

President's Report

A Report on
Discoveries and
Achievements
at the
University of
California

Vol. 12, No. 6, May 2003

The following is a glimpse of some recent achievements by faculty, staff and students of the University of California and the national laboratories managed by the university.

In the News

Founding faculty ... UC Merced has appointed eight leading scholars as its founding faculty, drawing the best people from some of the top universities in the nation and world. The new faculty will help establish a strong foundation for Merced's first signature research center, the Sierra Nevada Research Institute. The appointments represent the first round of 75 faculty and lecturers to be named prior to the campus' scheduled opening in Fall 2004.

Guggenheims ... Seven University of California faculty members have been selected as Guggenheim Fellows. They are *John Agnew*, *Timothy Tangherlini* and *Judith Baca* of **UCLA**, *Catherine Albanese* of **UC Santa Barbara**, *Lisa Lowe* of **UC San Diego**, *Catherine Robson* of **UC Davis**, and *Michael Watts* of **UC Berkeley**. They are among 184 scientists, scholars, and artists chosen from more than 3,200 Guggenheim applicants.

Joint program ... UC San Diego and **Los Alamos National Laboratory** have announced plans for a joint education initiative to train engineers in disciplines that support Los Alamos' mission of enhancing global security. A primary focus will be creation of a graduate-level, research-based engineering degree program co-located at UCSD and Los Alamos.

Affiliation discussions ... The **University of California** and the Monterey Institute of International Studies have jointly announced that they are in preliminary discussions regarding the possibility of the Monterey Institute becoming part of UC. If the institute joins UC, it would be administered as a unit of **UC Santa Cruz**, but its expertise and resources would be available to all UC campuses.

New biosciences institute ... Lawrence Livermore National Laboratory has unveiled a new **Physical Biosciences Institute**, an incubator for multidisciplinary projects that link the laboratory's experimental and simulation capabilities to research projects in quantitative biology. Biology is widely believed to be at the threshold of a great transformation into a quantitative and predictive science that will depend heavily on new technologies from the physical sciences and advanced computations.

Health and Nutrition

Polymer beads ... A simple method of shuttling proteins into cells via microscopic polymer beads shows promise as a general way of carrying vaccines or bits of DNA for gene therapy, according to chemists at **UC Berkeley** and **Lawrence Berkeley National Laboratory**. The polymer beads are imbedded with a protein – a vaccine antigen, for example – and made large enough to attract the attention of the immune system's scavenger cells, which engulf them and try to digest them with acid.

Pain treatment ... Attempting to resolve a long-standing controversy, **UC San Francisco** researchers have shown that patients with chronic neuropathic pain from nervous system damage improved significantly after an eight-week course of the morphine-like medication levorphanol. Such pain affects about three million people in the U.S. and is considered very difficult to treat.

Alzheimer's remedy? ... A **UCLA** scientist reports that common painkillers such as ibuprofen and naproxen may actually dissolve the brain lesions – or amyloid plaques – that are one of the definitive hallmarks of Alzheimer's disease. Researcher *Jorge Barrio* says that common over-the-counter pain medications – known as non-steroidal anti-inflammatory drugs – bind to amyloid plaques, and may help dissolve existing plaques and prevent the formation of new ones.

Heart attacks lowered ... In the first study of its kind, **UC San Francisco** researchers and colleagues have found that the number of heart attack victims admitted to a regional hospital dropped by nearly 60 percent during the first six months that a smoke-free ordinance was in effect in the area. The researchers note that this is the first empirical evidence suggesting that smoke-free policies not only protect people from dangers of secondhand smoke, but they also rapidly prevent heart attacks.

Anti-inflammatory ... Biologists at **UC San Diego** have discovered that eliminating the ability of white blood cells to respond to low oxygen levels effectively blocks the development of inflammation in mice. Their discovery could lead to the development of a new class of drugs for treating the debilitating and painful joint inflammation in the 43 million Americans who suffer from arthritis. It also may help doctors treat cancer more effectively, because tumor development is associated with a pronounced inflammatory response in the vast majority of cases.



Hidden HIV ... Scientists are now one step closer to understanding how HIV hides in cells and rears its ugly head once patients stop taking combination drug therapy. Eradication of the HIV-hiding cells could lead to a cure for HIV infection. Now researchers at the **UC San Francisco-affiliated Gladstone Institute of Virology and Immunology** have found a way to identify and study latently infected cells in the laboratory.

Cardiac function harmed ... Researchers at **the UC San Diego School of Medicine** report that a preliminary study of hospitalized crystal methamphetamine users showed a significantly higher rate of cardiac dysfunction in these patients than in non-users. The researchers found that 64 percent of the 76 users showed normal heart function compared with 85 percent in an age-matched control group, while 28 percent of the crystal methamphetamine users exhibited moderate to severe left ventricular dysfunction, compared with only 7 percent in the control group

Developments and Discoveries

Two-part breathing ... Until now, scientists believed that a single area in the brain generated breathing rhythm, enabling breathing to speed up or slow down to adapt to the body's activity and position. But **UCLA** neurobiologists have discovered that two systems in the brain interact to generate breathing rhythm – a finding that may translate into better treatment for sleep apnea and sudden infant death syndrome.

Overdiagnosing bites ... A **UC Riverside** study shows that where brown recluse spiders are common, people can cohabitate with them and bites are infrequent. Throughout the United States, however, physicians routinely make brown recluse bite diagnoses when no brown recluses are known to exist in their states. The results of the study point to the conclusion that doctors are severely overdiagnosing brown recluse bites in non-endemic recluse areas.

Similar toxic molecules ... **UC Irvine** researchers have discovered an important similarity in the causes of cell degeneration and death in diseases such as Alzheimer's, Parkinson's, Huntington's, type II diabetes and CJD, suggesting that a single therapy could combat these different ailments. They found that small toxic molecules believed to trigger cell damage in these diseases have a similar structure. The study implies that these molecules share parallel functions, which makes them suitable targets for new drugs or vaccines that could halt progression of many degenerative diseases.

Genome sequence ready ... **UC Santa Cruz** bioinformatics researchers have made the completed reference sequence of the human genome publicly available on the Web-based UCSC Genome Browser. The browser provides a Web-based "microscope" for exploring the human genome sequence and is used daily by thousands of biomedical researchers worldwide.

Old new-age plastic? ... Researchers at **UC Santa Barbara** and colleagues have developed a strategy for combining the versatile properties afforded by expensive "designer" plastics with the favorable economics of old-fashioned mass-produced plastics. They have found a way to combine the two types of plastics in one structure made mostly of the cheap plastic polystyrene (the stuff of Styrofoam), but with the properties of the designer plastic, including the ability to conduct electricity.

More polyphenolics ... **UC Davis** scientists report organically or sustainably grown berries and corn contain up to 58 percent more polyphenolics, natural antioxidants that are a natural defense for plants and may be good for human health. The work suggests that pesticides and herbicides used in conventional farming may reduce the production of polyphenolics by plants.

Manipulating DNA ... A DNA analysis by **UC Irvine's William Thompson** has led to the release of a Houston teenager who was convicted of rape and sentenced to 25 years in a Texas penitentiary. Thompson was asked to study eight cases that the Houston criminal justice system successfully prosecuted by primarily relying on DNA evidence. He found serious shortcomings in all of the cases and reports that in some cases, it appeared that DNA evidence had been manipulated to guarantee convictions.

3-D tracking ... Hoping to track cancer as it spreads cell-by-cell through the body, **Lawrence Berkeley National Laboratory** researchers have developed a way to shape high-resolution microscopy images into three-dimensional renditions of tissue such as mammary ducts. The result is a microscopic look at the molecular and genetic underpinnings of cancer on a glandular scale. It could ultimately portray how cancer spreads.

The Cutting Edge

Magic molecule ... In research with potential implications for both increasing fertilization and preventing pregnancies, **UCLA** biologists and colleagues report that they have isolated and identified a molecule that attracts sperm. The discovery could lead to a new generation of non-toxic contraceptives that would not require women to take hormones.

Big black hole ... **UC Berkeley** scientists and colleagues have uncovered a supermassive black hole at the core of a svelte, spiral galaxy. Supermassive black holes typically range from millions to billions of times the mass of the sun, dwarfing the more common stellar black holes that are created by the runaway gravitational collapse of the cores of massive stars. Their finding questions a recently devised rule of thumb in which only galaxies with bulging cores have such black holes.

Materials synthesized ... *UC Riverside* scientists have synthesized a family of semiconducting porous materials that have an unprecedented and diverse chemical composition. The new materials show several different properties such as photoluminescence, ion exchange and gas sorption. They also have a large surface area and uniform pore sizes. The researchers report the synthetic approach has the potential to generate new materials with even larger pore sizes.

Cosmic ray detector ... Fragments of cosmic rays could someday lead to the detection of smuggled nuclear materials, according to researchers at *Los Alamos National Laboratory*. They report that dense materials such as uranium can be detected and imaged by tracking the paths of muons as they pass through the target materials.

ALS cause? ... *UC Irvine* researchers may have taken a significant step toward finding a cause of amyotrophic lateral sclerosis (ALS), also known as Lou Gehrig's disease. They found that an important neurotransmitter induces the production of molecules called "free radicals" in nerve cells affected by ALS. Their findings may offer the first detailed look at how the devastating disease starts and could lead scientists to a way to treat it.

Ultra small ... Researchers at in the *California NanoSystems Institute* at *UC Santa Barbara* and *UCLA* have invented a new technique for producing ultra high-density nanowire lattices and circuits. The method for producing the ultra-tiny structures, for which a patent is pending, is akin to intaglio printmaking processes where printing is done from ink below the surface of the plate. The processes emboss paper into the plate's incised lines.

Silicon to plastic ... Researchers at *UC San Diego* have discovered how to transfer the optical properties of silicon crystal sensors to plastic. The team earlier had developed sensors from dust-sized chips of "porous" silicon capable of detecting biological or chemical agents that might be present in a terrorist attack. It also developed a new kind of nerve gas detector based on a porous silicon chip optical sensor that changes color when it reacts to sarin and other nerve agents. The researchers' latest achievement that could lead to the development of flexible, implantable devices capable of monitoring the delivery of drugs within the body, the strains on a weak joint or even the healing of a suture.

Evolving placentas ... *UC Riverside* biologists *David Reznick* and *Mark Springer* have developed a model system for studying the evolution of complex organs. They focus on the placenta (the organ that provides nutrients for the fetus and eliminates its waste products) in the fish genus, arguing that placentas serve as a good stand-in for complex organs whose histories have so far eluded evolutionary biologists.

Planet and Environment

Quick global warming ... Researchers at *Lawrence Livermore National Laboratory* and collaborating institutions have determined that without large-scale development and deployment of carbon dioxide-emission-free energy technologies, the Earth could warm up to 10 degrees Fahrenheit during this century. Furthermore, they say, to stabilize climate, more than three-quarters of our energy in the next 100 years may need to come from sources that do not emit carbon dioxide to the atmosphere.

Continental roots ... The roots of the continents go down between 200 and 250 kilometers (125-160 miles), forming a distinct boundary with the underlying mantle like that seen under the oceans, according to a team of seismologists at *UC Berkeley*. Their interpretation of seismic data resolves a debate within the geophysical community about the depth of the boundary between the rigid lithosphere that floats on the Earth's surface and the hot convecting mantle that underlies it.

Inevitable eruption ... It might be 500,000 years or five years, but the Central Valley of Costa Rica will experience major volcanic activity again, *UC Santa Barbara* researcher *Phillip Gans* reports. He says another pyroclastic flow like the last big one in Costa Rica will dwarf the Mount St. Helens eruption. Pyroclastic flows are high-speed avalanches of hot ash, rock fragments and gas that roar down the sides of volcanoes during explosive eruptions or when the steep edge of a dome breaks apart and collapses.

Weeds and roads ... *UC Davis* studies show that improved roads in wilderness areas spread more invasive weeds than primitive roads, while roadless areas act as refuges for native species against invasions. The researchers say roads promote invasion because vehicles can transport non-native seeds into uninfested areas and disturbed roadsides give weed seeds a place to grow.

Coots can count ... Coots, the Rodney Dangerfields of the bird world, might start to get some respect as a result of a new study by *UC Santa Cruz's Bruce Lyon* showing that these common marsh birds are able to recognize and count their own eggs, even in the presence of eggs laid by other birds. The counting ability of female coots is part of a defense mechanism to thwart other coots who lay eggs in their neighbors' nests, Lyon says

Focused earthquake forces ... Thanks to recent advances in parallel computing, researchers at *UC Santa Barbara* have discovered a peculiar aspect of how seismic waves are generated during an earthquake. They modeled earthquakes using computer simulations of rapidly expanding three-dimensional ruptures along faults and found that sections of the fault with increased material strength (called barriers) focus the earthquake's energy to an unexpected degree. This result comes as a surprise, since hard-to-break barriers were previously considered obstacles to the growing rupture.

Insights on Society

Gratitude and happiness ... A ground-breaking series of experiments at **UC Davis** suggests that counting your blessings makes you happier.^oThe research found that rather than objective life circumstances, individual happiness is a function of outlook and perception. And that when people consciously practice grateful living, their happiness will go up and their ability to withstand negative events will improve, as does their immunity to anger, envy, resentment and depression.

Coping teens ... Teenagers whose parents encouraged them to cope with the events of Sept. 11 by sharing their emotions reported lower levels of posttraumatic stress symptoms over time, **UC Irvine** researchers report. By contrast, teenagers who didn't talk to their parents – either because the teens thought doing so wouldn't help or would upset their parents – experienced more stress-related symptoms. In addition, teens who were encouraged by parents to seek support or advice elsewhere also reported higher stress symptoms over time.

Depression treatment ... Older men, African Americans and Latinos with clinical depression reported significantly lower rates of treatment than other participants surveyed in a national study led by **UCLA Neuropsychiatric Institute** researchers. Overall, fewer than one in three depressed older adults studied had received potentially effective treatment for depression in the last three months. The survey is part of the largest study of depression treatment in older adults published to date.

More Time ... Fewer college students today are completing college in four years than was the case a decade ago, **UCLA** researchers report. Among freshmen who entered baccalaureate-granting colleges in fall 1994, only 36.4 percent were able to complete their bachelor's degrees within four years, compared to 39.9 percent a decade earlier and 46.7 percent in the late 1960s.

Shaping human development ... The thought of young children handling knives makes many American parents shudder, yet toddlers in parts of Africa safely use machetes. Striking differences in child-rearing practices reflect the diverse range of what is considered developmentally appropriate for children around the world, depending on their cultural circumstances, says **UC Santa Cruz** researcher *Barbara Rogoff*. Familiar developmental milestones such as the ability to walk and read by certain ages reflect European American middle-class culture, but there is not just one best way, Rogoff says.

Looking to the Future

Testing energy saving ... An agreement has been signed for real-life testing of a system for energy saving based on research performed at **Lawrence Berkeley National Laboratory**. The test involves a 400-room Sacramento hotel. The technology demonstration contract calls for the "relighting" of the entire hotel with a new control system.

Down-to-earth application ... Detection technologies developed to search for black holes and supernovae in space have a new down-to-earth application – helping to fight terrorism. Researchers at **Lawrence Livermore National Laboratory** report methods for detecting astrophysics phenomena at the edge of the universe are being adapted to detect radiation from illicit or smuggled nuclear materials.

Lighting up the brain ... A team of researchers led by **UC San Diego's Elizabeth Bates** has developed a brain imaging technique that produces maps that "light up" the relationship between the severity of a behavioral deficit and the voxels (similar to pixels in computer images) in the brain that contribute the most to that deficit. The discovery will give researchers a new tool for pinpointing the specific areas of the brain that are most crucial for normal functioning during critical brain activities.

Sleep differences ... Some people thrive on little sleep, while others drag through the day if they don't get eight hours of shut-eye. For most individuals, sleep deprivation isn't a factor in their daily lives. For others – long-haul truck drivers, pilots and soldiers in the Iraqi war – lack of sleep can cause lapses in performance and possibly jeopardize their safety. Now, **UC San Diego School of Medicine** researchers will seek to unravel the mystery of sleep differences by using functional magnetic resonance imaging brain scans to study healthy adults who function well with very little sleep on a regular basis and individuals who normally sleep more than average.



President, University of California

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