BioEngineering

University of California, Berkeley
2010-2011

Conolly Lab's magnetic personality

Launching Synthetic Biology

Alumni profile: Heather Bowerman in D.C.

NRC rankings, new masters program and more!

Bioengineering at Berkeley

- Kevin E. Healy

I am delighted to draft my first correspondence from Berkeley Bioengineering as the Department Chair. I have been present since the inception of the department, and am impressed by the growth and diversity of our faculty, and their teaching and research programs. This publication highlights some of those endeavors, but is in no way comprehensive, so I encourage you to reach out and contact faculty and staff to learn about our most recent activities.

One area we are focusing on is synthetic biology, especially through the efforts of the new Synthetic Biology Institute (SBI), profiled on page 4. A truly unique and interdisciplinary effort, SBI provides an opportunity for the different large applications centers in which Bioengineering faculty participate and lead (e.g., Energy Biosciences Institute and the Synthetic Biology Engineering Research Center), to learn from each other, to train students, and translate their work out into the world. We see SBI playing a central role also in providing events, funding, and educational guidance for students, post-doctoral fellows and the broader community who wish to learn more about the field. Bioengineering is the only department with a defined emphasis in synthetic biology and, therefore, the interaction between the institute and Bioengineering will certainly be synergistic.

We anticipate significant beneficial cross-pollination will also result from our recent agreement to place laboratories for several BioE faculty from the SBI in the new Helios Building on the western edge of Campus. Helios was conceived as the home for the Energy Biosciences Institute, a unique academic-industrial partnership with an amazingly broad and deep approach to understanding biological approaches to solve energy problems. This co-location will form a nucleus informally linking the two Institutes and the Bioengineering Department, leading to a community poised to solve the Nation's energy woes.

We are also placing significant effort in our tissue engineering and regenerative medicine thrusts. Faculty in the department have taken leadership and laid out plans for a comprehensive effort in translational medicine. In the near future we envisage an institute focused on this theme, essentially pushing our discoveries in stem cells, tissue engineering, micro- and nanotechnology, biomaterials, imaging, and diagnostics closer to the clinic. Preceding this initiative, we have recently launched a one-year master's degree program in the area of translational medicine. By pursuing industry partnerships and real-world experience, we hope to dramatically increase the impact of our research - accelerating its path to the clinic, the patient, and the consumer. This program, joint with UCSF, is unique and without peers both nationally and internationally. Our inaugural class of master's students has just finished their studies, and are entering into the workforce as highly skilled and desirable employees. We expect to see great things from their work in the coming years.

These brief highlights demonstrate that the department has progressed from its infancy and is well into its adolescence, with our brightest days clearly ahead of us. It is extremely exciting for me to lead the department during this time.

Until next year,

Chair, Department of Bioengineering,
Jan Fandrianto Distinguished Professor in Engineering

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Chair - Professor Kevin E. Healy
Editor & Design - Pamela Reynolds

On the cover:
Bioengineering graduates enter the Greek Theater for Commencement 2009. Photo by Peg Skorpinski, courtesy of College of Engineering.

Who are we?

Berkeley Bioengineering is one of the premier departments of bioengineering research and education in the country. We are the newest department in the University of California, Berkeley's College of Engineering, consistently ranked among the top three engineering schools in the world.

Founded in 1998, Bioengineering is now one of the largest and most in-demand majors among undergraduates.

Our doctoral program is administered jointly with the Department of Bioengineering and Therapeutic Sciences at UC San Francisco, and grants the Ph.D. and a new Master's degree from both campuses. Now over 25 years old, the graduate program has tripled in size since the Berkeley Department of Bioengineering was founded and continutes to attract top students and faculty from around the globe.

Undergraduate Program

Fall 2010 Enrollment. 420
Female students.....37%
Applicants for Fall 2011.....1441

Graduate Program

Fall 2010 Ph.D. students.....164
Fall 2010 M.S. students.....16
Female students.....35%
Applicants for Fall 2011.....512

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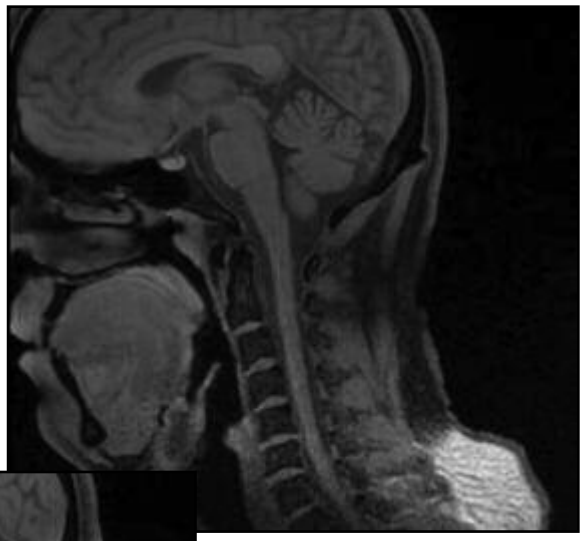
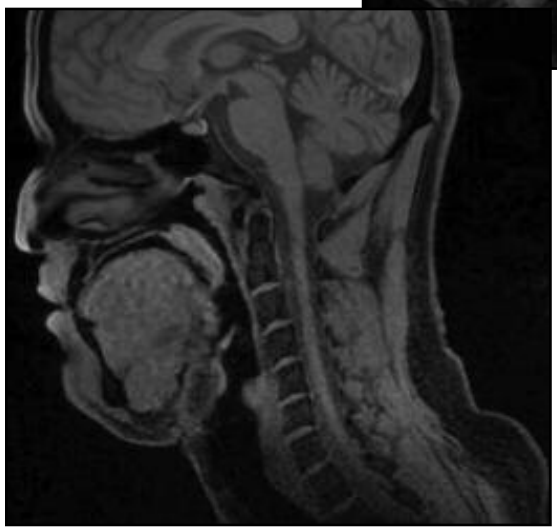
Conolly Lab's

Professor Steve Conolly has magnets on his mind. Not IN his mind - yet. But after 25 years of working in MRI and other medical imaging, Conolly admits that thoughts about magnetics fill a disproportionate share of his brain. That's a good thing for the rest of us, as his magnetic obsession may someday allow doctors to see inside our bodies, clearly and safely.

"I have always been inspired by how magnetic fields can see through tissue as if it was completely transparent," said Conolly. "This is not true for any other fields or waves we use to image inside humans: X-rays, ultrasound, and light are all highly attenuated as they move through tissue. Magnetic fields are safe - no ionizing radiation, no toxins - and really simple to detect, both of which are critical in medicine."





Cervical spine images, with fat surpression, without PG Foam above, and with PG Foam, left.

His career in imaging began in graduate school in electrical engineering at Stanford working with Albert Macovski, a pioneer of CT, ultrasound, MRI and dual-energy x-ray. After his Ph.D., Conolly stayed on at Stanford as a research associate working on a number of projects, includinga new MRI architecture called Prepolarized MRI.

PMRI allows the use of cheaper, strong, non-uniform magnets to pre-polarize the area of scanning, then switches to a low-strength, very uniform magnet for readout. The scanners cost less, and can produce better images in some areas, such as around metal implants.

Conolly was attracted to imaging research for it's interesting combination of physics, engineering and medicine. Some form of imaging is used in almost every patient treatment plan, from diagnostics to therapeutics. It is truly multi-disciplinary, making it a good fit for bioengineering.

Unsurprisingly, magnets are a major theme in Conolly Lab, where they are working on a number of projects that combine magnetics with medicine. One project uses a novel pyrolytic graphite foam (PG Foam) for susceptibility matching in standard MRI scanning.

Using PG foam is a technique to mitigate MRI's inherent problems in imaging near the surface of the body. The edge of the body represents an air-tissue interface, a site of sudden change from the magnetic susceptibility (the degree of magnetization of a material in response to an applied magnetic field) of tissue to the higher magnetic susceptibility of the surrounding air. This change creates distortions in the MRI image near the edge of the body. Currently, MRI scanners use electronic shimming methods, which cannot eliminate the abrupt field changes near the skin.

With the help of BioE Ph.D. student Gary Lee, Conolly determined that a simple foam cushion doped with 4% pyrolytic graphite matches the magnetic susceptibility of the human body precisely, and the foam can be shaped into pads to be fitted around the patient. The largest potential application is to replace the existing table pad on which patients lie during an MRI.

Other uses being pursued are pillows to improve cervical spine imaging and improvements in breast MRI, where the PG foam can prevent normal adipose background tissue from obscuring cancer in studies using a gadolinium contrast agent. Breast MRI research is being pursued with Professor Nola Hylton of UCSF and Professor Brian Hargreaves of Stanford.

PG foam has been conclusively demonstrated effective in human volunteer studies. The lab is now collaborating

Magnetic Personality

with researchers at UCSF, Stanford and GE to assess clinical usefulness. If all goes well this could be in production in just a few years.

Conolly Lab is also one of the world leaders in a brand new imaging modality called Magnetic Particle Imaging (MPI), which detects the presence of highly magnetic nano-particles (~20nm) in the blood vessels of a patient. This new technique could replace tens of millions of iodinated contrast studies (where iodine-based radiographic dyes are injected to improve the image contrast).

An MPI test image of nanoparticle contrast agent in a 1mm groove in plastic. Conolly hopes to increase the resolution from 3mm to 300 microns - the major remaining technical challenge.

"With this project, we're really going after the holy grail of all medical imaging, which is to replace X-ray angiography," said Conolly. "That is a sixty-year-old technique used to produce exquisite images of coronary arteries in a fluoroscopic X-ray suite, after a catheterized, arterial injection of iodine. It is highly invasive, with a high X-ray dose for both the patient and clinicians, and significant kidney risks. MRI and CT researchers have been aiming to replace X-ray angiography for almost 20 years, but have not yet matched the reliability."

The contrast agent used in millions of X-ray and CT angiograms annually presents a serious risk of kidney failure for patients with kidney disease, about one quarter of X-ray angiogram patients. With MPI, however, Conolly hopes to be able to use very low concentrations (perhaps as low as 1 to 10 micromolar) of the nanoparticle contrast agent, ferumoxide, which is processed completely in the liver instead of the kidneys. Ferumoxides have already been through human trials and some are currently used as treatment for anemia in late-stage chronic kidney disease patients.

"Our long-term dream," said Conolly, "is to replace X-ray and CT angiograms with superior contrast MPI, done with venous injection of nanoparticles - removing all risks of ionizing radiation, catheterization, and kidney failure. MPI already has extraordinary sensitivity, exquisite contrast, and is completely safe for patients. We are now busy improving the spatial resolution with nanoparticle collaborator Professor Kannan Krishnan of the University of Washington. We are very close to making this new imaging modality competitive with X-ray, MRI and CT angiography."

Conolly and former graduate student Dr. Patrick Goodwill have designed and built the only four MPI scanners that now exist in North America. They are planning to undertake small animal *in vivo* studies within one year. Human studies could occur as early as five years from now, depending on funding and regulatory approval.

MPI imaging may also soon revolutionize quantitative stem cell tracking inside live animals, which will be crucial for advancements to therapeutic stem cell delivery. The Conolly lab is developing this in collaboration with Professor David Schaffer.

"Even though medical imaging has MRI ,CT, X-ray, nuclear medicine, etc., the ideal imaging modality has not yet been invented. There are significant physical limitations to imaging through opaque humans, which make for very interesting and exciting engineering puzzles. I believe that researchers will invent a major new modality every 10 years or so, and I hope UC Berkeley continues to be a big part of that tradition."

The Conolly Lab - five grad students, one research associate, one Siebel Fellow postdoc, and five undergrads - is funded by the California Institute for Regenerative Medicine, a UC Discovery Grant, the Siebel Foundation, and likely soon by the NIH.

Conolly lab loves their tools

Launching Synthetic

by Karen Holtermann

UC Berkeley, already a leader in the growing field of synthetic biology, has launched a new institute to help spark "an industrial revolution in biological engineering" by clearing a path to the widespread production of biologically engineered solutions to global challenges in health, energy, agriculture, the environment, and other critical arenas.

The UC Berkeley Synthetic Biology Institute (SBI) will advance our capabilities to engineer biological components, systems, and whole cells to perform improved, novel, and complex functions. It aims to take this work to a new level, making the engineering of biological function more transparent, efficient, reliable, predictable, and safe.

The ultimate aim is to "create an industrial revolution in biological engineering," said Matthew Tirrell, the outgoing chair of the Department of Bioengineering. "SBI seeks to bridge the gap between the small-scale, biological engineering of the present and industrial-level production, by developing design tools and other infrastructure to produce synthetic biological systems reliably on a large scale."

Berkeley has been a hub of interdisciplinary activity in synthetic biology, and SBI provides a robust framework for extending that work. The institute's 37 affiliated faculty and scientists represent eight campus departments in four colleges, plus three divisions at nearby Lawrence Berkeley National Laboratory.

Researchers will address five major themes in their work through SBI: health and medicine, environment and agriculture, chemicals and fuels, fundamental science, and E3LSI – the ethical, economic, environmental, legal, and social impacts of the emerging field.

The new institute was celebrated at an inaugural public forum on campus on April 25, which also honored SBI's first industrial member, Agilent Technologies, a leader in measurement technologies and products to advance science and engineering research. Agilent's multi-year, multi-million dollar commitment defines SBI's unique partnership model, which includes active collaboration between university and company research scientists and engineers.

Featured at the spring forum were remarks by Agilent CEO William P. Sullivan and UC Berkeley deans Shankar Sastry of Engineering and Richard Mathies of Chemistry. A panel discussion on the promise of synthetic biology highlighted the evening. Panelists were Nobel Laureate Paul Berg, Professor Emeritus of biochemistry at Stanford University; Agilent CTO Darlene Solomon; venture adviser and biotechnologist Douglas Cameron; synthetic biology pioneer Jay Keasling, UC Berkeley Professor of Bioengineering and Chemical and Biomolecular Engineering; and Professor Tirrell. SBI director Adam Arkin and associate director Doug Clark moderated.

The panel addressed some fundamental questions about the future of synthetic biology:

What is the goal of the new institute?

RICHARD MATHIES - [SBI seeks to] define the field of synthetic biology, develop a deeper understanding of how biological systems work, develop robust, transferrable tools to enable the reliable engineering of these systems, and, most importantly, develop standardized design rules that are transferrable from location to location, that will enable the constructing of enzymes, metabolic pathways, chromosomes, even whole cells, that have the functions and the properties that address society's needs.

Is a new industrial revolution in the works?

DARLENE SOLOMON: Synthetic biology is really a disruptive technology, and as such it's going to enable us to improve some of our existing industrial processes, literally by orders of magnitude – whether that's making them better, faster, or lower-cost. But synthetic biology can also contribute to some new industry paradigms... [that] will integrate electronics with biologically engineered materials and harness the power of both... This integration can transform how

Darlene Solomon

we approach everything from information technology...to human health, and how we interact with the world of artificial machines.

Is more basic science needed?

PAUL BERG: I worry a little bit about the lack of emphasis on how synthetic biology is going to actually generate fundamental knowledge. It's going to make products, it's going to make technology, it's going to make fuels... but I still think that somewhere we still have to figure out how synthetic biology is going to be used to create fundamental knowledge, something on which the next generation of biological advances will rely.

photos by Kat Wade

Keasling and panel

JAY KEASLING: There are a lot of things we don't know, there are quite a few things we do know... By thinking about biological components as reusable parts that we can engineer and reuse in many different applications – that we can build different circuits from the same biological components reused over and over again – that gives you, then, a motivation for really understanding those components.

What kind of impact might synthetic biology have?

JAY KEASLING: We burn 225 billion gallons of transportation fuel [each year]; roughly two-thirds of it is imported fuel. If you look at a barrel of oil, 15% of it goes to chemicals that we use, which is almost everything that we're touching here today. And you say now that we're going to use synthetic biology to replace, say, a third of that petroleum-based fuel and a large fraction of those chemicals... It's an enormous industry in terms of its total volume, and its societal implications are also enormous in terms of transforming American agriculture.

Can we build safety into biological engineering?

Paul Berg

PAUL BERG: Not so long ago I did a talk on synthetic biology to a group of economists [and] some engineers ... What astonished me was the very strong negative reactions that I got from many in the audience... "How do you guys know that the stuff you're going to be making is safe? How do you know that somebody's not going to use the technologies that you want as an open source to do some nasty things?" And the answer is we don't know. So we have to devise ways of anticipating or detecting or creating barriers to some of these kinds of things.

ADAM ARKIN: Synthetic biology gives you the opportunity to engineer for safety. One of the things that we can say about natural systems is that they are evolved not to do that; they're evolved to compete... You move a cane toad from Hawaii to Australia and it destroys the ecology as it moves across that continent... With engineering, you have the possibility of trying to think ahead to what might happen and to engineer the safety in.

What does synthetic biology need to succeed?

MATTHEW TIRRELL: There's certainly not a widespread infrastructure [for synthetic biology], but I think we can and should and will have to create one... If you look at device technology or materials technology in general, these things have been driven by investments in large-scale facilities, where people can try things out, where they can pilot plants, where there can be test runs and that sort of thing. I really think we have to lead a drive that produces the right kind of investments in large-scale facilities to enable the field of synthetic biology to take off the way we're talking about.

For information about SBI and more excerpts from the panel discussion, visit synbio.berkeley.edu.

NRC Rankings!

The UC Berkeley - UCSF Graduate Program in Bioengineering ranks near the very top of the nation's doctoral programs in Bioengineering, according to a detailed survey released in 2010 by the National Research Council.

The survey did not assign a single rank to any program, but rather placed programs within a range, such as between second and sixth place in their discipline. The UC Berkeley - UCSF joint program ranked between 2nd and 6th overall among national bioengineering programs, placing us well into the top ten!

"We are pleased to get this recognition, but the rankings that mean the most to us are made by the graduate students who choose to come here," said Professor Tejal Desai, Chair of the Bioengineering Graduate Group. "Our students hail from all over the world and conduct daring and path-finding work in their areas. These are not just students, but active scientists who are integral to the work we do."

The first detailed NRC survey conducted since 1995, this study collected and analyzed data about more than 5,000 programs in 62 fields at 212 universities with research-based programs. The NRC's periodic, comprehensive assessments and rankings of American doctoral programs are highly respected among academic institutions.

"These rankings reflect the results of the increasing investments that Berkeley and UCSF have been making in bioengineering over the last decade," said retiring Chair Matthew Tirrell, "and the powerful cooperation between a highly ranked engineering school and a leading medical research campus."

The methodology was quite complex and produced several different rankings: Survey data, in which program heads were surveyed on what factors are most important and departments were ranked based on those measures, and Regression data, in which program heads were surveyed on which departments they felt were the best programs. The graduate program did extremely well by both measures, with a 90% confidence range of being between #2 and #6 by Survey, and a 90% confidence range of being between #2 and #9 by Regression. These results agree well with our understanding of our own strengths as an outstanding program that has not yet achieved high name recognition nationwide.

New staff for new efforts

The Bioengineering Department was thrilled to welcome two new staff this year: Karen Holtermann and Kyle Kurpinski.

New staff Karen Holtermann and Kyle Kurpinski

Longtime Berkeley staffer Karen has joined us as a Senior Major Gifts Officer. Karen is working in partnership with Bioengineering and the College of Engineering to build a development program for the recently launched Synthetic Biology Institute and the Department of Bioengineering.

A Cal alumna in journalism and english, she led the College of Engineering's public affairs group from 1982 to 2000, serving as director for more than a dozen years. From 2000-09, Karen was executive director of university communications for the Berkeley campus. We know Karen's skills and long campus experience will be a great asset to Bioengineering at Berkeley.

Kyle Kurpinski has joined us as Executive Director of the new UC Berkeley - UCSF Master of Science in Bioengineering program, which focuses on translational medicine. Kyle received his Ph.D. in 2008 from our own Berkeley - UCSF Bioengineering Graduate Program, after which he served as Senior Product Development Engineer at NanoNerve, Inc., a local tissue engineering startup. He is also the co-author, with BioE Lecturer Terry Johnson, of "*How to Defeat Your Own Clone*," a popular biotechnology book.

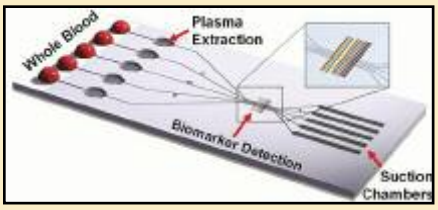
Kyle is using his blend of industrial and academic perspective to manage all aspects of the new Master's Program, including cross-campus coordination and strengthening ties with local industry for job placement.

Welcome Karen and Kyle!

Research Updates

Lee Lab achieves lab-on-a-chip milestone

In 2011 Professor Luke Lee and his laboratory made a major advancement in microfluidics, which could lead to stand-alone, self-powered chips that can diagnose diseases within minutes.



The device, developed by an international team of researchers from UC Berkeley, Dublin City University in Ireland and Universidad de Valparaíso, Chile, is able to process whole blood samples without the use of external tubing and extra components. The device, named SIMBAS (Self-powered Integrated Microfluidic Blood Analysis System), appeared as the cover story of the March 7 journal *Lab on a Chip*.

For the new biochip, the researchers took advantage of the laws of microscale physics to speed up processes that may take hours or days in a traditional lab. The SIMBAS chip uses trenches patterned underneath microfluidic channels that are about the width of a human hair. When whole blood is dropped onto the chip's inlets, the relatively heavy red and white blood cells settle down into the trenches, separating from the clear blood plasma. In experiments, the researchers were able to capture more than 99 percent of the blood cells in the trenches and selectively separate plasma using this method.

Co-lead authors of the study are Ivan Dimov, post-doctoral researcher in bioengineering, Lourdes Basabe-Desmonts, senior scientist at Dublin City University's Biomedical Diagnostics Institute, and Jose L. Garcia-Cordero, currently post-doctoral scientist at École Polytechnique Fédérale de Lausanne (EPFL Switzerland). Antonio J. Ricco, adjunct professor at the Biomedical Diagnostics Institute at Dublin City University, also co-authored the study.

CellScope keeps going strong

The brainchild of Professor Dan Fletcher, the CellScope is a cellphone-based mobile microscopy platform, designed for diagnostic use in remote and underserved areas. The CellScope was begun in Fall 2006 in an undergraduate microscopy course (see our 2006 annual report) and has since become a device poised to change world health.

Since the prototypes pictured below, the CellScope has now evolved to use an iPhone or iPod Touch, imaging infectious disease agents at the same resolution as a standard medical lab microscope. More than a dozen prototype units have been constructed - several are currently traveling in India to test a telemedicine network. Others have gone to Uganda to screen for tuberculosis, and earlier models to Peru.

The lab will soon be starting an early partner program where applicants can borrow a CellScope to test new ideas and applications.

On a lighter note, the CellScope concept was used in 2010 to create the world's smallest stop-motion animation film. The team behind the famous Wallace & Gromit movies used a cell phone to film a miniature adventure featuring Dot - a .35-inch-tall character (search for 'Dot' on YouTube).

The evolution of the CellScope. Top to bottom: the class project team, an intermediate design, and the current model.

Photos by Peg Skorpinksi and Fletcher Lab

Faculty and Student Awards

BioE's Big Ideas

Bioengineering students won big in this year's Big Ideas @Berkeley competition. UC Berkeley's annual "Big Ideas" prize competition inspires innovative and high-impact student projects aimed at solving the world's most pressing problems. Both teams sharing the first place prize in the *Social Entrepreneurship* category include Bioengineering students, as well as the second place winners in the *Scaling Up Big Ideas* and *Emerging and Neglected Diseases* categories.

Winning ideas included pathways for turning class projects into social ventures, worldwide distribution of plans to help scientists build their own lab equipment, K-12 science education outreach for the developing world, microfluidic systems for infectious disease diagnosis, and a simple and disposable device for treatment of severe ear infections.

Johnson collects teaching awards

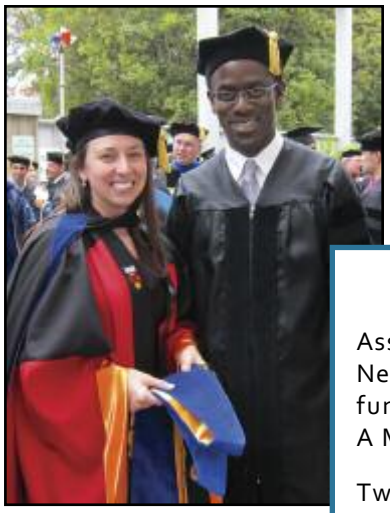
Bioengineering students have always been wild about Lecturer Terry Johnson's energetic teaching style, and he's starting to collect an impressive array of awards to prove it.

Johnson, with a golden apple

This spring Johnson was awarded the BioEngineering Honor Society Outstanding Instructor Award, for the third time. He also received the 2011 Outstanding Faculty of the Year Award and was named an Eminent Engineer by the Tau Beta Pi engineering honor society.

Johnson was the recipient of the 2010 Golden Apple teaching award, a student-run award, which "represents the determination of UC Berkeley students to honor those professors who consistently dedicate themselves to their students."

And he was one of only 12 people on campus selected to participate in the 2009-2010 UC Berkeley Lecturer Teaching Fellows Program. *Congratulations Terry!*



Herr and Ph.D. recipient Akwasi Apori
photo by Cindy Manly-Fields

NIH New Innovator Awards

Assistant Professor Amy Herr was awarded a 2010 NIH Director's New Innovator Award. The award grants $1.5 million in research funds for her project, "Towards High Throughput Proteomics: A Micro/nanofluidic Framework for Blotless Western Technology."

Two BioE alumni were also recipients. Dino DiCarlo, Ph.D. 2006, and Michelle Khine, Ph.D. 2005, have both received this five-year grant, the largest and most prestigious grant awarded to junior investigators by the NIH.

Tim Downing

Poster awards galore

Bioengineering graduate students have been collecting a notable crop of poster awards. Tim Downing was the winner of this year's "Grand Challenge" competition at the annual UC Systemwide Bioengineering Symposium. Akwasi Apori took first place in the research poster competition at the 26th International Symposium on MicroScale Bioseparations in May, while Kelly Karns won the Academic Poster Award at this year's LabAutomation 2011 conference. Javad Golji and Mohammad Azimi won 1st and 2nd place in the Ph.D. student paper and podium presentation competition at the 2010 ASME Summer Bioengineering Conference.

Herr, Kumar, Mofrad receive NSF CAREER Awards

Awards

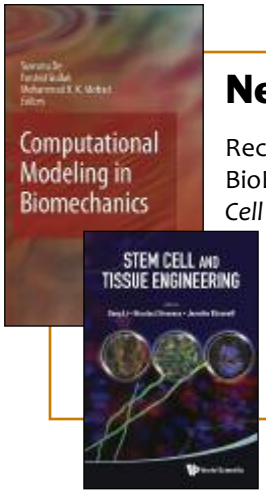
Assistant Professors Amy Herr and Sanjay Kumar have received 2011 National Science Foundation Faculty Early Career Development (CAREER) Program awards. Assistant Professor Mohammad Mofrad received a 2010 award. CAREER awards are given to young researchers who have also translated their work into significant educational activities.

Herr, a leading researcher in microscale biomarker detection technology, was recognized for her proposal on "microMOSAIC Frameworks for Next-Generation Proteomic Technology." Kumar was awarded for his project: "Microscale Mechanobiology of Actomyosin Stress Fiber Bundles: An Integrated Program for Research and Education in Cellular Bioengineering." Kumar is a pioneer in molecular cell dynamics and the mechanobiology of the cytoskeleton. Mofrad's project is titled "Cellular Mechanotransduction: An Integrated Research and Education Program".

Capstone course gets NIH grant

The department has been awarded a 5-year grant by the National Institutes of Health to support our senior bioengineering design course. The grant for "Team-Based Design in Biomedical Engineering Education" will enhance and significantly extend our BioE 192 project-based course and engage our graduating seniors in an immersive educational experience. The combined lecture and experiential training will provide a comprehensive introduction to project design in translational medicine, supplementing theoretical knowledge with hands-on clincial work.

The bioengineering capstone design course partners with clinicians at UCSF to coach project-based teams of undergraduates in solving real clinical device problems and is taught by grant PI, Assistant Professor Amy Herr.



New books by faculty

Recently released: two new books by BioE faculty! Song Li is co-author of *Stem Cell and Tissue Engineering*, with Nicolas L'Heureux and Jennifer Elisseeff. Mohammad Mofrad has edited *Computational Modeling in Biomechanics* with Suvranu De and Farshid Guilak.

CIRM grants fund cutting-edge bioengineering research

Bioengineering faculty have recently garnered an impressive batch of grants for stem cell research from the California Institute for Regenerative Medicine (CIRM), the state stem cell research agency created by proposition 71. Associate Professor Song Li was one of only 19 University of California scientists receiving grants from CIRM in the latest round. Li received $1.3 million to fund his research in "Induced Pluripotent Stem Cells for Tissue Regeneration." Earlier this year, Professors Steve Conolly and David Schaffer were awarded renewals for their Tools & Techniques grants. Conolly received $1.4 million to develop and test Magnetic Particle Imaging, while Schaffer and collaborators were awarded $1.4 million to develop new molecular tools and novel technologies for high- efficiency gene targeting in stem cells.

And More!

Luke Lee was awarded the 2010 Ho-Am Prize, widely known as the "Korean Nobel Prize", in Engineering.

BioE Chair Kevin Healy won the 2011 Clemson Award for Basic Research from the Society for Biomaterials.

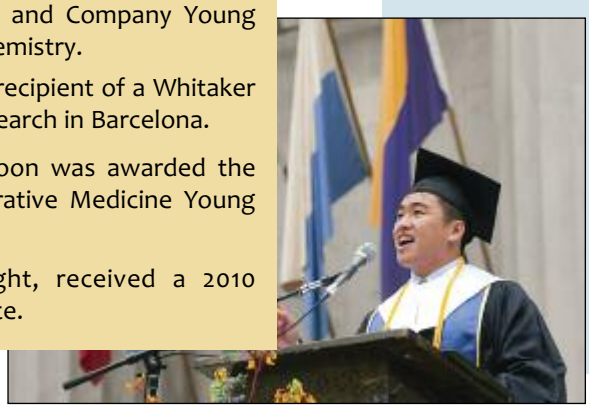
Dan Fletcher was named a Tech Awards Laureate for 2010 by The Tech Museum of Science and Technology in San Jose.

Amy Herr received a 2010 Eli Lilly and Company Young Investigator Award in Analytical Chemistry.

Grad student Johnny Tam was the recipient of a Whitaker International Scholar Award for research in Barcelona.

Undergraduate alumnus James Moon was awarded the Wake Forest Institute for Regenerative Medicine Young Investigator Award.

Recent alumnus Tu Tran, at right, received a 2010 Chancellor's Award for Public Service.



Tu Tran, photo by Bay Area Event Photography

New Master's Program!

Some of our first class at Commencement 2011
photo by Cindy Manly-Fields

In 2010, the UC Berkeley - UCSF Graduate Program in Bioengineering launched an innovative one-year Master's Degree, focusing on translational medicine. Administered jointly by the two campuses, this is the first program of its kind aimed at accelerating the translation of cutting-edge research into advances in patient care.

The goal of the program is to address the critical need for expediting new therapies to treat devastating diseases such as cancer, neurological disorders and diabetes. Students in the program are immersed in translational medicine through coursework, projects, and contact with leaders in the field. The curriculum combines bioengineering principles, clinical exposure, and business fundamentals - three critical components for modern medical innovation.

"We see this program filling an important gap," said Clay Johnston, Associate Vice Chancellor of Research at UCSF and Director of the UCSF Clinical and Translational Science Institute. "Clinicians generally don't have the skills to be good inventors, and engineers often don't understand the clinical problems."

In Fall 2010 we welcomed our inaugural class of sixteen master's program students, a group with diverse backgrounds and educational experiences. Students are currently putting the final touches on their team-based capstone projects, which were presented on July 25. Topics include "Interface Design for Robotic Surgery," a "Minimally Invasive Probe for the Detection of Pre-term Labor," "Biomimetic Matrices to Improve Post-Infarct Cardiac Function," and others. After their final presentations, many of our students will be moving on to positions in industry, pursuing additional degrees, or working to commercialize their project innovations.

The master's program initiative was jump-started by a $1.5 million gift from former Intel Corp. chief executive Andy Grove, who believes that the model which has fueled innovation in technology can do the same in health care.

"What we have learned from decades of rapid development of information technology is that the key is relentless focus on 'better, faster, cheaper' - in everything," Grove said. "The best results are achieved through the cooperative efforts of different disciplines, all aimed at the same objective."

Big BEAR: If I knew then what I know now...

What do you wish you knew when you were an undergraduate? How to choose a graduate program? How to talk to a professor? How to get a good letter of recommendation?

A group of bioengineering graduate and undergraduate students have formed a partnership to help younger students get just those sort of answers, called Big BEAR for BioEngineering Advising Representatives.

Big BEAR is an alliance of members of the BEAST (BioEngineering Association of STudents) graduate student group and Berkeley's BioMedical Engineering Society (BMES) chapter. They have set up a Graduate Advisor Program, where grad students take on one to five undergraduates as mentees, and are available to answer questions.

Mentors and mentees at their first mixer

Additional first year events included a Medical School panel, a "Graduate School Timeline" panel, an "I just got into grad school, now what do I do?" panel, and a Research Forum where undergrads could be matched with graduate students who need help in the laboratory. In the coming year, Big BEAR hopes to add more mentors, and provide critiques and guidance for admissions essays and fellowship applications.

"Big BEAR is working closely with BMES to provide mentoring and support to undergraduate bioengineers as they make their way through college and decide about grad school," said founder Eric Jabart. "We want to be a constant resource for undergrads when they have questions about classes, research, if they should apply to grad school, etc."

Alumni Profile: *Heather Bowerman*

Catching up with Heather Bowerman, who received her B.S. in Bioengineering in 2005. After working in venture capital for several years, Heather is now with the White House Office of Science and Technology Policy.

How did you end up in the world of entrepreneurship, and how did you get where you are today?

When I finished my undergraduate degree, like many grads I felt challenged to build a meaningful skill set or pick a specialty, yet simultaneously conflicted about what specific field to pursue because of the range of options available to bioengineering graduates. The best advice I was given was to listen to my own instincts, and I knew that I needed to build work experience yet wanted broad exposure to science and business.

Ultimately, I landed a position in private equity in New York City and was quickly jolted by the real-world, sink or swim business experience that I'd been looking for. The job afforded me the opportunity to learn a lot about the biotech industry, and to develop research, analytic, and strategic business skills. The core skills and perspective that I learned in that first job have stayed with me in every role that I have had since.

Heather at the White House

What are you doing now?

I work at the White House in the Office of Science and Technology Policy as an Associate. Earlier this year, I helped with The Strategy for American Innovation that came out in February, which provides a multifaceted, commonsense, and sustained approach to ensuring America's future prosperity. It explains the essential role of innovation in our past and future prosperity, the central importance of the private sector as the engine of innovation, and the role of government in supporting our innovation system. Later, I was involved with a White House initiative called Lab to Market, which focuses on the commercialization pipeline for technologies from universities and federal laboratories. Lab to Market is under the Startup America umbrella, and will expand access to capital for entrepreneurs, connect mentors and entrepreneurs, make government work for entrepreneurs, accelerate innovation, and unleash market opportunities.

What do you like best about the work you do?

It has been life changing to have the chance to work every day with some of our country's brightest minds, and to learn from them what public service really entails. Thinking about the policy side of how to help promote the success of businesses and our nation's economy has given me a more well-rounded perspective.

How did your bioengineering education prepare you for the work you do now?

Understanding the fundamentals of science and technology has been the essential building block for everything since Berkeley bioengineering, from getting my first job in private equity to OSTP at the White House.

What important lessons have you learned?

I have learned that building a career can be a wonderful adventure in self-exploration. As a college student, it is nearly impossible to predict where your career will take you, and it is important to keep doors open and follow opportunities. When I graduated from Berkeley Engineering, I was twenty years old and had met many wonderful professors who would help me, through their networks, continue to grow professionally.

Between working in New York, grad school, and then the White House, I have moved more times than I can count since Berkeley! I've had way too much experience dragging furniture and luggage into walk-up apartments with no elevators, especially in Boston and NY. Totally worth it though... at least that's what I tell myself on those mornings when I'm late for a flight for work and trying to get a huge suitcase down my tiny stairs in heels.

What tips do you have for recent alums?

It's important to reflect on what you are looking for post-Berkeley, talk to as many people as possible from different industries, and don't sell yourself short or feel like you need to rush your timeline. Sometimes industry or work experience is crucial to gain perspective on your long-term goals.

Any advice for current students?

Network with each other and keep in touch with your bioengineering classmates. You hear it all the time, but it's true. Berkeley is a big place, but get to know as many peers and faculty members as you can. I am still close with several of my classmates from Berkeley BioE -- we supported each other throughout the program and we're a great sounding board for each other today.

Alumni notes

Keep up to date with Bioengineering!

Let us know how to reach you by updating your contact info on @Cal or at http://alumni.berkeley.edu/join/update-your-contact-info.

Ph.D. alumni can also network and keep us updated at http:// bioegrad.berkeley.edu/graduatealumni.php.

We've created new mailing lists to distribute alumni job opportunities that come to the attention of the department. To sign up, send your name, email address, degree and graduation year to bioealum_admin@berkeley.edu.

What can you do at @Cal?

@cal great minds online

UC Berkeley's online alumni community

- ✔ Keep your Berkeley email address forever!
- ✔ Find old friends and meet new business contacts
- ✔ Join our "Cal Bioengineers" alumni interest group
- ✔ Join local and special interest groups
- ✔ Update your profile information

Try it out at alum.berkeley.edu

Friend Us

Find us on Facebook!
Join our alumni group *UC Berkeley Bioengineering Alumni*, or friend *Berkeley Bioengineering*.

Connect with us on LinkedIn as *Berkeley Bioengineering*

Hire a student

Contact the BioE Department at bioeng@berkeley.edu for help with recruiting graduating students, summer interns, or 6-month Co-Op interns.

Give directly to BioE!

Recent Graduates

Bachelor of Science

Summer 2010

Chen, Michael
Kumar, Angelee
Nguyen, Nhu
Rubalcava, Leticia

Fall 2010

Chou, Amanda
Chang, Amy
Chang, Jefferson
Chen, Francis
Chyou, Wynne
Dang, Brian
Fanjung, David
Hablani, Neeraj
Holstlaw, Taylor
Hui, Tiffany
Jayagopal, Aishwarya
Kita, Ashley
Lee, Sang
Mehdizadeh, Amir
Ouadah, Youcef
Pendse, Mihir
Phuong, Kevin
Pimentel, Kevin
Richardson, Christopher
Ruiz, Carlos
Saleh, Gaber
Shau, Jasper
Tran, Tu
Venkateswaran, Neeraja
Wang, John
Wei, Margaret
Yang, Evan
Yu, Xinxing

Spring 2011

Abdul Aziz, Syed Umer
Assadian, Salar
Bao, Xuan
Bartlett, Trisha Diane
Bawal, Mihir Subhash
Beeve, Danielle Louise
Bozorgi, Seyed Amir Abbas
Cam, Richard Nelson
Chambers, Tiffany Simone
Chan, Tiffany Wyn-Yin
Chang, Jonathan Shutarng
Chang, Kevin Chih-Wei
Che, James
Chen, Daniel
Chen, Joanna Ying
Chen, Susan Yushan
Chen, Timothy Han
Cheng, Sabrina Swan
Chun, Jonathan W
Chung, Joseph J
Cohen, Michael Jarrett
Fang, Charles X
Freimer, Jacob Wingfield
Fu, Eunice Andrea
Fu, Yuan Fang
Girn, Simrunn Singh
Ho, King Chung
Hsieh, Chih Ming
Huang, Curtis Alexander
Huang, Fang
Hyun, Eugene Taehoon
Jiang, Felix
Johnson, Ryan Alexander
Kadambi, Achuta
Kan, Iris Calli
Kury, Matthew Wilson
Kwong, George
Labog, Regine Mallillin
Lan, Li-I
Lee, Chih-Han
Lee, Elaine Diana
Lee, Jason Shinjen
Lee, Lloyd J
Lee, Nathan Hyunil
Linn, Felicia C
Liu, Joshua J
Marcus, Michelle Elizabeth
Mehech, Daniela Faustino
Modak, Ashin
Neyer, Christoph Andreas
Ni, Jason Ching-Arn
Nofal, Michel Ibrahim
Patel, Amit Kirit
Patel, Hinesh V
Patel, Nikit Bhavesh
Peng, Albert Dillon
Peralta, Shane Alexander
Ramachandran, Sweta K
Ramakrishnan, Aparna Kotra
Reber, Clay D
Reese, Riley John
Saito, Tomoya
Salvado, Keith Henri
Shah, Mansi Rajendra
Shi, Angela Ang
Shin, Jong H
Si, Catherine
Silvestre-Ryan, Jordi Joaquim
Srinivasan, Tara
Sylvia, Meghan Kathleen
Tai, Chia-Hung
Takami, Eri Ashley
Tandiono, Christopher Bo
Tulanont, Dorothy D
Velasco, Justine Jasmine
Viswanathan, Nickesh
Weisenstein, Lauren Josephine
Williams, Bryan Lee
Xu, Liyi
Yang, Daniel Xiao
Yik, Barnabas Ka-Fai
Zhu, Alyssa Huichao

Master of Science

Wang, Yue (Sarah), Fall '10

Doctor of Philosophy

Fall 2010

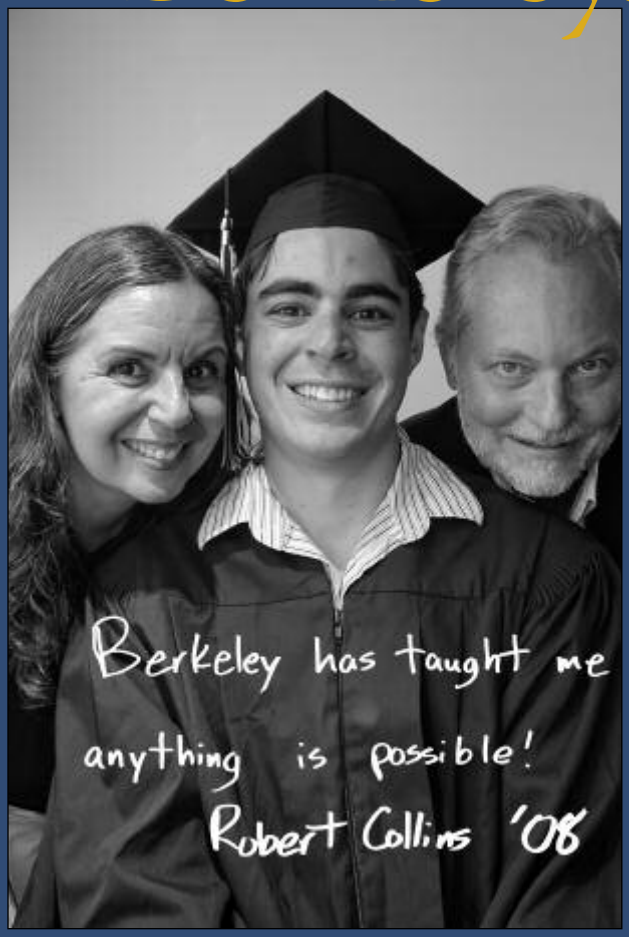
Cho, Hansang
Fischer, Kathleen
Janairo, Randall Raphael
Park, Il Woo
Rodriguez, Azucena
Schoenecker, Matthew
Singer, Lisa
Sode, Miki
Steedman, Mark
Steen, Eric
Wong, Derek
Wootton, Jeffery
Zhu, Yiqian (Eugene)

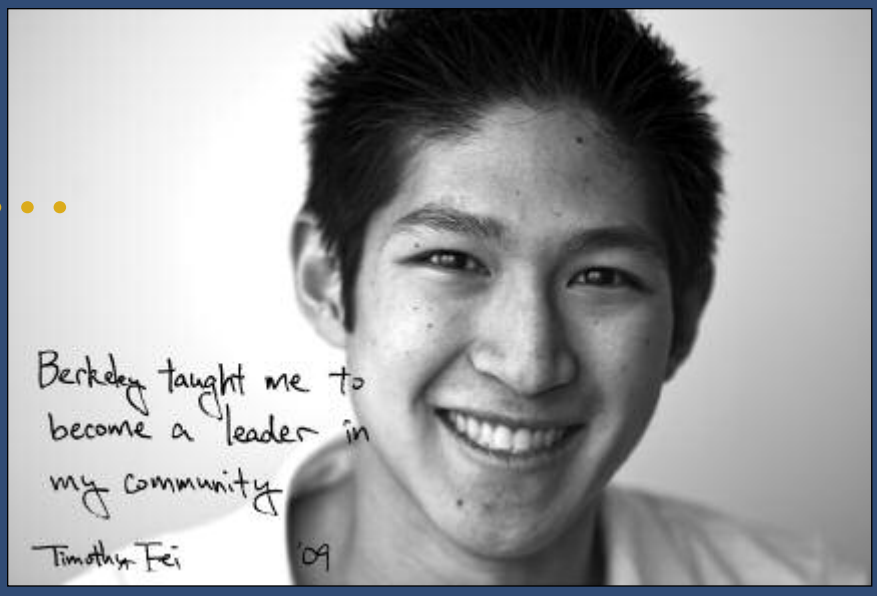
Spring 2011

Del Bueno, Nadia
Dietrich, Jeffrey
Engelberg, Jesse
Mendelsohn, Adam
Ulrich, Theresa
Vu, An

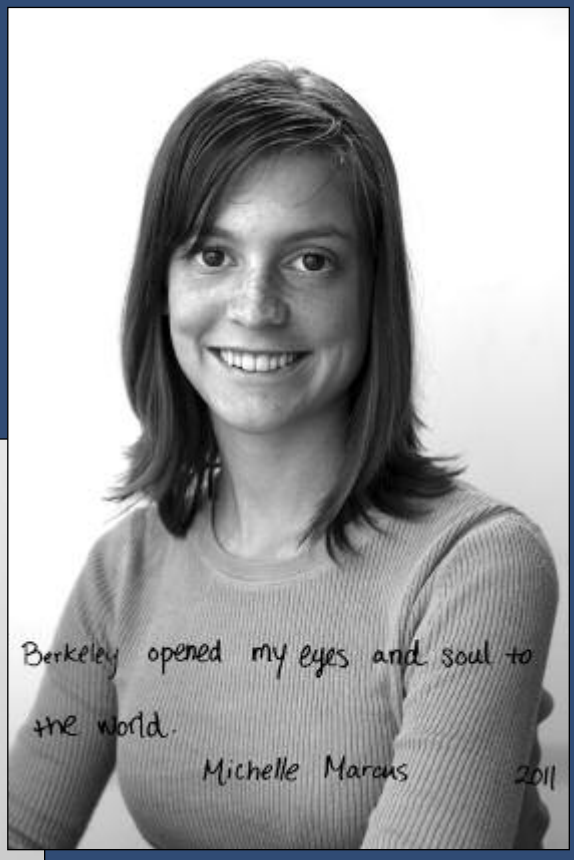
photos by Bay Area Event Photography and Cindy Manly-Fields

Thanks to Berkeley...





these Bioengineering alumni
have a chance to change the world.



What's your Berkeley story?

Donate directly to your choice of Bioengineering programs at
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