

Awards for Accelerator Health Physicists

**Sponsored by the Accelerator Section and Northern California Chapter
of the
The Health Physics Society**

Table of Contents

1. The Birth and Early History of Accelerator Radiological Protection

2. Burton J. Moyer (1912–73)

Biography. “The Father of Accelerator Health Physics”

Burton J. Moyer Memorial Fellowship

3. H. Wade Patterson (1924–1997)

Biography. “The Man and his Contribution to Radiological Protection”

H. Wade Patterson Memorial Award

4. Lutz E. Moritz (1943–2008)

Biography. “A Renaissance Man”

Lutz Moritz Memorial Award

1. The Birth and Early History of Accelerator Radiological Protection

The final years of the nineteenth century saw the birth of the profession we now call radiological protection or health physics. While it is arguable whether accelerator radiological protection can rightly claim to be the founder of the entire and diverse profession we know today, nevertheless the major discoveries that led to the need for our profession resulted from the discoveries of atomic and nuclear physicists. The X-ray tubes of those days were indeed primitive electron accelerators and the “x-rays” discovered by Roentgen in 1895 were rapidly applied in medicine with perhaps untoward enthusiasm and to substantial numbers of people—necessarily leading to an immediate need for protection measures with a focus on external irradiation by low-energy photons.

However 1932, that seminal year in which Cockcroft and Walton in Cambridge and Lawrence and Livingston in Berkeley announced their experiments with the new particle accelerators and in which the neutron was discovered, was to spark a deeper interest in higher energies and “high-LET” radiations. The pace of events changed gears. Neutron-induced radioactivity, radiopharmaceuticals, tritium, and the first transuranic element had been identified before the days of the Manhattan Project.

From this time on there was an interest in the biological consequences of exposure to the radiation produced by the early accelerators. The Lawrence brothers pioneered studies of the radiological effects of radiation using accelerators. This interest was put to good use. As early as the mid 1930's there was already concern for the safety of the cyclotron staff of Crocker Laboratory (Berkeley) because they were exposed to both photons and neutrons. Subsequent biological experiments suggested that neutrons were more biologically hazardous than x-rays by a factor of as much as an order of magnitude. At that time the accepted tolerable limit to x-rays was 0.1 r/day and a prudent limitation on the exposure to n-rays was set at 0.01 r/day. Over the following years this early work served us remarkably well, in part because the population exposed to “accelerator radiation” was relatively small and technically well-informed.

Pief Panofsky has written a shrewd analysis of the development of the accelerator health physics profession from the end of the Second World War until the late fifties: *“During those days the principal calculations relating to accelerator radiological protection were more than likely done by the responsible physicists rather than separate specialists. For instance, Norman Ramsey at Harvard University personally did many of the shielding calculations for the Harvard cyclotron, and I had the privilege to calculate electromagnetic shower propagation and the*

resultant track-length for photonuclear processes in shielding for the proposal to construct the Stanford two-mile linear accelerator. But the burden of accelerator radiological protection became sufficiently heavy that specialists were needed; in consequence, they were grown from within the accelerator and particle physics communities after the war”.

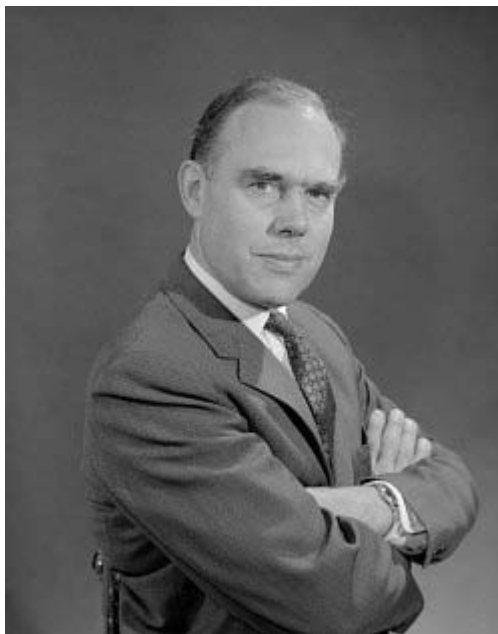
Thus in one sense the first “accelerator health physicists” were exceptional scientists but necessarily only “part timers” with many demands on their time. Despite the brief time available significant contributions were made those mentioned by Panofsky and many others including the group of scientists at Berkeley (discussed later); G. J. Neary (United Kingdom); M. M. Komochkov (USSR); and R.G. Almilller (ORNL) and S.J. Lindenbaum (BNL) (both from the USA). It is intriguing to speculate on what might have been possible were this level of talent fully available to concentrate their efforts totally on radiological protection!

By 1957, at a conference held in New York, it was possible to share the experiences of those around the world who were designing the new generation of particle accelerators. It was a somewhat sobering experience but fortunate in that many of those in attendance were later to become laboratory directors, leaders of accelerator design teams or professional accelerator health physicists. These engineers and scientists left New York determined to learn from and not repeat the experiences in the design and construction of the early proton synchrotrons, the “Cosmotron” and the “Bevatron.”

As pointed out earlier the protection standard developed during the thirties served remarkably well within the context of the times. Predictable developments in accelerator technology suggest that the future may be very different. It is interesting to predict the challenges that will greet the accelerator health physicist of the future.

The availability of compact, relatively low-cost but high-energy and high-intensity accelerators applied in industry and medicine will increase both the size and nature of the exposed population. Improved radiotherapy techniques with high-LET radiations will be available. New applications of these new radiations to medical diagnosis will be found. Accelerator health physicists will need to define the radiation environment of these new facilities perhaps improving measurement techniques for these higher energies. Perhaps, more importantly, the make-up of the population who will be exposed to these new radiation fields must be identified and quantified. Finally, accelerator health physicists will be called upon to develop the data necessary to enable those bodies that recommend radiological protection standards to do so in a rigorous and socially acceptable manner.

2. Burton J. Moyer (1912–1973)



Burton J. Moyer (1962)

Biography. The Father of Accelerator Health Physics

Burton J. Moyer was born in 1912 in Greenville, Illinois, where his father was professor of chemistry at Greenville College. He was greatly influenced by his parents, both deeply religious persons, who instilled in him a great sense of responsibility and service. Moyer received his undergraduate degree at Seattle Pacific College and completed his Ph.D. in physics at the University of Washington in Seattle in 1939.

He returned to Greenville College as a professor of physics but was soon lured to Berkeley to work under Ernest Lawrence in the growing field of radiation physics. After joining the Radiation Laboratory in 1942, Moyer initially worked on the separation of uranium isotopes; his research eventually encompassing topics in both nuclear and high-energy physics. A series of papers soon established him as one of the world's leading high-energy physicists. Perhaps his best-known paper, "High Energy Photons from Proton Nucleon Collisions" (1950), announced the discovery of the neutral pi meson—a milestone in the field of particle physics.

Moyer did not sequester himself away in the lab, however. He enjoyed teaching, particularly mechanics, and was appointed associate professor in the physics department in 1950 and professor in 1954. He directed the thesis research of 62 students, generating a steady stream of significant papers. In both his writing and lectures, Moyer was notable for his clarity, precision, thoroughness, and expert analysis.

Moyer's outstanding intellect and sense of ethical responsibility made him uniquely well suited to respond when, in 1947, Ernest Lawrence requested that he establish a professional health physics group at the RadLab. The successes of early proton synchrotrons had led to a radiation crisis that required prompt attention—technically difficult work that was of vital importance for the safety of his colleagues.

Moyer accepted the challenge, and established a standard that would be adopted by accelerator laboratories around the world, as independent health physics groups consulted with accelerator designers on matters of radiation safety. In 1962, he successfully installed shielding at the Bevatron designed to reduce radiation intensities by a factor of 100. His “Moyer Model” subsequently served in the design of many accelerator shields.

Moyer continued to direct the health physics activities at the laboratory until 1970. Throughout his tenure, he made significant decisions that shaped the health physics profession. His research and publications led in large measure to our present understanding of radiation protection problems; he was a key figure in establishing the dosimetry of accelerator radiation fields and in developing modern radiation transport codes.

In spite of his heavy commitment at the laboratory, Moyer was active on several campus committees as well as on the Statewide University Radiological Safety Committee (1959–60). In 1962, he accepted the chairmanship of the physics department at Berkeley and became a trusted administrator who successfully weathered the campus tumult of the 1960s. “At the time of the worst student unrest, he was one of a handful of people who managed to gain the confidence of both the administration and of the rebellious students,” recalled Emile Segré in 1993.

Moyer was an elder in the Presbyterian Church and had wanted to spend time in missionary work in China. Although various events prevented this, in 1965 he traveled to the India Institute of Technology at Kanpur, where he spent a year teaching, aiding the research program, and helping to create a viable technical school. In 1968, Moyer retired from the physics department chairmanship and returned to research and teaching, as well as to work with the National Science Foundation and Atomic Energy Commission. In 1971, he accepted the position of dean of the College of Liberal Arts at the University of Oregon, where his sound judgment and good humor helped guide the university through that institution's worst budgetary crisis. He died in Eugene, Oregon, on April 21, 1973.

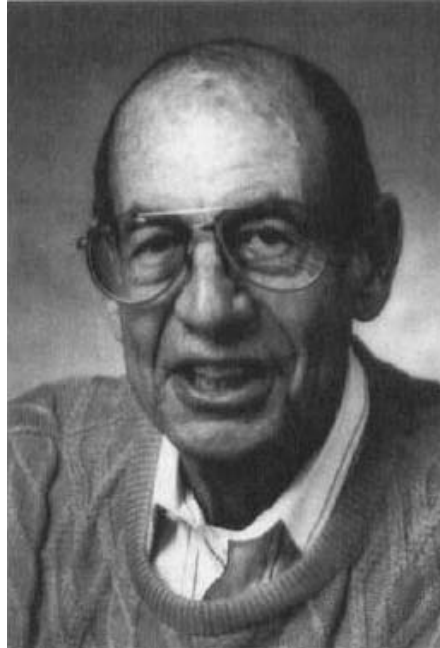
As a supervisor, mentor, and friend, Professor Moyer was admired as a man of generous and serene goodwill and absolute integrity. The Burton J. Moyer Fellowship honors his legacy of service to our fellow men everywhere.

Burton J. Moyer Fellowship

The prestigious Burton J. Moyer Memorial Fellowship was established by the Northern California Chapter of the HPS to memorialize the late Burton J. Moyer and to encourage his ideals in the study of the safe use of radiation for the benefit of all people. One of the most highly regarded awards for education in radiological protection, the Burton J. Moyer Fellowship consists of an award of \$8,000. The fellowship is accompanied by a travel grant to be used in attending the HPS annual meeting.

Wade Patterson (1924–1997) was instrumental in the founding of the Burton Moyer Memorial Fellowship.

3. H. Wade Patterson (1924–1997)



H. Wade Patterson (circa 1995)

Biography. The Man and His Contribution to Radiological Protection

Wade Patterson's professional career spanned five decades and was entirely spent with the University of California, Berkeley. Wade was successively a laborer and part-time employee at Lawrence's Radiation Laboratory; an undergraduate at the Berkeley campus, where he majored in anthropology; upon graduation, he served on the staff of the Radiation Laboratory, advancing to senior management positions at both Berkeley and Livermore National Laboratories. He is generally regarded to be the first professional accelerator health physicist.

What is not generally known is that Wade also made his mark in the broader field of radiological protection. For example, he was involved in some of the first measurements in high natural radiation areas around the world (India and Egypt); examination of dental radiological procedures with consequent improved protection of staff and patients; evaluation of the incidence of cataracts in cyclotron workers; measurement of the energy spectrum of neutrons produced in the Earth's atmosphere; nuclear weapons test fallout studies in the San Francisco Bay Area; and limitations in the power of epidemiological studies in understanding the health effects of humans exposed to ionizing radiations.

Wade's arrival at the RadLab was at the most felicitous of times. In 1947, Ernest Lawrence asked Burton Moyer to take responsibility for accelerator radiological safety and Wade was

invited to join the new Health Physics Group. At that time for leadership, support, and counsel, Wade could draw on a group of eminent scientists who had congregated at the RadLab. Among them were the Lawrence brothers, Edward Lofgren; Edwin McMillan; Burton Moyer; Wolfgang Panofsky; and Cornelius Tobias. All had made significant decisions that greatly influenced the future of our profession although, among all this talent, no one had a greater influence on Wade's professional life than did Burton Moyer. It seems natural, therefore, that the "Birthplace of the Cyclotron" should later have become known as the "Birthplace of Accelerator Health Physics."

It is almost incredible to reflect that, despite the great strides in accelerator technology by the end of the Second World War, it had only been 13 years since Lawrence and Livingston had first published an account of their invention of the cyclotron. The deflection of accelerator technology to the war effort had proved a great military, political and scientific success. Scientists from the National Laboratories were recognized as experts in their disciplines and as national resources. A time of rapid change in the accelerator health physics profession was about to begin.

The Patterson-Moyer group established the model which most accelerator laboratories were to later follow. This diverse mix of able scientists and technicians was eminently capable of forging the dreams of theorists into working instruments so vital to their mission. With such a group of highly motivated and talented people, the achievements of the RadLab Health Physics Group became almost legendary.

At the request of USAEC, from 1967 to 1971 Wade to organized the Berkeley Accelerator Health Physics Training Course. With a cadre of lecturers drawn from the RadLab, as well as invited lecturers from accelerator laboratories around the world, this course was one of the most effective means of rapidly and widely dispersing the collective experience of accelerator radiation safety. Over a hundred scientists from around the world attended this course and it might be said that most of the first-generation accelerator health physicists were deeply influenced, directly or indirectly, by this course. The experience gleaned was later distilled into two books.

If one word described Wade Patterson it would be "integrity." He was as good as his word and, in many respects, was ahead of his time. Through the Health Physics Group at Berkeley passed "all sorts and conditions." Wade supported many women in advancing their careers in a male-dominated discipline. He did this instinctively, not because of any imposed rules, but because it was the human and decent thing to do.

H. Wade Patterson Memorial Award

Established in 2003, the H. Wade Patterson Memorial Award is presented each year at the annual Health Physics Society meeting to recognize an outstanding student presentation on accelerator health physics. The winner receives a check for \$150 and an engraved plaque.

The award is a tribute to H. Wade Patterson (1924–1997), who was the first president of the Accelerator Section of the Health Physics Society and is generally regarded as the first professional accelerator health physicist. His work at Lawrence Berkeley and Lawrence Livermore national laboratories established him as one of the world's experts in shielding at high-energy accelerators. As a life-long educator and organizer of the first accelerator radiation protection training programs, Patterson is an apt role model for students aspiring to a career in accelerator health physics.

4. Lutz E. Moritz (1943–2008)



(Circa 2006)

Biography. A Renaissance Man

Lutz is the third of the distinguished group of accelerator health physicists who were pioneers in their field and whose names have been honored by the Health Physics Society and its Accelerator Section by awards established in their memory. This trio plays in pleasant harmony! Indeed, some have speculated that Lutz was to Canada what the combination of Burton Moyer and Wade Patterson was to the United States.

In his early life Lutz and his family faced great adversities—so great that it is probably difficult for those that have not themselves suffered the blight of those dark days of the Second World War to comprehend them. Lutz was born in 1943, close to Berlin, perhaps at one of the worst places to be at the worst possible time. By 1954 the family decided to seek out Canada as a place to rebuild their lives.

From those hard times Lutz carried at least one good memory. His birthplace stood within sight of Einstein's former summer cottage. During his boyhood Lutz must certainly have heard many anecdotes about the great man. It is pleasant to reflect that, perhaps because of these tales, Lutz's ambitions for his life's work were drawn to physics—as was his subsequent career to prove. Lutz was an excellent student; he won a scholarship to McGill University, graduating in 1965 with an honours degree in physics. He followed this in 1967 with an M.Sc. thesis from the Vancouver campus of the University of British Columbia entitled "A ^3He -filled Proportional Chamber for Measuring Neutron Flux," suggesting the course of his future career. In the interim,

he had supported himself teaching mathematics and physics at high schools in Ontario and British Columbia—perhaps a practical course in real economics!

In October 1973 he joined the Radiation Safety Group at TRIUMF, advancing steadily through the ranks and with a growing national and international reputation. His important and highly regarded work on the ISAC and ISAC-II projects at TRIUMF identified him as Canada's foremost expert on accelerator radiation safety and his advice became increasingly sought from the international accelerator community. In the USA his service included advice on the radiological safety aspects of the Super-Conducting Super-Collider Project in Waxahachie, Texas, and for the ORNL Holifield Radioactive Ion Beam Facility. Two major high-energy laboratories, CERN in Geneva and KEK in Tsukuba, invited him to spend "mini-sabbaticals" with them. Last but not least—because it now so "newsworthy"—Lutz was a member of the task force invited to CERN in 1989 to prepare a report for laboratory management that evaluated radiological aspects of the environmental impact of the CERN Large Hadron Collider.

His expertise and personable manner of working led to his assistance in the organization of many scientific meetings for organizations such as CERN; CRPA; HPS, IRCS; OECD/NEA and SLAC. Those who have undertaken such duties know that they require infinite energy and patience—two characteristics that are not often contained in the same person but found abundantly in Lutz.

Lutz had many talents. His keen insight, extensive knowledge and dry sense of humor amply demonstrated his stature in his chosen field. He was of course a scientist, but he was above all curious and lived his life pursuing many interests impelling himself along many other paths. He was fluent in three languages. He loved cooking, horticulture (to grow vegetables for cooking!), literature and music, and he was himself a very fine artist. He was indeed a renaissance man and it is indeed fortunate that he applied some of his many talents to our own profession which is much the better for his contribution.

The annual meeting of the Health Physics Society at Salt Lake City in the summer of 2010 was a significant time for the memory of Lutz. The Accelerator Section awarded the Lutz Moritz Memorial Award for the first time (see below) and the Health Physics Society made Lutz Moritz the first honoree on the newly created Honor Roll for eminent but deceased members of the Society which will be "given posthumously to honor society members who significantly contributed to the profession of health physics during their careers, but were not otherwise honored by the society during their lifetimes."

The Lutz E. Moritz Memorial Award

In the summer of 2009 the Accelerator Section of the Health Physics Society determined to establish the Lutz Moritz Memorial Award recognizing his wide-ranging contributions to the field of accelerator health physics and his dedication to and support for the Accelerator Section, which he served for many years as a founding member, newsletter editor (1993–1995), and president (1995–1997). This award will be made every year to a promising health physics student who has presented an outstanding talk or poster on accelerator radiation protection. The winner receives a check for \$150 and engraved plaque. This award in Lutz’s honor is especially significant because Lutz was not only a gifted researcher, but one of his life’s vocations had been the teaching and the welfare of students. Lutz is remembered by all the students whose lives he touched and now will also be remembered by the future generation of health physicists who will receive the Lutz Moritz Memorial Award.

Editor’s Comment

These notes have been derived and edited from exiting sources, most importunately from the websites of the Accelerator Section of the Health Physics Society and the main the web site of the Society itself. The text has been weaved from these website sources and several sources already published, too many to list here in detail, with only appropriate and minor editing of the formatting and text of the originals. This brief explanation is provided for the benefit of the reader and to thank and acknowledge all those who have participated in this work.

The text for “The Birth and Early History of Accelerator Radiological Protection” was derived from several sources already published by the editor.

The biography and description of the Burton J. Moyer Fellowship was drawn from text already available on the Health Physics Society website and written by Linda Schmidt. Only minor changes to the text and formatting changes have been made. Ms. Schmidt acknowledges that her material was gathered from “In Memoriam” by E. Segré, E. D. Commins and A. C. Helmholz; from the G. William Morgan Lecture “Accelerator Radiological Protection—A Personal and Privileged Odyssey” and “A Man and his Contribution to Radiological Protection—A Tribute,” both by the editor. Identical sources were also used for the biography and description of the H. Wade Patterson Memorial Award.

The biography and description of the Lutz. E. Moritz Memorial Award were based on the obituary published in the journal Radiation Protection Dosimetry and information on the website of the Accelerator Section.

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Ralph H. Thomas (Editor)
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