond of, Laurie often walked to and from school. Impressed by his father's broad scientific knowledge, Laurie took all of the math and science courses offered. He knew German would be important for a scientific career, but he had to take French instead because German courses were forbidden during World War I. He remembered having to recite French grammar and verbs to his mother's satisfaction on Friday evening to be permitted to work in his laboratory on Saturdays. He particularly enjoyed the manual training classes where he developed the woodworking skills that he used and enjoyed the rest of his life.

Laurie very early on became engrossed with wireless telegraphy and he eventually became a licensed amateur radio operator, a licensed electrician, and a licensed plumber. Many years later during his travels to Europe to participate in the International Commission on Radiological Protection (ICRP) and International Commission on Radiation Units and Measurements (ICRU) meetings, Laurie often took with him a small tool kit to cope with possible plumbing emergencies in third-rate hotels. While in elementary and high school, he took on a number of electric wiring jobs to earn some money. When Laurie was only 12 y old, his father took him to a meeting of mechanical engineers, which happened to be held in Thomas Edison's laboratories. The engineers were all impressed upon seeing their own moving images projected on the wall soon after they entered the building. After Edison addressed the group and gave some demonstrations, he entertained questions. When Laurie expressed his interest in gas tubes, Edison offered him one of his own x-ray tubes. But, Laurie never got a chance to energize the tube because his father, knowing something about the hazards of x rays, warned his son against playing with it. That was Laurie's first introduction to radiation safety.

Laurie wanted to study electronics. Since he had only limited finances, he decided to attend Steven's Institute, an engineering school, because it was near home. After 2 y, his funds were exhausted. Fortunately, a neighbor helped him get a job at the Western Electric Laboratories (precursor to the Bell Laboratories). He soon learned that a solid background in physics rather than in engineering would be best for a career in electronics. Therefore, with the money earned at the Bell Labs, Laurie enrolled in physics at Cornell. However, since Cornell was an Arts and Sciences University and not an engineering school, it would not allow Laurie to transfer his residency time from Stevens.

He took almost all of the physics courses offered, passed his preliminary exams and completed his doctoral thesis, but he needed another 1½ y on campus to meet the minimum residency requirements. In the meantime, Laurie was awarded a research fellowship working with Professor Richtmyer on x-ray spectroscopy. Laurie was looking forward to returning to the Bell Laboratories, but he was still uncertain whether to pursue an academic career or to go into industry. Richtmyer referred Laurie to an opening at the National Bureau of Standards (NBS) involving x-ray work. He decided to take it for 1 y before returning to Cornell to get his

doctorate. As it turned out however, Laurie stayed, not for 1 y, but for 37 y and he never found time to complete the residency requirement at Cornell. Thirty-three years later in 1960, however, he was awarded an honorary Doctor of Science degree by the University of Pennsylvania and one by St. Procopius College in 1965.

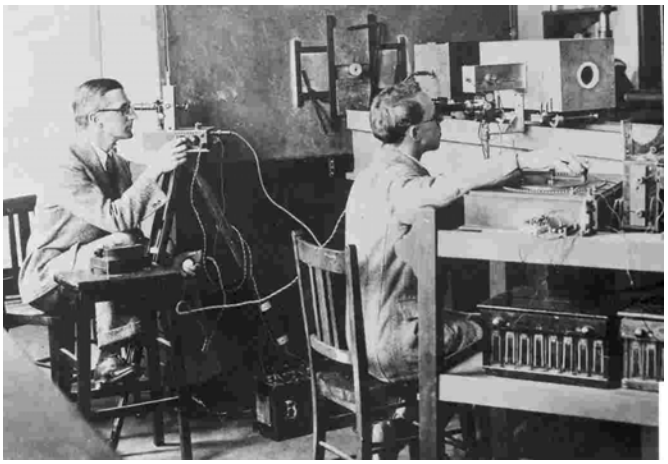
When Taylor arrived at NBS in 1927, he made two alarming discoveries. The first was that Dr. Hunt, to whom Laurie was supposed to report, was leaving the Bureau the following week to work at the Bell Laboratories, the very place to which Laurie had expected to return. Second, he was recruited not to work in x-ray spectroscopy, as he was led to believe, but on the medical uses of x rays. It seems that the three national radiological societies had prevailed upon the U.S. Department of Commerce to begin funding a modest program on medical x-ray dosimetry. Laurie told the Section Chief he knew nothing about that field, but was willing to take a look at it.

Laurie researched the American and European radiological journals and soon realized that there were many unresolved technical problems in applying x rays to medicine, particularly in cancer therapy. Upon learning of Dr. Failla's prominent role in the field, Laurie hastily arranged to spend a week with him at Memorial Hospital in New York City. Dr. Failla convinced Laurie that not only did he have the scientific background to work in the field of medical radiological physics, but also that Laurie's position at the Bureau gave him a great opportunity to provide a sorely needed service for the medical community.

At the time, the Bureau had only one x-ray machine in a lead-lined room poorly configured for making radiation measurements. There were practically no funds for purchasing equipment. Fortunately, Laurie had the help of skilled instrument makers and machinists who fabricated what he needed. To conduct measurements outside the lead room, a large section of lead lining had to be removed temporarily.

Laurie relates in several interviews how, in 1929 he was accidentally exposed to 150 +/- 50 rads whole-body radiation when someone forgot to replace the shielding, leaving him exposed to the unattenuated primary beam.

This is a photograph taken in June 1931 of Laurie Taylor and Dr. Walter Binks at the National Physical Laboratories in England, intercomparing for the first time the American and British x-ray standards. Intercomparisons with the German standard were also made during this same period.



The First International Congress of Radiology (ICR) in 1925 had established a radiation units committee, which later became known as ICRU. Dr. Kaye of the National Physical Laboratories of England was asked by the ICR to put together a similar committee on radiation protection. In seeking a representative from the United States, Dr. Kaye visited the Director of NBS and was referred to Taylor. Not speaking French or German, he asked Taylor to help him by visiting the leading radiological centers in Europe and to find a representative from Germany. Laurie spent six weeks in Europe in the summer of 1928 and recruited Dr. Grossman, Director of Research at the Siemens Company to serve on what became known as ICRP. Laurie attended both meetings in Stockholm that August. ICRP adopted with slight modification the British radiation protection code. The ICRU adopted the first formal definition of the roentgen unit.

Laurie not only was present at both of these meetings, he also attended all but one of the subsequent meetings until his retirement in 1969. He was Chairman of the ICRU and Secretary of the ICRP for many years.

It is interesting to note that no travel funds were provided Laurie by the Bureau or any other group to attend the Stockholm meeting. He had to go to the bank and take out a personal loan, backed by a friend, to finance the trip himself and he had to go by passenger liner which, at that time, took around 10 d.

Upon his return from the ICRP/ICRU meetings in Stockholm, Laurie Taylor obtained the unanimous support of the three American radiological societies to participate in the creation of

the U.S. Advisory Committee on X-Ray and Radium Protection, with one physicist and one radiologist from each society. The American Medical Association and the x-ray manufacturers also were invited to participate. This committee, which after World War II became known as NCRP, held its first meeting in 1929 when it also adopted, with some modification the British protection recommendations. The first two NCRP reports on x-ray and radium protection specified the means and rules for protection with no reference to dose limitations. The 1934 NCRP report was the first to include recommendations in terms of the "tolerance dose." After 1 y, Laurie succeeded Dr. Coolidge as Chairman of NCRP and continued in that role for 46 y until retiring in 1977. He served on the ICRP and ICRU in various capacities as member, secretary or chairman until 1969. He continued in an emeritus or honorary status on all three organizations until his death. I won't attempt to review the tremendous expansion of NCRP programs during that time nor Laurie's extensive service on ICRP and ICRU. In 1934, Taylor played an essential role in initiating the "registration of qualified x-ray physicists" by the Standardization Committee of the Radiological Society of North America. This initial program to certify radiological physicists qualified to calibrate medical x-ray machines was taken over by the American Board of Radiology (ABR) in 1947. Taylor was certified by both the ABR and the American Board of Health Physics (ABHP). He served on the ABHP and was an examiner for both boards.

With the approach of World War II in 1940, Laurie was put in charge of the Bureau's research program on the development of the proximity fuse for bombs and rockets. In the spring of 1943, he was asked to join the "Operational Research Division" for the 8th Air Force Fighter Command in England, and a few months later he greatly enlarged the Division for the 9th Air Force where he served as the Chief Scientific Advisor to General Hoyt Vandenberg.

Here is a photograph taken, soon after the War, of Laurie and his two sons, Nelson on the left and Lauriston, Jr. in the back.

Laurie returned to the NBS to resume directing the x-ray physics section. Soon the recently created Atomic

Energy Commission (AEC) prevailed upon him in 1948 to organize the Biophysics Branch and to set up Health Physics Training Centers at the various national laboratories while on loan to the AEC from the NBS for 1 y.

Laurie's Atomic and Radiation Physics Division at NBS expanded greatly after the War from three professionals to over 100 in seven sections, and he became an administrator of a large technical staff performing the various activities he wished he had the time to do. In a new laboratory building, constructed in 1940, Laurie's Division embarked on a high energy accelerator program using a 50 MeV betatron and a 180 MeV synchrotron. In 1952, Laurie was appointed Director of the Atomic and Radiation Physics Division and he became Associate Director of NBS in 1962.

In 1965, Laurie retired from NBS, 38 y after his arrival in 1927. He began a new career at the National Academy of Sciences (NAS) as Special Assistant to the President and as Executive Director of the Advisory Committee on Emergency Planning. At first he was involved in studying the sonic-boom effects of supersonic aircraft. That program was interrupted by another one of greater urgency, namely, studying how the United States could survive a nuclear attack. Laurie retired again in 1972 to devote all of his time to NCRP.

Finally, in 1977 he retired as President of NCRP, a position he held for 48 y. He remained as Honorary President of NCRP for the rest of his life. A few of us in this room have fond memories of Laurie's farewell banquet in the Washington's Mayflower Hotel on March 17, 1977, when many early NCRP members including, Carl Braestrup, Paul Hodges, Edith Quimby, Harold Wyckoff, and Warren Sinclair paid tribute to Laurie for his lifelong devotion to NCRP, ICRP and ICRU and for his many scientific and administrative accomplishments.

I should elaborate somewhat on the creation of this Council. In the early 1950s, Taylor, representing NCRP, was asked to participate in hearings conducted by the Joint Congressional Committee on Atomic Energy on radioactive fallout from weapons testing. During one such hearing, the Committee was startled to learn that AEC had no radiation protection standards of its own. The AEC spokesman said it had been relying on NCRP's expertise in formulating

protection standards. Another revelation that became of great concern was the fact that NCRP reports were being published as handbooks of NBS, a governmental agency, which did not review the reports and had no competence to do so, particularly on matters pertaining to biology and medicine.

One of the developments arising from the Joint Committee Hearings was the creation of the Federal Radiation Council in 1959 by Executive Order, consisting of the Secretaries of AEC, Commerce, the U.S. Department of Defense, and the U.S. Department of Health, Education and Welfare. At the same time, the Joint Committee Chairman recognized that NCRP, an independent private organization of radiation experts was an important national asset serving the public interest. Accordingly, to preserve that valuable independent resource, Representative Hollifield and Senator Pastore introduced in Congress a bill creating a federal charter for NCRP. The charter of NAS was used as a template with one very important difference. Unlike the NAS, NCRP is not mandated to take on every project that a governmental agency may request. The Council came into existence when President Johnson signed the bill into law on the 14th of July 1964. On that date, all of the members of the National Committee became members of the new National Council.

This photo was taken at the organizational meeting several weeks later at the Mayflower Hotel in Washington, DC on August 3, 1964. Of the 49 new Council Members, 31 were present for this photograph. I think there are only five or six of us left 41 y later.

I would like to show a few more photographs of Laurie. This is Laurie with a small part of his extended family taken on Christmas Day, 1986. Besides Laurie and his wife, Robena, we see his sons, Lauriston Jr. and Nelson and wife Marilyn. In total, Laurie and Robena have five children, 18 grandchildren, 24 great grandchildren, and two great-great grandchildren. Laurie was preceded in death by his first wife, Azulah Walker Taylor, in 1972 and by his eldest son, Lauriston, Jr. in 1992.

This photo is taken from a video clip of my interview with Laurie in 1994.

This photograph was taken during the NCRP farewell party for Wil Ney at Bill Beckner's home on June 28, 1997, when Wil retired as the first Executive Director of the Council. Besides Laurie and his wife Robena, Harold Wyckoff and our other past presidents, Charles Meinhold and Warren Sinclair. were present.

Partly in jest, Laurie attributed his longevity to radiation exposure. He was an expert witness for the U.S. Department of Justice in a number of cases claiming radiation injury from small doses of radiation. He was critical of the practice of relying on the linear dose model to extrapolate from high dose, and high dose rates, to calculate the carcinogenic effects of very low

doses and dose rates. His testimony was particularly effective when the lawyers for the defense would elicit from Laurie his estimate that he had accumulated without discernible ill effect a whole-body dose-equivalent of over 1,000 rem from accidental, occupational and medical exposures. He also felt that NCRP and ICRP both were partly responsible for the public's misconception of the alleged hazards of very low doses. But, at the same time, as past President of NCRP, he was very careful not to exert any influence on their deliberations. From his earnings as an expert witness, Laurie donated $10,000 to NCRP's Resources Development Fund in 1983.

Soon after Laurie retired as President of NCRP in 1977, he embarked on several new projects. John Villforth, the Director of the Bureau of Radiological Health prevailed upon Laurie to conduct a series of videotaped interviews of senior radiation scientists (whose careers began before World War II) under the sponsorship of the Bureau. The recent deaths of some of the early pioneers created a sense of urgency to record the recollections of their peers while they were still living. The series, recorded during the period from July 1977 to November 1979, was called "*Vignettes of Early Radiation Workers*." Twenty-five interviews are preserved on videotape and two others on audiotape. Transcripts of the series were published by the U.S. Publich Health Service in 1984. (Laurie, who was interviewed himself, outlived all of the other interviewees including many early NCRP members.)

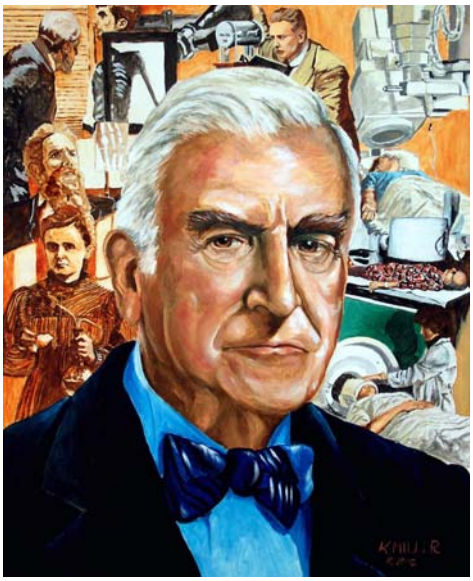
Since Laurie had saved most of the early NCRP, ICRP and ICRU records and was, in a sense, the sole archivist of many documents and communications, he felt duty bound, as it were, to review and preserve their content in some reasonable, manageable manner for the benefit of scholars and future historians. This project took 5 y culminating in 1980 with the publication of a 12-pound 2100-page tome entitled "*Organization for Radiation Protection, Operations of the ICRP and NCRP 1928-1974.*" This document was followed in 1981 by another entitled "X-Ray Measurements and Protection 1913-1964," detailing the role of NBS and other national radiological organizations during those five decades. The latter contains many photographs of early dosimetry instrumentation. In its preface, Laurie says that the underlying motivation for writing these documents is that "I am nearly the last of the x-ray research workers covering the period from the 1920s until about 1942". He lived almost a quarter century after writing that statement and he, of course, outlived all of his contemporary peers in the radiological disciplines.

The radiological world owes Laurie a tremendous debt of gratitude for collecting and condensing into book size the early records of radiation protection, dosimetry and instrumentation. Yet Laurie apologizes to the reader at the end of that same preface as follows, “So that the reader may understand and be patient with my shortcomings as a historian, I must emphasize that I am really only a radiological physicist feeling a great debt to many people and organizations for the incomparable opportunities that have been open to me over five decades.”

A radiologist by the name of Dr. Robert Hawes of Harvard Medical Center made arrangements to have Laurie donate his huge collection of radiological artifacts to the Countway Library of Medicine of Harvard Medical School. Laurie carefully inventoried several hundred large boxes containing 180 books and monographs, 65 radiation instruments (some dating back to 1910), and 80 experimental x-ray tubes and rectifiers (some dating back to 1897), and hundreds of journals, reports and hundreds of glass slides and tapes, thousands of pages of legal briefs and testimony in radiation litigation cases, and other artifacts. This vast collection was shipped to the Countway Library from 1979 to 1987.

Laurie lived a very long and prolific life. He left us a legacy we will always cherish; one his profession can never forget. The Lauries of the world are very rare. We are very lucky to have been blessed by one of them. We all thank you, Laurie.

Let us all stand for a moment of silence to honor his memory.



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