# President's report

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Vol. 14, No. 2, September 2004

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

## IN THE NEWS

**UC in Athens …** UC students and alumni won 35 medals (12 gold, 10 silver and 13 bronze) at the recent Summer Games in the birthplace of the Olympics, Athens, Greece. Swimming phenom and ***UC Berkeley*** alum Natalie Coughlin, 22, led the medal winners with two gold, two silver and one bronze. Lisa Fernandez, 33, a ***UCLA*** alum and the country's best softball player, piloted the U.S. softball team – which included four other UCLA alums – to its third consecutive Olympic gold medal. Swimmer and ***UC Santa Barbara*** alum Jason Lezak, 28, brought home gold and bronze medals.

**Medical advocacy award …** *Michael V. Drake*, M.D., ***UC*** vice president-health affairs, has received one of the highest honors bestowed by the Association of American Medical Colleges, the Herbert W. Nickens, M.D., Award, in recognition of his tireless efforts over the past 35 years to enhance diversity in the medical profession. Drake was cited for his career-long efforts to recruit minority medical students, as a medical student at ***UC San Francisco*** and later as UCSF faculty, and to improve health care for minority and disadvantaged communities. Drake retains his appointment at UCSF as a professor of ophthalmology.

**Marine ecology …** Two ***UC Santa Cruz*** graduate students have won a Tegner grant to investigate changes in the diets of killer whales during the past century. *Seth Newsome* and *Daniel Monson* will investigate a controversial hypothesis regarding the ongoing collapse of marine mammal populations in the Bering Sea and Gulf of Alaska. Over the past few decades, populations of pinnipeds (seals and sea lions) and sea otters in this region have declined dramatically, but the cause of the declines remains unclear. The "killer whale predation hypothesis" holds that the depletion of whale populations by industrial whaling forced killer whales to change their diets, relying less on baleen whales as a food source and eating more pinnipeds and sea otters instead. The Tegner grants honor the memory of Mia J. Tegner, a marine biologist at ***UC San Diego's Scripps Institution of Oceanography***.

**Protecting our food supply …** ***UC Davis*** received a $4.7 million grant from the federal Department of Homeland Security to help protect the food supply of California and the nation against acts of terrorism. The two-year grant to the Western Institute for Food Safety and Security will support the development and delivery of training programs to help personnel in the food-production system prevent, recognize and address potential terrorist acts. The UC Davis grant was the largest awarded nationwide to 14 out of 217 applicants.

## HEALTH AND NUTRITION

**Modulating sleep …** ***UC Irvine*** pharmacology researchers have found that the brain protein neuropeptide S, which was only discovered in 2002, is an important modulator of sleep and alertness. Neuropeptide S increases alertness, suppresses sleep and even controls stress responses. This discovery has potential as a target for new drugs to treat sleep as well as stress related anxiety disorders.

**Tracking the flu …** A team of international experts in computation, virology and medicine working at the ***Los Alamos National Laboratory*** have developed a computer modeling method for mapping the evolution of the influenza virus. The system can visualize the evolution of viruses, monitor antigenic differences among vaccine and circulating viral strains, and help quantify the effects of vaccination. Understanding mutations and quantifying the effects of vaccination will help scientists predict the relative infection success of emerging virus strains.

**Baby's health …** A new study led by researchers at ***UC Berkeley*** suggests that women who eat more vegetables, fruit and foods containing protein before pregnancy may have a lower risk of having a child who develops leukemia, the most common childhood cancer in the U.S. The study compared 138 women – by sex, age, race, and county of residence at birth – who each had a child diagnosed with acute lyphoblastic leukemia with a control group of 138 women whose children did not have cancer. A growing number of scientists believe that genetic changes linked to cancer later in life begin in the womb.

**Brain aging …** A new MRI analysis technique at ***UCLA*** examining myelin sheaths that insulate the brain's wiring finds that as people age, neural connections that develop first are the last to degenerate. These findings support the model of Alzheimer's as a disease driven by myelin breakdown. The MRI analysis technique offers new opportunities for studying the impact of lifestyle on brain aging and for developing medications that could slow aging or prevent Alzheimer's.

**Breast cancer …** A team of scientists at ***Lawrence Berkeley National Laboratory*** and ***UC San Francisco*** report that the telomere crisis has an important role in breast cancer development. Scientists also report that the transition from hyperplasia to carcinoma in situ is where the telomere crisis occurs. These findings suggest that people at higher risk of developing cancer can be identified in advance by measuring telomerase activity, genome instability and other signals. Possible ways of stopping cancer by derailing transition through the telomere crisis are already being tested.

**Alzheimer's …** ***UC Irvine*** neurobiologists found that using specific antibodies to clear amyloid plaques from the brain reversed and even halted the progression of Alzheimer's disease. This discovery is the first strong findings to support the "amyloid cascade hypothesis," which suggests that the accumulation of amyloid plaques triggers the onset of Alzheimer's. UC Irvine researchers also found that the earlier the treatment begins, the better the chance of success.

**Inflammation and cancer …** Researchers at ***UC San Diego*** provided the first evidence of the molecular link between inflammation and cancer. When a pro-inflammatory gene, IKK beta, was deleted in mice, cancer incidence and tumor growth decreased by 80 percent. Although the relationship between cancer and inflammation due to chronic infection has been suspected for many years, UCSD researchers were the first to prove it with this discovery. It suggests that specific pharmacological inhibition of IKK beta may be very effective in preventing colitis associated cancer.

## DEVELOPMENTS AND DISCOVERIES

**Mercury mission …** A team of scientists and engineers from ***Lawrence Livermore National Laboratory***, in collaboration with ***UC Berkeley's Space Science Laboratory*** and other colleagues, designed and built a high resolution gamma-ray detector that enables NASA's Messenger, on a five-billion-mile journey to Mercury, to measure the elemental composition of the planet's crust. Messenger is expected to arrive in orbit around Mercury in 2011. Livermore's role was critical in ensuring that the spacecraft's gamma-ray spectrometer could withstand the heat of the galaxy's closest planet to the sun.

**Muscle activity …** Scientists at ***UC San Francisco*** discovered that during periods of intense muscle activity, a transporter is needed to clear acetylcholine from the nerve-muscle synapse. Muscles that remain excited too long may degenerate if this protein fails. The discovery of this new transporter will ultimately lead to an effective treatment for some diseases based on altering acetylcholine levels, including common forms of muscular dystrophy.

**Controlling invasive species …** The wind transports pollen far less effectively than scientists assumed, according to a new study of invasive Atlantic cordgrass by researchers at ***UC Davis***. This discovery will help control a cordgrass, *Spartina alterniflora*, that is invading wetlands on the Pacific coast, and could help save rare plants as well. Working in the salt marsh of Willapa Bay, Wash., the researchers found that late in a Spartina invasion, when plants form a solid meadow, wind pollination led to high seed production. But early, when plants are spread farther apart, wind pollination worked poorly.

**Illuminated genes …** A technique developed by ***UC San Diego*** biologists, which uses bright fluorescent dyes to reveal the activity of genes in individual cells of an organism, promises to be a boon to developmental biologists. For the first time, scientists can simultaneously visualize the activity of multiple genes in the same cell, providing new insight into how cancerous tumors begin and grow by revealing what genes are turned on and when. With this information and further study, cancer biologists may be able to predict how aggressive a tumor will be from its early patterns of gene expression.

**Humans and primates …** ***UC Riverside*** biochemists have come up with one explanation for why humans and primates are so closely related genetically, but so clearly different biologically and intellectually. According to the researchers, one important factor resides in something called Alu DNA repeats, which are volatile, and prone to sudden mutations, or genomic rearrangements. The biochemists identified over 2,200 new human specific Alu DNA repeats that are absent from the chimpanzee and most likely other primates. This explosive expansion of the DNA repeats and the resulting restructuring of our genetic code may be the clue to what makes us human, say the scientists. Determining the genetic differences between humans and primates is important for several reasons, they say, including advancing knowledge about how life developed and evolved on earth. Other benefits include making it easier to identify human predisposition to genetic disease, by comparing humans with other primate species.

**Prions protein? …** Scientists at ***UC San Francisco*** are reporting what they say is compelling evidence that the infectious agents known as prions are composed solely of protein. Scientists discovered that a small change in the condition of a cell can cause the development of a prion, explaining the spontaneous and sporadic form of Creutzfeldt-Jakob disease. Their findings promise to create new tools for early diagnosis of prion-causing bovine spongiform encephalopathy, or "mad cow" disease in cattle, and Creutzfeldt-Jakob disease in people. Their work may also help advance investigations of more common neurodegenerative diseases, such as Alzheimer's and Parkinson's disease and amyotrophic lateral sclerosis.

**Gene slicing …** A new gene slicing technique, called transcriptional gene silencing, provides a new research tool to study gene function and could potentially become a method for therapeutic modification of the expression of disease-producing genes. For the first time, scientists at ***UC San Diego*** demonstrated the ability to shut down a gene literally before it is born in the nucleus of a cell. Further study will tell if this new technique has the potential to modify gene expression in disease.

## THE CUTTING EDGE

**Powerful tool …** One of the strongest-ever magnets built for resonance imaging and spectroscopy has arrived in ***UC San Francisco's*** new ***Mission Bay*** campus. At 36 tons and equipped with 250 miles of superconducting wire, it will allow experts to examine parts of the body with greater sensitivity – and in a noninvasive way – than with conventional MR machines. Examining the body more closely with 7 Telsa makes the difference between finding a tumor in the brain, and detecting the telltale chemical signals associated with different cancers at different regions of a tumor. Experts will also use the machine to analyze metabolic characteristics of living tissue to improve diagnosis and treatment, as part of the ***California Institute for Quantitative Biomedical Research***, a collaboration between UC San Francisco, ***UC Berkeley*** and ***UC Santa Cruz.***

**Quantum computing …** A team of ***UCLA*** and ***Los Alamos National Laboratory*** scientists have succeeded in flipping and detecting a single electron spin in an ordinary transistor. This has implications that ordinary transistors used in cell phones or desktop PCs can be adopted for quantum computing. Professors *Eli Yablonovitch* and *Hong Wen Jian* and graduate student *Ming Xiao* used microwave radio frequency to control the electron.

## PLANET AND THE ENVIRONMENT

**Space discovery …** Astronomers using telescopes in Hawaii, California and Texas have found the first Neptune-size planets outside our solar system, far smaller than any planets previously detected. One of them is perhaps only 14 times the mass of Earth, which is small enough to have a solid surface and possibly temperatures conducive to life. *Geoff Marcy* of ***UC Berkeley*** and colleagues discovered the planets by tracking the star's wobble caused by the planet's gravitational tug on the star as it orbits, which produces a Doppler shift in the light emitted by the star.

**Plant mystery explained …** A biological process in plants thought to be useless and even wasteful actually has significant benefits and should not be engineered out, particularly in the face of looming climate change, says a team of ***UC Davis*** researchers. The process, photorespiration, is necessary for healthy plant growth and if impaired could inhibit plant growth, particularly if atmospheric carbon dioxide continues to rise globally. Some scientists, thinking that photorespiration was an evolutionary holdover, have set about to genetically engineer crop plants to favor photosynthesis and minimize photorespiration.

**Sea and sky …** An international team of researchers, including ***UCLA's*** *Nicholas Gruber*, have determined that Earth's oceans absorbed approximately 118 billion metric tons of carbon dioxide, about half of the total man-made emissions, between 1800 and 1994. Half of the carbon dioxide taken up over the last 200 years can be found in the upper 10 percent of the ocean, meaning the diversity of many species of marine organisms, such as corals and free-swimming algae at these high carbon dioxide levels, will be altered by the end of this century. The ocean is absorbing what would otherwise be in the atmosphere.

## INSIGHTS ON SOCIETY

**Taxpayers' burden …** Wal-Mart's employee policies shift $86 million of labor costs annually to California taxpayers, according to ***UC Berkeley's*** *Arindrajit Dube* and *Ken Jacobs.* The employees' low wages, costs for health plans, plan quality and eligibility issues for coverage offered by Wal-Mart force their employees to rely on the state for health-related services, assistance in subsidized school lunches, food stamps and subsidized housing. Dube and Jacobs also determined that if other big California retailers apply the Wal-Mart model to their employees, California taxpayer support would total $1.46 billion a year.

**Unequal school funding …** California unfairly channels much of nearly $13 billion in education aid – often to wealthy school districts – through a disparate array of 124 programs with unknown benefits for students, according to a study by *Thomas Timar*, an associate professor in the ***School of Education*** at ***UC Davis.*** The array of so-called categorical aid programs, originally aimed at closing achievement gaps in the 1970s, has grown dramatically and now comprises almost a third of all state spending on public schools. The new study reveals for the first time that billions of dollars now go to higher-wealth school districts, exacerbating inequities in school funding.

## LOOKING TO THE FUTURE

**Impact of transgenes …** The spread of transgenes from engineered crops to non-engineered crops and natural populations is under investigation with a $1.5 million National Science Foundation grant to ***UC Riverside.*** Genetics professor *Norman Ellstrand* will direct the project, which will assemble faculty and graduate students from botany and plant sciences, economics, sociology and statistics into three multidisciplinary teams. One group will focus on the natural process that disperse genes, such as wind, timing of plant flowering or proximity to compatible wild relatives. A second team will focus on human elements, such as farmer management and transportation of seeds. The third team will use state-of-the art mathematical and computational models to estimate timing and patters of transgenes across space, national borders and their ecological consequences.

**Nanowire breakthrough …** For the first time, ever, researchers at ***Lawrence Berkeley National Laboratory*** and ***UC Berkeley*** have been able to control the direction in which a gallium nitride nanowire grows, which is critical to determining the wire's electrical and thermal conductivity and other important properties. *Peidong Yang* and his group of researchers used substrates of lithium aluminum oxide and magnesium oxide that caused nanowires to grow perpendicular to the substrate, but aligned in a direction unique to each substrate. Yang believes that within a few months, he and his group will be able to produce a light-emission diode, a transistor or a hybrid, nanowire-thin film laser.

**Changing the colonias …** The colonias in the Coachella Valley (Riverside County) are getting help to create programs that will boost employment, analyze health dangers and provide access to technology. ***UC Riverside*** will lend its expertise to develop self-help projects that will address conditions for a economically improverished region. For a community of 15,000 where unemployment is 22 percent, the programs will focus on improving living conditions that would also transfer into improved job prospects, such as asking residents to research, document and create educational materials for their community.

## KUDOS

**Major gift …** The ***Donald Bren School of Environmental Science and Management*** at ***UC Santa Barbara*** has received $5 million from Donald Bren, who in 1997 pledged $15 million to the school. Bren's latest gift will help bring some of the world's best researchers and scholars by offering 11 endowments to support nine faculty chairs, a distinguished visiting professor program and fellowships for students pursuing master's degrees. Bren, who has provided substantial support to the University of California, is chairman of The Irvine Co.

**Agents of change …** ***UC Davis*** Chancellor *Larry Vanderhoef* and former UC regent Charles Soderquist were recently were named by the *Sacramento Business Journal* as among the 20 people who have helped change the Sacramento region over the past two decades. Vanderhoef, Chancellor since 1994, has "a passion to make things happen," the paper wrote. "We're eager to see what's next." Although the region and the university lost Soderquist last March, when he died at age 57, "the entrepreneurial spirit he fostered lives on," the *Business Journal* noted.

**Marine microbiology …** The Gordon and Betty Moore Foundation has selected *Jonathan Zehr*, ***UC Santa Cruz*** professor of ocean sciences, to receive more than $4 million over the next five years as a Moore Foundation Investigator in marine science. The award will support Zehr's groundbreaking research on microorganisms that "fertilize" the oceans by converting nitrogen gas into a form that other organisms can use, a process called nitrogen fixation. Zehr's discovery of nitrogen fixation by certain kinds of marine microbes, for example, has implications for everything from the ecology of the open ocean to global warming. Because nitrogen is one of life's essential nutrients, nitrogen fixation helps determine how productive ocean waters can be.

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