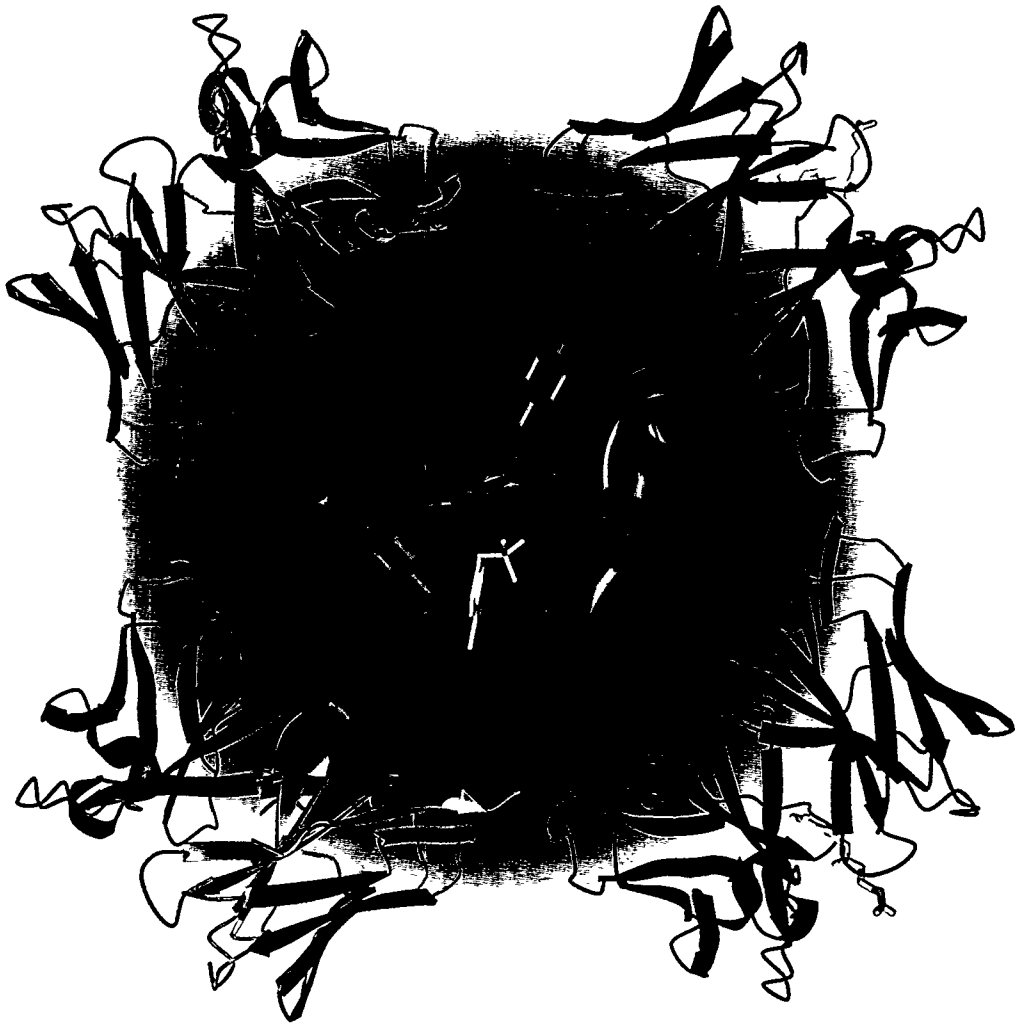

UNLOCKING AN ANTIBODY'S SECRET One of the body's mysteries is how the immune system responds to the virtually unlimited variety of foreign molecules it must combat. However, insights are emerging from images such as these, produced from data obtained at the DOE-supported Stanford Synchrotron Radiation Laboratory. X-ray crystallography reveals the detailed molecular structures of a "naive" antibody in both its free form (blue) and with an antigen bound to it (purple), as well as a "mature" antibody (green and red). The binding of the antigen (yellow) to the naive antibody leads to structural changes in the antibody that establish a more secure lock-and-key interaction with the antigen. This effort by Berkeley scientists working at SSRL was supported by the DOE, the NIH, and the Howard Hughes Medical Institute.

To take but one example, understanding the genome-structure-function connection will reveal the genetic and functional reasons behind individual susceptibilities to various environmental insults—and may lead ultimately to reliable screening tests for susceptible populations. Such breakthroughs will protect DOE workers involved in environmental cleanup, as well as the population at large.

In reaching to the genome for an understanding of biological function, the new research paradigm extends to nuclear medicine as well—thus the nascent field of molecular nuclear medicine. The BER program has been the principal steward of nuclear medicine for fifty years, touching millions of lives with epochal developments. No more than enticing novelties in the forties, radiotracers, radiopharmaceuticals, and advanced medical imaging systems are now staples of medical practice and biological research. Today, molecular nuclear medicine offers prospects no less bright. The promise of directly imaging gene function in living tissue, already realized in recent research, dramatically enhances the prognosis for treating diseases such as cancer, since it would allow genetic dysfunction to be detected long before the resulting ail-