



Letter from the Director

Lawrence Berkeley National Laboratory

April 14, 2010

Dear Friends and Neighbors of Berkeley Lab:

My name is Paul Alivisatos, and I am director of Lawrence Berkeley National Laboratory, a Department of Energy-funded research center located in the hills above the University of California, Berkeley campus. I live in the East Bay, have worked at Berkeley Lab for more than 20 years, and know that as an institution with a global mission, we have not always taken the time to fully explain to our local friends and neighbors the kind of work we are doing up here on the hill and why we are so excited by its promise. This letter is a fresh step in communicating with you more directly and more often – as well as an invitation for you to communicate with us.

Focusing on Solutions

I am happy to report that Berkeley Lab's scientists continue to seek technological solutions to some of the world's most urgent energy and environmental problems. Increased reliance on fossil fuels delivers a one-two punch: volatile and upward-trending energy prices and mounting greenhouse gas emissions, which is a key force behind climate change.

To **avoid drastic environmental and social consequences**, we must:

- discover transformational solutions for energy production and use
- develop cleaner, renewable sources of energy
- adopt better methods for efficiently using the energy we produce.

Berkeley Lab is leading the way in *all of these research areas*.

Smart Buildings and Better Batteries

For example, the Lab's Environmental Energy Technologies Division, which gave California and the world smart windows, energy-efficient lighting systems, cool roof products, and the science behind the national Energy Star program, is mobilizing around several new initiatives including better batteries and smart buildings.

People often lose sight of the fact that the nation's commercial and residential buildings consume three-quarters of this country's electricity and result in 40 percent of all of our carbon dioxide emissions. Clearly, if we can design, coordinate, and integrate all the systems that regulate and **monitor energy use** in new buildings, we can have an impact on greenhouse gas emissions.

If we can **retrofit existing buildings** to the same standards, the impact will be greater still. Better batteries would also allow us to make **electric vehicles** a mainstream transportation option, and store and distribute a wide variety of renewable sources of energy across our electrical grids.

Producing Biofuels

Producing biofuels and biomaterials from biomass offers a solution of a different kind, and in the Joint Bioenergy Institute (JBEI) and the Joint Genome Institute, the Department of Energy has provided Berkeley Lab with the country's **two leading centers of research and development**.

Using plant matter as an energy source presents enormous challenges. We will need to be able to quickly and effectively break down tough cellulose fibers and then, through various steps that are both affordable and scalable, produce a fuel that can go directly into your gas tank—all without putting pressure on our food supply or requiring carbon-intensive fertilizers.

Berkeley Lab researchers are working on all aspects of this problem, and just recently, a collaboration led by JBEI researchers demonstrated that an engineered microbe can produce an **advanced biofuel** from biomass.

Carbon Cycle 2.0 Initiative

When faced with big and complex scientific problems like a planetary **carbon cycle thrown out of balance** by our stepped-up use of fossil fuels and other human activity, scientists work best in interdisciplinary teams. Berkeley Lab's new call to action, called Carbon Cycle 2.0, is just such an effort. We recently held a symposium at the Lab to spark collaborations among scientists across our many divisions who are working in such programs as carbon capture and storage and turning sunlight into fuels. Those presentations have been archived on the Berkeley Lab website and are available at carboncycle2.lbl.gov/index.html.

Human Health

As we try to improve the health of the planet, we also are taking steps to improve human health. The National Institutes of Health just provided nearly \$13 million to fund 14 different individual research projects targeting everything from **cancer and neurodegenerative disease** to the development of tools for medical researchers.

A Community Partner

Apart from being a national resource, the Lab is also a neighbor – 25 percent of our approximately 4,000 employees live in the city of Berkeley, 12 percent in Oakland and 4 percent in Albany. With this in mind, we have been working hard over the last five months to assemble our first-ever **Community Advisory Group (CAG)**. In mid-March, the CAG, consisting of representatives from diverse organizations that reflect a wide swathe of opinion, held its first meeting. Its founding purpose will be to consider and advise me and other Lab leaders on growth and development issues. Meetings are open to the public; the next one is scheduled for April 28. For more information about the CAG and its meeting schedule, please call 510-486-7292.

Public Tours

Sign-ups for our revamped public tours program will also begin anew this month. You will be able to register online by visiting the Friends of Berkeley Lab website at friendsofberkeleylab.lbl.gov. One of the highlights of the tour will continue to be the **Advanced Light Source**, which is famous for being the starting point for many discoveries in materials science, biology, chemistry, physics, and the environmental sciences. We hope to one day build an even brighter x-ray light source—the world's brightest—that would enable us to see inside atoms and literally catch the material world taking shape.

Old Town

At the center of the Lab is a cluster of older buildings, called “Old Town,” that we would like to dismantle and rebuild with a mix of new laboratories and ample green space. Much depends on whether we receive the necessary federal funds, but we are hopeful that Old Town will provide the footprint for a **better and more concentrated use of space**, away from the perimeter of the Lab.

Recovery Act Funds

We have received more than \$200 million in American Recovery and Reinvestment Act (ARRA) funds in the past year. The surge in ARRA dollars helped to push the Lab's operating budget near the \$650 million mark in 2009. As a result, Berkeley Lab has assumed an even greater role as an economic engine in the local and regional economy. The most recent data reveal that the Lab's spending in the Bay Area resulted in the creation of more than **1,700 direct, indirect and induced jobs in the city of Berkeley** itself.

There is much more to report, but I will save it for my next letter. If you would like to receive more regular updates via email, contact me at director@lbl.gov. In the meantime, you can stay current with Lab research and other developments by visiting the Berkeley Lab website at lbl.gov.

Please pay particular attention to the link to the Lab's “Breakthroughs” brochure, which lists 25 ways that Lab research has improved the world and our lives. A summary of these major achievements is on the reverse side of this page.

Sincerely,



Paul Alivisatos
Director
Lawrence Berkeley National Laboratory

Discovered sixteen elements.

The periodic table would be smaller without Berkeley Lab. Among the Lab's handiwork is an instrumental role in the discovery of technetium-99, which has revolutionized the field of medical imaging. There's also americium, which is widely used in smoke detectors.

Identified good and bad cholesterol.

The battle against heart disease received a boost in the 1960s when Lab research unveiled the good and bad sides of cholesterol. Today, diagnostic tests that detect both types of cholesterol save lives.

Confirmed the Big Bang, and discovered dark energy.

Lab detectors aboard a NASA satellite revealed the birth of the galaxies in the echoes of the Big Bang. And dark energy — the mysterious something that makes up three-quarters of the universe and causes it to expand at an accelerating rate — was discovered by Berkeley Lab's Supernova Cosmology Project.

Turned windows into energy savers.

Americans save billions of dollars in energy bills each year thanks to a Lab-developed window coating that prevents heat from entering in the summer and escaping in the winter. More than half of all windows sold each year have this coating.

Unmasked a dinosaur killer.

Natural history's greatest whodunit was solved in 1980 when a team of scientists led by Berkeley Lab's Walter Alvarez pinned the dinosaurs' abrupt extinction on an asteroid collision with Earth. Case closed.

Explained photosynthesis.

Ever wonder how plants turn sunlight into energy? Berkeley Lab's Melvin Calvin determined the path of carbon through photosynthesis, a scientific milestone that illuminated one of life's most important processes. Today, this work allows scientists to explore how to derive sustainable energy sources from the sun.

Created the toughest ceramic.

Lab scientists mimicked the structure of mollusk shells to create what may well be the toughest ceramic ever produced. The material could lead to incredibly strong yet light composites that are perfect for energy and transportation applications.

Pitted cool roofs against global warming.

The Lab leads the way in analyzing and implementing cool roofing materials, which reflect sunlight, lower surface temperature, and slash cooling costs. Think globally: If all the world's roofs and pavement used cool materials, the reduction in carbon dioxide emissions would be equivalent to taking the world's 600 million cars off the road for 18 years.

Exposed the radon risk.

You can sleep easier thanks to Lab research that quantified the health risk posed by radon gas in parts of the country. Subsequent EPA standards, coupled with radon detection and mitigation measures pioneered by the Lab, prevent the naturally occurring gas from seeping into basements, saving thousands of lives every year.

Given fluorescent lights their big break.

Chances are you're reading this using energy-efficient fluorescent lighting, and chances are those lights use electronic ballasts, which control the current flowing through the light. Berkeley Lab developed the ballast in the 1970s with the lighting industry. A 2001 study found that electronic ballasts sold through 2005 would provide \$15 billion in energy savings.

Built a better battery.

A new family of long-lasting rechargeable batteries was made possible when Lab scientists invented a novel class of solid polymer cathodes. Now, Lab scientists are developing long-life, safe batteries for plug-in hybrid vehicles.

Preserved the sounds of yesteryear.

Lab scientists engineered a high-tech way to digitally reconstruct aging sound recordings that are too fragile to play, such as Edison wax cylinders from the late 1800s. Archivists estimate that many of the millions of recordings in the world's sound archives, including the U.S. Library of Congress, could benefit from the technology.

Fabricated the smallest machines.

The world's smallest synthetic motor — as well as radios, scales, and switches that are 100,000 times finer than a human hair — were engineered at Berkeley Lab. These and other groundbreaking forays into nanotechnology could lead to life-saving pharmaceuticals and more powerful computers.

Made appliances pull their weight.

U.S. consumers save \$7 billion each year thanks to Lab scientists who helped to develop the federal government's energy efficiency standards for appliances. And those Energy Star labels you see on appliances? The Lab helped to implement those too.

Brought safe drinking water to thousands.

More than half a million people drink clean water thanks to a fast and cheap purifier developed at Berkeley Lab. The device, called UV Waterworks, uses ultraviolet light to kill water-borne diseases such as dysentery, which is a major cause of child mortality in the developing world.

Created a pocket-sized DNA sampler.

A tool that identifies the microbes in air, water, and soil samples is fast becoming a workhorse in public health, medical, and environmental cleanup projects. Only a few years old, the credit-card sized PhyloChip is already pinpointing the diseases that kill coral reefs, and cataloging airborne bacteria over U.S. cities.

Revealed the secrets of the human genome.

Berkeley Lab, no stranger to big science, played a key role in the landmark Human Genome Project. The Walnut Creek-based Joint Genome Institute, managed in part by Berkeley Lab, sequenced human chromosomes 5, 16, and 19, which are regions of the genetic library implicated in diabetes, atherosclerosis, asthma, and other diseases.

Redefined the causes of breast cancer.

A new path in cancer treatment research was forged thanks to a revolutionary theory developed at Berkeley Lab that links breast cancer to a breakdown in the micro-environment surrounding breast cells.

Given buildings an energy makeover.

The Lab wrote the book, or program rather, when it comes to wringing every penny out of a building's energy use. Software developed at Berkeley Lab is used worldwide to audit a structure's energy consumption. If you've set foot in the San Francisco Airport, Sears Tower, or the Nestle Head-quarters in Switzerland, you've experienced energy savings thanks to Berkeley Lab.

Supercharged the climate model.

Climate simulations conducted at the Lab's National Energy Research Scientific Computing Center helped to make global warming a dinner table conversation. Lab scientists are now developing a more powerful model that forecasts climate change's impact on ecosystems and human health around the world. It will also predict how well carbon-cutting strategies curb global warming.

Derailed an ecological danger.

In the 1980s, Lab scientists linked the poisoning of birds at a reservoir in California's San Joaquin Valley to selenium contamination from agricultural runoff. Their work exposed a looming national problem and sparked environmental agencies to take action.

Caught malaria in the act.

A never-before seen view of the malaria parasite inside a red blood cell was obtained at Berkeley Lab's Advanced Light Source. The images led to a better understanding of how malaria changes red blood cells and may help scientists improve drugs that fight the deadly disease.

Helped bring energy efficiency to China.

Since 1988, Lab scientists have worked to make the world's second largest energy consumer after the U.S. as energy efficient as possible. Energy labels and appliance standards, developed with considerable support from Berkeley Lab, will reduce carbon emissions in China by about 9.1 billion tons between 2009 and 2030. The Lab has also helped improve energy efficiency in China's residential and commercial buildings, and in industries such as cement manufacturing.

Pioneered medical imaging.

In the 1950s, Berkeley Lab's Hal Anger developed a scintillation camera that enabled physicians to detect tumors by imaging gamma rays emitted by radioactive isotopes. The camera that bears his name evolved into modern imaging systems, such as PET, which enable doctors to detect many diseases early enough to save patients' lives.

Brought the stars closer.

Scientists can glimpse supernovae billions of light years away thanks to revolutionary telescope technology developed at Berkeley Lab in the late 1970s. The segmented mirror design is used at many observatories worldwide, including the giant twin telescopes of the Keck Observatory on the summit of Mauna Kea in Hawaii, which are the most powerful ground-based telescopes in the world.