interface

California Institute for Telecommunications and Information Technology

Volume 1 | Issue 2 | Winter 2006

Scientific Marriage Gives Birth to New Technology

University of California, Irvine

interface-2-face

The Benefits of Collaboration

Collaboration is a bridge that spans ideas, concepts and cultures, connecting the university with industry in a mutually beneficial partnership.

The benefits are numerous. Industry provides internships, mentoring opportunities, facilities that may not exist in academe, subsidized lab equipment and experienced guest lecturers. Industry also funds the development of programs that might otherwise not be available.

Industry scientists work hand-in-hand with academic researchers, giving them access to facilities that might not exist in their companies. Just as importantly, these industrial researchers find fresh ideas and solutions while working with their academic counterparts.

Business leaders bring fresh perspectives to the research challenge and guide the university into newly emerging technologies.

Industry also helps prepare the workforce of the future and hires university graduates, creating economic advantages for the state and nation.

These partnerships are win-win propositions. The Zeiss Center of Excellence, opening in the Calit2 Building, is a perfect example. Carl Zeiss SMT supplied UCI with three state-of-the-art electron microscopes for teaching and research. UCI supplies a dynamic mix of academic and industrial researchers working with Zeiss instruments, and a Southern California location to which the company can bring potential customers.

Technology transfer is another good example. The process launches innovative discoveries developed at the university into commerce, leading to new companies and new jobs.

Calit2 exemplifies this spirit of collaboration. Hand-in-hand with its industry partners, Calit2 explores new frontiers in information technology, leading to products and services that will benefit society and enhance the state's economy.

Collaboration is a growing trend in the university. Our increasingly sophisticated world demands a multidisciplinary, multi-layered approach to education and research. I congratulate Calit2 as it continues to advance collaborations that will benefit UCI, the state of California and the nation.

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Chancellor

Interface
Winter 2006

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Cover: Rick Lathrop, Robert Molinari and G. Wesley Hatfield (See article, page 2)
Photo: Paul Kennedy

The California Institute for Telecommunications and Information Technology is a two-campus multidisciplinary research institute built on a foundation of collaboration. Calit2 integrates UC Irvine and UC San Diego research expertise with industry experience to innovate and advance information technology approaches that will benefit society and ignite economic development.

Calit2@UCI has more than 200 faculty and student affiliates researching health care, transportation, emergency management, the environment, global economics, education, gaming and entertainment. Research teams from various disciplines, linked by their IT interests, work in the building's living laboratories.

The unique approach is advanced by ties with industry partners, accelerating the development and commercialization of research discoveries. Calit2 offers numerous opportunities and levels of involvement for industry partners.

A Portfolio of Industry Opportunities

Virtual Incubator
Calit2 can help entrepreneurs take the first steps toward converting a research success into a startup company. Example: commercializing advances in computational genomics.

Sponsored Research Partner
Industry funds research for its own use or joins in seeking funds from government sources. Examples: research on power usage in integrated circuits or on rapid dissemination of emergency messages.

Demo and Design Center
Industry establishes a major 'name' presence in the Calit2 Building. Example: outfitting a lab with new equipment that can be used by researchers and demonstrated to potential customers.

Gifts of Funding or Equipment
Companies fund Calit2 research, facility needs or outreach/educational activities. Examples: sponsoring seminar programs, supporting faculty awards or donating used equipment.

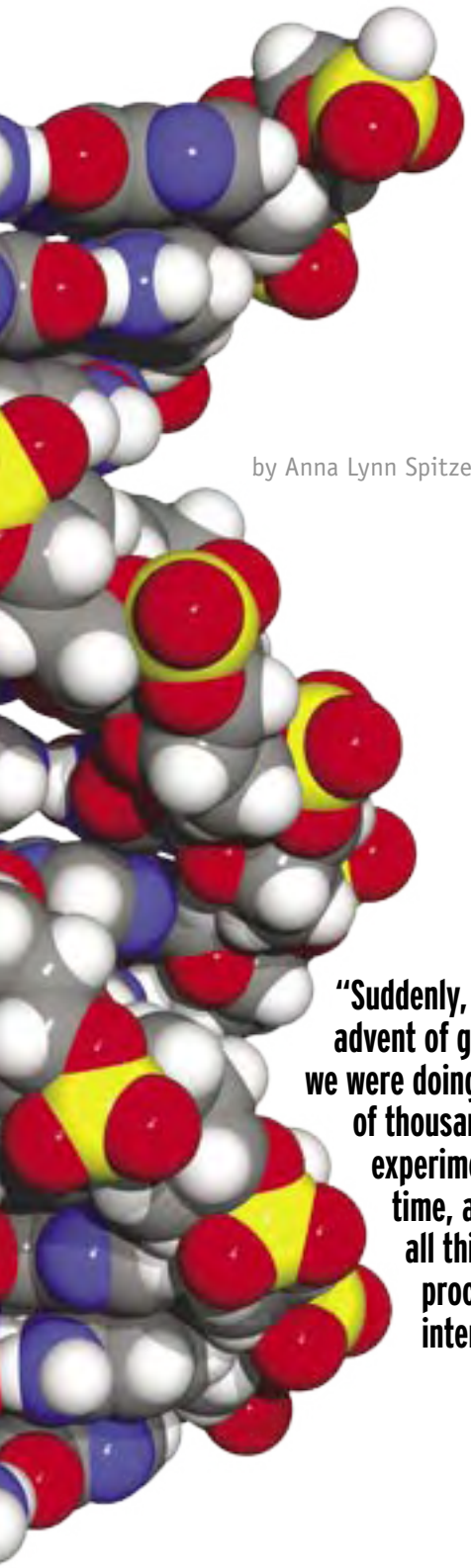
'Living Lab' Test Bed
Industry partners collaborate with research projects to develop better products through testing, analysis and modeling. Example: Calit2's IT infrastructure aids testing of new network devices for use in emergency management.

Workforce Development
Companies can groom well-trained students with IT experience. Example: sponsoring year-round internships, fellowships or intensive summer research programs.

Calit2@UCI – where a collaborative spirit innovates, integrates and ignites ideas in information technology.

innovate integrate ignite

Scientific Marriage Gives Birth to New Technology



by Anna Lynn Spitzer

Once upon a time, computer science and biology were two separate disciplines and nary the twain did meet. Those days are over. The two fields have merged into synthetic biology, a new branch of science that uses the power of computation to design and build novel biological materials and systems.

At UCI, the collaboration has been productive and profitable, leading to several patents, millions of dollars in research grants, a Computational Biology Research Laboratory and CODA Genomics, a successful spinoff company.

A Meeting of the Minds

The affiliation began about nine years ago, when a group of forward-thinking medical school professors began meeting on a weekly basis with like-minded colleagues from the computer sciences department to problem-solve. "As biologists, we were used to doing one experiment at a time and interpreting our data," says G. Wesley Hatfield, professor of microbiology & molecular genetics. "Suddenly, with the advent of genomics, we were doing tens of thousands of experiments at a time, and we had all this data to process and interpret. We didn't know how to do it so we had to start collaborating with people who did know how."

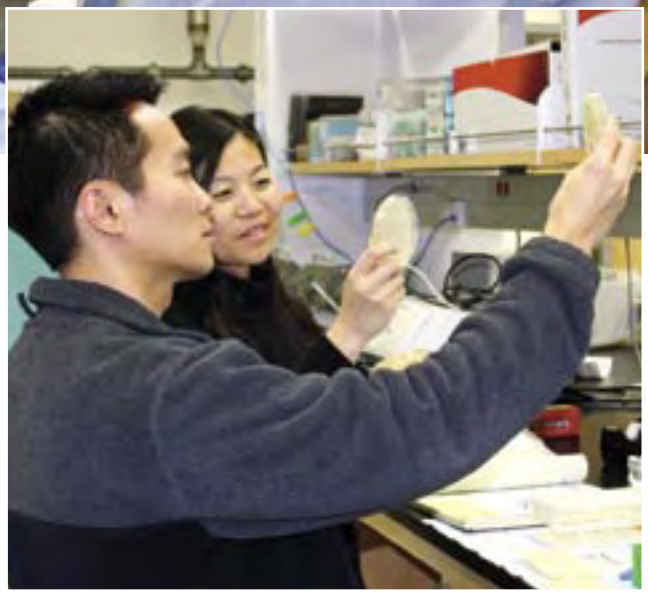
"Suddenly, with the advent of genomics, we were doing tens of thousands of experiments at a time, and we had all this data to process and interpret."

Those people included Rick Lathrop, professor of computer science-computing. Before coming to UCI, Lathrop had worked for 15 years in an artificial intelligence lab at MIT and he had experience in applying computer science to biology.

The Tuesday morning meetings were a revelation for all. "We came from totally different cultures and on a scholarly level, it was difficult for us to have the same vocabulary," Hatfield says, joking that "as biologists, it took us the first six months to explain our problem to the computer scientists, and once they understood the problem and explained the solutions, it took us six months to understand that."

Despite the initially rocky courtship, the relationship blossomed, resulting in research grants and continued collaboration. Five years ago, the group launched the Institute for Genomics and Bioinformatics (IGB) under the leadership of Pierre Baldi and today, the Computational Biology Research Lab, an offshoot of IGB, operates in the

Karen Sutton, CBRL staff research associate, inoculates bacteria culture during the gene-cloning process.



CODA Genomics' visiting scientist Brandon Chen and She-pin Hung, director of molecular biology, examine transformed E. coli cells on a Petri dish.

Calit2 Building. In addition, research conducted in the CBRL led to CODA Genomics, a spinoff company developed at UCI through a "virtual incubation" process. (See Virtual Incubator, page 5.)

Protein Manufacturing Kits

CODA Genomics sells kits for the manufacture of synthetic genes designed to self-assemble by a complex computer-based process. The gene kits allow customers to produce proteins outside of the human body in a procedure that involves stringing together chains of amino acids specified by the gene, much like pearls on a necklace. The challenge is that the speed at which the amino acids assemble themselves into a protein must be regulated. If they assemble too quickly or too slowly, the amino acids fold incorrectly, damaging the final product.

Lathrop developed a sophisticated computer platform that ensures correct timing of assembly – a process CODA Genomics refers to as Translation Engineering™ – by utilizing algorithms and a number-crunching cluster of high-powered computers. UCI patented the technology and subsequently licensed it to CODA. "The process is proprietary and very specialized and I wouldn't even try to explain it," says Albrecht Frauendorf, CODA's senior vice president of operations. "But the end result is that we get the information right so that each synthetic gene produces high levels of a desired protein." The company even guarantees its results, an assurance unheard of in the industry until now.

CODA Genomics' customers – mostly pharmaceutical and biomedical companies – manufacture proteins to use in developing and testing new drugs. Because the human body manufactures very small quantities of protein, they are expensive to extract, making a quick and inexpensive synthetic protein-production system a boon to research.

Birth of a Virtual Company

CODA Genomics was conceived at a 2003 IGB symposium. Lathrop and Hatfield had explained the process of using an algorithm to control the hybridization temperature of DNA molecules,

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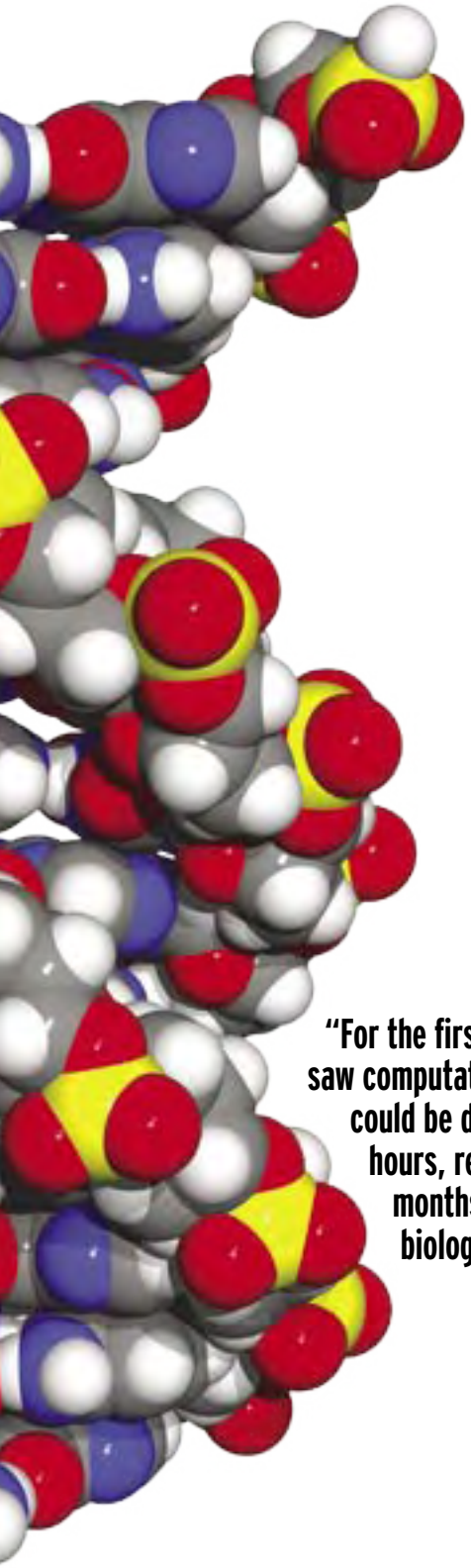
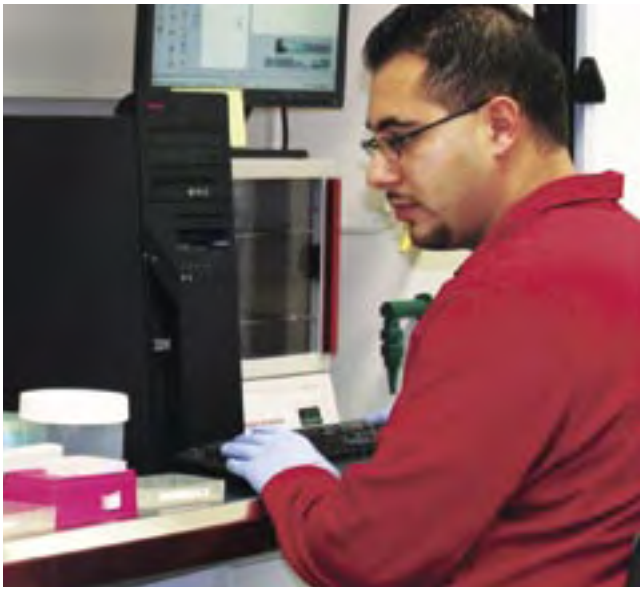


"For the first time, I saw computation, which could be done in hours, replace months of wet biology."

mentioning synthetic gene manufacturing as a possible application. Several UCI colleagues besieged them with requests to build specific genes for their research.

Those requests led to a search for funding to underwrite the project. Lathrop and Hatfield quickly obtained a prestigious $1.5 million NSF Information Technology Research grant. With this funding, and financial support from four UCI deans and the vice chancellor for research, they established the CBRL under the auspices of the IGB. To date, they've produced more than 70 genes for 27 campus faculty members.



Mahmud Penjwini, CBRL staff research associate, mixes oligonucleotides, small DNA fragments that are building blocks used in gene assembly.

The CBRL initially was housed in the medical school, but moved to Calit2 last fall. "It was a natural fit for us – multidisciplinary with an IT component – and it has potential for tremendous impact," says Albert Yee, Irvine division director.

Lathrop and Hatfield's techniques were well-received. IGB advisory board members recommended a spinoff company and suggested that the two researchers contact Bay-area biotech entrepreneur and startup investor Bob Molinari. Molinari liked what he heard so much that he took the helm as founding CEO of CODA Genomics in 2004. (See Licensed to Succeed, page 5.)

Hatfield and Lathrop, both members of the company's scientific advisory board, are pleased with the support they received from university leaders. "We have to compliment Dave Schetter and the Office of Technology Alliances, and the administration all across campus," says Lathrop. "They've really been ahead of the curve and very proactive in making this happen."

While the fledgling company builds its portfolio, Hatfield and Lathrop continue their research, looking for more breakthrough technologies. "There are still things to learn about the proper folding of the proteins and how they will function in different organisms," Hatfield, CBRL director, says. "We're looking for ways to make the process yield better results." Another goal involves increasing the number of genes that can be assembled at one time. Such a 'multiplexed' system would greatly reduce the cost of manufacturing genes and commoditize the gene market.

"That's a visionary goal," says Lathrop, "but we're supposed to be visionary. If you can conceive it, you can do it."

Licensed to Succeed

CODA Genomics is a "virtual incubator" technology-transfer success story. The company is rooted in research that occurred in the UCI labs of Professors G. Wesley Hatfield and Rick Lathrop, who developed a method for making synthetic genes that express proteins in heterologous hosts.

Other UCI researchers inundated Hatfield and Lathrop with requests to manufacture specific genes for their own research. "We started making genes, but it was fairly clear that we couldn't continue without obtaining additional funding," says Hatfield. The Institute for Genomics and Bioinformatics, under whose auspices Lathrop and Hatfield were conducting their research, contributed seed funding, as did the vice chancellor of research, and deans from the schools of biological sciences, medicine, information and computer sciences, and physical sciences. The $200,000 contribution allowed the researchers to establish the Computational Biology Research Laboratory, where they began manufacturing the requested genes while continuing their research into improved methods for synthetic gene production.

Success in the lab and customer feedback soon led to thoughts of a spinoff company.

Fledgling Startup Takes Flight

UCI's Office of Technology Alliances patented the technology and licensed it to a startup company formed by Hatfield and Lathrop, and **CODA** (**C**omputationally **O**ptimized **D**NA **A**ssembly) Genomics Inc. was born. Bob Molinari, a prominent Bay-area biotechnology executive, came on board as CEO in the summer of 2004.

"After years of looking at biotech markets, this was the first time I had seen computational rigor applied to a problem that simplified the way biology research was done," Molinari says. "For the first time, I saw computation, which could be done in hours, replace months of wet biology and succeed in getting proteins to express reliably."

(continued, page 6)

'Virtual Incubator' Cultivates Tech Companies

Picture this. A UC Irvine researcher, hard at work in her lab, makes an astounding breakthrough that could forever change the face of science. The invention, initially only an idea or basic discovery, could have long-lasting benefits for society, but first it has to reach the marketplace.

Enter UCI's Office of Technology Alliances. OTA manages intellectual property that originates at the university and encourages private-sector partners to commercialize technology for the public benefit.

OTA currently manages a total of 700 inventions, a number that is expected to grow by 150 this year, according to Dave Schetter, assistant vice chancellor of research and technology alliances. All of the projects are either licensed or have sufficient commercial promise to be actively marketed. UCI technologies form the backbone of nearly 40 spinoff companies, with another eight currently in development.

> **"Virtual incubation is a step in the technology-transfer process, not a final destination."**

Schetter says about 15-20 percent of the startups fail, either because they can't secure the necessary funding or the technology runs into regulatory problems or marketplace challenges.

Help Getting Started

Strategies for commercialization include technology options or licenses that can be linked to sponsored and collaborative research agreements. Virtual incubation – a cost-effective approach to launching a startup company – is another alternative, one that OTA chose for commercializing the synthetic gene technology developed by Wes Hatfield and Rick Lathrop.

Virtual spinoff companies, after all patent and licensing issues are resolved, become California corporations, but without manufacturing facilities, research staff or equipment. Agreements with the university – including those for sponsored research, and sales and service – allow the new company to collaborate with UCI faculty and use university facilities and equipment through a recharge arrangement. "The process enables companies just starting out to utilize the university's expertise, equipment and facilities that are otherwise well beyond their means," says Schetter.

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Licensed to Succeed

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"... we're supposed to be visionary. If you can conceive it, you can do it."

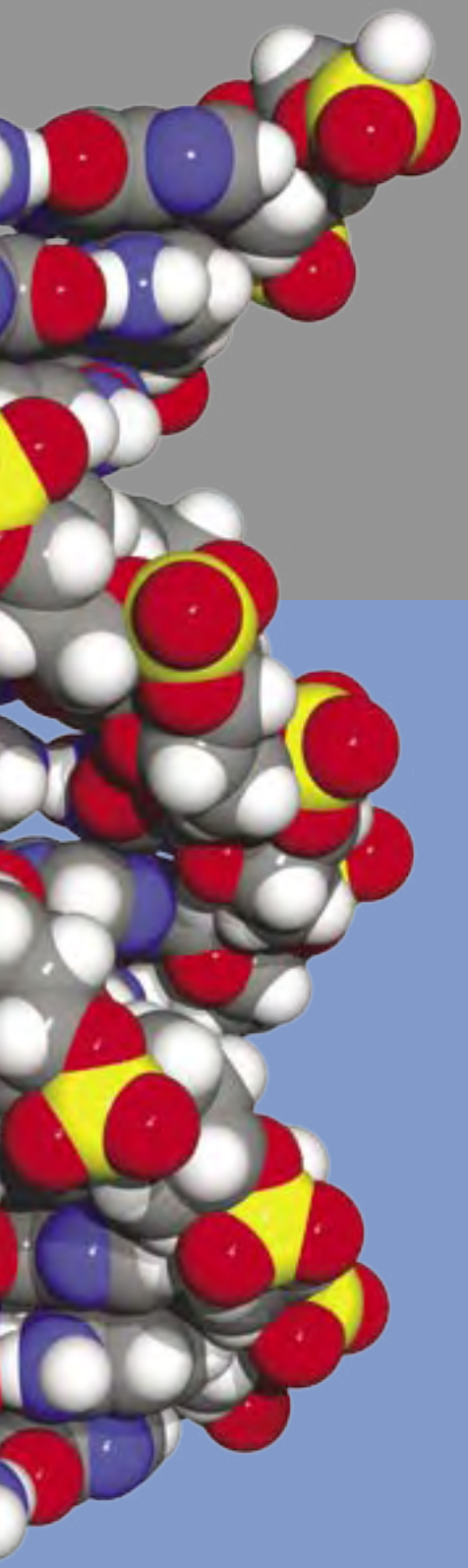
The fledgling company raised $180,000 from friends and family before raising $800,000 in a first round of funding from the Tech Coast Angels, an early-stage technology-and-life-science funding group. That was followed by a second, recently closed outside round that raised more than $600,000 led by Life Science Angels, a San Francisco-based funding group.

Initially, CODA Genomics operated as a "virtual" company – it was incorporated as a California corporation, but it possessed few physical assets, such as facilities, equipment or research staff. Rather, it operated under sponsored research agreements, and sales and service agreements with UCI that were implemented by OTA. These agreements, which covered university overhead, gave the company access to the UCI facilities, equipment and instrumentation it needed.

The company, which licensed the gene-engineering tools developed in the CBRL, has completed more than 100 projects for customers, according to Joseph Kittle, Jr., senior vice president of market development. With 2,000-5,000 potential customers worldwide and a 75 percent prospect-to-customer conversion rate, Kittle is optimistic about CODA's future. "Our marketing is driven by our customers' unmet need for predictable expression of proteins from genes they have identified," he says. "Now we can also go beyond the task of getting the protein made and offer new means of tweaking a protein's structure and activity, all without changing its amino acid sequence."

Home Sweet Home

CODA's founders, scientific and management staff, and investors see a bright future ahead. "They're all successful people who have done this kind of thing before," says



'Virtual Incubator'

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Virtual incubation is a step in the technology-transfer process, not a final destination. Once a spinoff company has gained its footing, it moves out of the virtual phase, purchasing its own facilities and equipment. Like CODA Genomics Inc., these companies are the success stories.

Many Avenues of Assistance

The OTA assists faculty researchers in transferring technology to market in several ways. The office manages the patent application, arranges for licensing or options to license the technology, markets the intellectual property and helps the inventors obtain funding. "Finding the investment money is the licensee's responsibility, but we're instrumentally involved," says Schetter. OTA also oversees the progress of each invention, ensuring that the technology is being moved diligently to market. "Every time we get a license, we get a business plan that identifies milestones for moving the product to market," he says. "Public benefit is a large part of what we're trying to accomplish, so we can't let anything get in the way of that."

Technology transfer from the university to the marketplace benefits UCI, the local economy and California taxpayers.

Mission in Mind

According to Schetter, technology transfer, when handled properly, benefits the University of California's three-part mission of education, research and public service.

The university's educational mission

UCI OFFICE OF TECHNOLOGY ALLIANCES
BUILDING ALLIANCES FOR INNOVATION

Photo: Paul Kennedy

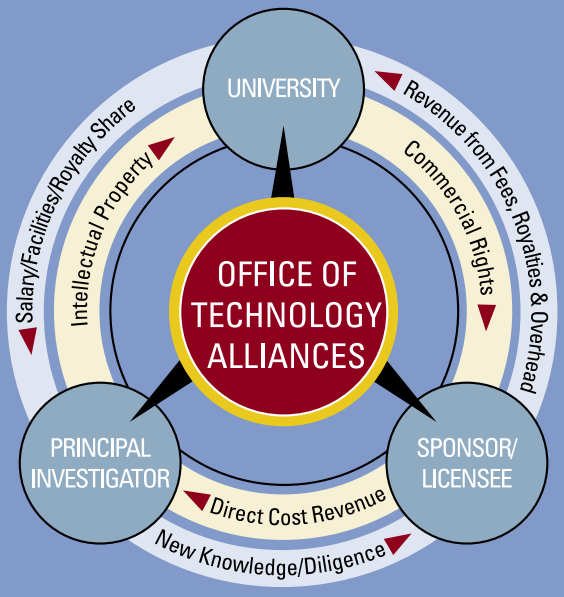
From left: Rick Lathrop, Robert Molinari and G. Wesley Hatfield. Lathrop and Hatfield developed the technology that led to the formation of CODA Genomics; Molinari is the company's CEO.

Hatfield. "They agreed to join us not just for the financial reward but because they see a lot of important potential in the company and they're excited to be involved."

As a result of its success and growth, CODA Genomics Inc. is moving to new headquarters in Laguna Hills, Calif. this month. The move will take the company out of its virtual status – and that's a big step.

"The 'virtual' situation is a step on the way to technology commercialization that allows a company to get itself established, raise funds, acquire IP rights, carry out research and development activities, and apply for grants at the lowest possible cost at a time when there is not much cash to go around," explains Dave Schetter, head of OTA. "CODA has proven to be a successful 'virtual' company because it was able to become non-virtual."

That's important to Molinari, too. "The company's success is significant to the many customers who are now using its products to solve critical problems in protein-based research and drug discovery," he says.



OTA focuses on building long-term corporate alliances founded on new technologies. The goal is to help the company, the faculty inventor and UCI achieve their objectives simultaneously.

benefits from intellectual property revenue by making available resources to support graduate student fellowships and undergraduate scholarships.

The research mission benefits as well since this funding can also be used to support further research and to purchase necessary equipment. Last year, UCI generated a record $12 million in revenue from intellectual property. Companies also are incentivized to invest in research on campus to further develop the technologies they have licensed, which expands the campus's research base.

Lastly, public service: when useful research is commercialized, the public benefits. "We're able to take inventions that come from our research and make useful drugs, devices, processes and products," Schetter says. "Startup companies spun off from university research create jobs and local economic demand for services – from leasing of office space to shopping and restaurants to buying homes," he concludes.

Based on the collaborative nature and IT focus of Calit2's research, Schetter has high hopes for future tech-transfer possibilities. "Calit2 has wonderful potential for taking new ideas into the marketplace," he says. "The CBRL is a perfect example of research taking place at Calit2 that was ready for commercialization. Given Calit2's mission, I know there are a lot more inventions in the pipeline."

As a matter of fact, Schetter and Hatfield plan to use the CBRL's research again for 'virtual incubation.' A newly proposed OTA endeavor – "The Life Sciences and Information Technologies Commercialization Program" – will spin off additional UCI technologies into startup companies.

"Here we go again," says Hatfield.

FUNDING NOTES

by Stuart Ross

Calit2 helps researchers obtain support for projects with a significant IT component, particularly multi-investigator and multidisciplinary projects. Below is a sampling of government funding opportunities and deadline dates in 2006.

May 1-19 UC Discovery Grants

http://uc-industry.berkeley.edu/welcome.asp

The UC Office of the President offers funding to assist faculty research agreements with corporations. Letters of intent for biotechnology, digital media and information technology for life sciences are due May 8; full proposals are due May 19. For communications and networking, and electronics manufacturing and new materials, letters of intent are due May 1; full proposals are due May 12.

July 10 Biological Databases and Informatics

National Science Foundation Solicitation # 05-577

Seeks to encourage new approaches to the management, analysis and dissemination of biological knowledge for the benefit of both the scientific community and the broader public. The program is geared toward the development of informatics tools and resources that have the potential to advance all fields of biology.

July 18, 19, 20 Faculty Early Career Development (CAREER) Program

National Science Foundation Solicitation #05-579

Offers funding in support of the early career-development activities of teacher-scholars in all NSF disciplines. Such activities should build a firm foundation for a lifetime of integrated contributions to research and education. Several UCI faculty have won CAREER awards in the past.

July 24 CISE Computing Research Infrastructure (CRI) Letter of Intent

National Science Foundation Solicitation #04-588

Funds support a wide range of infrastructure needs, including instrumentation required by a small number of projects, as well as major experimental facilities for entire departments or multi-institutional projects, and testbeds or data archives for entire subfields of researchers. The program will support a variety of needs, such as general or specialized research equipment, technical support and/or software, as well as the development of infrastructure for use by others such as data archives or libraries of software.

Aug. 1 Science and Society

National Science Foundation Solicitation # 05-588

Funds research that examines issues arising in the interaction of engineering, science, technology and society in four components: Ethics and Values in Science, Engineering and Technology; History and Philosophy of Science, Engineering and Technology; Social Studies of Science, Engineering and Technology (SSS); and Studies of Policy, Science, Engineering and Technology.

Sept. 13 Information Exploitation Technology

Defense Advanced Research Projects Agency BAA 05-45

Technologies that interest DARPA include but are not limited to: sensors, sensor processing, tracking, information fusion, network analysis, modeling, computational social science, emergent behavior exploitation, *ad hoc* networking, autonomy, robotics, very large databases, processors, displays and human-computer interaction.

Oct. 1 Manufacturing Enterprise Systems (MES)

National Science Foundation PD 05-1786

Supports research on design, planning and control of manufacturing operations, from shop floors to procurement and distribution supply chains. Projects should impact and extend the analytical and computational techniques used in extended enterprise operations, and/or advance novel models offering policy insights or the prospect of employable solutions.

Oct. 1 Nanomanufacturing

National Science Foundation PD 05-1788

Promotes fundamental research and education at the nanoscale to transfer developments from the laboratory to industrial application. The interdisciplinary program emphasizes a systems approach for high-rate production, reliability, robustness, yield and efficiency, and includes mechanical, thermal, fluidic, chemical, biochemical, electromagnetic and optical nano-manufacturing.

Podcasting

Paul Dourish is an associate professor of information and computer sciences, as well as Calit2 Irvine division's associate director for research. Before coming to UCI, Dourish spent some time at Apple Research Labs, making him an ideal expert for this topic.

What is podcasting?

A podcast is the audio equivalent of a blog. Think of it as an episodic radio series available on the Internet. Podcasts can be about anything. Some professors are podcasting their lectures while radio stations podcast their programs, so anyone can subscribe to BBC or NPR podcasts, for instance. When a user subscribes to a podcast, it is delivered over the Internet to the user's computer or MP3 player, allowing the user to listen to it whenever he or she wants.

How would someone start listening to podcasts?

The easiest way is to use a program like iTunes, Apple's free music player, which is also available for Windows. It has the ability to find podcasts, so a user can easily see what is available. Once a user indicates an interest in a particular podcast, iTunes will keep checking for new episodes and download them to the chosen music player. In some ways, the hardest part is determining which podcasts to subscribe to.

Where does the term podcasting originate?

It is a combination of two terms: iPod and broadcasting. Podcasting is like broadcasting since it is essentially a radio show, but the vehicle is usually an MP3 player. Subscribers do not actually need iPods because they can listen to podcasts on any computer that can play audio files. The most convenient way of listening to podcasts, however, is on the go. A listener with an MP3 player can download these regularly updated audio broadcasts and then listen to them anywhere.

Why all the excitement about podcasting?

One of the things people always claimed about the Internet is that it would democratize publishing by allowing everyone to produce content instead of just consuming it. Blogs have recently become a popular form of self-expression. Only a few people can write articles for a newspaper, but many people can write Web pages. Podcasting adds to that because people can listen to podcasts at times when they cannot read a blog. In addition, there was a convenient confluence of events. The huge upswing in the number of MP3 players sold (14 million iPods in the last quarter of 2005) and the rising production of blogs came together to generate great interest in podcasts. It was just fortuitous timing in some ways, since podcasts are not new. There were already people who recorded lectures and made them available online. Now there is a name for that.

Adam Summers, assistant professor of biology at UCI, recently set up a regular podcast of his lectures.

When did you get the idea to podcast your lectures?

When I teach Human Physiology, there are often dozens of tape recorders laid on a table in the front of the room. The issue of equal access to the material was my initial motivation for exploring the technology.

Are you worried about students skipping your lectures?

If attending lecture is not helpful when presented with the podcast, then I suppose some people will stop coming. Others will see a benefit in seeing the "live" performance before they see the tape-delayed one.

Are there any technological challenges you have run into?

There have been no serious barriers. We ended up using a PC tablet as a recording device and "white board" for the classroom. The frame-recording software gives us an AVI file that can be easily converted into several formats and posted in a feed hosted by BioSci Computing. The class Web site will then have links to these different feeds.

For more information visit:

www.podcast.net
www.digitalpodcast.com
www.twis.org
www.sciencefriday.com/audio/

House Call

Delivering Home Health Care with an Integrated Computing System

If Dr. Steven C. Cramer has his way, spinal cord injury (SCI) patients in remote locations could have their therapeutic progress tracked by a doctor or physical therapist without leaving the comfort of their own homes. Funded by the Calit2 Nicholas Foundation Award for Cross-Disciplinary Research, the UCI associate professor of neurology has teamed up with Crista Lopes, assistant professor of information and computer science, and with Project Walk, a Southern California-based SCI recovery program. Together, they are designing a self-contained communications platform that makes in-home health care administration and monitoring readily available for SCI patients.

"These are people who cannot come to the office and get examined very easily, so we are using wireless communication technology to enable repeated measurements from afar."

"These are people who cannot come to the office and get examined very easily, so we are using wireless communication technology to enable repeated measurements from afar," says Cramer. "The project really fits into the mission of Calit2."

by Jonathan Cheung

There are two main goals for the project: to measure the gains of SCI patients who undergo intense physical therapy and to test the wireless component of the communications platform designed to monitor patients' neurological status. To accomplish this, Cramer is conducting a pilot study involving a test group of Project Walk participants who will undertake a rigorous six-month exercise program and a control group of volunteer SCI patients not enrolled in any recovery program. At the beginning of the study, both groups will undergo a short battery of tests at UCI, including brain mapping, and will subsequently be tested at regular intervals.

Wireless Wonders

One communications platform, which consists of a laptop connected to a broadband modem, webcam and several testing devices – including a harness, a goniometer for measuring joint angles and a custom-designed apparatus – will be installed at the Project Walk center in Carlsbad, Calif. There, personal trainers will use the laptop to log each patient's exercise hours, as well as recordings taken from devices that measure balance, muscle strength and range of motion. This information will be sent by the broadband modem back to UCI to be studied by Cramer and his post-doctoral fellow, Nuray Yozbatiran.

The control group will also have a communications platform with a modem and webcam, but only a harness and goniometer as testing devices. This group will be tested only for balance and range of

Above: Dr. Steven Cramer and Crista Lopes are designing a self-contained communications platform to facilitate in-home health care administration and monitoring for patients with spinal cord injuries. Below: Cramer demonstrates monitoring equipment.

motion at the knee; this information will also be sent back to Cramer, who expects little or no improvement from these patients. Because there is only one available platform, it will be installed for one week at a time in different control patients' homes.

Since Internet access was not a requirement for patient participation, Lopes, who is in charge of the remote data transfers, considered many options and ultimately decided upon a Verizon broadband modem. The modem uses Verizon's cellular network bandwidth and once connected, allows the laptop to transfer data to the server computer using file-transfer protocol. Since coverage provided by the modem depends on Verizon's coverage, Lopes will determine how well the connection works in remote locations.

Measuring Motion

Another challenge was deciding how to digitally quantify the gains made by SCI patients. "Usually when a doctor examines an SCI patient, it involves a 20-minute analog exam with comments such as 'weaker today' or if there's a scale, they measure the number: 'hip is three, ankle is two, knee is zero,'" explains Cramer. Cramer's team solved the problem by constructing custom devices that quantitatively digitize measurements, recording range of motion as the number of degrees at joints and strength as Newtons of force.

The benefit of intense exercise for SCI patients has received limited scrutiny to date, though results appear promising. Eric Harness, director of research, training and development at Project Walk, believes that quantifying the improvements will lead to further acceptance and more options for SCI patients. "I believe if this project is successful, it may be the beginning of a paradigm shift in the medical community, where insurance will be willing to pay for a portion of the program, and doctors will be more willing to bring up the subject of functional recovery to newly-injured patients," declares Harness.

Project Walk also offers an in-house program and is opening a second center in Portland, Ore. With patients in different places, a platform capable of real-time data transmission will allow increased collaboration between the facilities. And studying whether this technology can improve patient therapy is just the beginning. "I would like to instrument the patients' houses with more sensors," says Lopes. "We want to be able to monitor different aspects of their daily activities and be notified in case of emergency." Cramer adds, "Measuring neurological status remotely could open up a range of new options for reaching more patients with time-sensitive therapies and for monitoring home therapies in a range of conditions."

Coffee and Camaraderie Jumpstart Fridays

Gaining popularity with each cup of java served, the Friday Morning Coffee Network has become a pleasant way to rise and shine with Calit2. The network provides the IT community – on and off campus – with a casual opportunity to meet each other, learn more about research possibilities, and keep current on building news and information. Continental breakfast is served 9-10:30 a.m. every Friday in the atrium.

Chili and Cheers Collection Brightens the Holidays

During December, Calit2@UCI collected ingredients for a bountiful holiday season to support the Someone Cares Soup Kitchen. Located in Costa Mesa, the kitchen was founded in 1986 and serves more than 250 meals daily to those in need. Generous employees and friends donated more than 1200 pounds of non-perishable items into festive bins placed in the building atrium. The spirit of giving culminated Thursday, Dec. 15, when guests gathered for a hearty bowl of chili and festive entertainment.

Calit2 Displays Research Projects for IEEE Events

Several hundred researchers attending the fourth annual IEEE International Sensors Conference in Orange County in November spent an evening at UC Irvine enjoying a California beach barbecue. Attendees took guided tours of the Calit2 building that featured six interactive research demonstrations, including the cockroach-controlled robot being developed by Calit2-Emulex graduate fellow Garnet Hertz. Additionally, the Orange County Chapter of the IEEE Computer Society held their quarterly meeting at Calit2. The event included presentations by Calit2 Director Larry Smarr and Irvine Division Director Albert Yee, and demonstrations of HIPerWall, the world's highest-resolution visualization display.

ZEISS Center of Excellence Debuts

A research center for nanotechnology, biotechnology and advanced materials development will open in the Calit2 Building at UCI this year, the result of a partnership between the university and Carl Zeiss, SMT, a global semiconductor and nanotechnology instrument manufacturer. The ZEISS Center of Excellence houses three fully equipped state-of-the-art electron microscopes worth approximately $2.5 million. The lab will be shared by Calit2 researchers, its industry partners and Carl Zeiss SMT's application development team.

Student Game Developers Go Mobile

Cell phone games currently comprise a very small piece of the computer gaming industry, but are expected to grow exponentially in the near future. UCI students enrolled in a game development class presented their versions of potential mobile games during a December hands-on demonstration in the Calit2 building. The showcase was sponsored by Glu Mobile, a San Mateo-based game developer that banked on the creative talent of young inventors by investing in the course. While the students own their games, the company has first rights to buy a game if it chooses.

Best of OC Tech Forum Showcases EcoRaft

Hummingbirds were all abuzz at the November 3 Orange County Technology Alliance Network's (OCTANe) information technology forum. The EcoRaft project, an interactive educational game environment designed to teach restoration ecology, was among the local, robust innovations featured at the annual event. Regional technology leaders gave a "state-of-the-industry" snapshot, incorporating large companies, startups, entrepreneurs, venture capitalists and university researchers. EcoRaft, which was demonstrated by Calit2-affiliated graduate student Eric Baumer, integrates stationary monitors and mobile tablet PCs that allow participants to move species between virtual islands.

All the Research Fit to Print (and Air)

Who says seeing is believing? When it comes to news radio, picturing research takes on a whole new meaning, especially if the project being featured is the world's highest-resolution visualization display wall. Calit2 researcher Falko Kuester discussed the HIPerWall in an interview with KNX News Director Mike Landa. The project was also featured in a special "Innovators in Technology" section of the *Orange County Register*, along with a separate feature on the EcoRaft project. The Calit2 Game Culture and Technology Lab also made the news, in both print and local television, including a guest appearance by the lab's associate director, Walt Scacchi, on the PBS program "Inside OC with Rick Reiff."

New Series Showcases Entrepreneurial Research Opportunities

Calit2@UCI has partnered with intellectual property law firm Knobbe Martens Olson & Bear LLP to present a four-part "Igniting Technology" series that showcases multidisciplinary, cutting-edge research and promotes technology transfer by attracting industry partnerships. "We have been looking for an opportunity to partner with UCI on a method for sharing research results with the broader community," said James Hill, M.D., J.D., a partner with Knobbe Martens. "Calit2 offers a unique opportunity to explore information technology opportunities in great depth." One of the largest intellectual property law and litigation practices in the United States, a vast majority of the firm's 179 lawyers hold technical degrees and have previously worked as engineers, software developers or scientists.

Intelligent Transportation Takes to the Fast Lane

The technologies that support intelligent transportation systems (ITS), including sensing, computing, communications and advanced algorithms, provide enormous opportunity for enhancing travel in California, the U.S., and the world. However, the deployment of these technologies has been slower than some advocates would hope. In January, Joseph Sussman, Calit2 advisory board member and MIT professor, discussed some of the key factors constraining ITS deployment with researchers from the Irvine and San Diego campuses. A highly regarded scholar and author of complex transportation systems, Sussman explored a new process for making faster progress in intelligent transportation research through technological and institutional opportunities.

Usage Note:
The noun *interface* has been around since the 1880s, meaning "a surface forming a common boundary, as between bodies or regions." But the word did not really take off until the 1960s, when it began to be used in the computer industry to designate the point of interaction between a computer and another system, such as a printer. The word was applied to other interactions as well as between departments in an organization, for example, or between fields of study. Shortly thereafter *interface* developed a use as a verb, designating the interaction between people, various communities or the private and public sector. But its niche still lies in the computer world, where the use of *interface* thrives.
Source: The American Heritage Dictionary of the English Language, Fourth Edition

Calit2 Building A Winner

Visitors often comment on the beauty of UC Irvine's Calit2 Building. Now the facility has received the 2005 Higher Education award from California Construction magazine in its "Best of 2005" edition.

Judges deemed it "a very well-done project." Editors gave it an additional honor by featuring it on the magazine's December 2005 cover.

The 120,000-square-foot building was dedicated in November 2004, and consists of research labs, offices, support space, meeting space and a four-story atrium. It includes a 3,700 square-foot clean room that provides a filtered-air environment, a large-scale visualization lab, a network lab, and labs for optical devices, nanotechnology and media arts.

The building was designed by Johnson Fain Partners and constructed by PCL Construction Services; Leo A. Daly served as executive architect.

Calit2

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