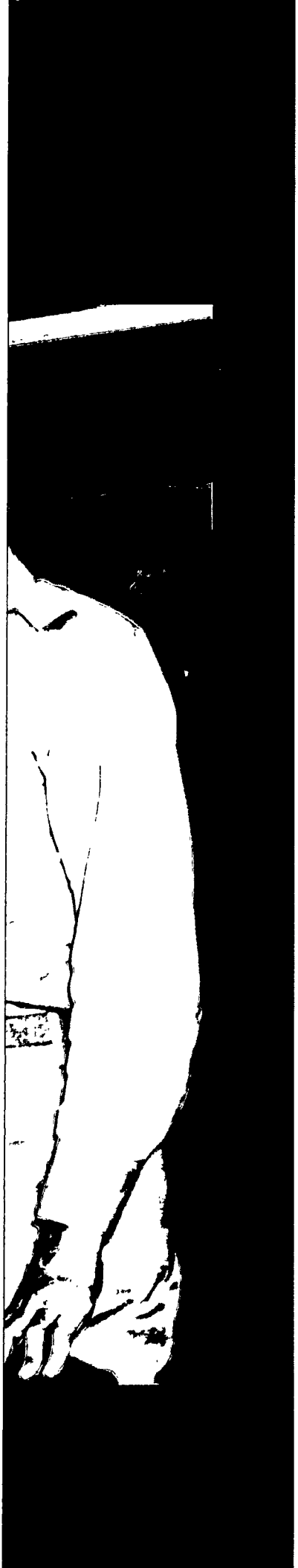

Modern nuclear medicine has a pedigree that stretches almost a hundred years. As early as the first years of the twentieth century, radium was used in several hopeful experiments to treat conditions for which no effective therapies were known: tuberculous skin lesions, goiter, tumors, and chronic infections. Two decades later, George de Hevesy was the first to explore the use of radioactive tracers, following the course of radioactive lead in plants. Over the next few years, minute quantities of radioactive elements were injected into humans and animals to study metabolic processes and to trace the circulation of blood. Then, in the thirties, at the University of California's Radiation Laboratory in Berkeley, Ernest O. Lawrence produced radioactive isotopes under controlled conditions for the first time. In a few short years, Lawrence's cyclotrons produced iodine-131, technetium-99m, carbon-14, thallium-201, and gallium-67, all of which would play pivotal roles in the future of nuclear medicine and biology. At the same time, the therapeutic use of radionuclides and their application to physiological studies increased in proportion to the sudden availability of these new "artificial" substances.

Atoms for Health

The AEC thus inherited a field not yet mature, but brimming with potential. In 1946 the veil of wartime secrecy was lifted from the nuclear reactor at the Clinton Laboratories, which had for three years been the clandestine origin of phosphorus-32 being produced for medical purposes. A prolific new source of radioisotopes was thus revealed, and before production ceased in 1963 at the original reactor, Oak Ridge had filled over a half-million orders for radioactive tracers and pharmaceuticals.

Nor did the AEC limit itself to supplying the biomedical community with isotopes already well characterized. In the late sixties, for example, under AEC sponsorship, Paul Harper, at the University of Chicago's Franklin McLean Memorial Research Institute, developed radioactive thallium as an imaging agent and proposed it as a potassium analog for visualizing the living heart. Subsequently, in the mid-seventies, Brookhaven scientists developed the first practical techniques for producing thallium-201 and then used the isotope successfully in obtaining cardiac images from goats. Today, thallium-201 exercise testing is among the standard noninvasive methods of scanning for reduced blood flow or tissue damage to the heart. In 1995 about one million thallium-201 scans were performed in the U.S. alone, most of them heart scans. The underlying idea is common to the use of all diagnostic radioisotopes. The isotopes themselves, or biochemicals containing them, are taken up preferentially by one organ or another, whereby the emitted radiation can be measured or used to produce pictures not unlike conventional x-ray images. The results reveal not so much the structure of