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# Reconstruction-free total-body PET: Realizing the full potential of the tracer kinetic method

*Friday, June 3, 2022 10:00 AM (20 minutes)*

The radiotracer principle, as first introduced by George Hevesy in 1923 [1], and supported by sophisticated radiation imaging systems, highly specific radiotracers, and mathematical modeling, has been a powerful tool with broad uses in biomedical research. Applications span animal models, and in vivo human imaging in many disease states and the tracer method has been used to interrogate and elucidate physiology, metabolic pathways and molecular targets. The recent advent of long axial field of view and total-body PET scanners [2] now permits application of these approaches across the entire human body, and provides a unique new tool to contribute to the burgeoning field of systems medicine.

PET is unique among tomographic medical imaging modalities in that timing resolution at the level tens of picoseconds is sufficient to directly generate 3-D images of the radiotracer distribution. Advances in radiation detector science, technologies and electronics, as showcased by this workshop, now tantalizingly offer the prospect of practical reconstruction-free radiotracer imaging in the not-too-distant future.

This presentation examines the possible impact of combining total-body PET with radiation detectors capable of a timing resolution of 30 ps or less. What are the capabilities of such an instrument? What new opportunities would this present for biomedical research and ultimately for clinical applications? This envisioned scanner would represent the ultimate embodiment of Hevesy's vision, and the tracer principle, in living human beings.

1. Hevesy G, "The absorption and translocation of lead by plants." Biochem J 17; 439-445 (1923)
2. Badawi RD et al, "First Human Imaging Studies with the EXPLORER Total-Body PET Scanner." J Nucl Med 60; 299-303 (2019)

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