Michael E. Phelps, PhD (born August 24, 1939)

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Received Oct 18, 2018; accepted Oct 19, 2018
doi:10.1007/s12350-018-01492-z

When Michael Phelps appeared on the scene of nuclear imaging in the 1970s, the stars were aligned favorably for realizing the full potential of positron imaging.

Over the course of many decades, the building blocks of PET imaging had been created. This started with the invention of the cyclotron (Lawrence 1931), followed by the production of biologically important tracers (C-11, N-13, O-15, F-18, and I-131) (Tobias et al. 1945, Ter-Pogossian 1958), high-density Bismuth Germanate scintillators (Nestor and Huang 1975), and the understanding of the potential of annihilation coincidence detection (Wren 1951, Brownell 1950). In addition, early positron camera prototypes (Brownell and Sweet 1950), the advent of computers that rapidly became more powerful, and the associated development of sophisticated acquisition and reconstruction software (Budinger 1974) created a fertile environment for seeds of PET imaging to sprout. Ter-Pogossian envisioned that a multidisciplinary approach was critical. Phelps seized the opportunity and ran with it.

Although Michael Phelps has been honored many times as the inventor of the clinical PET imaging, the prior scientific contributions of so many must be recognized as well.

Phelps was born in 1939 in Cleveland, OH. He grew up in an Irish community in Washington State. As a teenager, he wanted to become a professional boxer, but at the age of 21, that ambition came to an end when he was seriously injured in a car accident. He decided to go to college and attended Western Washington University in Bellingham, WA. He graduated in 1965 with a BS in chemistry and mathematics. He continued his studies at Washington University in St. Louis, MO, earning a PhD degree in nuclear chemistry in 1970.

At about that same time, Dr. Michael Ter-Pogossian at the Mallinckrodt Institute of Radiology at Washington University, St Louis, MO was assembling a multidisciplinary group of scientists for his research on the functioning of the brain using positron tracers. Michael Phelps, because of his background in biophysics, mathematics, and nuclear chemistry, was recruited as an assistant professor of radiology.

Ter-Pogossian's research involved measuring in vivo glucose kinetics and metabolism in the brain of Rhesus monkeys using intravenous C-11-glucose and non-imaging scintillation detectors. Phelps, stimulated by the publications of Gordon Brownell (1951), David Kuhl (1963), and Godfrey Hounsfeld (1971), intuited that coincidence detection of positron emissions might be well suited for computerized tomographic image reconstruction. In 1973, Phelps and two associates, Edward Hoffman and Nizar Mullani, built the first single-slice positron emission transaxial tomographic (PETT I) imaging device, using scavenged parts of commercial scintillation detectors. The images were of suboptimal quality due to limited angular sampling, difficulties with attenuation, the use NaI as radiation detector, and bad collimation. Phelps then approached the manufacturer of the detectors, Ortec Inc, Oak Ridge, TENN and persuaded Ortec to collaborate with the building a new prototype. PETT II had a circumferential hexagonal array of 24 (NaI(Tl) detectors with

The members of the History Corner are listed in the acknowledgements.

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J Nucl Cardiol 2019;26:34–5.
1071-3581/$34.00

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coincidence detection, attenuation correction, and image reconstruction with filtered back projection. The first human studies with PETT II performed in 1974 were very promising (1975).[1,2]

The next iteration of the imaging device, named PET III (1976), was designed for whole-body imaging with 48 detectors and movable detector banks and gantry. It should be noted that all the early PET camera prototypes were single-slice devices. The first four-slice camera was developed by Ter-Pogossian (PET IV, 1978).

In 1975, Michael Phelps relocated to the University of Pennsylvania and, in 1976, to UCLA as the Norton Simon Professor and Chairman of the Department of Molecular and Medical Pharmacology.

PET imaging was rapidly recognized as an important advance in nuclear imaging because of the high spatial resolution, the ability to probe biological processes in vivo with C-11, N-13, O-15, or F-18, and quantitative assessment of blood flow and function.

During the following years, Phelps continued to develop PET imaging, both technically and clinically by focusing on the brain, heart, and cancer.

In 1981 and 1985, Phelps and Mazziotta published images of the functioning of the brain. Visual and auditory stimuli, cognitive, memory, and motor tasks activated distinctly different areas in the cortex and could be visualized as regions of increased glucose metabolism with F-18 FDG PET imaging.

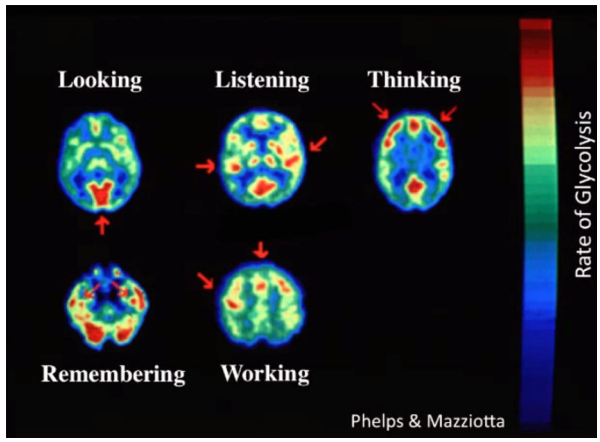
For most of the PET cardiac imaging studies, Michael Phelps collaborated with Heinz Schelbert.[3] They pioneered quantitative studies of regional myocardial oxidative metabolism (C-11 palmitate) and regional myocardial blood flow (N-13 ammonia). PET became widely accepted as the gold standard for myocardial blood flow quantitation. They visualized also, with F-18 FDG, increased glucose utilization under ischemic conditions and defined imaging patterns indicating myocardial viability.

In 2001, Phelps was instrumental in getting Medicare approval of reimbursement for F-18 FDG PET imaging in patients with cancer.

Dr. Michael Phelps published over 700 peer-reviewed scientific articles and books.

He received numerous awards for his work, including The George von Hevesy Foundation Price (1978,1982), the Oldendorf Award, Society for Computerized Tomography and Neurological Imaging (1981), the S. Weir Mitchell Award, American Academy of Neurology (1981), the Paul Aebersold Award, Society of Nuclear Medicine (1983) the Ernest O. Lawrence of U.S. Department of Energy (1984) the Special Award for Individual Distinction, American Society (1984), the Sarah L. Poilley Memorial Award, New York Academy of Sciences (1984), the Richard and Hinda Rosenthal Foundation Award, American College of Physicians (1987), the Landauer Memorial Award, American Association for Physicists in Medicine (1988), the Claire Pasarow Foundation Award (1992), the Enrico Fermi Presidential Award (1998), Election to National Academy of Medicine (1985) and National Academy of Sciences (1999), the Gold Medal Award of World Molecular Imaging Society (2012), and Georg Charles de Hevesy Nuclear Pioneer Award of the Society of Nuclear Medicine (2015).

Dr. Michael Phelps continues his scientific work at UCLA to this day.



Increased regional F-18 FDG activity (red arrows) following cerebral stimulation (Science 1985).

Acknowledgements

The Members of the History Corner: William Strauss, MD (Chair); George Beller, MD; James Udelson, MD; Frans J. Th. Wackers, MD, PhD; Ignasi Carrio, MD.

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