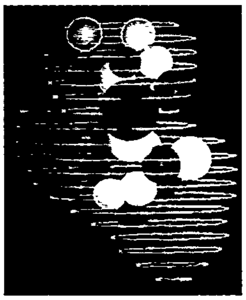
achieved in treating pituitary tumors, cancer of the eye, and a life-threatening malformation of cerebral blood vessels. Today, the legacy of these early experiments and clinical trials includes several proton accelerators around the world—including one at the Loma Linda University Medical School, designed and built by Berkeley and Fermilab physicists—and a heavy-ion accelerator in Japan dedicated to patient treatment.

An approach that is potentially even more effective in treating brain tumors that resist conventional therapies is being explored at several DOE and university laboratories. In boron neutron capture

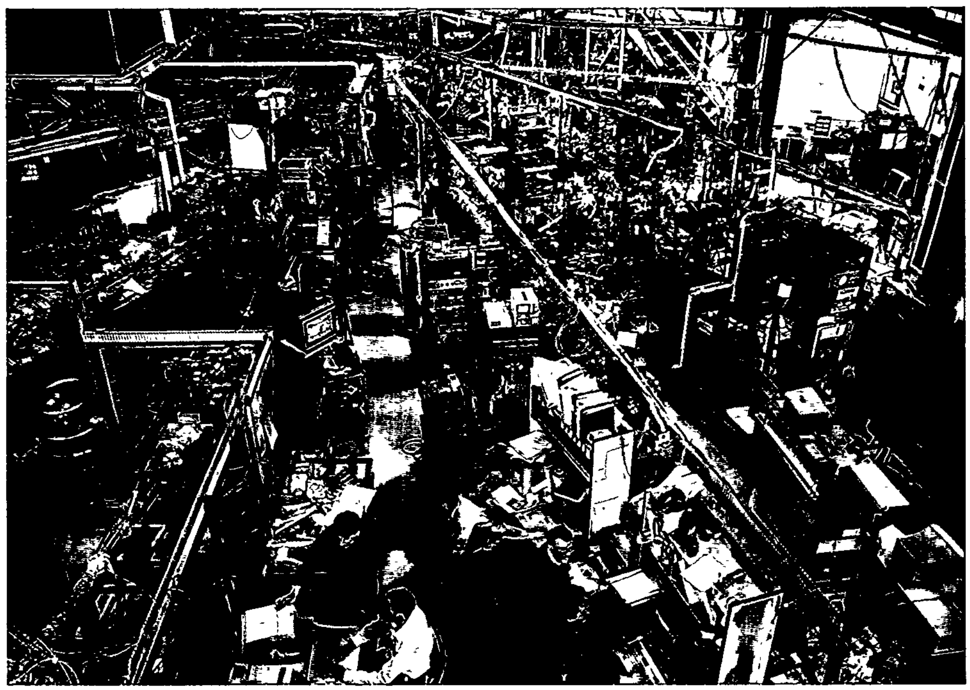


1968 Brookhaven scientists developed the technique of neutron diffraction for the structural analysis of protein molecules. In the image above, neutron-scattering data were used to produce a picture of a bacterial ribosome subunit comprising twenty-one proteins.

1968 Researchers at the Oak Ridge Institute for Nuclear Studies (now the Oak Ridge Institute for Science and Education) discovered the affinity of gallium-67 for soft-tissue tumors, leading to its widespread medical use in imaging lymphomas, lung cancer, and brain tumors.

1974 Following work with several prototypes, a Washington University team partially funded by the AEC developed the first practical PET scanner (PETT III) designed for human use. The first studies of human brain and liver tumors and cardiovascular disease were carried out with this system.

BIG MACHINE BIOLOGY



■ Biomedical scientists continue to do some of their most notable research at the bench, using the tools and techniques of the small laboratory. But an increasing fraction of their research demands the involvement of physicists, chemists, and engineers. Indeed, throughout this account of biological and medical progress, the instrumental contrivances of science and medicine have shared the spotlight with biological insight. Not surprisingly, then, the resources of biology extend even to some of the nation's largest scientific facilities, national user facilities built and supported for the use of all qualified individuals and research groups. The DOE plays the preeminent role in constructing and operating these facilities. ■ Studying biological function, for instance, increasingly relies on uncovering the detailed structure of biological macromolecules. This is now commonly done by using the intense x-ray beams produced at synchrotron radiation facilities—machines often costing hundreds of millions of dollars to construct. X-rays are focused on a tiny protein crystal, producing a diffraction pattern that can reveal the protein's intricate structure. Today, almost half of the new structures of biological macromolecules reported in the leading journals have been refined using synchrotron data. The busy floor of Brookhaven's National Synchrotron Light Source, shown above, reflects this intense current interest in synchrotron radiation. Users of these and other major DOE facilities include scientists from many universities, medical schools, government laboratories, and pharmaceutical companies. ■