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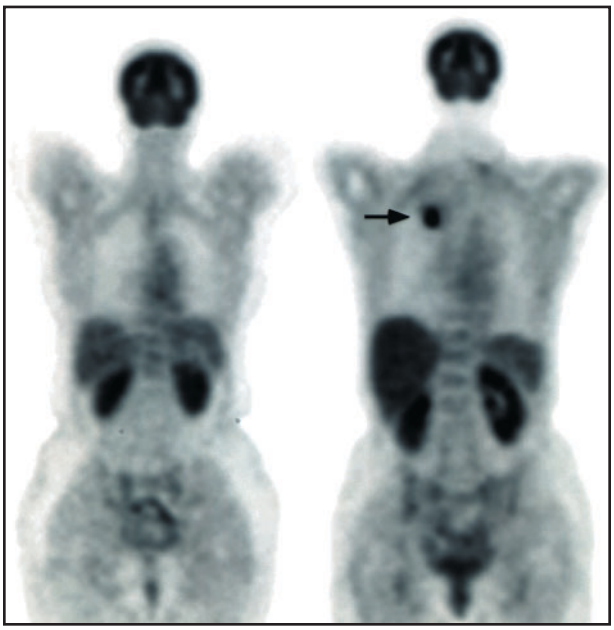
PET and SPECT

Advanced Imaging Systems

Special imaging systems called "positron emission tomography" (or PET) and "single-photon emission computed tomography" (or SPECT) scanners produce 3-dimensional (tomographic) images. The scans look like multiple slices through the body. In SPECT (scanner at left), a gantry rotates one or more detectors around the body to acquire many image projections. PET scanners usually surround the body with a stationary ring of detectors. PET and SPECT were first conceived by **BER** scientists and developed over the 1950s, 1960s, and 1970s.



Whole-body PET scans from two patients. The left scan is normal; the right scan is from a patient with a lung tumor that spread from **primary breast cancer**. This scan shows increased F-18 FDG uptake in the tumor (arrow) because a growing tumor has a higher rate of sugar metabolism than the surrounding normal tissue.

PET and SPECT

Advanced Radiopharmaceuticals

SPECT radiopharmaceuticals emit gamma rays, whereas PET radiopharmaceuticals emit another form of energy, positrons, which converts to gamma rays. These radiopharmaceuticals "interrogate" cells and molecules. They are "molecular probes" designed to provide answers about healthy, normal biology, the biological process of disease, and even the molecular errors that cause disease.

These PET scans (on the left) were obtained with fluorine-18 fluorodeoxyglucose (FDG, a form of sugar). F-18 FDG, the most common PET radiopharmaceutical used in medicine today, was developed by **BER** scientists in the 1970s.

Glucose (a sugar, the primary fuel for cells) is just one example of the thousands of molecules related to human biology that can serve as carrier molecules for radiopharmaceuticals. In the future, PET and SPECT radiopharmaceuticals may target gene function and expression to answer questions about the genetic causes of disease.