

President's Report

A Report on
Discoveries and
Achievements
at the
University of
California

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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

Twins Separated ... Doctors at **UCLA's Mattel Children's Hospital** have performed more than 27 hours of surgery to separate a pair of conjoined twins. The girls were joined at the tops of their heads, which occurs in only 2 percent of conjoined twins. The surgery required 22 hours; a second operation lasting nearly five hours was necessary on one of the twins to remove a build-up of blood in her brain. More than 40 medical workers were involved.

"Hot" Campus ... **UC Santa Barbara** has been named one of the nation's 12 "hottest" colleges in the 2003 edition of the Kaplan/Newsweek "How to Get Into College" guide. It noted three UCSB professors have won Nobel Prizes in the last four years and that a quarter of the undergraduates participate in research, teaming up with faculty and graduate students.

Cope Award ... **Larry Overman** of **UC Irvine** has won the Arthur C. Cope Award from the American Chemical Society. The award recognizes outstanding achievement in organic chemistry and includes a certificate and gold medallion, \$25,000 in cash and an unrestricted grant of \$150,000 in support of research efforts.

Bomb blast protection ... Engineers at **UC San Diego's Jacobs School of Engineering** are investigating ways to retrofit U.S. embassies and critical structures worldwide against bomb blasts by using composite overlays originally developed at UC San Diego to protect buildings from earthquakes. The composite overlay material is about as thin as a cotton shirt and is made of carbon threads that are precisely woven to increase the strength and flexibility of a structure.

Dean Elected ... **Steve Kang**, dean of the **UC Santa Cruz Baskin School of Engineering**, has been elected president of the Silicon Valley Engineering Council. Founded in 1989 as a nonprofit educational organization, the council brings together several local engineering and technical societies, coordinating activities and assisting communications to better serve its members and the community.

Health and Nutrition

"B" Benefits ... A team of researchers led by **UC San Diego** cardiologist **Guido Schnyder** has found that a six-month regimen of folic acid, vitamin B-12 and vitamin B-6 had lasting benefits. The regimen prevented patients who had undergone coronary angioplasty procedures from redeveloping blocked arteries for a full year, including the six-month period after the patients stopped taking the vitamins.

Stopping AIDS? ... **UCLA AIDS Institute** researchers predict that widespread use of antiretroviral drugs can eventually stop the HIV epidemic in its tracks – even in African nations where a high percentage of people are infected. Although the drugs can't cure people, they do decrease the community level of HIV infection, the researchers say, and as fewer people become infected, the epidemic eventually runs out of steam.

Tartness and Bleeding ... The common additive that gives "tartness" to orange juice, lemon juice and sodas also can dramatically boost the production of a protein critical for treating victims of hemophilia and other bleeding disorders, a **UC Irvine** study has found. The findings indicate that citric acid, the juice additive, may help alleviate recurring shortages of a protein called Factor VIII, which is important for the normal clotting of blood and is missing in most victims of hemophilia, a genetic bleeding disorder.

Therapeutic Gene ... Researchers at the **UC San Diego School of Medicine** have developed a therapeutic gene and molecular delivery system that provides successful long-term gene therapy that halts chronic heart failure in experimental animals. There is no cure for chronic heart failure other than transplantation or mechanical pump devices including new types of artificial hearts.

Too Many Rejections ... Nearly half of the donated lungs currently rejected for transplantation may actually be suitable, according to a preliminary study by scientists at **UC San Francisco** and colleagues. The study concluded that existing criteria for rejection may be too rigid. Currently, more than 85 percent of lungs are considered unusable for transplantation.



HIV Vaccine ... Researchers at the *Los Alamos National Laboratory* and colleagues are using their extensive genetic understanding of the HIV-1 virus – the most common form of the virus that causes AIDS in humans – to consider best strategies in the pursuit of creating a vaccine to fight the virus. They suggest using a consensus or genetic ancestor of the HIV-1 virus when developing vaccines, rather than basing vaccines on geographically specific strains of the virus.

Developments and Discoveries

Heavier Isn't Safer ... Folks who believe that driving big is driving safe or that lightweight, fuel-efficient vehicles are inherently more dangerous than their heavyweight counterparts need to think again, according to a report from *Lawrence Berkeley National Laboratory*. The risk analysis study shows that, contrary to conventional wisdom, vehicle quality is a much more important safety factor than weight for the drivers of vehicles involved in a crash.

New Spinal Repair ... *UC San Francisco* scientists are studying the long-term effects of a new spine repair surgery for osteoporosis sufferers. In the procedure, a small incision is made on each side of the osteoporosis-affected vertebra. Through a canula, surgeons insert a small instrument with an inflatable balloon at the tip. Once it is placed inside the vertebra, the balloon is filled with air to increase the space inside the collapsed bone. After the fracture is reduced and normal anatomy restored, the team injects a cement-like substance that helps the vertebra stay reformed.

Cancer Advance ... Researchers at *UCLA's Jonsson Cancer Center* and in the *department of urology* have demonstrated for the first time that they can locate prostate cancer metastases in laboratory models. They engineered a virus that can identify prostate cancer cells based on the prostate-specific antigen (PSA) protein expressed only in prostate cells. The discovery could lead to safer and more effective treatments for advanced prostate cancer.

Stardust Secrets ... *Lawrence Livermore National Laboratory* astrophysicist *John Bradley* and colleagues have found that some nanodiamonds, the most famous and exotic form of stardust, may instead have formed within the inner solar system. The findings argue with the widely held belief that nanodiamonds recovered from meteorites from the asteroid belt have been the most abundant type of presolar stardust grain.

Blue Jade Found ... A team that includes *UC Riverside* archaeologist *Karl Taube* has discovered a Rhode Island-sized area in eastern Guatemala that contains huge veins of blue jade, used extensively by the Olmecs in pre-Columbian times to sculpt jewelry, masks and figurines. Until recently, scientists have been baffled about the source of the jade. Hurricane Mitch, which swept through the area in 1998, may have uncovered the site, which includes boulders the size of buses.

Helpful Parasite ... Parasites typically pester – and sometimes kill – their host, but scientists at *UC Berkeley* have found one that helps: it makes a sterile fruit fly fertile again. It is one of a group of bacteria called *Wolbachia* that has been found to live inside some insects, disrupting their sex lives to increase the number of female offspring and suppress males. The researchers have discovered that the bacterium *Wolbachia pipientis* allows a sterile female fruit fly to lay eggs, circumventing a genetic mutation in a gene that is the key to determining the sex of offspring.

Bleaching Enzyme ... Researchers at the *UC Davis School of Medicine and Medical Center* and *UCLA* report that an enzyme that stimulates the production of chlorine bleach in cells to kill bacteria also turns off a signal that regulates blood vessel dilation during inflammation. The research may reveal a new molecular target for the development of drugs to treat a variety of inflammatory vascular diseases.

Chronic Beryllium Disease ... *Los Alamos National Laboratory* scientists are seeking to better understand the pathology of Chronic Beryllium Disease, a long-duration, allergic-type lung response that can make the sufferer abnormally weak and is sometimes fatal. The scientists are studying the fundamental properties of metal interaction with carboxylate molecules, carbon/oxygen structures that are common in the body, to better understand how metals, specifically beryllium in water solution, might attack human cells.

Molecular Rheostat ... When little oxygen is available, plants use a rheostat-like mechanism at the cellular level to balance the production of the enzyme "ADH" with the consumption of stored carbohydrates, *UC Riverside* researchers have found. They report that the rheostat-like mechanism needs to be turned up and then down to initiate the proper physiological response to a stress of low oxygen.

The Cutting Edge

Botulism Treatment ... An eight-year research effort by *UC San Francisco* researchers and colleagues has produced the first drug that can be mass-produced to prevent or treat botulism, the paralyzing disease caused by a nerve toxin that is considered one of the greatest bioterrorism threats. Botulinum toxin, naturally produced by a soil bacterium, is the most poisonous substance known. A gram of it, if evenly dispersed and inhaled, could kill a million people, according to a study.

Antiterrorism Testing ... Scientists at *Lawrence Livermore National Laboratory* are testing commercial instruments and developing new ways to detect nuclear materials inside cargo containers. The work is designed to help prevent the smuggling of nuclear materials inside the millions of cargo containers that enter the United States annually. Since Lawrence Livermore researchers have experience in designing and testing nuclear weapons, they have expertise in assessing ways of detecting improvised nuclear devices.

Bugs Inside Bugs ... Like tiny Russian dolls, the mealybugs that infest houseplants carry bacteria inside their cells that are themselves infected with another type of bacteria. A study by **UC Davis** researchers shows that instead of spreading from bug to bug, the second set of bacteria infected the first several times in the past and are now being passed along and evolving with them. The knowledge could be useful for working out how the insect species are related to each other, aiding pest control efforts.

Editing DNA ... A surprising amount of the DNA sequence in the genes of humans and other higher organisms ends up on the cutting-room floor, so to speak, spliced out by the cellular machinery that turns genetic code into functional proteins. Differences in the editing of genetic information may, in fact, be a significant source of genetic variability. Now, **UC Santa Cruz** researchers report they are able to analyze the editing of all the genes in a cell simultaneously, enabling them to study how mutations or environmental perturbations affect the vital editing process.

"Smart Dust" ... Researchers at **UC San Diego** report they have developed dust-sized chips of silicon that allow them to rapidly and remotely detect a variety of biological and chemical agents, including substances that a terrorist might dissolve in drinking water or spray into the atmosphere. The technique would allow something as small as a piece of dust with some intelligence built into it to be inconspicuously stuck to paint on a wall or the side of a truck or dispersed into a cloud of gas to detect toxic chemicals or biological materials.

Planet and Environment

Millennium Run ... Scientists have just completed a 1,000-year run of a powerful climate system model on a supercomputer at the **Lawrence Berkeley National Laboratory's National Energy Research Scientific Computing Center**. The simulation will enable scientists to study the variability of the Earth's climate system on decade to century time scales.

Accelerating Extinctions ... Extinction rates of native California plants are occurring at a faster rate than expected and the problem is connected directly to human development, **UC Santa Barbara** researchers report. The researchers studied native plant species in 93 regions of the state and say when there is contiguous human development of the land, the likelihood of losing whole species is greater.

No "Snowball Earth" ... The Snowball Earth hypothesis suggests that the oceans were covered with a sheet of ice on several occasions 650 million years ago. **UC Riverside's Martin Kennedy** and colleagues challenge the hypothesis of a completely ice-covered ocean by arguing that life in the oceans during the snowball event continued as usual. Their data suggest that a healthy and productive marine ecosystem prevailed during the glaciation, pointing to business-as-usual as far as marine organisms are concerned.

Climate Simulations ... Scientists at **Lawrence Livermore National Laboratory** have performed the first global climate simulations with spatial resolutions of roughly 30 miles. Typical global climate simulations use spatial resolutions of about 186 miles, which limits their ability to simulate climate and climate change on a regional scale. New high-resolution capability will be used to assess climate change and its societal impacts.

Injection Depth Critical ... Researchers from **Lawrence Livermore National Laboratory** report that the depth of an injection of carbon dioxide into the deep ocean is a good predictor of how effective that location is at sequestering carbon away from the atmosphere. Direct injection of CO₂ into the deep ocean has been proposed as a way to slow the accumulation of carbon dioxide in the atmosphere, one of the causes of global warming. The scientists' models showed that injection at 3,000 meters is effective for several centuries; injections at shallower depths are less effective.

Acid Rain ... **UC Riverside** scientists report acid rain may pose a graver threat to forests than previously estimated, by leaching essential metal nutrients such as potassium, calcium and magnesium from topsoil. Hydrogen ions from the acid in acid rain replace nutrient elements in the soil. Researchers found that for every unit of acid added to the soil, an equivalent amount of nutrients are removed, resulting in more nutrients leaching from the soil than arrive from weathering of rocks or precipitation.

Insights on Society

Go For It ... After reviewing nearly 20,000 first quarter plays in 732 NFL regular season games in 1998, 1999 and 2000, a **UC Berkeley** researcher challenges the rarely questioned consensus that it's usually far better to kick on a fourth down than to go for a first down or touchdown. In a new study, **David Romer** says the statistical analysis implies that teams should be more aggressive, but in practice teams almost always kick on fourth down early in the game.

Anxious Teens ... A **UC Irvine** study has found unexpectedly high rates of anxiety among teenagers, and their anxiety may make them more prone to overeating and smoking. The study, one of the first to involve teenagers' use of hand-held computer diaries, found that teens with high rates of anxiety also had more frequent episodes of anger, sadness and fatigue as well as altered behavior patterns.

Higher Suicide Attempts ... **UC San Francisco** researchers have found that 12 percent of urban gay and bisexual men have attempted suicide in their lifetime, a rate three times higher than the overall rate for U.S. adult males. Almost half the men in the study reported multiple attempts, and the attempts are happening at a younger age.

U.S. Model Spreading ... Industrialized nations are adopting the United States' increasingly market-driven approach to providing welfare benefits, **UC Berkeley** researcher *Neil Gilbert* says. Even Scandinavian countries, famous for their social programs, are switching to what Gilbert calls "the enabling state," or public support for private responsibility. For example, Swedish citizens are taking control of investing part of their social security contributions, and the country has adopted a school voucher program.

Happy Docs ... Physicians who specialize in the treatment of children, newborns, the elderly and skin disorders and who practice in the New England and West Central regions of the country are more satisfied with their careers than their colleagues in other specialties and regions, say researchers at the **UC Davis School of Medicine and Medical Center**. The finding, based on a study of more than 12,000 physicians representing 33 medical disciplines, found an overwhelming majority of physicians, more than 70 percent, were "satisfied" or "very satisfied" with their careers.

Detecting Cheaters ... Humans are hardwired to detect cheaters, say researchers at **UC Santa Barbara**. They have produced neurological and anthropological evidence in support of their theory that detecting social cheaters requires specialized neural circuitry. Because the ability to understand and navigate social exchanges makes trade and the reciprocation of favors possible, this evolved competence provides a cognitive foundation for human economic activity and other forms of cooperation, they conclude.

E-Commerce ... Business executives can, and probably should, proceed carefully with the development of e-commerce in their firms, researchers at **UC Irvine** and colleagues report. The findings from an international e-commerce study by the **Center for Research on Information Technology and Organizations** show that while the Internet has grown dramatically, it has not resulted in large-scale business use of e-commerce.

Looking to the Future

Gecko "Glue" ... **UC Berkeley** scientists have discovered the secret behind geckos' ability to walk up walls and dangle from the ceiling, and to prove it, have synthesized the very tips of the toe hairs geckos rely on to stick. The minute artificial hair tips show that it is possible to mimic nature and build a nano-scale self-cleaning dry adhesive that would have many uses, such as moving semiconductors around in a vacuum chamber and could stick to surfaces underwater or in space.

Saving Energetically ... An analysis from **Lawrence Berkeley National Laboratory** says energy-efficient purchasing in local, state and federal governments could save taxpayers \$1 billion annually through reductions in energy bills. Energy-efficient purchasing at all levels of government could also reduce the amount of carbon released into the atmosphere by 2.9 million metric tons each year.

Damaging Marker ... **UC Davis** physicians have discovered that a new predictor of heart disease risk, c-reactive protein, is not just a marker for cholesterol, but actually damages the blood vessel wall by blocking a critical "protector" protein and by promoting plaque formation. The work is important because it provides a new target for drug development efforts, explains why cholesterol screening is not enough to accurately assess heart disease risk, and underscores the need to use c-reactive protein screening to more accurately assess at-risk populations.

Learning from Spiders ... Researchers at **UCLA** report the secret to creating stronger, better materials may be solved by studying the common spider. They say engineers can improve materials by emulating some of the spider's web-spinning abilities, enhancing the functionality of products ranging from tennis rackets to stealth bombers. Spider silk has a rare combination of strength and toughness, meaning that not only can it hold relatively heavy objects, it can stretch great lengths without snapping.



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