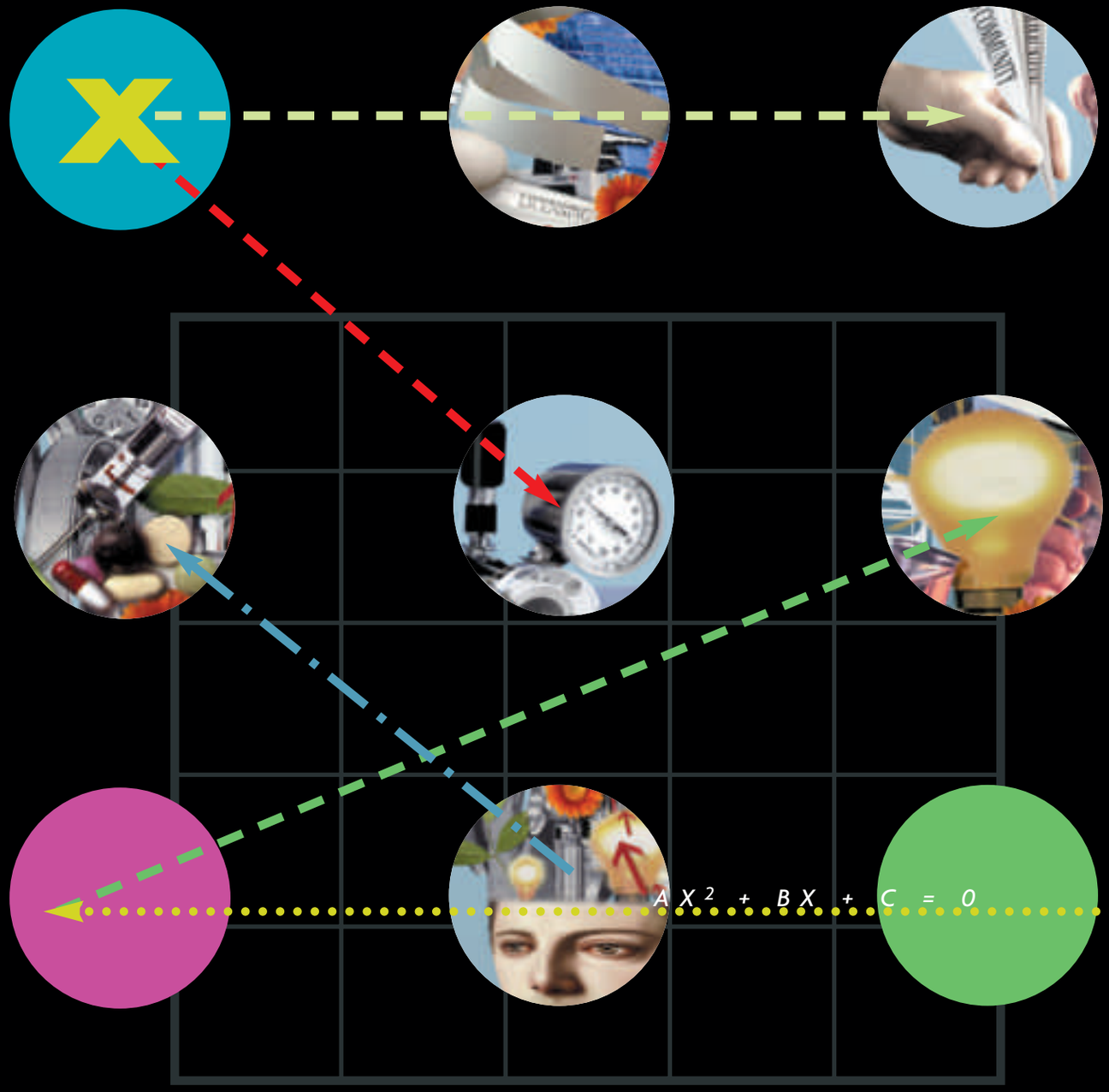
UCLA INVENTS

OFFICE of INTELLECTUAL PROPERTY



Driving innovation to market

UCLA OIP

OFFICE OF INTELLECTUAL PROPERTY

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Letter from the Executive Vice Chancellor

Los Angeles has an openness to invention, creative thinking and non-traditional collaboration. As a research powerhouse, UCLA is uniquely situated to make the most of southern California's innovative drive. New organizational structures will continue to promote and facilitate relationships between researchers and the business and investment communities.

Here at UCLA, we believe that protection and management of intellectual property is critical to the mission of a modern research university. As a result, I have restructured the Office of Intellectual Property (OIP) under a vice provost for intellectual property and industry relations. The revitalized organization provides even stronger support to UCLA's research, education and public service mission by:

- *educating the academic community about appropriate methods for protecting intellectual property;*
- *accelerating the development of UCLA discoveries for the public good;*
- *promoting economic growth in California;*
- *facilitating collaborations with industry for next-generation scientific breakthroughs.*

This shift to academic leadership of OIP under the vice provost — reinforcing the strong shared governance that is a signature of UCLA — has been embraced by the campus community. Faculty and OIP leadership and staff have forged a collegial relationship, working together in pursuit of the most effective strategies for commercializing discoveries to advance faculty research and teaching goals. Students seek out the office for internships in management and commercialization of technology and for novel experiences in working with angel investors. These initial accomplishments demonstrate that we are building a structure and culture that can make UCLA a world-class model for academic intellectual property management.

Daniel M. Neuman
Executive Vice Chancellor

Letter from the Vice Provost

DRIVING INNOVATION TO MARKET

It's no secret: Business is fueled by advances in technology. New ideas and innovations are essential to continued economic growth – and they are the order of the day at UCLA.

Still, challenges persist. For the fourth year in a row, research funding to universities from U.S. companies has declined, and federal funding for the National Institutes of Health remains flat. Meanwhile, President Bush in 2006 launched the American Competitive Initiative, partly over concerns that too few students are choosing to study science and technology. What do these alarm bells mean for American research universities? More precisely, what role should a premier, research-intensive university like UCLA take in addressing such concerns?

We at the UCLA Office of Intellectual Property (OIP) work to bridge the funding gap by building rewarding partnerships between researchers, investors and industry. As university technology transfer offices go, ours is long-standing and increasingly successful. The campus' patent portfolio, managed jointly by OIP and the systemwide technology transfer office since 1990, now includes more than 1,100 inventions and 2,569 faculty inventors. A better indicator of the office's success, however, is our growing role as a conduit between the faculty and the business community, both locally and around the world. OIP is rapidly moving faculty inventions into companies large and small, helping to fuel advances in many fields, including biomedicine and computer modeling.

Last year, we crafted a new mission statement to support UCLA's research, education and public service mandate. Simply stated, OIP's ongoing goal is to provide guidance to faculty and university researchers who wish to safeguard their intellectual property, to build relationships with investors and industry leaders, and to facilitate the development and distribution of faculty innovations for the corporate market.

It is an exciting time. This year, we have added staff specialists in industry contracting, business development and licensing, and have sought advice from outside consultants regarding what OIP can do to further our faculty's ability to create successful alliances and partnerships. On the level of corporate partnership, we foresee a continued strong connection between faculty and business, with the OIP providing "one-stop shopping" – sponsored support for applied research, the sharing of materials, scientific exchanges between faculty and corporate scientists, and licenses to UCLA technology.

The scope and quality of research at UCLA provides innumerable opportunities for collaboration and partnership. Our desire is to create an environment that promotes fruitful communication between the faculty, the technology transfer officer and commercial partners. Preparing future leaders in technology transfer is also part of this corporate partnership; to that end, we have expanded opportunities for students to interact with OIP to learn aspects of technology transfer that they can then take with them to their new employers. This is yet another way we at UCLA are strengthening partnerships with business.

We are ready to work with you, and we hope you'll take the opportunity to contact us. We'd like to get to know you – and you us. It only starts with this first annual report.

Kathryn A. Atchison
Vice Provost, Intellectual Property and Industry Relations

STARTUPS

FOUNDING A NEW COMPANY TO BRING DISCOVERIES TO MARKET

Dr. Alan Fogelman

Sometimes, discovering one groundbreaking treatment just isn't enough. Dr. Alan Fogelman is dedicated not just to finding solutions, but to finding the *best* solutions.

First, Fogelman determined that the protein apoliprotein A-1 (Apo A-1) serves as an anti-inflammatory agent in HDL ("good cholesterol") function, making it a key weapon in the fight against unhealthy cholesterol. However, there was more work to be done.

Fogelman, chair of the department of medicine at UCLA and a researcher specializing in cardiovascular disease, soon recognized that as a potential therapeutic, Apo A-1 had a significant drawback – it required intravenous administration. So Fogelman and his colleague Dr. Mohamad Navab, also a cardiologist at UCLA, together with Dr. G. M. Anantharamaiah at the University of Alabama at Birmingham, began searching for an Apo A-1 mimetic peptide – a molecule that would mimic the protein but could be administered orally to patients. Their work led to D-4F, a drug that dramatically reduced arterial plaque buildup in animal studies and demonstrated significant anti-inflammatory activity. D-4F, which continues to show promise in ongoing studies, soon became a major focus of Fogelman's research at UCLA.

Though promising, D-4F came with some major commercialization challenges. An HDL-centered strategy to fight heart disease would not necessarily be attractive to the pharmaceutical industry, the consensus being that high HDL levels in a patient did not always translate to low risk for heart disease. Fogelman determined that the best way to champion D-4F's development was through a start-up company dedicated to and focused on the drug. In 2002, Fogelman and his friend and patient Jerry Magnin founded Bruin Pharma – named after the UCLA mascot – to spearhead the development of D-4F and significantly increase its availability.

The company's work is based on the premise that not all HDL is equal; a patient may have high levels of HDL and still be susceptible to heart disease, so a scientific assay is necessary to detect the efficacy of the HDL in a patient's blood. Bruin Pharma has been working on validating its assay and getting exposure that would lead to its adoption by the industry as a viable diagnostic test.

Bruin Pharma's efforts to make D-4F a drug candidate attractive to the pharmaceutical industry have paid off. In 2004, Bruin Pharma announced a partnering deal with Novartis, a Switzerland-based company. The partnership put D-4F on the map as a promising new cardiovascular drug in what analysts believe could become the pharmaceutical industry's most lucrative market. In 2005, human trial studies began. If Bruin Pharma's strategy proves successful, D-4F or a similar drug could one day clear a patient's arteries of decades' worth of plaque buildup without the need for surgery. The start-up company is hopeful that its small peptide will fulfill its promise and make a success story of Bruin Pharma and Fogelman's vision – while making inroads in the fight against one of the nation's leading public health concerns. ⌘

If Bruin Pharma's strategy proves successful, D-4F or a similar drug could one day clear a patient's arteries of decades' worth of plaque buildup without the need for surgery.

LICENSING

COMMERCIALIZING A NEW TWIST ON STROKE TREATMENT

Dr. Fernando Vinuela

When treating a stroke, time is of the essence. Stroke is responsible for 168,000 deaths in the United States each year – placing it ahead of every other killer except heart disease and cancer – and is the leading cause of disability. Today, only one treatment, tissue plasminogen activator (tPA), is approved for dissolving the blood clots that cause strokes, and it must be administered within three hours of onset. Unfortunately, only a small percentage of stroke patients receive treatment within tPA's three-hour window, and even when they do, the drug's effectiveness is limited by the time it takes to dissolve a clot and open a vessel – typically one to two hours.

A new device developed by Concentric Medical, Inc. of Mountain View, Calif., offers hope to more stroke patients. Based on technology invented at and licensed from UCLA, the device is designed to treat the 85 percent of strokes that are ischemic, or caused by clots that block blood supply to the brain. A tiny corkscrew captures blood clots from vessels deep inside the brain, almost instantly reversing the symptoms caused by ischemic stroke, according to the first report on the safety and efficacy of the device, presented in February 2004 at the American Stroke Association's 29th International Stroke Conference. Three UCLA inventors were involved in the design: Fernando Vinuela, Yuichi Murayama and Guido Guglielmi.

The device, known as the Concentric MERCI Retrieval System, restored blood flow in 54 percent of patients in phases I and II of clinical trials, which studied stroke patients at 25 sites who were not eligible for standard tPA therapy. In these trials, restoring blood flow reversed paralysis and other stroke symptoms. In February 2006, results reported from another multicenter trial were even more encouraging, showing that 69.4 percent of ischemic stroke patients treated with the device experienced blood-flow restoration, and one out of three was functionally independent within 90 days following the procedure.

For those who are fortunate enough to survive a first stoke, it is estimated that nine in 10 will have long-term impairment.

The MERCI Retrieval System is inserted into an artery in the groin and then carefully guided via standard angiography into the brain until it reaches the blood clots. The device is made from a combination of nickel and titanium, which gives it a "memory" so that, when deployed, it forms itself into a helical, corkscrew-like shape.

In August 2004, Concentric Medical received clearance from the U.S. Food and Drug Administration to market the MERCI retriever, making it the first medical device cleared by the FDA to remove blood clots from the brain in patients experiencing an ischemic stroke. For those who are fortunate enough to survive a first stoke, it is estimated that nine in 10 will have long-term impairment of movement, sensation, memory or reasoning, ranging from slight to devastating. The technology discovered at UCLA and employed by Concentric Medical promises to make a difference not only in saving the lives of stroke victims but in enhancing their quality of life. ⌘

Dr. Yuichi Murayama

CRAFTING LICENSES TO MEET URGENT NEEDS IN DEVELOPING COUNTRIES

Dr. Marcus Horwitz

News reports constantly warn about new diseases and the possibility of pandemics. Although press coverage often goes to the recent discoveries, researchers continue to seek cures for diseases that get less public attention but cause more deaths.

Many people mistakenly think of tuberculosis as a disease of a previous era, but that is far from the case. Each year, 8 million people develop new cases of TB, and 2 million people die of the disease – nearly all of them in the developing world. International health experts have identified the advent of a more effective vaccine for tuberculosis as one of the most achievable tools for improving global public health.

Bacillus Calmette-Guérin, or BCG, the TB vaccine used in most of the world, is almost a century old and has limited efficacy. In conjunction with drug therapy, a more effective vaccine would greatly reduce the TB disease burden around the world. Although it has proven successful in preventing TB in infants, adults do not benefit to the same degree from the existing vaccine.

Dr. Marcus Horwitz and a team of researchers at the David Geffen School of Medicine at UCLA set out to develop such a vaccine. They designed one that uses recombinant DNA technology to add a specific protein from *Mycobacterium tuberculosis*, the bacterium that causes TB, to the basic BCG vaccine. The result, rBCG30, does a better job of protecting guinea pigs from TB than BCG does, Horwitz found in an animal study.

The study used guinea pigs because they are naturally susceptible to the bacteria that cause tuberculosis, and they develop lung diseases that resemble TB in humans. Additionally, guinea pigs used in experiments have a level of genetic diversity that mirrors diversity among humans.

A more effective vaccine would greatly reduce the TB disease burden around the world.

Last year, UCLA and the Aeras Global TB Vaccine Foundation of Bethesda, Md., executed a non-exclusive license to enable Aeras to develop and market UCLA's rBCG30 tuberculosis vaccine technology for use in the developing world. Aeras is a nonprofit organization dedicated to developing new TB vaccines and distributing them to people in areas of the world hardest hit by the disease. Because the organization is not commercial, UCLA granted a license with a low up-front fee and modest royalty rates.

"Tuberculosis ranks among the world's most important diseases, yet it has received relatively little attention in the highly industrialized nations," says Horwitz, a professor of medicine, microbiology, immunology and molecular genetics. "I am pleased that through this agreement, efforts will be made to continue the development of a vaccine that has the potential to reduce substantially the enormous burden of tuberculosis in the developing world." ⌘

COPYRIGHT

USING COPYRIGHT TO EDUCATE AND PRESERVE RIGHTS

Dr. Diane Favro

Rome was not built in a day, but computers have sped up the process remarkably. A decade ago, a team of experts from UCLA's departments of classics, architecture, archaeology and computer science began the ambitious task of recreating ancient Rome – byte by byte.

The Rome Reborn project launched UCLA's Cultural Virtual Reality Lab (CVRLab), which combines three-dimensional computer graphics technology with meticulous historical and archaeological research to create vivid, interactive models of culturally significant sites around the world. The CVRLab also plays to one of UCLA's strengths by bringing together scholars from diverse disciplines, allowing them to gain new insights by collaborating on big projects. Rome Reborn epitomized this cross-disciplinary mixing.

By 2003, the CVRLab team, headed by classics professor Bernard Frischer and architecture and urban design professor Diane Favro, had completed a digital model of the Roman Forum as it appeared in late antiquity, circa 400 A.D. The idea was to enable users, through the spatial experience, to explore the Forum at the height of its development as Rome's civic and cultural center. The model includes more than 20 buildings and major monuments that fill the western zone of the Forum, from the Temple of Vesta and Temple of Antoninus and Faustina on the east to the Tabularium facing the western slope of the Capitoline Hill.

With funding from the National Science Foundation, the CVRLab also embarked, in 2002, on a three-year project to create a Web site about the digital Forum model. The resulting Digital Roman Forum site (*http://dlib.etc.ucla.edu:8080/projects/Forum)* takes advantage of the Internet to grant free use and easy viewing of the digital model by anyone in the world. The site provides documentation on the archaeological evidence and theories used to create the model and offers basic information on the model's individual features so that their history and cultural context can be easily understood.

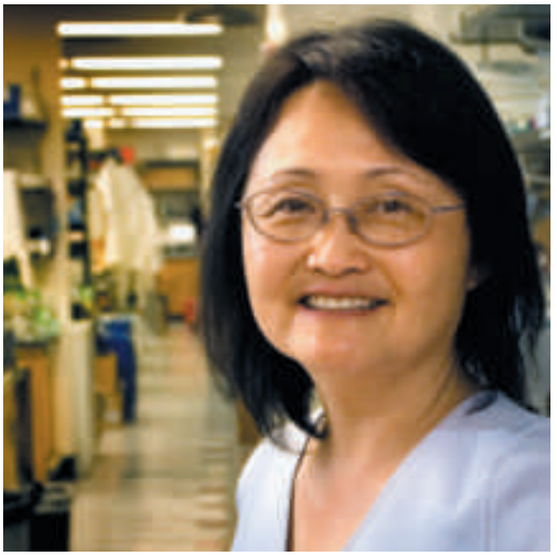
Historically, copyright was developed as a means of safely sharing information – without such protection, authors would be motivated to keep their discoveries and innovations under wraps. For the Digital Roman Forum, UCLA developed a copyright that allowed anyone to use the material for educational purposes but preserved the university's right to develop commercial licenses for the product. In this case, UCLA signed a commercial license agreement with Past Perfect Productions, a Rome-based company that is creating a virtual reality center for experiencing ancient Rome.

Taking her students on a tour of the Roman Forum – virtually speaking – transforms the educational experience, Favro says. Previously forced to rely on floor plans, photographs of ruins and other two-dimensional representations to learn about Rome's vanished buildings, students today can walk through the Forum in real time, experiencing the sights and sounds that Roman senators, citizens and slaves would have encountered. They can explore, among other sites, the temple where Julius Caesar's corpse was cremated, the Roman Senate chambers, and a monument marking the point of convergence of the major roads leading out of the ancient city. As students immerse themselves in the heart of one of history's greatest empires, Favro engages them in discussions about how the Forum was built, how it evolved over time and what happened inside.

"The kinds of questions they're asking now are different from when we were relying on two dimensions," Favro says. "These students have a deeper understanding. It seems more real to them." And thanks to the copyright agreement that is transmitting the Digital Roman Forum across the Internet, ancient Rome will come to life in the years ahead for countless students, historians and other interested viewers throughout the world. ⌘

BAILMENTS

FORGING AN AGREEMENT THAT ALLOWS RESEARCHERS TO SHARE CANCER MODEL



Dr. Hong Wu

To keep people safe in car accidents, engineers rely on models and crash-test dummies. With these tools, they can study how the human body responds to the stimulus of a car accident and devise ways to protect passengers.

Of course, car accidents are not the only hazard we face. Scientists hope that the development of models can also help treat – and possibly even prevent – disease. A team led by Dr. Hong Wu, professor of molecular and medical pharmacology at UCLA's Jonsson Cancer Center, has developed one such model, which may prove to be an invaluable tool for studying an important form of prostate cancer.

Wu engineered a new strain of laboratory mice that develop prostate cancer due to a mutation in the same gene implicated in a subset of men with the disease. This gene, known as PTEN (phosphotase and tensin homologue deleted on chromosome 10), has been identified by researchers as a tumor-suppressor gene, and its malfunction or deletion has been linked to a number of cancer types in addition to prostate cancer. Research has shown that PTEN is mutated or absent in 30 percent of primary prostate cancers and 63 percent of malignant cases, making it one of the most common determinants of prostate tumor progression.

Wu and her team developed the first PTEN prostate-cancer animal model by deleting the PTEN tumor-suppressor gene, leading to PTEN loss specifically in the prostate. The model mimics the disease progression in humans, allowing researchers to study prostate tumor development from initiation to metastasis, as well as during androgen-independent growth, when prostate cancer cells cease being affected by hormone therapy.

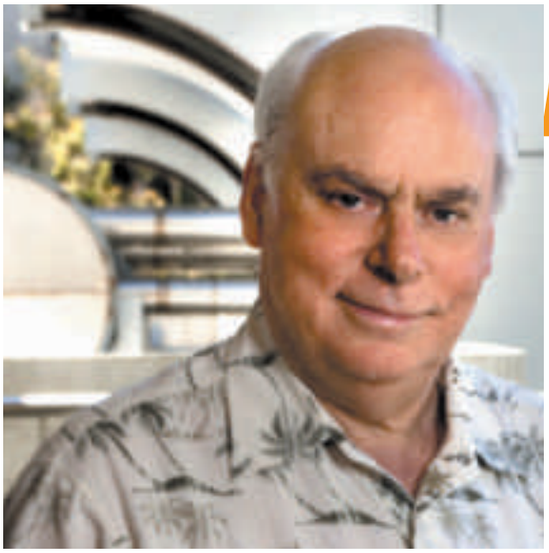
In addition to advancing Wu's research at UCLA, the PTEN model is available for use at numerous other institutions thanks to a material-transfer agreement, or *bailment*. A bailment allows transfer of possession without a change of ownership. This ensures that the intellectual and other property rights of inventors are protected, even as other investigators make use of the inventors' discoveries. Sponsoring agencies such as the National Institutes of Health (NIH) often require that materials generated from NIH-sponsored research be made available to investigators at other institutions. At UCLA, the Office of Intellectual Property executes more than 600 material transfer agreements each year, ensuring that research tools are shared for the public good.

A bailment allows transfer of possession without a change of ownership.

Through her work, Wu has gleaned new insights into the molecular processes driving tumor development. Perhaps most importantly, her research has shown that PTEN-controlled signaling pathways are promising targets for therapeutic strategies. Her laboratory model can now be used to test new drugs for prostate cancer and help guide their use in the clinic, providing a major new tool in the arsenal of researchers seeking to find answers to a deadly disease. ⌘

CNSI

FULFILLING THE PROMISE OF NANOTECHNOLOGY THROUGH CLOSER TIES WITH INDUSTRY



Dr. J. Fraser Stoddart

Big things are happening in the science of the very small. At UCLA, it's changing the way university scientists interact with the companies that ultimately bring their discoveries to fruition.

UCLA is one of California's lead institutions in a university-industry partnership forging ahead in the new frontier of nanoscience. Substantial resources are being invested in this new field, which is creating machines and materials by measuring, modifying and manipulating the very building blocks of our world: atoms and molecules.

In 2001, the California NanoSystems Institute (CNSI) was established as one of four California Institutes for Science and Innovation, a combined effort between the state, leading-edge businesses and UC campuses to develop commercial applications of nanotechnology, educate the next generation of scholars in nanosystems R&D, and promote development in this key sector of California's economy. CNSI, a research center run jointly by UCLA and UC Santa Barbara, has raised more than $300 million in federal research grants and industry funding. In 2005 alone, CNSI members submitted to the Office of Intellectual Property 119 invention disclosures, and five patents were issued.

Nanoscience is a new scientific approach with the potential to drive progress in medicine, information technology, energy and manufacturing, to name a few. To exploit this potential, CNSI is drawing on the breadth of the university's research expertise and its culture of cross-disciplinary collaboration. The institute has assembled researchers from across the campus, in many cases marrying scientific disciplines that were long foreign to each other.

"The exciting thing about nanosystems research is that it's bringing about a sea change in the academic environment," says Dr. J. Fraser Stoddart, UCLA professor of chemistry and biochemistry and director of CNSI. "It's allowing the breakdown of barriers between disciplines to achieve a seamless integration between chemistry, physics, biology and engineering in all their different forms."

In the same way, CNSI is breaking down traditional boundaries by bringing together the university and industry in unprecedented ways, with the goal of rapid commercialization of discoveries.

"Part of CNSI's charge is to work at an early level with industry partners," explains Dr. Leonard Rome, professor of biological chemistry and senior associate dean for research at the David Geffen School of Medicine at UCLA. "This isn't business as usual, in which faculty work in their laboratories and then if something looks like it might have commercial value they try to find an industry partner. The idea here is that we start working with industry at the early, developmental stage."

CNSI is drawing on the breadth of the university's research expertise and its culture of cross-disciplinary collaboration.

CNSI is breaking down traditional boundaries by bringing together the university and industry in unprecedented ways.

CNSI is moving into a new 188,000-square-foot, world-class research facility on the UCLA campus that includes a significant amount of space where UCLA scientists will work shoulder to shoulder with industry partners on projects jointly funded by the companies and federal grants. In addition to bringing faculty closer to the technology transfer process, the arrangement provides students with valuable exposure to companies that can hire them after graduation.

"This is a new paradigm that requires different types of intellectual property agreements negotiated up front," Rome notes. "But we believe everyone will benefit – the university, industry partners, and the public that stands to gain from the new knowledge and products that these collaborations generate." ⌘

Dr. Leonard Rome

SMALL SCIENCE... *three among many ongoing CNSI research projects*

• MANY PEOPLE HOPE THAT HYDROGEN FUEL CELLS will serve as an efficient fuel alternative. One of the biggest challenges has been finding ways to store large amounts of hydrogen at the right temperatures and pressures. CNSI member and UCLA Professor of Chemistry Omar Yaghi has made headway in that area by following up on his invention of metal-organic frameworks. These tiny scaffold-like objects are made of linked rods with tiny pores that can hold gasses. Exploiting these objects' ability to store large amounts of hydrogen in fuel cells, Yaghi has begun to collaborate with a number of companies in efforts to use fuel cells to power devices such as cars, cell phones and laptop computers.

• RESEARCHERS AT UCLA HAVE FOUND THAT A NANOCOMPOSITE thin film can purify water as effectively as conventional reverse osmosis membranes while consuming as little as half of the energy. Eric Hoek, professor of civil and environmental engineering, and his colleagues at the Henry Samueli School of Engineering and Applied Science have shown that their films can be modified to possess broad-spectrum antimicrobial activity, serving as a more efficient water filter. They are now applying their aquatic discoveries to non-aquatic materials as they develop antimicrobial film coatings for sensing devices, dental surfaces, and medical implants in collaboration with faculty from UCLA's medical, dental and engineering schools.

• ALONG WITH NANOTECHNOLOGY'S UNLIMITED PROMISE comes a concern about potential safety risks: Nanotechnology's interaction with biological materials may have toxic effects on the environment and human health. Andre Nel, professor of medicine and a CNSI member, is addressing these concerns through the recently established NanoSafety Research and Testing Center. The center uses a testing model developed at UCLA to provide manufacturers with state-of-the-art toxicological laboratory analysis and consulting advice about the safety/risk profiles of specific nanomaterials in the workplace and environment. Nel's model helps predict which materials could be hazardous – information that is crucial as companies begin to capitalize on this important new scientific frontier.

NEW IDEAS, NEW SOLUTIONS

USING OBSERVATION AS A SPRINGBOARD TO INVENTION

By paying close attention to the experiences of her own patients, UCLA neurologist and researcher in autoimmune diseases Dr. Rhonda Voskuhl made an intriguing observation. Voskuhl, professor of neurology and program director of UCLA's Multiple Sclerosis Center, noticed in her clinical practice that during pregnancy, MS patients seemed to experience fewer symptoms – sometimes even a complete remission. This was particularly pronounced in the third trimester, when levels of the pregnancy hormone estriol are highest. The observation led Voskuhl to investigate the potential of a therapeutic role for estriol in MS and other autoimmune diseases. The results of her research have been encouraging.

With support from the National MS Society, Voskuhl completed a pilot clinical study using oral estriol to treat patients with multiple sclerosis. In this single-agent clinical trial, MS patients who were treated with oral estriol experienced a 79 percent decrease in lesion volumes and an 82 percent decrease in the number of lesions in the first three months after the initiation of therapy. Over the next three months, both lesion volumes and the number of lesions decreased by 82 percent. Voskuhl also has discovered that estriol, which is a type of estrogen, may be particularly helpful for use in postpartum women suffering from autoimmune diseases.

Dr. Rhonda Voskuhl

Estriol has been marketed in Europe and Asia for approximately 30 years to treat women's health disorders such as hot flashes. The hormone is produced by the fetal placental unit and is not detectable in appreciable amounts until pregnancy, when it progressively increases. Previous studies have found that when estriol was administered to mice with experimental autoimmune encephalomyelitis (an animal model of MS), their multiple sclerosis was ameliorated, with a favorable shift in immune response similar to that seen during pregnancy.

In 2005, UCLA licensed the patent rights to a venture-backed start-up company, Miami-based Effective Pharmaceuticals, Inc., to develop estriol as an oral therapy in diseases such as MS, psoriasis, postpartum MS and postpartum depression.

"I am excited by the prospect of finding an easily administered treatment for MS based on a naturally occurring phenomenon in pregnancy," Voskuhl says. "At present, the only approved treatments are anti-inflammatory drugs administered with injections. Our findings also hold promise for finding new treatments for a host of other autoimmune disorders that improve during pregnancy."

UNCOVERING A POWERFUL ANTIBIOTIC IN AN UNLIKELY SETTING

Dr. Robert Lehrer

If a tree falls in the forest and no one is around to hear it, does it make a sound?

While the question is a staple of popular philosophical debate, researchers from the David Geffen School of Medicine at UCLA, Georgetown University Medical Center and Novozymes laboratories in Denmark have rendered moot a variation of the tree-in-the-forest riddle: If a powerful antibiotic grows in remote forests of northern Europe without anyone realizing it, is it medicine?

It now is – or at least it has the potential to be – after the research group reported that a peptide identified in a fungus found in northern European pine forests possesses as much power as penicillin and vancomycin.

The researchers reported in the journal *Nature* that they have isolated plectasin, the first defensin ever found in fungi. Defensins are peptides – miniature protein molecules produced by a wide range of animals to protect themselves against infection. Humans have defensins in their white blood cells and in their skin, for example, but the researchers believe that this new fungal defensin is more potent and targets certain bacteria more specifically.

Indeed, when plectasin was tested in laboratory animals, it proved to be highly effective against the bacteria *Streptococcus pneumoniae* and *Streptococcus pyogenes,* including against strains that are now resistant to conventional antibiotics. These bacteria are responsible for such diseases as meningitis, community-acquired pneumonia, strep throat, life-threatening sepsis and flesh-destroying skin infections.

The field of antibiotic development hasn't changed much since 1929, when Alexander Fleming realized that the fungal "bread mold" *Penicillium,* which had landed by chance in a Petri dish, produced a substance that eliminated colonies of staphylococcal bacteria. But the discovery of plectasin has implications for the development of defensins as a treatment against many common, and deadly, infections, and may initiate a new era of antibiotic discovery and development, according to the research team.

"This finding, and the existence of about 200,000 additional species of fungi, opens up a vast universe to explore for novel peptide antibiotics," says report co-author Dr. Robert Lehrer, distinguished professor of medicine at the David Geffen School of Medicine at UCLA, adding that plectasin, if proven safe and effective in humans, could be on the market by 2012.

BUILDING ON NATURE'S SUCCESS TOWARD NEW TREATMENT FOR BACTERIAL DISEASES

Scientific discovery is often rooted in serendipity. Minghsun Liu, a former UCLA M.D.-Ph.D. student working in the laboratory of Dr. Jeffery F. Miller, professor and chair of microbiology, immunology and molecular genetics at UCLA, was looking for bacterial viruses to study genetics when he found a remarkable property in a particular virus. Miller and colleagues decided to study the phenomenon. What they found may well lead to an invaluable new class of antibiotics.

Miller's team discovered a new class of genetic elements, similar to retroviruses, that operate in bacteria, allowing the bacteria to diversify their proteins to bind to a large variety of receptors. Moreover, the researchers encountered this fundamental mechanism in the most abundant life-forms on earth: bacteriophages, the viruses that infect bacteria.

Dr. Jeffrey F. Miller

The so-called "diversity generating system," which has evolved naturally in certain bacteriophages and bacteria, is second only to that of the immune system in the magnitude and diversity of proteins that can be created. Moreover, when compared to the antibody diversity system, the diversity generating system is far less complex structurally, and thus easier to manipulate.

The finding could one day lead to an effective alternative to antibiotic drugs for treating bacterial diseases. To capitalize, UCLA and San Francisco-based AvidBiotics Corp. agreed to an exclusive, worldwide license granting AvidBiotics the patent rights associated with the diversity generator technology discovered by Miller and his colleagues. The technology has broad potential for use in human therapeutics and diagnostics, veterinary medicine, agriculture, and research tools and reagents.

"This elegant process of generating diversity in nature has many potential applications in the life sciences," says David Martin, CEO of AvidBiotics. "We are excited by the opportunity to build on nature's successes."

Most notably, AvidBiotics will use the diversity generating system to address the threat of infections by antibiotic-resistant bacteria. Miller believes it may be possible to engineer bacteriophages to function as 'dynamic' antimicrobial agents, which could provide a renewable resource of smart antibiotics for treating bacterial diseases.

"A problem with antibiotics is that bacteria can mutate and become resistant to a particular antibiotic, while the antibiotic is static and cannot change," says Miller. "Bacteriophages are nature's antimicrobials, and they are amazingly dynamic. If the bacterium mutates in an effort to evade, the bacteriophage can change its specificity using the mechanism we discovered to kill the newly resistant bacterium."

If Miller's team is successful, smart antibiotics could serve as potent weapons in the battle against the growing public health problem of antibiotic-resistant pathogens. ⌘

Prolific Inventor Gains Appreciation for Tech Transfer Process

Dr. Sherie Morrison

She is one of UCLA's most prolific inventors, having compiled 56 technology transfer agreements and made 67 invention disclosures over her illustrious scientific career. But Dr. Sherie Morrison admits that she wasn't always convinced of the importance of working with the technology transfer office.

"At one time, I thought that if you patented something you were keeping it from getting out to where it could be used, but in fact the reverse is true," says Morrison, professor of microbiology, immunology and molecular genetics at UCLA. "I came to realize that without intellectual property protection, no company will ever use your ideas because it couldn't afford to make the investment."

Morrison is a world-renowned immunologist whose research is directed toward acquiring a greater understanding of antibody structure, function and regulation, and using that information to produce antibodies with novel functional properties. She is credited as a co-inventor, in 1984, of functional antibody technology – specifically, a system to produce antibodies in a host cell. The research, which Morrison completed while at Columbia and Stanford, resulted in a patent that has led to products such as Remicade for the treatment of Crohn's disease and rheumatoid arthritis, and the anti-clotting agent ReoPro.

The early experience with that patent taught Morrison about the importance of early disclosure to the university of any finding with commercial potential. "When I made that initial discovery, I had no appreciation of the potential value of the work we had done," she says. "Now I'm careful to make the university aware of our discoveries soon enough so that it has the opportunity, if it chooses, to get protection for the ideas that can be patented and marketed."

Of Morrison's dozens of invention disclosures, many were not pursued by the university. "The UC campuses haven't always been as good as they could be at pushing inventions out into the market," she says. "Now we're seeing significant efforts to change that."

"My goal as a research scientist at UCLA is not to make products; it's to make knowledge."

She notes that once she discloses her inventions, the ball is in the university's court. "Pushing for commercialization isn't part of my role," Morrison says. "I come up with the ideas, do the research, validate the findings and let the university know if our findings are something that might be useful. My goal as a research scientist at UCLA is not to make products; it's to make knowledge."

OIP Flexibility Fuels Startup of Leading Plant Genomic Company

Dr. Robert Goldberg's discoveries could one day change the way we think about what plants can contribute to humankind.

If the world population continues to grow as predicted, more food, feed, and fiber will be needed over the course of the next 50 years than during all of history up to now. And we will need to meet this need on a decreasing supply of land suitable for agriculture and crop production. But Goldberg is among an elite group of plant molecular biologists who are capitalizing on the technological revolution spawned by genomics to usher in a new era for agriculture – one in which future crops may, for example, show improved tolerance to drought, heat and cold; require fewer fertilizer and pesticide applications; and even provide vaccines to prevent major communicable diseases.

So Goldberg, professor of cell, molecular and developmental biology, speaks with a certain authority when he applauds UCLA's Office of Intellectual Property (OIP) for what he considers to be "visionary" efforts a decade ago. That's when the office planted the seeds, metaphorically, for what has blossomed into a multimillion-dollar discovery enterprise.

Goldberg specializes in plant gene expression; he seeks to understand how plant cells differentiate and how genes are activated selectively in specialized cell types during plant development. In the mid-1990s, in collaboration with scientists at Plant Genetic Systems in Ghent, Belgium, Goldberg utilized genes identified in his laboratory to develop a novel system to genetically engineer for male fertility control in crop plants. This system was used to develop new hybrid varieties of canola plants that are in commercial production and have significantly increased yields of oil. Additionally, the male fertility control system has the potential to significantly increase the yield of other major crop plants.

"When people look back a thousand years from now, they will say that this was the beginning of directing our biological destiny."

These are heady times for Goldberg and his colleagues. "We're in a new era where genetic engineering opens the possibility to use plants as factories of novel chemicals, and this will change the economics of agriculture," he says. "When people look back a thousand years from now, they will say that this was the beginning of directing our biological destiny."

In 1997, with assistance from OIP, Goldberg co-founded Ceres, Inc., an agricultural biotechnology company in Thousand Oaks, Calif., whose mission is to use state-of-the-art functional genomics and pathway engineering technologies to develop breakthrough plants and plant-based products for a variety of industries. The following year, the University of California and Ceres announced a partnership to create the Seed Institute, a multi-campus "institute without walls," with Goldberg as co-director, to collaborate on basic research in plant genomics and seed technology.

As part of the agreement, Ceres provided funding for research, including sponsoring undergraduate research fellowships at the institute's four UC campuses: UCLA, UC Berkeley, UC Davis and UC Santa Cruz. In addition, Ceres provided $1 million to establish the Plant Genomics Technology Center at UCLA with the most sophisticated technologies available – including state-of-the-art DNA sequencing machines – for plant genomics research. For its part, Ceres was able to obtain exclusive license agreements for the Seed Institute's discoveries.

"This was a very new arrangement at the time, and when I look back with the benefit of hindsight, I see that the campus was visionary in establishing this industrial-academic alliance," Goldberg says.

Ceres, Goldberg's start-up, now has 150 employees and is one of the world's most successful plant genomic companies. The Seed Institute has supported significant research efforts by dozens of students and postdoctoral fellows. Moreover, the institute has made pioneering discoveries in how seeds work, laying the groundwork for large research grants from the federal government.

Dr. Robert Goldberg

"We could never have done that if we hadn't had this interdisciplinary, multi-campus collaboration between industry and the university," Goldberg says. "Rather than merely facilitating a patent, UCLA wanted to do something different, something big that would help everyone involved – a new model for doing science." ⌘

FUTURE DIRECTIONS

WHERE DO WE GO FROM HERE?

Boasting some of the world's leading scientists, engineers and artists, UCLA is a hotbed for new intellectual property, often turning out products with great societal benefit. With that in mind, the Office of Intellectual Property (OIP) is examining what it can do to better protect and more efficiently commercialize future UCLA innovations. Faculty need incubation space to develop and advance their technologies, to facilitate support and mentorship for new start-up formation and financing, and to foster relationships with potential commercial partners. These are key components to successful technology transfer and commercialization, and OIP is focusing on their development.

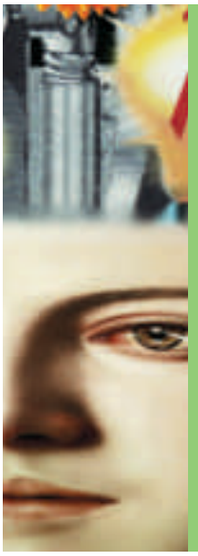
Because university intellectual property often comes with too much technology risk to attract industry partners and investors initially, incubation space allows further development of new innovations through proof of concept and feasibility testing. While state-supported laboratories might not be ideal for widespread incubation, pilot technology-transfer spaces on campus, such as in the soon-to-be-completed California Nanosystems Initiative building, offer new opportunities. Additionally, OIP is working to attract non-university partners and develop alternative models, such as off-site laboratories, to help answer faculty's need for lab incubation space.

UCLA innovations have led to the creation of more than 72 companies. Despite this already substantial foundation for economic development, creating new companies remains the dream of many successful faculty and graduate students whose insight and passion are crucial to pushing new technology forward. With the support of commercial partners, OIP will continue to build stronger support services that will assist UCLA faculty and students in developing new companies to bring their innovations to market.

Starting new businesses goes hand in hand with having strong and far-reaching industry relations. Collaboration with industry can yield new resources and open new avenues for technology commercialization, help identify end-users and licensees, elicit knowledgeable advice on new and emerging businesses that might mesh well with UCLA technology, and enhance mutual understanding between the campus and the business community. University and industry partnerships may include negotiating technology license agreements; co-sponsoring R&D projects of mutual strategic interest; having scientists participate in UCLA laboratories; helping to host, participate in, or establish academic-industry forums; and offering student internships. The list could go on and on.

UCLA has entered a new era of forward-looking technology transfer and industry relations. Watch for our growth and change over the coming years. We look forward to working with you. ⌘

FUTURE DIRECTIONS



HELPING THE NEXT GENERATION

Eric Shiozaki, a postdoctoral researcher at UCLA's Molecular Biology Institute, is deep into investigations of transmembrane proteins, which play an important part in the effectiveness of therapeutic drugs. But outside the lab, Shiozaki takes on a different role: getting down to business in the technology transfer internship program at UCLA's Office of Intellectual Property (OIP).

Under the guidance of licensing officers, patent attorneys and other OIP staff, Shiozaki and fellow postdoctoral and graduate-student interns combine their scientific expertise with hands-on training in academic technology transfer, working to commercialize UCLA inventions via the complex process of technology patenting, marketing, licensing and policy. "I've always been interested in applying what we discover in the research lab to real-life situations," Shiozaki says. "In this program, I've learned about how companies and investors think about ideas."

That perspective can give students a leg up as they graduate and enter the workforce. "This program provides a marvelous opportunity for students to understand the business concerns that underscore science," says Fred Fox, UCLA professor of microbiology and molecular genetics. The founder of the biotechnology company Ingene and a longtime advocate of enterpreneurial training for scientists, Fox helped drive the development of OIP's internship program.

Nearly 70 percent of graduate students end up working in the private sector rather than academia, Fox notes. The internship program gives them a preview of that arena overall and an introduction to a potential career in tech transfer. Says Fox: "This is a way for students to ask, 'Do I see myself in this work?' and to find out at a reasonably high-skills level with good mentors." Graduate student Michael Tong spent a summer as an OIP intern. As a Ph.D. candidate in UCLA's Henry Samueli School of Engineering and Applied Science, Tong is working in the field of materials science to develop specialized packaging for nano-sized electronic devices. Throughout his student career, Tong says, "I've seen a lot of inventions come out of the lab, but I never knew what happened to them after that. This program has given me insight about what happens after the creation of an invention."

OIP's Kathryn Atchison, vice provost of intellectual property and industry relations, says the internship program helps fulfill OIP's mission of educating and informing faculty and students about disseminating their findings to the public as products and services, or in other forms. She adds that the program serves the interests not only of interns but also of faculty members and the university.

"This office and UCLA faculty researchers benefit by having a young scientist take a close look at their discoveries, help determine the most promising commercial possibilities and look for potential industry partners," she says.

"The experience has been very interesting," says Shiozaki. "I've come in contact with inventors, learned about patent law and more." He is, in fact, considering a career in the science side of business and has gone on to create a campus organization that helps other UCLA postdoctoral students learn about entrepreneurship and business development.

Tong sees himself applying what he has learned to advance his engineering research. "When I get to the point of inventing something," he says, "I now know what kind of information I need to develop and market my product more effectively. I feel a little more secure knowing what goes on once it leaves my hands." ⌘

BY THE NUMBERS

Did You Know? *Research materials can be licensed even if not patented. Since 1997, campus units share in patent royalties. New startups based on UCLA discoveries are launched every year. NSF's latest report (2003) ranks UCLA second in U.S. for academic R&D spending. In FY05, UCLA received more than $821 M in research awards. Overall royalty and fee income for UCLA during FY05 was $19,488,000.*

IP PROTECTION, TECHNOLOGY TRANSFER AND RESEARCH ACTIVITIES

Invention Disclosures	291
New U.S. Patent Filings	155
Secondary Filings	92
Issued U.S. Patents	34
Foreign Filings	67
Confidentiality Agreements	115
Letter Agreements	14
License and Option Agreements	34
Inter-Institutional Agreements	11
Material Transfer Agreement (case related)	14
Material Transfer Agreement (non-case related)	657
TOTAL	**1484**

UCLA licensed 498 inventions to 264 companies, including 77 start-ups and 187 established companies.

TOP 10 REVENUE-PRODUCING INVENTIONS

RANK	TITLE
1	Treatment Intracranial Aneurism
2	Nicotine Patch—Smoking Cessation
3	Biodegradable Polymer Coils for Intraluminal Implants
4	Chinese Hamster Ovary Cells with New Sugars
5	Vaccine Against Legionnaires
6	High Resolution Detector Array for Gamma-Ray Imaging
7	Peptide Reagents for Diagnosis and Treatment of Diabetes
8	Profiles 3D Software
9	HTLV-II in Diagnosis
10	Tuberculosis Vaccine

UCLA inventors earned $5.3 M from their successful technologies for FY05

PATENT EXPENDITURES AND REIMBURSEMENTS

	EXPENSE (IN THOUSANDS)	REIMBURSEMENTS (IN THOUSANDS)	%
FY 2003	$3,387	$2,282	67%
FY 2004	$4,402	$2,278	52%
FY 2005	$6,437	$2,226	35%

UCLA generates over $6 billion in Southern California economic activity

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UCLA puts knowledge to work.

Many of this university's most successful innovations are the direct result of removing traditional department fences, inviting fresh perspectives and new ways to wonder.

As one of the nation's leading research universities—public or private—UCLA has become the engine for real time, real world accomplishments that enrich our community, our nation, our world on a daily basis.

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