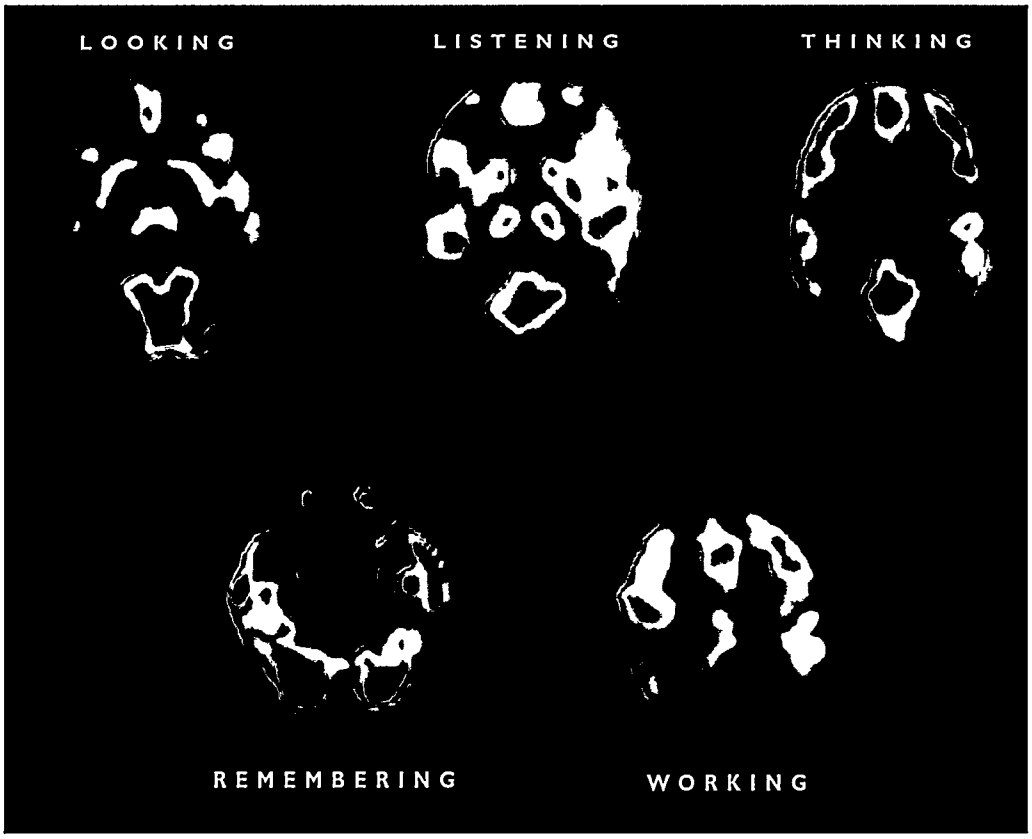


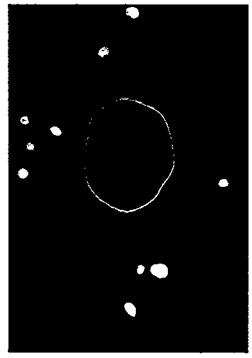
THE BRAIN AT WORK These classic PET images, obtained at UCLA's Laboratory of Structural Biology and Molecular Medicine, depict brain activity during five typical tasks. The highest level of activity, meaning the highest rate of glucose metabolism, is indicated by the red areas. The five tasks were "looking" at a visual scene, "listening" to a mystery story that included both language and music, counting backwards from 100 by 7's ("thinking"), "remembering" previously memorized objects, and touching the thumb consecutively to the four fingers ("working").

used in both treatment and diagnosis; indeed, until the advent of technetium-99m, it was the most commonly used radioisotope for medical diagnosis. In 1951 it became the first radiopharmaceutical approved by the FDA for human use.

Many of the early radiopharmaceuticals were first produced at Berkeley's cyclotrons, which propelled atomic particles—protons and the nuclei of light elements, for example—into awaiting targets, thereby producing trace amounts of materials never before seen, many with medical applications. But as the cyclotrons grew in size, another enticing possibility emerged. In 1946 Robert Wilson, then in Berkeley and later director of the Fermi National Accelerator Laboratory, suggested that the racing beams themselves might be directed at deep-seated tumors. X-rays were already used for such purposes, but they are indiscriminate beams, depositing their potentially destructive energy all along their paths. Charged particles, on the other hand, behave more like explosive depth charges, doing most of their damage just before they stop. The trick would be to tailor a beam of such particles to stop exactly where a tumor was known to be.

With this vision in mind, researchers led by John Lawrence and Cornelius Tobias began to lay the groundwork for medical treatments with charged particles. Then, between 1954 and 1993, with the DOE (and its predecessors) and the NIH providing support, beams from two Berkeley accelerators were used to treat more than 2000 patients whose conditions were judged inoperable or surgically risky. In these clinical trials, striking successes were

1961 Melvin Calvin, a Berkeley chemist, received the Nobel prize for his elucidation of photosynthesis, the process by which plants convert carbon dioxide, water, and sunlight into chemical energy. His work was a landmark application of radiotracers to the study of metabolic pathways.



1966 The scanning transmission electron microscope (STEM) arose out of AEC-funded basic research under the direction of Albert Crewe, at Argonne and at the University of Chicago. In the eighties, Brookhaven scientists would develop heavy-atom-conjugated labels (yellow in the image above) for pinpointing specific molecules or sites in biological structures.

1968 George Cotzias at Brookhaven published the first report of long-term L-dopa treatment for Parkinson's disease. L-dopa analogs remain the medications of choice today.