Hal O. Anger, DSc (hon) (1920-2005)

Frans J. Th. Wackers, MD, PhD[a] on behalf of the History Corner

[a] Yale University School of Medicine, New Haven, CT

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Hal Oscar Anger was not only a pioneer in nuclear medicine, he also invented multiple instruments that fostered the growth of nuclear medicine, including the scintillation well counter to measure radiotracer activity in blood and tissue samples and the gamma camera and positron camera.

Hal Oscar Anger was born on May 24, 1920 in Denver, CO. His father was a first-generation German American and his mother was British American. When Hal was 5 years old, the family moved to Long Beach, CA.

In high school, he demonstrated a fascination for electronics. As a teenager he built a television set from scratch. He entered the College of Engineering at the University of California at Berkeley (UCB), graduating in 1943 with a BSc in electrical engineering. After graduation, he worked on radar jamming in the Radio Research Laboratory at Harvard University until the end of WW II.

In 1946, he returned to UCB and joined the Donner Laboratory, where he worked under Director Dr. John H. Lawrence and biophysicist Cornelius Tobias. The Donner Laboratory was dedicated to research on the use of radiation in medicine as well as the development of instrumentation to detect and measure the biodistribution of radiopharmaceuticals.

In 1950, Anger invented and patented the scintillation well counter. This invention remains the most widely used measuring device in radiation chemistry and research. Modern well counters are still based on Anger's basic design.

In 1951 Benedict Cassen (UC LA) developed the rectilinear scanner, the first practical imaging device in clinical nuclear medicine. A single radiation detector was connected to a motor and moved from side to side and from one line to the next line, thus covering the entire area to be scanned. The amount of radioactivity at each location was indicated by the number of dots placed on a piece of paper depicting the location and intensity of radioactivity. A complete scan was quite time consuming, about 45 min.

Anger recognized that the slow mechanical movement of a single detector over the patient's body lacked efficiency and that only photons directly beneath the scanner were detected. Anger designed an imaging device that could detect photon emissions simultaneously from the entire field of view. In the first prototypes of his scintillation gamma cameras (1952-1957), he used pinhole collimators mounted on a thallium-activated sodium iodide crystal. Anger conceived a positioning logic by placing multiple photomultipliers in a hexagonal array to localize the scintillations in the scintillator. Since the scintillation crystals were relative small, 4 and 8 inches, the field of view was still limited.

In later prototypes, Hal Anger used parallel-hole collimation and larger crystals to determine the location of each scintillation. Anger's idea to use multiple

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Reprint requests: Frans J. Th. Wackers, MD, PhD, Yale University School of Medicine, New Haven, NJ; *frans.wackers@yale.edu*

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photomultipliers to determine exactly where the scintillation events originated from was truly revolutionary. Images of the distribution of radioactivity were recorded by exposing polaroid film to light flashes on a cathode ray tube (CRT).

By 1962, Hal Anger had improved the scintillation camera to a clinically usable and commercially viable instrument. The first commercially available cameras (manufactured by Nuclear Chicago and now on display in the Smithsonian Institute) incorporated parallel-hole collimation, an 11-inch sodium iodide crystal, 19 photomultiplier tubes, and a CRT.[1]

Around that time Dr. Alex Gottschalk, a young clinical radiologist from Dr. Paul Harper's laboratory in Chicago, arrived at the Donner Laboratory. He collaborated with Hal Anger on the first clinical applications of the new imaging equipment. Gottschalk recognized the substantial advantages of the gamma camera over the rectilinear scanners: ''particularly the potential of simultaneous imaging the distribution of tracers in large regions of the body including brain and heart, the feasibility of imaging a variety of radiotracers (positron and gamma emitters), the substantially shorter imaging times and the possibility of acquiring images from different angles.''[2]

Initially, the positron-emitter gallium-68 (as ^{68}Ga-EDTA) and single-photon radionuclide iodine-13l were used for imaging in the Donner laboratory and in clinical settings. In 1964, Anger and Gottschalk started working with technetium (Tc)-99m generators. The combination of a thin scintillation crystal in the camera, the 140 keV energy emissions from metastable Tc-99m, the 6-hour half life, and the more favorable radiation dosimetry made this radionuclide the preferred agent for labeling radiopharmaceuticals for clinical use. Gottschalk and Anger successfully performed cerebral angiograms and even dynamic cardiac studies. The Anger camera and Tc-99m were a perfect match.

During the next 20 years, Anger continued to invent imaging equipment including: a whole body scanner using an array of 10 scintillation detectors, one of the first positron cameras based on co-incidence counting (1959), and the first simultaneous multiplane tomographic scanner (1966).

Anger was the co-inventor of 15 US patents and authored more than 110 scientific articles and book chapters. He received numerous awards, including the John Scott Award (1964), Guggenheim Fellowship (1966), Gesellschaft fur Medizin Award (1971), Honorary doctorate in Science, Ohio State University (1972), Nuclear Medicine Pioneer Citation, SNM (1974), Modern Medicine Award for Distinguished Achievement (1975), SNM First Western Regional award for contributions to nuclear medicine (1976), Centennial Year Medal, Institute for Electrical and Electronics Engineers, IEEE (1984), Societé Française de Biophysique Medal (1988), George de Hevesy Memorial Medal, Vienna (1991),Honorary Member and Fellow of the American College of Nuclear Physicians (1992), and First Cassen Price for Distinguished Achievements in Nuclear Medicine from the Education and Research Foundation of the SNM (1994).

In 1982, Hal O Anger retired from the Donner Laboratory after a productive 36 years.

He died from heart failure on October 31, 2005 in Berkeley, CA at the age of 85 years.

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