

mentioned early on. Instead, only in box 1 is it noted that he shared a 1979 Nobel Prize with Godfrey Hounsfield. Cormack was the first to demonstrate the feasibility of x-ray CT through mathematical derivation and experimental validation. His investigations in that area, done with little or no funding, began in 1956 in South Africa, where he was assigned to a Cape Town hospital to oversee their radioactive sources. Observing how crudely radiotherapy planning was done at that time, he wondered if it would be possible to determine the internal inhomogeneities of each patient to improve their individual treatment plans.

In his 1964 paper, Cormack experimentally demonstrated the CT principle.¹ He built a hand-operated scanner to measure the attenuation of a cobalt-60 beam as it passed through an object along paths at various angles, referred to now as translate-rotate geometry and shown in figure 1a of Boone and McCollough's article. Using data collected over a two-day period, he reconstructed the scanned object's attenuation-coefficient profiles along several lines through the object and showed that, aside from some slight ringing artifacts, the reconstructed values matched the known values. Those profile plots demonstrated that he had achieved his goal of determining the attenuation values inside an object from its x-ray attenuation measurements.

Cormack, in his 1963 paper, presciently suggested the application of his work to two other modalities: positron emission tomography and single-photon emission computerized tomography, commonly referred to as PET and SPECT, respectively, which are frequently performed in the clinic today.² Prompted by an earlier suggestion by Robert Wilson that protons could be useful in medicine,³ Cormack was especially interested in the promise of proton CT, which is currently being investigated for proton-therapy treatment planning.⁴

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I would like to add a historical footnote to the excellent article by John Boone and Cynthia McCollough in the September 2021 issue of *PHYSICS TODAY* (page 34). The origins of computed tomography (CT) can be traced to William Oldendorf's pioneering work in the late 1950s and 1960s. Oldendorf was a professor of neurology at the UCLA School of Medicine when he developed a prototype of an automated tomographic device in which he used his son's electric train set, a phonograph turntable, an alarm clock motor, and other household items. It was the first demonstration of "a radiographic method of producing cross-sectional images of soft tissue by back-projection and reconstruction."¹

In his 1961 breakthrough paper, Oldendorf laid out CT's basic concept,² which Allan Cormack later used to develop its underlying mathematics. In October 1963 Oldendorf received a US patent for a "radiant energy apparatus for investigating selected areas of the interior of objects obscured by dense material."³

The 1975 Albert Lasker Clinical Medical Research Award recognized the importance of Oldendorf's contributions to discoveries that enabled CT. He shared the prize with Godfrey Hounsfield, who with Cormack would receive the Nobel Prize in Physiology or Medicine four years later for "the development of computer assisted tomography."

Some have speculated that Oldendorf was on the original Nobel announcement but was removed at the last minute at the behest of certain members of the Nobel Assembly at the Karolinska Institute, which votes on the nominating committee's recommendations. It is possible some assembly members felt that the inclusion of a clinician would cheapen the award, making it appear overly pragmatic and thereby reducing its prestige.⁴

Oldendorf gave a lecture at UCLA shortly after the Nobel announcement was made. In it, he reviewed the work that earned him a Lasker and should have made him a Nobel laureate. Everyone who heard Oldendorf's presentation that day (myself included) came away convinced he was unjustly deprived of the pinnacle of scientific recognition. Readers wanting to learn more about

Oldendorf's contributions to tomography and their historical context should consult his book on the topic.⁵

References

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► **Boone and McCollough reply:** We appreciate and agree with the comments from Steven Greenberg and Kenneth Hanson regarding our article, "Computed tomography turns 50." While writing it, we realized that so many people were involved in the development of modern computed tomography (CT), starting with Johann Radon in 1917, that we couldn't mention them all in our limited space. So we chose to mention only the few who were intricately involved early on in the clinical translation of CT—which is what the 50th anniversary celebrated. Many others could be mentioned for their contributions to CT technology, of course, and after our article was published, we received some wonderful anecdotes from those who were involved in the early days of CT.

We also learned that another, more comprehensive 50-year tribute¹ to CT was published around the same time as our *PHYSICS TODAY* article. In summary, we concur with Greenberg's and Hanson's recommendations that many others deserve credit for CT.

Reference

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