Many mysteries of the human brain have been unraveled by positron emission tomography (PET), an imaging tool used worldwide to diagnose cancer and heart disease and perform scientific studies. The development and usefulness of PET—which offers a millionfold greater sensitivity than other techniques for studying regional metabolism and neuroreceptor activity in the brain and other tissues—rests on a number of advances made with Office of Science support. Much of the credit is due to Alfred P. Wolf, a chemist at Brookhaven National Laboratory known as the father of organic radiochemistry, a field that links medicine and chemistry. In 1976, Wolf and colleagues developed and used a radiotracer called 18-fluorodeoxyglucose (a combination of the short-lived radioactive element fluorine-18 and a sugar, glucose) to generate the first functional map of the human brain at work. When a radiotracer is injected into the body, its signal is picked up by PET equipment. Glucose is virtually the only energy source for the brain, so images of the location of 18-FDG provide a signature or map of brain function. This development enabled scientists to see, for the first time, regions of the human brain "lit up" in response to stimuli such as looking, listening, and remembering.

**Scientific Impact:** The development of 18-FDG, as well as improvements in image reconstruction algorithms and nuclear detector technologies, enabled widespread use of PET by the mid-1980s. Scientific uses include studies of human metabolism, brain activation and function, addiction, and mental illness. Radiotracers have also been used to track the movement of air in the atmosphere and study basic chemical processes.

**Social Impact:** Wolf’s work laid the foundation for imaging procedures now used in hospitals worldwide to diagnose disease, saving thousands of lives each year. These developments opened new vistas for mapping of human brain function in schizophrenia, Alzheimer’s disease, stroke, addiction, and other psychiatric and neurological disorders.

**References:**

**SC-Funding Office:** Office of Biological and Environmental Research