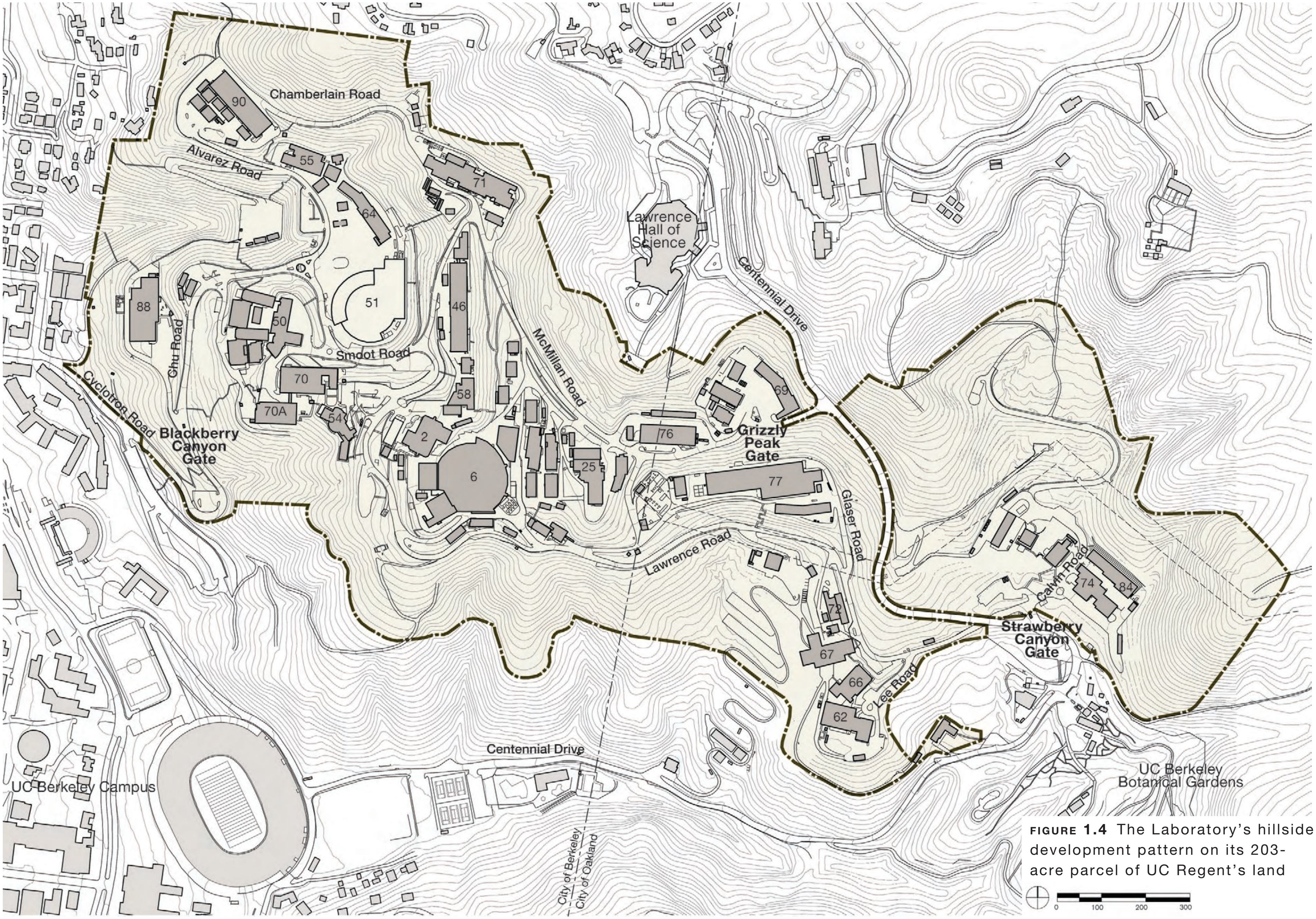


FIGURE 1.4 The Laboratory's hillside development pattern on its 203-acre parcel of UC Regent's land

Berkeley Lab: Historical Perspective

In the Laboratory's first 75 years it has grown from a single-purpose facility into today's Berkeley Lab—a multi-program scientific research facility. As the Laboratory's research portfolio has grown from high-energy physics to include energy, life & environmental sciences, high performance computing, and physical sciences, the Laboratory's facilities have evolved to meet these needs. What follows is the story of the Laboratory's evolution—its science and its facilities.

In the 1920s UC President Robert Gordon Sproul undertook the task of developing UC Berkeley into a major research university. Physics was an important part of this effort, and in 1928 Physics Chair Robert Birge recruited a promising assistant professor, Ernest Lawrence, to join the faculty.

In 1929 Lawrence invented the cyclotron, which made possible the dramatic growth of particle physics and equally dramatic discoveries about the nature of matter over the following decades. Lawrence also launched the modern era of multidisciplinary "team science." When he came to Berkeley, the traditional practice for scientists was to work within their own specialized field, seldom working with engineers or collaborating outside of their departments. But in August of 1931 Lawrence

FIGURE 1.5 The Radiation Laboratory originated the national laboratory system on the campus of UC Berkeley

Figure 1.6 The Laboratory has a 75-year history of achievement in Berkeley

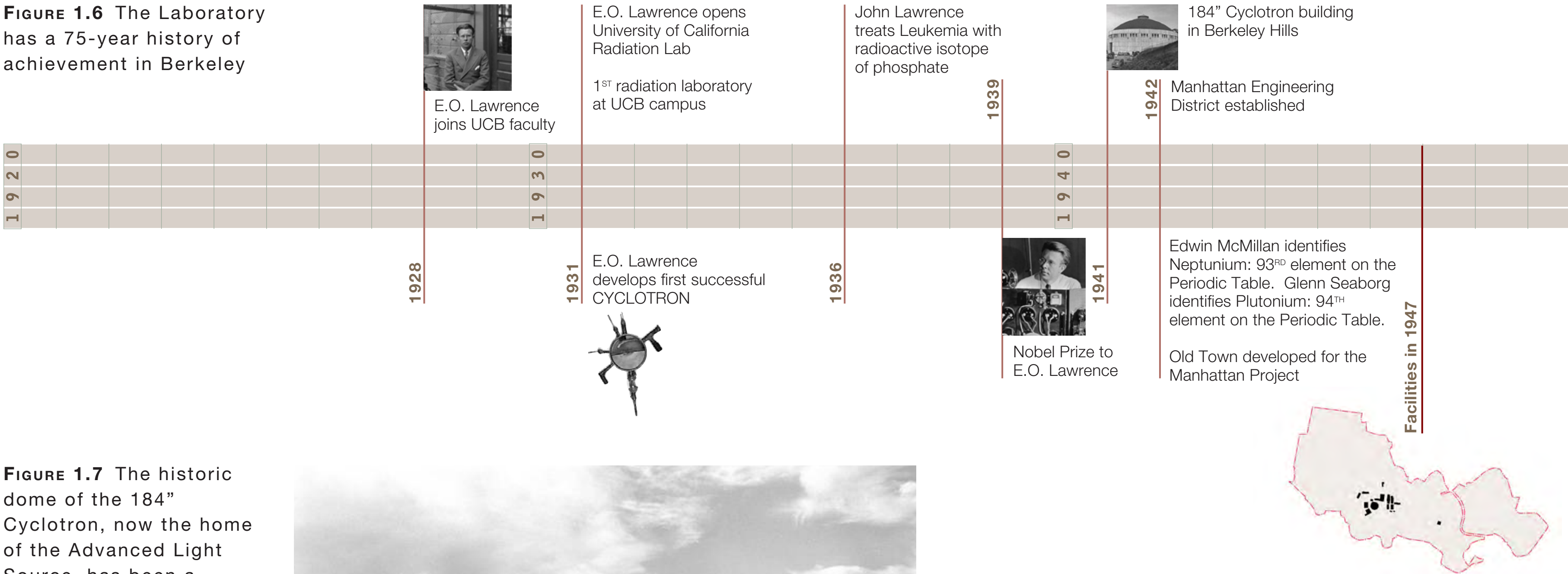
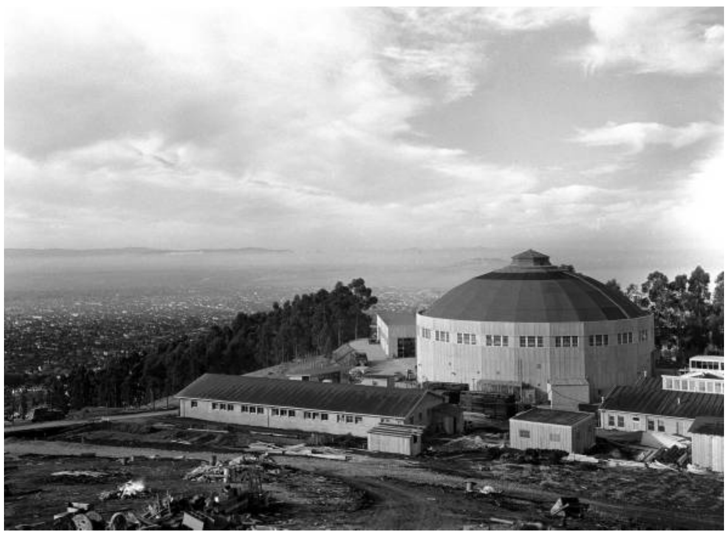


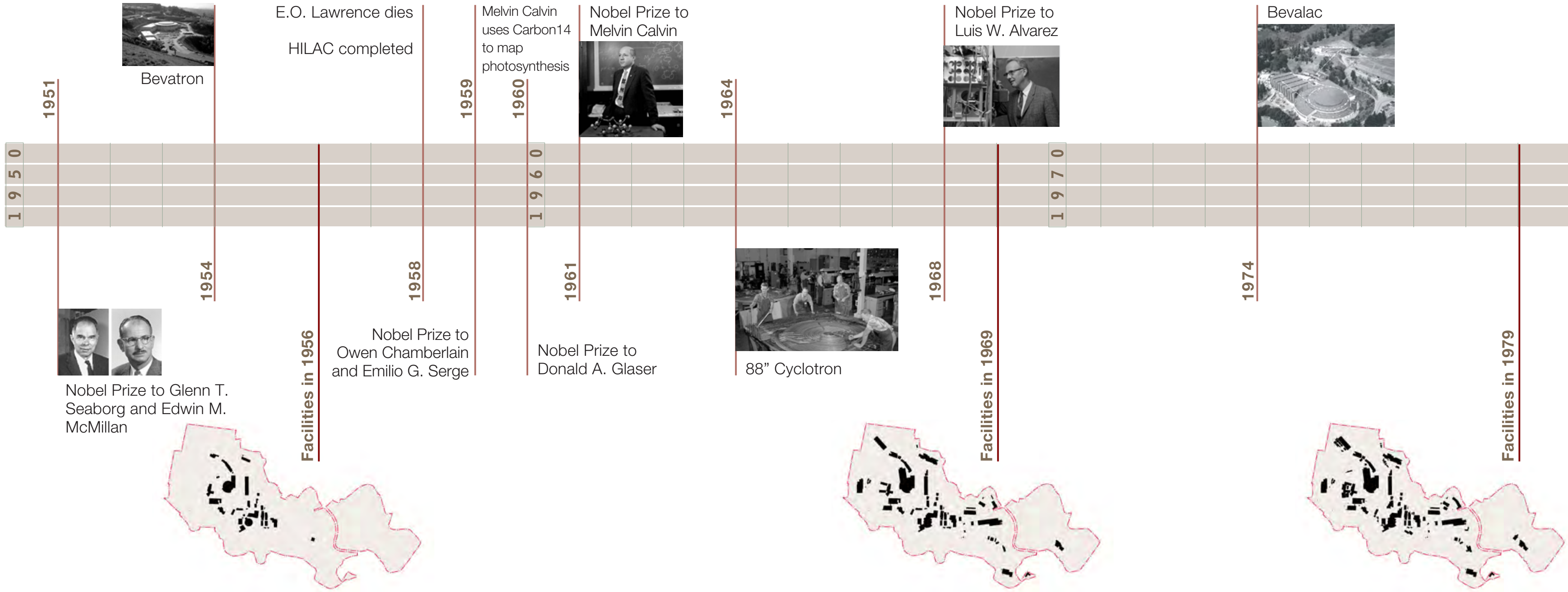
Figure 1.7 The historic dome of the 184" Cyclotron, now the home of the Advanced Light Source, has been a Berkeley Hills landmark since 1941



created his Radiation Laboratory on the Berkeley campus and began recruiting a brilliant circle of colleagues from physics, chemistry, engineering, and medicine whose ground-breaking teamwork would be critical to the Laboratory's legendary success.

In its first decade the Radiation Laboratory outgrew its original building on the UC Berkeley campus, extending into other campus buildings such as Crocker Hall, which housed the 60-Inch Cyclotron. At the same time, the scope of the Laboratory's research expanded to include a wider range of disciplines. In 1936, for example, John Lawrence, Ernest Lawrence's brother, started a biomedical research program. He was the first to treat a leukemia patient with a radioactive isotope and used particle beams for radiation therapy, establishing the Laboratory as the birthplace of nuclear medicine and a center of biophysics and imaging research.

The Laboratory expanded to its present location in 1940, when ground was broken on what was then called Charter Hill for the 184-Inch Cyclotron. Designed by Arthur Brown, architect of San Francisco's City Hall and Coit Tower, the domed building is an East Bay Hills landmark, and reinforces the visual axis created by UC Berkeley campus architect John Galen Howard that runs west through campus, aligning with the Golden Gate Bridge across the Bay.

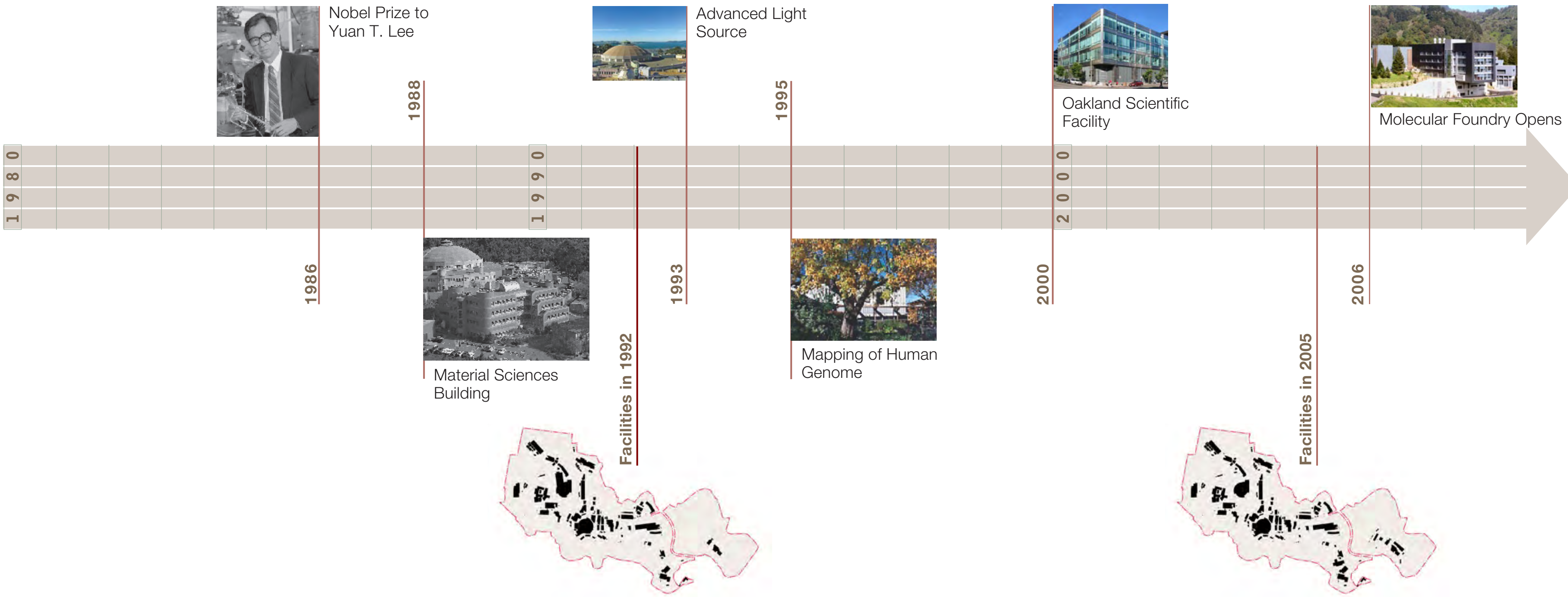


During World War II, the Charter Hill site became crowded with a number of hastily constructed temporary buildings as the Laboratory responded to national defense needs, developing machines for the electromagnetic separation of uranium isotopes as part of the Manhattan Project. Thereafter, development on the main site would feature the construction of permanent concrete and steel-frame structures east and west of the original buildings.

Under the sponsorship of the Atomic Energy Commission, new, more powerful particle accelerators and a broader base of research programs were initiated. 1948 saw the appearance of Luis Alvarez's proton linear accelerator and the first electron synchrotron, invented by Edwin McMillan.

The Bevatron, which followed in 1954, became the nation's leading high-energy physics facility, achieving distinction in the same year with the discovery of the antiproton. In 1958 the Heavy Ion Linear Accelerator (HILAC) came on line. It was later combined

FIGURE 1.8 Laboratory Director and Nobelist Ed McMillan (left) with Edward Lofgren on the Bevatron, 1963



with the Bevatron to form the Bevalac, ushering in a new era of relativistic heavy-ion nuclear physics. The 88-Inch Cyclotron was completed in 1964 as an important experimental facility in low energy nuclear physics. During the 1950s and early 1960s, a number of permanent laboratory and office buildings were constructed to accommodate the growth in accelerator-related and other programs.

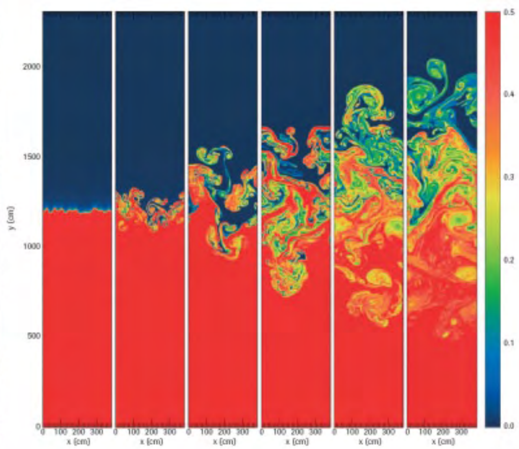
In the aftermath of the 1973 oil embargo, new research program growth targeted national energy supply and end use. The Laboratory's population reached a new high point in 1978 following the establishment of the Department of Energy (DOE), but no permanent buildings were constructed to accommodate this growth. Instead, temporary trailers were installed, existing spaces were adapted, and building space was leased in Berkeley and Emeryville for research programs and support services.

By 1980 Berkeley Lab was a national laboratory with recognized expertise in a broad range of scientific areas, with high energy and nuclear physics accounting for only 25 percent of the research—a dramatic change from 75 percent in 1970. With its research scope supporting DOE's science, energy, health, and environmental missions, as well as the scientific needs of other governmental agencies, the Laboratory emphasized energy sciences, materials sciences, and life sciences while maintaining historically important roles in high energy and nuclear physics.

In the 1980's DOE chose Berkeley Lab as the site for the new National Center for Electron Microscopy (NCEM) and the Advanced Light Source (ALS). These facilities, known as "national user facilities" are operated specifically to provide researchers from academic, private sector and other national laboratories with specialized scientific infrastructure they would not otherwise have access to. For example, the ALS, which reused the 184-Inch Cyclotron Building, is one of the world's brightest sources of x-ray and ultraviolet light and serves scientists from around the world. Other modern research buildings such as the

Materials Sciences

Supercomputer Modeling, Simulation, and Visualization



Life Sciences and Genomics

FIGURE 1.9 The wide range of research disciplines at the Berkeley Lab

Surface Science & Catalysis Laboratory and Advanced Materials Laboratory were completed in the late 1980s.

In the 1990s DOE formulated development plans for programs in genome sciences and computational sciences that built upon Berkeley Lab's multidisciplinary capabilities. The Genome Sciences Building was completed in 1997 to serve DOE's national Human Genome Program. In 1999 the Laboratory adapted buildings in Walnut Creek to house the DOE Joint Genome Institute's Production Sequencing Facility. Three of the human chromosomes were sequenced in this facility for the Human Genome Project. At the same time funding for research programs in some of the older science facilities such as the Bevatron and HILAC was discontinued and the massive equipment and facilities closed down.

Berkeley Lab's computational sciences capability was greatly strengthened when the DOE National Energy Research Scientific Computing (NERSC) Center moved here in 1996, bringing with it one of the nation's most powerful unclassified high-performance computers as well as expertise that further broadened the Laboratory's capabilities. High-performance computing is now regarded as an equal and indispensable partner, along with theory and experiment, in the advancement of scientific knowledge and engineering practice.

In 2006 the Molecular Foundry, a facility for the design, synthesis and characterization of nanoscale materials, began operation. This national user facility was built to provide advanced instrumentation, technical support, and scientific expertise to U.S. and international scientists in their nanoscience research activities. The building earned the U.S. Green Building Council's "Silver" rating for sustainable design and construction.

In many ways the Molecular Foundry sets the standard by which the Laboratory plans to develop facilities in the future. The facility is considered to be a state-of-the-art research facility in 2006 and is designed for collaborative team projects and to be highly adaptable to future research needs. Beyond this, the facility provides scientists with an efficient and collegial work environment within a building that makes the least environmental impact necessary to support the scientific endeavor within.

FIGURE 1.10 The Molecular Foundry is dedicated to supporting nanoscience research by scientists from around the world