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**On the cover:** The university, the business community and the state implement programs to nourish a new ecosystem of entrepreneurship and innovation.



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At the dawn of a new age, UC Irvine advances the entrepreneurial ecosystem **History has always been characterized by age.** The Stone Age, the Bronze Age and the Iron Age were followed by the agricultural, industrial and information ages. Now dawns a new era.

Welcome to the age of innovation and entrepreneurship.

Fueled by the always-available Internet, inexpensive and readily accessible software and technology platforms, the ease of social media marketing and – the mother of all invention – necessity, the millennial generation is eschewing in greater numbers a still-rocky job market in favor of birthing its own startup companies. *The Economist*, in a January 2014 special edition, refers to the phenomenon as an "entrepreneurial explosion."

"I think there are just endless possibilities with entrepreneurship. That really appeals to me because anything can happen," says molecular biology and biochemistry graduate student Ashley Fong, who is a member of team NoreGen, last year's big winner in UCI's Merage School Business Plan Competition. (See case study #1)

Creating successful startups, however, is not an organic process. It requires expertise and entrepreneurial support, customers and capital, mentors and markets.

Calit2 has long been a campus hub for innovators and entrepreneurs, a milieu where innovation thrives and new companies have easy access to essential assistance on their way to successful commercialization. Designated a Governor Gray Davis Institute for Science and Innovation, Calit2, since opening its doors, has collaborated with industry to accelerate technology transfer of university research into the commercial marketplace, creating jobs and fueling the economy.

The institute's comprehensive roster of services, facilities and experiential student programs continues to feed an increasingly ravenous innovation engine. Technology business incubator **TechPortal** has provided a low-cost home and entrée to support services, facilities and equipment for 10 startup companies, while a wide array of **proof-of-concept services** offers a convenient boost to startups as well as faculty and industry partners.

Prototyping assistance is just the beginning. "We're going beyond prototyping," says Calit2 Irvine Director G.P. Li. "We are actually seeding projects by helping to develop them and shepherding them through the research process."

The institute is not resting on its laurels, however. The **Resonance Lab**, a new Calit2 effort to prepare students to succeed in the complex and cutthroat world of commercialization, debuted this year.

"Resonance is when a lot of things working together make a huge impact," explains Mark Bachman, the lab's cofounder.

The competitive two-year program, limited to 30 motivated students, collaborates with local businesses and institutions to imbue its participants – all of whom

# **#1** COMMERCIALIZING COLLABORATORS

It is a dream team: three physicists, two biomedical engineers (one of whom is earning an MBA), a molecular biologist/biochemist, and a medical student who is also working toward his MBA. They join forces, enter last year's Merage School Business Plan Competition, and win big – the \$30,000 grand prize and an additional \$3,500 award.

Their entry, NoreGen - the name is a contraction of nanopore genetics seeks to produce a microfluidic device that can identify the size, shape and stiffness of cells while keeping them alive. If they succeed, the circulating tumor cell detection device could offer an advanced diagnostic and prognostic look at disease and treatment. must develop and deploy a prototype for commercialization – with business skills, technical expertise, legal acumen, fundraising insight, familiarity with market analysis, performance evaluation skills and more. (See case study #2)

As innovation and entrepreneurship take root and flourish, institutional efforts to cultivate and nurture them are increasing across the university, creating a vibrant innovation ecosystem. UCI, which offers a host of options to would-be entrepreneurs, recently consolidated its efforts under a new umbrella.

The **Institute for Innovation**, funded by a \$5 million endowment from the Beall Family Foundation, seeks to accelerate technology transfer and commercialization of research. UCI Provost & Executive Vice Chancellor Howard Gillman envisions it as "an epicenter of innovation in Orange County."

The scientists on the team say the business plan competition opened their eyes to new possibilities. "Through this experience we really connected with entrepreneurship," says Ashley Fong, the molecular biology student. "That's what ignited this flame in us and got us thinking about wanting to form a company."

Physics student Bobby Joachim says entrepreneurship appeals to him because it allows a practical outlet for his highly technical lab work. "It's nice to be able to take something out of the lab and bring it to people."

Neychelle Fernandes used her doctorate in biochemical engineering to do R&D work at a startup before deciding to return to school for an MBA. "I like the fact that you can do a lot of different things as an entrepreneur," she says. "I like having input into the product; I eventually want to have my own company." And medical school/MBA student Jonathan Lin hopes to combine medicine and entrepreneurship when he graduates this year. "I have a lot of mentors who are practicing physicians and they own companies; that's just something I think I would really enjoy," he says.

The group is still in its research phase and has received a provisional patent and permission from the Institutional Biosafety Committee to work with live human cells.

"I'm very confident because we've done a lot of preliminary work with mouse cells," says physics student Laura Innes. "And as we near commercialization, we are well aware that there are a ton of resources here on campus that we can use. That's very exciting."



# **#2** FINDING FUNDING

Having a great idea is one thing. As most entrepreneurs know, however, finding funds to launch and sustain a startup company is quite another.

UCI professor Mark Bachman, along with Nizan Friedman and Jordan Linford, who were trained in the Resonance Lab, were looking to jumpstart a new business. They turned to Kickstarter to fund InXus Interactive and its first product, VERVE.

VERVE is a sensor system that can turr any computer or hand-held device into a motion-driven controller. Its seven pre-calibrated, plug-and-play sensors and user-friendly interface allow people to operate their devices by squeezing, waving, dancing and/or otherwise moving around and can be used to control any application or video game.

The trio didn't like the strings tied to raising funds through formal channels

Venture capital and angel investing usually involve ceding a percentage of the company in return for funding. Investing personal funds or asking friends and family to contribute can be risky: 75-90 percent of startups fail.

So they went online. A variety of websites – Kickstarter, Indiegogo, Crowdfunder and RocketHub, to name a few – support crowdfunding. Entrepreneurs post projects, set a goal and solicit donations (usually promising a gift or prototype in return). Interested parties make pledges, and funds are only collected if the company meets its fundraising goal.

Last year alone, 3 million people pledged \$480 million to Kickstarter projects; that's more than \$1.3 million per day. By the end of the year, 19,911 projects were successfully funded.

InXus Interactive's Kickstarter campaign reached its \$20,000 goal on day 5 of its 40-day campaign, and went on to almost double it, raising \$38,617 from 409 backers.

The initiative encompasses current efforts, including UCI's **Office of Technology Alliances** and the **Don Beall Center for Innovation and Entrepreneurship**, and will be "highly synergistic" with other innovation-based efforts on campus, according to Vice Chancellor for Research John Hemminger.

"Making [entrepreneurship] a more strategic focus is especially vital for UCI, given that we're located in a region known for its entrepreneurial spirit," Gillman said in a press release announcing the institute.

Don Beall, the benefactor of several campus centers that bear his name, sees successful technology transfer as crucial if America is to remain competitive in today's global economy. "UCI has been a driving force in uncovering breakthroughs that have a real-world impact, and the Beall family is pleased to help the university take its leadership to the next level ... ," he says. "Together, we hope to bring discoveries to life, benefiting students, faculty, business leaders, the community and society as a whole."

This effort to advance innovation and research commercialization extends well beyond the Irvine campus. Both the University of California Office of the President and the state of California are prioritizing technology-transfer initiatives.

"Tech transfer is directly related to UC's efforts to address some of the major problems we face as a state, nation and world today: food scarcity, energy sustainability and disease prevention," says Shelly Meron, a spokeswoman for UC President Janet Napolitano. "It is also essential in terms of the university's role as a catalyst in California's innovation-based economy.

"That's why it's critical that UC look at how we can unleash the full potential of the university's research activities and speed the translation of ideas and inventions developed by our faculty, researchers and students – ideas and inventions that can help benefit all of society."

Gov. Jerry Brown created an Office of Business and Economic Development – known as **GO-Biz** – to serve as a single point of contact for economic development and job creation in the state. In addition to offering services to business owners, GO-Biz collaborates with California universities to advance innovation. An unforeseen benefit accompanied the influx of cash. "It's awesome marketing. You're showing off your product, and you're getting an unbiased account of what people think about it," Friedman says. "People pay a lot of money for that kind of feedback."

The team is incorporating many of the suggestions it received from online observers, including a wireless version, and temperature and sound sensors.

"That definitely influenced how we explored the development," Linford says. "Because you put a project up before it's finished, the backers are actually guiding the development. People really like that; they feel they're influencing the projects they're helping to support."

"Innovation drives today's economies, from efficiency improvements in traditional manufacturing to advances in nanotech," says GO-Biz Deputy Director for Innovation and Entrepreneurship Louis Stewart. "It is more important than ever to foster the innovation happening here in California and throughout the university system in order to stay competitive in today's global marketplace."

UCI is committed to the cause, providing a wide range of services for those interested in entrepreneurship.

Undergraduate Esosa Agbonwaneten is working with the **Antrepreneur Center/ Blackstone LaunchPad** located in the Student Center. (See case study #3) The LaunchPad, opened in February, is part of an entrepreneurship program already underway in five other states and funded by the Blackstone Charitable Foundation.

"I've loved working with them," she says of Antrepreneur Center Director David Ochi and Co-director Ryan Foland. "Having someone mentor you, believe in your idea and help expand your business development has been invaluable. I came in with some wild ideas and they definitely helped me focus."

Ochi, who has more than 20 years of entrepreneurship to his credit, says mentoring is just the beginning. "Our overarching goal is to be the center that everyone starts at, that directs them to all these other resources so they can maximize their odds of success. We don't have to reinvent everything; we just need to help students get tapped into the right places," he says.

Other programs catering to UCI students include the **Butterworth Product Development Competition** in the School of Information and Computer Sciences, and the **Beall Student Design in Engineering Competition** in the Samueli School. Both seek to encourage new technologies with the potential for commercialization and offer cash prizes. **Entrepreneurship for Scientists and Engineers** is a course that offers a realworld introduction to the theory and practice of entrepreneurship.

"I think the class is useful whether or not a student is ready to develop a venture right away," says Goran Matijasevic, who has taught the class since its inception. "It shows students what it takes to be an innovator. The elements of determining the value proposition that the new company brings to the table and the work on identifying who exactly will be the customers are important things to know regardless of whether they are applied in an existing company or a new venture.

"The reality is that most of today's Fortune 500 companies started as entrepreneurial ventures that grew to their current size."

The **Don Beall Center for Innovation and Entrepreneurship** has been promoting entrepreneurship since 2007 by planning relevant programs, offering online resources and helping students enhance relationships with those in the business community, according to center director Charlie Baecker, himself the founder of a couple of startups.

In 2003, when the idea for the center took root, "we had just come off the Internet bubble," Baecker remembers. "Startups as a means of changing society and creating wealth had captured everyone's imagination, especially our students, with all of these businesses being grown in dorm rooms."

A \$6.5 million gift from the Beall Family Foundation launched the center, which now offers trademark programs like its annual Business Plan Competition. UCI students, staff and/or researchers form teams, create business plans and seek funding during the six-month challenge, attending workshops led by local business experts and gaining direction from experienced coaches.

"We like to think of ourselves as nice, loamy soil that's friendly to startups and students," Baecker says. "Students may not have a lot of resources but they have wicked intelligence, a deep understanding of science, and a lot of passion and energy.

"We use our soil to grow them into seedlings, and then, if they're going to move on, we pot them and send them on to a nursery."

That hypothetical nursery could be a community resource like **OCTANe's** LaunchPad.

OCTANe, a longtime UCI and Calit2 partner, is a local non-profit dedicated to growing new technology companies in Orange County. Founded in 2002, the organization is one of six Small Business Development Centers in Orange County and part of the California SBDC Network. It was named a state iHub (Innovation Hub) by the California Business, Transportation and Housing Agency in 2010.

Its LaunchPad is a free accelerator that helps startups attract investment funding. The in-demand service selects about 50 companies per year from the nearly 150 that apply; those are evaluated through a process OCTANe calls "predictive analytics," which compares a company's ratings in a range of categories with other companies – both funded and non-funded – in the same market segment. "We try to identify where the gaps are and try to help them close those gaps," says Paul Symczak, LaunchPad executive director.

The approach has yielded impressive results. Since 2005, 128 LaunchPad companies have garnered \$494.4 million in investments. Last year alone, 21 companies received \$140.5 million in funding after going through the process, creating an estimated \$6.5 million fiscal impact on the Orange County economy.

"We call ourselves an accelerator but we take a slightly different approach; we charge no fees and take no equity interest in the company," Symczak says. "We're doing it to build up the Orange County innovation economy and create jobs."

Another community resource, **The Portal**, a non-profit organization funded by K5 Ventures and The Beall Family Foundation, opened this spring in offices adjacent to UCI; its goal is to provide students with hands-on experience and exposure to successful companies and investors outside of the university. The Portal will host events, including "hackathons," sponsored by CEOs and CTOs of innovative companies; and CEO Roundtables, which will connect interested students with local executives. It also offers internship opportunities, where students can work on real projects in cutting-edge startups.

"We want to connect UCI to the outside startup world and mitigate the fear and unknown around entrepreneurship," says Rena Zuabi, manager of The Portal. "We provide practical experience with successful companies and show prospective entrepreneurs that there are plenty of success stories to learn from."

By all appearances, the age of innovation and entrepreneurship is in full bloom. UCI, the Orange County business community and the state continue to strengthen their collaborative efforts to promote innovation and create opportunities for startup companies to flourish.

"We need to make sure that we not only capture the innovation but also develop a workforce that has the skills, and can understand and speak the entrepreneurial language," says GO-Biz's Stewart. "Universities like UCI do both and are crucial for the future success of the state."

Calit2's Li enthusiastically concurs. "This economy is an innovation economy and universities are the source of innovation," he says. "It's important to have a holistic approach to creating an entrepreneurial ecosystem within our community and to plug our efforts into that ecosystem.

"At Calit2, we have put a lot of emphasis on this effort over the years. This goal is more and more important, and we will continue to look for new ways to advance it."

Want to learn more about this entrepreneurial ecosystem?

Register for Calit2's May 29, 2014 "Ignite Your Innovation" panel presentation.

Visit www.calit2.uci.edu for details.

# **#3** BORN OF NECESSITY

Last summer, on the brink of her senior year at UCI, Esosa Agbonwaneten was a biology major looking for housing. Craig's List, Facebook and numerous flyers posted around campus were not yielding results, and she was running out of time.

That's when the idea hit her. "I know it sounds cliché," she says with a wide smile, "but I literally woke up, got out of bed and started writing a bunch of things down."

Her original idea to build an online, UCI-specific, student marketplace is evolving into the "Bulletin," a social networking website where students can manage class schedules, collaborate interactively, buy and sell items, and manage household expenses.

Agbonwaneten plans to add a mobile app and has recruited two programmers to assist her.

She has been working hand-in-hand with David Ochi and Ryan Foland at the Antrepreneur Center, and credits them with keeping her on track. "They definitely helped me focus," she says, encouraging her to finish one task before moving on to the next. "They've guided me through a step-by-step process; that's been really helpful."

Agbonwaneten's venture has resulted in some other life-changing decisions. The onetime pre-med student changed her major to public health science and added a minor in digital information systems. "I was trying to be something I thought I had to be and trying to live up to my parents' expectations," she says. "But the closer I got to graduation, the more I realized I had to pursue something I really love to do."

It seems the novice entrepreneur has found her calling. "I am more passionate than ever to see this through," she enthuses, adding that she expects to have a prototype within two years.

Her advice to fellow students considering entrepreneurship? "Stop thinking about forming a company; just go out there and do it. If you're passionate about it and you work to the best of your ability, there is really nothing stopping you but yourself."

# Entrepreneurial Spirit

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music glove

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# RECOVERNY

**STARTUP OFFERS AN INSTRUMENTAL APPROACH TO STROKE THERAPY** 

by Shari Roan

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# One wouldn't expect the leaders of a company specializing in products for stroke patients to be in their mid-20s.

But youth is clearly the genius behind Flint Rehabilitation Devices, a startup company headquartered in TechPortal, the Calit2 technology business incubator.

Nizan Friedman (on right, page 11) and Danny Zondervan (on left), both recent doctoral graduates of UC Irvine's Samueli School of Engineering, admit that a few years ago, they didn't think a whole lot about the 795,000 Americans, mostly older adults, who suffer a stroke each year. But their engineering skills — Friedman in biomedical and Zondervan in mechanical — and their millennial-generation love of the video games "Guitar Hero" and "Rock Band" have placed the duo in the unlikely position of rethinking the traditional approach to stroke rehabilitation.

"THE REASON OUR SOFTWARE IS INSPIRED BY 'GUITAR HERO' IS BECAUSE PEOPLE GET ADDICTED TO THE GAME. WE WANT PEOPLE TO GET ADDICTED TO THERAPY. ANYTHING THAT CAN MOTIVATE PEOPLE TO DO THERAPY FOR A LONG TIME IS THE RIGHT WAY TO GO."

By summer of this year, their company will launch its first product, the Music Glove, a device designed to help stroke patients with hand paralysis regain function. The device can be used at home or in a clinic to augment traditional physical therapy.

Friedman hit upon the idea while working on a hand robot under the auspices of engineering professors Mark Bachman, director of the eHealth Collaboratory, and David Reinkensmeyer. Bachman urged Friedman to design something simpler than the highly complex robots many researchers were working on. A later discussion between Friedman and Bachman – both musicians, as is Zondervan – sparked the idea of adding music to the device.

"We tried it out and it worked really well to help people recover hand function after a stroke," recalls Friedman, the company's president. "It just seemed to click."

The device is a glove with sensors on the fingertips that works with a dedicated game console or a touch-screen tablet device. Much in the same way that someone playing "Guitar Hero" hits buttons on a guitar to sync with notes on the screen, the Music Glove wearer taps notes with his fingertips and thumb to the beat of a song. Playing the game prompts the neural connections between the hand and brain to recover.

"The reason our software is inspired by 'Guitar Hero' is because people get addicted to the game," Friedman says. "We want people to get addicted to therapy. Anything that can motivate people to do therapy for a long time is the right way to go."

The Music Glove has gone through many iterations. Reinkensmeyer provided valuable insights into the field of rehabilitation and the pitfalls of trying to build highly complex, expensive robots.

"Simple devices have a better chance of actually being used by people, especially in the home environment," Reinkensmeyer says.



Eventually, Friedman and Zondervan launched clinical trials of the product in the eHealth Collaboratory. The study participants, who were more than six months out from having a stroke resulting in disability, used the device for two weeks. Their progress on timed tests – such as moving a pile of blocks in 60 seconds – was compared to a two-week period in which they performed standard physical therapy.

# "THIS HAS BEEN A COOL BLEND OF THE SCIENCE, THE **PRACTICALITY OF DESIGNING A PRODUCT AND THEN HAVING** TO FIGURE OUT THE COMMERCIAL SIDE. BUT ULTIMATELY, WHAT INSPIRES US THE MOST IS THE HOPE THAT THIS DEVICE WILL IMPROVE THE LIVES OF THE PEOPLE WHO USE IT."

The study demonstrated that the Music Glove produced a threefold improvement in function compared to traditional therapy. Better yet, says Zondervan: "People just seemed to love it."

Janet Johnson, 59, entered the clinical trial after suffering a severe stroke that caused right-side paralysis. Physical therapy helped her learn to walk again, but her right hand remained stubbornly and severely affected until she began using the glove.

"I really fell in love with it," says the Los Angeles woman. "You hit the key you want to hit without thinking about it. You get in the flow. You just groove along to the song, and the next thing you know, you've hit every note."

After using the device for three months, Johnson found she could once again type efficiently and use the television remote with her right hand.

The key to a successful rehabilitation product is to integrate the human experience with technology, Bachman says. "Innovation is about designing something people will use that makes them feel good and is helpful."

Friedman and Zondervan learned some of their early prototypes were too complicated for some stroke patients. After all, most stroke patients are not of the "Guitar Hero" generation.

"We found that when you bring a rehabilitation device home, it needs to be dirt simple," Friedman says. "If there's anything as difficult as double-clicking an icon, that's too hard. It needs to be as simple and intuitive as possible; otherwise it just won't be used."

If easy to operate, however, the Music Glove actually inspires people to work harder, Friedman says.

"The glove motivates high-intensity movement," he explains. "People have to complete their movement in order to play the game. If they try to move their finger a little bit but don't complete that movement, they won't be able to play the game. That motivates them. It's also very repetitive. People are doing thousands of movements per hour."

Studies show music can induce cortical reorganization in the brain after a stroke. But the device also encourages active learning. Patients receive immediate feedback on their "scores" from the display on the game console after completing the song.

"We make sure you know if you were successful or not because if you weren't, you need to correct something," says Zondervan, the company's chief technical officer.

After receiving several Small Business Innovation Research grants from the National Institute on Disability and Rehabilitation Research to develop the product, the pair earned a \$1.5 million grant in January that allowed them to proceed with product manufacturing.

"This has been a cool blend of the science, the practicality of designing a product and then having to figure out the commercial side," Zondervan notes. "But ultimately, what inspires us the most is the hope that this device will improve the lives of the people who use it."

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Robotic innovation reaches out to socially challenge and

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From left, Jeff Krichmar, Ting-Shuo Chou, Liam Bucci and Carl-SJR.



# carl-sJR isn't your typical-looking robot, if, in fact, there is such a thing.

It doesn't have arms and legs, or other human-like features, but it enjoys being touched and rubbed. It's these traits that may just be what make the robot a winner with its target audience – children with autism and other developmental disorders.

"Children with disorders such as autism and ADHD can sometimes be intimidated by people and nonrepetitive or sudden movements," says Jeff Krichmar, UCI cognitive sciences professor and Center for Cognitive Neuroscience and Engineering director. "This is where a lot of newer therapies like trained animals and specially designed, socially assistive robots are stepping in, helping to teach social interaction skills."

The need is acute; since 2000, the U.S. Centers for Disease Control and Prevention report that the number of children diagnosed with autism has nearly doubled from 1 in 150 to 1 in 88 in 2008, the center's last published surveillance year.

Enter Carl-SJR, short for Cognitive Anteater Robotics Laboratory – Spike Judgment Robot. Developed in Krichmar's social sciences research lab, the surface of its "body" is covered with 67 track balls, the same as those used in Blackberries and older computer mice. When touched or petted, the balls send a signal to LED lights that can display in a variety of colors. The goal is for the user to get comfortable interacting with an object that responds to his or her actions.

"A lot of socially assistive technologies rely on a secondary sense, like vision, to initiate and operate, and they usually require the use of touch board and fully self-contained computer unit that records all movements. This will eventually allow the robot to learn and adapt its patterning to the user, says Krichmar. It can also send commands, like a Simon Says color game, to help the user learn to mimic patterns using both touch and vision.

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The researchers were recently awarded a provisional patent for the technology behind Carl-SJR. And while they are in the process of applying for grant funding to further develop it, they have already begun a pilot study at UCI's

#### "Carl-SJR has the ability to learn what the child likes or dislikes and can tailor the game to his/her needs."

screens and articulating movements with your fingertips to engage with the technology," says Ting-Shuo Chou, a computer sciences graduate student who works in the lab. "We wanted to create something that responds to touch on a larger scale, more like petting, using something that isn't vision-based so that the sense of touch could be emphasized."

Chou worked with Krichmar and Liam Bucci, an engineer on staff in the lab, to design Carl-SJR with this in mind. The track balls, which cover a large surface area, are connected to a complex circuit Child Development School, where the robot is being introduced to children as a behavioral intervention during free-time play.

"Many children with developmental disorders have tactile or touch impairments. Carl-SJR addresses this problem by playing fun, engaging games with children where they learn appropriate social skills," Krichmar says. "Carl-SJR has the ability to learn what the child likes or dislikes and can tailor the game to his/her needs."

# Face of Calit2

# Outside

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# the



UROP director prods undergrads to look beyond their majors and into their futures

by Anna Lynn Spitzer



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# Said Said Shokair was supposed to be a doctor.

His high school test scores qualified him for medical school, which he entered at age 17 in his native Syria. Six months later, though, after chatting with an uncle who was a UCLA pediatric cardiologist, he opted to come to Southern California to complete his studies.

Several thousand UC Irvine students and alumni have good reason to celebrate that seemingly serendipitous about-face; Shokair exposed them to an education they might otherwise not have experienced.

After trading medical school for a UCI double major in electrical engineering and biology, Shokair graduated in 1990 and began to work with students at his alma mater. At first, he was a math counselor, a mentor for under-represented students and a grant writer/curriculum developer.

Then, in 1994 he helped write the proposal that redirected his career and possibly, the careers of thousands of UCI students who learned that the best education often is found in the world outside their textbooks.

Shokair became the founding director of what is now UCI's Undergraduate Research Opportunities Program (UROP), where he has spent nearly 20 years designing and directing collaborations that get his young charges out of the classroom and into the laboratory or field.

Two of those efforts were created in partnership with Calit2. The Summer Undergraduate Research Fellowship in Information Technology (SURF-IT) and the Multidisciplinary Design Program (MDP) – each of which pairs students with faculty mentors and emphasizes cross-disciplinary collaboration – give students the opportunity to participate in applied research, present their results and learn a little something about the real world in the process.

Shokair is unswervingly committed to cultivating a new breed of student. Using a no-holds-barred, in-your-face approach and enough infectious energy to power a moon shot – let's hear a *hoo-ya!* – he prods and chastises, praises and challenges, sometimes embarrasses but never demeans. He makes students laugh and he makes them groan. But there's no mistaking his message.

"I'm going to engage your mind and your energy. If you've been approaching your education as a robot, stop it. The purpose of this program is to transform you, to expand your knowledge and develop the skills to make you more competitive in whatever you decide to do in the future."

And always, he strives to shake up students' ideas about their education.

"For too long we have taught students how to memorize, how to master standardized tests. We condition them to focus on the process, to wait to be taught,"

"I want students to transform themselves. I want to help them go from dependent learners to independent learners."

he says. "I want students to transform themselves. I want to help them go from dependent learners to independent learners."

Social ecology professor Wendy Goldberg was on the UROP Faculty Advisory Board with Shokair, and has served as an MDP mentor. "I can't think of anyone on campus who has done more to promote research opportunities for undergraduates from all disciplines," she says. "His vision and his leadership have inspired thousands of UCI students over the years to get involved in designing and conducting innovative, important studies, and he has <image>

motivated faculty to step up to get involved and mentor these students."

Shokair first met Calit2 director G.P. Li when he was an undergraduate in Li's microelectronics class. (He remembers getting an A ... or was it a B+?) Ten years later, he solicited Li's help as a principal investigator when he submitted a proposal for a micro/nanotechnology summer research program funded by the National Science Foundation. The two have been collaborators and cohorts ever since, sharing a deep devotion to multidisciplinary research and a mutual appreciation for a room-shaking belly laugh.

"At Calit2, we focus on research and development of various technologies, with an emphasis on hands-on training, but typically, R&D happens at a more advanced level," Li says. "Said is the bridge between advanced research and hands-on learning experiences for undergraduate students. Over the years we have developed such a strong collaboration and relationship that we can finish each other's sentences without thinking."

"It's been a wonderful collaboration," Shokair says. "When G.P. and I get together, there's always laughter involved. But we are always so productive. UROP and Calit2 are similar in the sense that we both touch and collaborate with many different disciplines. When we focus on helping people identify their interests and turn those interests into a passion in that collaborative framework, it becomes a perfect marriage."

And that microelectronics grade that Shokair claims to have received? Li lets loose with a thunderous guffaw. "I don't *think* so," he chortles, then admits: "He was a really good student."



Top: Shokair and Li share a laugh during a SURF-IT orientation session.

Bottom: Shokair and 2010 SURF-IT alumnus Spencer DeBrosse signal their approval at the summer's final event.





From the inaugural SURF-IT class in 2005 (above left) to the MDP program (bottom right) Shokair has nudged, prodded, laughed, encouraged and demanded - whatever is necessary to force undergraduates to take charge of their futures. "Every point of view, every discipline, every major is as valuable as yours. Your job is to listen, figure out how to engage and come up with a win-win situation."

For students in Shokair's research programs, academic silos are verboten; collaboration is key. Shokair urges students to get acquainted, become familiar with each other's lexicons and keep their biases at bay.

Practicing personal responsibility, exceeding expectations, taking initiative and learning from failure are his mantras. "Teaching students these real-world values is extremely important," he states.

Johnway Yih was an undergraduate SURF-IT Fellow in 2010, earned a master's degree in engineering management and now works as a manufacturing engineer. "What I remember most ... was his insistence that as students and researchers, we would only be able to get out of the programs what we put into them," Yih says. "This give-to-get mentality is something that I have carried with me, and it has pushed me to learn and do more in education as well as my current career."

"I'm cousin Said; we're all part of the family so nobody should be shy. Just stand up and say how you feel about being part of the program. If no one volunteers I will call on you anyway." Telling students they are family is the highest possible compliment from the devoted family man. Shokair's face lights up as he describes playing on the floor at home with 3½-year-old daughter Yara or taking a Sunday nap with son Omar, who is almost 1.

He and his wife, Rasha, have opened their home over the years to house a continuing stream of family – sponsoring his parents, his brother and his sister in the U.S. and helping them get established. "It's family. It's what you do," he shrugs.

Engineering professor Abe Lee calls Shokair "one of the most passionate people I know." Lee, who has worked with him to develop research programs, adds, "He is passionate about everything he does and most of all, he is passionate about people. He always wears his affable smile and is always offering to help. He cares deeply about the students he touches."

And they return the sentiment. Jordan Sinclair, a 2008 SURF-IT Fellow, remembers Shokair's patience and persistence as Sinclair waffled about a career in research. "He asked me the right questions, the hard questions. He saw right though the 'b.s.', forcing some serious introspection." Sinclair ultimately decided on a non-research career in health information technology.



Wherever their futures take them, Shokair believes student researchers are likely to succeed after they graduate. "These programs have shortened their learning curve and helped them engage the world outside academia in a more productive way," he says.

His role is to ensure that students have considered their options. He likes to ask them if they know the proper angle for launching a rocket to get maximum range. "If you launch it at 0 degrees, it will blow your foot off. If you launch it at 90 degrees, it will come down on your head," he tells them, usually to peals of laughter. "The optimum angle is 45 degrees.

"Your job is to set up the optimum launching angle for your career. If you haven't done that already, start now."

Shokair estimates that approximately 2,000 students a year participate in one UROP program or another, and he's proud of that. "We're helping students develop the skills, expand their knowledge and enhance their own values so they're better prepared for the next phase, no matter the decision they make about the future. Our goal is molding students into people who can go out and change the world in a positive way."

Can we hear a hoo-yah?!







"What I remember most ... was his insistence that as students and researchers, we would only be able to get out of the programs what we put into them."



# interface Reaches a Milestone: TS 20TH SSUE

THE PUBLICATION HAS SERVED AS A VALUABLE RESOURCE NOT JUST FOR CALIT2 BUT FOR THE ENTIRE CAMPUS, HIGHLIGHTING ONGOING RESEARCH ENDEAVORS AND INNOVATIVE CROSS-CAMPUS COLLABORATIONS.

25

Goran Matijasevic is an outspoken advocate and usually can be found carrying a stack of back issues. The executive director of UCI's Chief Executive Roundtable and senior AVC in alumni and constituent relations uses the magazine as a go-to resource. "When I worked in engineering, and more recently in the Chancellor's Office, I have used it as a way of introducing a specific area of research - water, energy, biomedical, big data, computer games, etc. - to outside companies, agencies and individuals," he says. "Interface is a great way to present an overview of the multidisciplinary research applications within each of those areas." To mark this notable achievement, we highlight 20 of the institute's memorable moments from the magazine's archives.



#### NOVEMBER 2005

Inaugural issue of Interface debuts one year after the Calit2 Building Grand Opening ceremony. Calit2 is the first of the four Governor Gray Davis Institutes for Science and Innovation to have a bricks-and-mortar home on its UC campus. The first issue highlights the institute's newly created Summer Undergraduate Research Fellowship in Information Technology program.



#### February 2006

Intrigued by the expansive space of the Calit2 Building atrium, two graduate students collaborate on their master's thesis dance performance. "Submerged/Ascension" offers a unique two-night multimedia dance presentation and video installation staged in – and starring – the building.



#### **MARCH 2006**

Through a virtual incubation process, Calit2's Computational Biology Research Lab spins off a successful startup company, CODA Genomics. Now called Verdezyne, Inc., it is based in Carlsbad, Calif.



#### APRIL 2006

Igniting Technology premieres, showcasing Calit2's novel multidisciplinary research and technology-transfer efforts. The panel presentation becomes the institute's signature semiannual event – 17 programs to date – with ongoing support from Knobbe Martens, LLP.



#### SEPTEMBER 2006 Project ResCUE puts several

of its prototypes for first responders, including the Evac-Pack, to a test in an emergency response drill with the Orange County Fire Authority. The massive, five-year, \$12.5 million NSF-funded project – at that time the largest research grant in UCI history – is administered by Calit2, encompassing five university partners and ImageCat, an industry subcontractor.





















# #6 FEBI

#### February 2007

Interface examines a collaboration that pairs Calit2 and the U.S. Geological Survey. The partnership makes the Calit2 Building the first structure in the world to utilize sensors in both the building and the ground to monitor simultaneously structural integrity and ground soil movement.



#### APRIL 2007

Professor G.P. Li becomes Calit2's fourth director. With his experience as head of UCI's Integrated Nanosystems Research Facility and NSFfunded LifeChips program, Li launches the institute's Bio-Organic Nanotechnology (BiON) clean room facility.



#### AUGUST 2007

Calit2's research efforts grab national media attention. In the wake of the Minneapolis bridge collapse, NBC "Nightly News" features a research team at work in its Calit2 lab developing patented sensors that are embedded in bridges. CNN's "American Morning" features a live news feed from Calit2's HIPerWall, at the time one of the world's highest-resolution display walls.



#### **FEBRUARY 2008**

The "Telematic Drum Circle" debuts. The tele-robotic system built by graduate student Byeong Sam Jeon enables participants to log on from anywhere via the Internet and join in the virtual drumming experience.



#### January 2009

UC Irvine signs an exclusive agreement with spinoff company Hiperwall, Inc. to license its software for commercial use. The company, in turn, signs an agreement with Samsung Electronics to distribute the video wall technology via its network of worldwide sales and marketing subsidiaries. Four years later, Hiperwall Inc. leaves Calit2 for its own headquarters.



#### May 2010

TechPortal, a technology business incubator, opens on Calit2's second floor. The one-stop shop offers affordable space, access to facilities and services, business programs and mentoring expertise to startups based on or licensing UC technology. To date, 10 companies have utilized TechPortal space.



#### OCTOBER 2010

Professors David Kirkby's and Dan Stokols' *"uci@home"* is one of several ongoing university projects and community collaborations aimed at improving consumer efficiency and decreasing electricity use. A small pilot study is launched in the nearby University Hills neighborhood.



#### DECEMBER 2010

Calit2 celebrates its 10th anniversary with participants at UCI and UCSD united by a real-time HD Internet connection, making it a virtual two-campus, one-institute celebration. The ceremony serves as a backdrop for jointly unveiling official plaques renaming the institutes as the Governor Gray Davis Institutes for Science and Innovation.



#### **JANUARY 2011**

Work begins in the new third-floor eHealth Collaboratory in the Calit2 Building, where researchers from various disciplines share ideas, learn from each other and demonstrate working prototypes. A high-touch approach advances all facets of eHealth, including telemedicine, mobile operating systems and wireless solutions.



#### **JUNE 2011**

The inaugural year of the Multidisciplinary Design Program culminates with team presentations, including a project dubbed "Down with Food," which continues to gain traction. Undergraduate students see their paper accepted at a major research and design conference, and *workingexamples.org* features the team.



















# #16

#### SEPTEMBER 2011

The California Plug Load Research Center is established and housed at Calit2. The California Energy Commission awards the center a \$1 million research grant to support development of energy-conservation solutions, starting with set-top boxes.



#### **OCTOBER 2012**

The EVoKE (Emerging Values in Knowledge Expression) Lab opens on Calit2's second floor, offering an open space where students are encouraged to drop in and learn to design things while incorporating specific values.



May 2013

A fresh new look, added offerings and an environmentally friendly package debut. The magazine is now printed with soy-based ink on paper that is 30 percent post-consumer waste, 55 percent recycled, FSC-certified and manufactured by a "clean" mill with a sustainability charter.



#### AUGUST 2013

SRCH2, the inaugural startup housed in TechPortal, is the first to generate enough capital to move to its own offices nearby. The company's search technology makes data more discoverable with a user-friendly search interface, offering the only product on the market that can support instant/forward search and geolocation at the same time.



#### NOVEMBER 2013

For more than 10 years, Calit2 has been a campus hub for multidisciplinary, IT-enabled research projects. In an effort to further advance research and commercial possibilities, Calit2 expands its services, including proof-of-concept support, studies and surveys, fast prototyping, systemintegration assistance and standard electronics testing.





# Academic co-op project uses Kickstarter to push its way to reality

by Lori Brandt

# **It was a nail-biter,** 30 days of networking, texting, calling, emailing, tweeting and Facebooking – sharing by any means possible.



Launching a Kickstarter campaign is not for the faint of heart. For Michelle Khine and four of her graduate students, it was an all-consuming, month-long rollercoaster ride.

Khine and her students formed an academic co-op to produce and distribute

educational inventor kits. They used the crowdfunding platform to raise \$54,000 for the project, which they named A Hundred Tiny Hands. The team hopes the kits will inspire kids not only to conduct complex science in a fun way, but also to become inventors themselves.

An associate professor of biomedical

engineering, Khine is known for her playful approach to science. Early in her career, she used a toy - Shrinky Dinks - to invent a quick and cheap method for developing custom microfluidic chips for researchers to use in their labs. Today, her lab is experimenting with super-hydrophobic surfaces that have anti-bacterial applications and developing 3-D surfaces with micro-sized pits for the purpose of uniform stem cell or tumor cell cultures. The 30-day Kickstarter campaign had the whole lab amped with excitement. Students continuously checked the website and tracked progress on spreadsheets. The first day they had 75 backers pledging \$5,389. But after five days, activity started to slow. The low point was day seven, with only two pledges raising \$115. The high was day 27, when pledges reached close to \$8,000 in one day.

"Every day we were unsure if we would reach our goal. It was very stressful and a thousand times harder than writing a grant for a fraction of the amount," says Khine. "But it was a good learning experience, because we had to tell our message, distill our value proposition and design products that people would get behind. We also generated tons of publicity and reached people quickly. By word of mouth, this spread all over the world, including Japan, Australia and Switzerland."

Recently named one of Fast Company's Most Creative People in Business 1000, Khine had issued a challenge to her graduate students. "Many of the students in my lab serve as Rocket Science Tutors, so they are working with kids already," she says. "I wanted them to think about how to get children interested in becoming inventors."

"Be prepared for working on it 24/7 for 30 days and all the ups and downs that come with it." The students – Eugene Lee, Jolie McLane and Sophia Lin – developed three ideas for kits that are "fun, creative, and chock-full of scientific content and ah-ha moments for any child at heart." Nicole Mendoza, a doctoral student in biomedical engineering, joined the team as webmaster and marketing coordinator.

Lee, a doctoral student in biomedical engineering, came up with Polytropolis, a kit that teaches the fundamental concepts of electricity and circuits. "I thought about my own experience of learning about electricity in school," he says. "It was a lot of memorizing equations and only a few demonstrations. It wasn't until I could play around with making circuits myself that I really understood it."

With Polytropolis, kids play with conductive and insulating dough to build custom cities or mold figures, then form electrical connections with magnetic snap-together sidewalk pieces to light up LEDs. The pieces are interchangeable and reuseable, allowing customization of city layouts.

McLane, also a biomedical engineering doctoral student, created

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SuperVision, a kit that teaches kids how to make their own micro-lenses and attach them to their cellphone, so they can take pictures with up to 50-times magnification. Kids learn about optics while finding the optimal magnification for viewing small items – the hair on a bug's leg, perhaps.

With SuperHydroTension, Sophia Lin, a chemical engineering doctoral student, invented a kit that helps kids learn about surface tension and the basic properties of water. Kids can make their own waterrepelling tiles and guide water droplets through super-hydrophobic mazes.

Each kit's packaging features a cartoon character modeled after the corresponding graduate student and includes a booklet featuring the character to help children learn the scientific concepts. The idea is to create a virtual community of young inventors. A Hundred Tiny Hands plans to hold fun challenges – who can build the biggest

Polytropolis city with the maximum number of lit-up buildings generated from a nine-volt battery? It also intends to encourage kids to upload their own invention ideas. The graduate students would help them make and produce their own custom kits, including a cartoon character made from their likeness starring as the main character in the booklet and on the box.

With a total of 512 backers who contributed \$54,000, A Hundred Tiny Hands is now scaling up for mass production. The team hopes to have 300 of the Polytropolis kits ready by June to use at summer camps; all three kits are expected to be ready by fall.

Khine offers this advice to others thinking about launching a Kickstarter campaign: "Be prepared for working on it 24/7 for 30 days and all the ups and downs that come with it. Some days are good, with lots of people pledging. But then there are slow days when you just feel like pulling your hair out.

"This project was always a labor of love; now, it is ever the more near and dear to my heart. Together, I am confident we can build a community

> to support and inspire little inventors and future engineers and scientists all over the world!"



DERHMOROTENS



#### A timeline of select Calit2 activities

In the CalPlug Center, Director G.P. Li explains to Don and Ken Beall how the Wall of Power delivers cost-saving energyusage information to consumers. 16









Japan to give an invited talk at the International Medical Industry Forum in Nagano.

29

**OCTOBER** 

A group of regional California Republican state legislators learn about the eHealth Collaboratory's relationship with the life sciences cluster in Orange County.



#### NOVEMBER



DefineQA, a startup company specializing in portable diagnostic platforms, becomes a tenant in the TechPortal incubator.

Representatives from the technology commercialization division of the China-Singapore Suzhou Industrial Park visit CalPlug.



technology

Entrepreneur Society

Quick and Dirty Lessons Every Entrepreneur Should Know

December 5, 2013

5

The Technology Council of Southern California meets in the Calit2 Building auditorium, and invites Director G.P. Li to present opening remarks.

# DECEMBER





UCI representatives travel to Korea to explore collaboration with senior administrators at the Ulsan National Institute of Science and Technology.



quarter meeting of Calit2's Division

Council to discuss new academic

year priorities.





28

A new batch of undergraduate students joins the CalPlug team, earning independent research credit while contributing to various projects.



After a dozen years with Calit2, Stu Ross trades in his assistant-director-for-research-development hat for one more befitting a recent retiree.







Igniting Technology features the institute's proof-of-concept services, giving attendees an opportunity to learn about and see prototype solutions.



Calit2-affiliated faculty participate in a half-day workshop with physicians from Cedars-Sinai Medical Center to find synergies for collaboration in ehealth.







Researchers and staff enjoy good food, friends and frivolity at the annual Calit2/INRF holiday party.

5 Part

Participants in the semiannual CalPlug workshop absorb information regarding proposed industry energy-efficiency standards.



#### A timeline of select Calit2 activities

The Multidisciplinary Design Program launches another two-quarter session with an orientation led by the program's co-director, Said Shokair.

# JANUARY

**FEBRUARY** 





24

High school students from China visit Southern California universities, including a stop at UCI where they experience eHealth Collaboratory prototypes.

13

On the steps of Calit2, U.S. Department of Energy Deputy Secretary Daniel Poneman announces Team Orange as one of the 2015 Solar Decathlon competitors.



Representatives from Southern California Edison and CalPlug hold a half-day summit to discuss current and future collaborations.







Faculty members listen to the director's status report at the winter quarter meeting of the Calit2 Division Council.

MARCH







The CEO of MFLEX, one of the largest global flexible circuit manufacturers and assemblers, meets with several faculty-**L** | affiliated researchers during a visit to Calit2.





After nearly a decade of service, Calit2 bids a fond farewell to Andrea Bell-Wheelans, executive assistant to the director, as she moves to a new position on campus.





Melissa Valdez, an undergraduate CalPlug researcher, explains 1kWh Challenge activities to California Energy Commission Chair Robert Weisenmiller.



A drone-like video camera soars about the four-story Calit2 Building atrium, capturing footage for a campus promotional video.



25

A delegation from Ulsan National Institute of Science and Technology travels to UCI, following a visit to Korea last fall by campus representatives.





27

Tara Ruttley, NASA associate program scientist for the International Space Station, presents the latest ISS research findings to an audience in Calit2's auditorium.

**13** Students in the Multidisciplinary Design Program present their mid-term project progress, gaining valuable input for their final reports.





The CalPlug student team developing the Intelli-Home Electronic Interpreter participates in the annual UCI Engineering Winter Design Review poster session. **∠**| | ā

26

CalPlug researchers demonstrate a near-final prototype of the DirecTV/Southern California Edison smart-energy display to company representatives.



Under the direction of Professor G.P. Li, Calit2@UCI develops information technology-based innovations in a multidisciplinary research environment. By integrating academic research with industry experience, the institute seeks to benefit society, incubate new technology companies and ignite economic development. Calit2 focuses on the digital transformation of healthcare, energy, the environment and culture.

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## Calit2

photo: Steve Zylius/UC Irvine Communication:

CalPlug

After a big announcement on the steps of the Calit2 Building, **Deputy Energy Secretary Daniel Poneman**, center left, tours UCI's CalPlug research center during a February visit. Poneman was on campus to reveal the teams selected to compete in the U.S. Dept. of Energy Solar Decathlon 2015. Team Orange, comprising UCI, Chapman University, Irvine Valley College and Saddleback College, joins 19 others in the biannual competition. The Solar Decathlon will be held in fall 2015 at the Orange County Great Park.