OBER's mission is described more fully in the Program Management section (p. 59) of this report.

By 1985, progress in genetic and DNA technologies led to serious discussions in the scientific community about initiating a major project to analyze the structure of the human genome. After concluding that a DNA sequence would offer the most useful approach for detecting inherited mutations, DOE in 1986 announced its Human Genome Initiative. The initiative emphasized development of resources and technologies for genome mapping, sequencing, computation, and infrastructure support that would culminate in a complete sequence of the human genome.

The National Research Council issued a report in 1988 recommending a dedicated research budget of $200 million annually for 15 years to determine the sequence of the 3 billion chemical subunits (base pairs) in the human genome and to map and identify all human genes.

To launch the nation's Human Genome Project, Congress appropriated funds to DOE and also to NIH, which had long supported research in genetics and molecular biology as an integral part of its mission to improve the health of all Americans. Other federal agencies and foundations outside the Human Genome Project also contribute to genome research, and many other countries are making important contributions through their own genome research projects.

Coordinated Efforts

In 1988 DOE and NIH signed a Memorandum of Understanding in which the agencies agreed to work together, coordinate technical research and activities, and share results. The two agencies assumed a joint systematic approach toward establishing goals to satisfy both short- and long-term project needs.

Early guidelines projected three 5-year phases, for which the first plan was presented to Congress in 1990. The 1990

Anticipated Benefits of Genome Research

Predictions of biology as "the science of the 21st century" have been made by observers as diverse as Microsoft's Bill Gates and U.S. President Bill Clinton. Already revolutionizing biology, genome research has spawned a burgeoning biotechnology industry and is providing a vital thrust to the increasing productivity and pervasiveness of the life sciences.

Technology and resources promoted by the Human Genome Project already have had profound impacts on biomedical research and promise to revolutionize biological research and clinical medicine. Increasingly detailed genome maps have aided researchers seeking genes associated with dozens of genetic conditions, including myotonic dystrophy, fragile X syndrome, neurofibromatosis types 1 and 2, a kind of inherited colon cancer, Alzheimer's disease, and familial breast cancer.

Current and potential applications of genome research will address national needs in molecular medicine, waste control and environmental cleanup, biotechnology, energy sources, and risk assessment.

Molecular Medicine

On the horizon is a new era of molecular medicine characterized less by treating symptoms and more by looking to the most fundamental causes of disease. Rapid and more specific diagnostic tests will make possible earlier treatment of countless maladies. Medical researchers also will be able to devise novel therapeutic regimens based on new classes of drugs, immunotherapy techniques, avoidance of environmental conditions that may trigger disease, and possible augmentation or even replacement of defective genes through gene therapy.

Microbial Genomes

In 1994, taking advantage of new capabilities developed by the genome project, DOE formulated the Microbial Genome Initiative to sequence the genomes of bacteria useful in the areas of energy production, environmental remediation, toxic waste reduction, and industrial processing. In the resulting Microbial Genome Project, six microbes that live under extreme conditions of temperature and pressure have been sequenced completely as