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## OBITUARY: MYRON POLLYCOVE

Ludwig E. Feinendegen and Jerry M. Cuttler, December 2013



Myron Pollycove was born in Arizona and died on August 4, 2013 in San Francisco, near his children, at the age of 92. He leaves many feeling sad at having lost a wonderful friend. He also leaves a multifaceted range of seminal achievements, highlighted by the use of radiotracers in clinical medicine and his attribution of the benefits and risks of a low dose of ionizing radiation to its effects on the adaptive protection systems.

In 1942, Myron began training in physics and mathematics at the California Institute of Technology (CALTEC). From 1942 to 1946, he served in WW II as a physicist in the US Navy. He completed medical school at the University of California in San Francisco (UCSF) in 1950. From 1951 to 1953, Myron served in the Army Medical Corps during the Korean War, with intermittent training in internal medicine at Harvard and work at the Army Chemical Center. After two years at Tufts Medical School in internal medicine, Myron returned to California to work as

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Research Associate at the Lawrence Radiation Laboratory and Donner Laboratory in Berkeley until 1961. In 1962, he accepted the position of Professor in Laboratory Medicine and Radiology at the UCSF School of Medicine, where he introduced the young field of Nuclear Medicine. In 1968, he became the Director of the Nuclear Medicine Department and Chief of Service, continuing there until his retirement in 1991. Myron, as a Professor Emeritus, moved to the Nuclear Regulatory Commission (NRC) in Maryland, where he was appointed to the position of Visiting Medical Fellow.

His biomedical research began in 1951 at the US Army Chemical Center on non-hemorrhagic fatal traumatic shock. It continued at various places using radioactive isotopes as tracers in glucose metabolism, in assessing the mono-carbon pool, folic acid, and vitamin B12 kinetics. It included the application of iron-59 and chromium-51 in hematology. His research data appeared in the most prestigious journals, and they became internationally accepted milestones in clinical medicine. Being a board-certified specialist in pathology and nuclear medicine, and as director of the Clinical Laboratory at the San Francisco General Hospital, Myron was responsible for the services of the Chemistry, Microbiology, and Immunology Divisions. He was also clinically responsible as the Division Chief of the Nuclear Medicine, Hematology, and the Blood Bank services. Not to be overlooked was his enthusiasm for teaching in Nuclear Medicine, Hematology, and Clinical Pathology to medical students, residents and house officers.

Myron's life-long clinical engagement and success, and his experience with radioactive tracers and his awareness of the associated health risks made him, in his top academic position, an ideal candidate for advising the U.S. Nuclear Regulatory Commission (NRC) as Visiting Medical Fellow. In 1991, he and Rosalyn, whom he had married when he was 20 years old, moved into a lovely townhouse in Maryland, close to the NRC headquarters in Rockville. Their home became a cultural gem. As an NRC Visiting Medical Fellow, Myron had to adjust to the workings and goals of the NRC. He delivered his expertise in the medical use of radioisotopes, both diagnostic and therapeutic, and he served as an effective interface between the NRC and the country's medical organizations.

Amongst his many obligations at the NRC, Myron began immediately to explore the experimental and epidemiological observations on effects and risks of low doses of ionizing radiation. These initial investigations led to the report "Positive health effects of low-level radiation in human populations." It was published in 1994 in the conference proceedings "Biological Effects of Low-Level Exposures: Dose-Response Relationships," edited by E.J. Calabrese; Lewis Publishers, Chelsea, MI: 171-187. About a year later at a meeting on low-dose risks at the US National Academy of Sciences, Myron and Ludwig Feinendegen met and

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they began a most fruitful collaboration producing together 14 peer-reviewed papers. This collaboration continued beyond Myron's retirement from NRC in 2005. They gave presentations, often together, at numerous conferences and workshops. These included Jim Muckerheide's "Radiation, Science, and Health" meetings, which also touched political issues.

Ludwig lived in Maryland not far from the Pollycoves. They became close friends and also enjoyed social functions in the region and common hobbies such as music and theater in DC and Maryland, always in the company of Rosalyn, an accomplished pianist herself. There was no get-together with colleagues, though, without talking and revolving at least a bit around the best way to accommodate published data and arguments into a pattern of mechanisms that could serve a model to describe system responses to low doses.

One of Myron's particular contributions was his courageous unraveling of low-dose response functions as they were published by epidemiologists on the basis of the Linear-no-Threshold (LNT) hypothesis, without consideration not only of actual data at low doses but also of the increasing experimental evidence and epidemiological suggestions against the validity of the LNT hypothesis and for hormetic responses to low doses. In doing so he uncovered shortcomings by epidemiologists and statisticians in dealing with hard data.

Another particular initiative by Myron was estimating the rate of DNA damage production from endogenous reactive oxygen species (ROS). This project together with Ludwig was supported by the US Department of Energy (DOE) as a potential input into formatting the DOE Low Dose Research program that had started just then. The execution demanded repeated group discussions with experts, also on the West Coast. It was a great satisfaction to see their estimates fall into agreement with the experimental data reported later from different laboratories. The essential finding was that, irrespective of quality, the average number of double strand DNA breaks (DSBs) per day from endogenous ROS per cell was about a thousand times higher than the respective DSB number from average background radiation. Until then, the production rate of non-radiogenic DSB had been grossly underestimated.

This finding supported the hypothesis that adaptive protection, induced by low-dose radiation, can significantly reduce the incidence of non-radiogenic cancer. The hypothesis rests on what is called *The Dual Response Model*. This model endeavors to describe net radiogenic cancer induction as the difference between a) low-dose induced cancer and b) low-dose induced protection against non-radiogenic plus radiogenic cancer, as functions of absorbed dose. It had been discussed since the early 90s in different ways, at various laboratories. The model predicts the beneficial effects of low doses as the balancing or even outweighing of detri-

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ment, and thus predicts a dose threshold for radio-oncogenesis or even a reduction of cancer incidence below the control level.

The growing evidence of beneficial effects of low doses, i.e., hormetic responses to low doses, strengthened the repeated proposal by Myron, with support from Jerry Cuttler and Ludwig, to attempt clinical applications of low doses in the treatment of cancer and infectious diseases, as Kiyohiko Sakamoto had carried out in Japan in clinical studies on two hundred cancer patients. Myron contributed this topic importantly already, in 1998, to the Pacific Basin Nuclear Conference (PBNC) in Banff, Canada and again to the 2004 PBNC meeting in Hawaii. The most recent paper on this issue was delivered by Myron and Ludwig just three years ago at the Low-Dose-Workshop in Richland, WA, in honor of Vic Bond. Thereafter, Myron had increasing difficulties in traveling, but he kept in touch and continued publishing. His last paper, together with Ludwig and Ron Neumann from the NIH, appeared in 2013 and presented an updated review on radiation hormesis.

It was a happy occasion in 2010 to witness Myron receiving the prestigious Outstanding Career Achievement Award from the International Dose Response Society, which was founded by Ed Calabrese and where Myron contributed greatly to the publication series *Biological Effects of Low Level Exposures (BELLE)*.

Throughout his work and many experiences, Myron was sharp-witted and meticulously precise in definitions, planning and execution of all he did. And Rosalyn was always at his side and support, until overcome by her fast-evolving illness less than 10 years ago. Eventually, the Pollycoves returned to the Bay Area in San Francisco to be closer to their children. Myron remained full of ideas. He had a warm-hearted approach to people and enthusiasm towards all progress for the good. He had a realistic vision of human endeavors at all levels of life with a great capacity for tolerance, yet a stubborn resistance against what he saw as preventable errors or misconducts – just as the compassionate classical music lover that he was rejects orchestras that are “out-of-tune.” His ideas will live on.