2016

Berkeley BIOENGINEERING

The future of biology. The future of engineering.

Message from the Chair

Connections: Bioengineering + The World

Being part of a field that lies at the intersection of other disciplines—biology, engineering, chemistry, physics—bioengineers know better than most that our work is all about connections. Patients to doctors, home to hospital, lab to clinic, students to jobs, academia to industry.

At Berkeley, we work a lot with connections. Our department's global health diagnostics efforts bring the healthcare technology of big cities into the countryside and the developing world, and our senior capstone design class connects students with real-life clinical problems that need solutions. Recent faculty discussions have sparked new collaborations within our department, and a town hall meeting of faculty and undergraduates has forged stronger relationships and better communication.

Lately we have been looking beyond the campus and thinking about how stronger outside connections can enrich the lives and work of our students, faculty, and alumni. Discussions with our colleagues at other universities are helping us build a curriculum that keeps up with the rapidly advancing field of bioengineering. Partnerships with local industry are providing hands-on training and career opportunities for students. Meetings with friends and donors are inspiring new goals and helping us achieve them. Close relationships with alumni are providing career guidance for current students, and inspiring us all to continue making a positive impact on the world.

These human connections are a renewed priority for us in the coming years, and we hope you'll join us in planning a bright future together.

Thank you, and Go Bears!

Daniel A. Fletcher
Department Chair, Bioengineering and Purnendu Chatterjee Chair in Engineering Biological Systems

Berkeley
BIOENGINEERING
The future of biology. The future of engineering.

About us

Undergraduate program ranked 8th in the U.S.

91% of seniors have done extracurricular research

23 core faculty

7 endowed faculty chairs

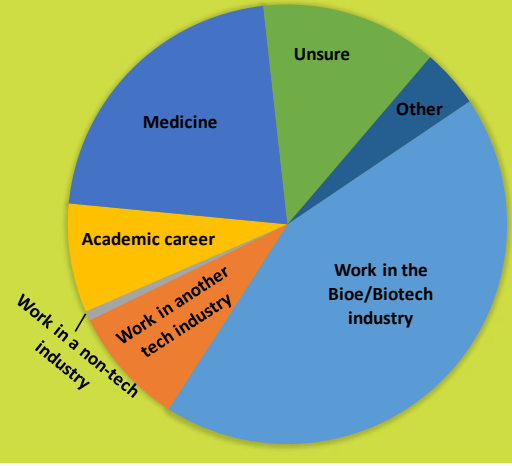
340 undergraduates

78 masters students

PhD program ranked 6th in the U.S.

Average upper division class size: 26

UC Berkeley, the #1 best value college in the US by Forbes magazine



Undergraduate long-term career plans

42% female undergraduates!

43% female PhD students

173 PhD students

it's all about. . . connections

with industry

The department has made a renewed committment to building our relationships with the biotech industry. The bioengineering job market is expected to grow 23% by 2024, and our current and future students will be an integral part of that growth—as employees, leadership, startups, and innovators.

One facet of our commitment is helping our students build rewarding careers in the biotech field. We've launched a new **Bio-Tech Connect** series of events and programs to help them make the connections they need to plan their futures.

1. Our Bio-Tech Connect: Learn from Alumni night each Fall brings back BioE alums to share their career advice.

2. The Spring Bio-Tech Connect: Industry Networking gathers representatives from dozens of local companies for informal networking.

3. The Bio-Tech Connect Infosession Series features one corporate infosession each month for face-to-face recruiting.

Faculty are in the mix too, meeting with members of industry before and during events, as well as individual collaborations and guest speakers.

If your company would like to connect with Berkeley BioE, or send out a job posting, let us know at bioeng@berkeley.edu.

with alumni

Our alumni are the mission and reward of the department. They're our ambassadors, our advertisement, our final product, and the force that we send out to change the world.

We're ramping up our alumni engagement with more invited talks from program alumni, more communication through email and social media, and of course, our new annual alumni party, with a special collectible each year:

BioE Alumni Summer Bear Bash!

Don't miss the next one - June 3, 2017!

with other schools

We inaugurated two new distinguished seminars this year, the **Rising Star Lecture** and the **Berkeley Distinguished Lecture in Bioengineering**, with visits from two outstanding researchers.

The Rising Star Lectureship invites one up-and-coming early-career faculty member to speak at UC Berkeley, and was launched by Professor Kim Woodrow of the University of Washington on September 21, 2016.

Woodrow is an Associate Professor in the Department of Bioengineering, where she is known for her work on the design and synthesis of biomaterials for applications in mucosal infections and mucosal immunity.

On December 2 we were pleased to welcome Professor Robert Langer of MIT as our first Distinguished Lecturer.

Langer is the David H. Koch Institute Professor at MIT, the most cited engineer in history, and a world-famous bioengineer. He spoke to a standing-room-only crowd on "Biomaterials and biotechnology: From the discovery of the first angiogenesis inhibitors to the development of controlled drug delivery systems and the foundation of tissue engineering."

Thank you to both of our guest speakers!

with supporters

It takes a lot of money to change the world! That's why we so appreciate our donors, no matter what size the gift. Below we acknowledge just a few of our benefactors.

To continue to thrive during the current lean times for the university, our goal is to secure **two new endowed faculty chairs** in bioengineering and **five new endowed graduate student fellowships** over the next five years.

Berkeley is about looking beyond ourselves to make a difference in the world, and we thank everyone who makes a difference for us!

Partial list 2015-16 donors to Bioengineering

Daniel Chao
Ovijit Chaudhuri
Daniel Imamura
Sophia Lo and Hunter Chen
Olagappan Manickam
Rajat Monga
Kim Nguyen and Joseph Daniel
Dominique and Nancy Philippine
Steven Rockhold and Julie Tsoi
Kate and Mike Rosenbluth
Jonathan Yuen and Benji Paradewelai

The **Friends of Bioengineering** fund provides much-needed discretionary money for use where it is needed most: teaching lab equipment, student travel to conferences, outreach events, student activities. Most of the donors to Friends of BioE are our own alumni and parents.

Give directly to BioE at *Give.Berkeley.edu/bioe*, or contact bef@coe.berkeley.edu or 510.642.2487.

Keep in touch!

Like our **Facebook page** at *www.facebook.com/BerkeleyBioengineering*

Alumni, join our private **LinkedIn group,**
UC Berkeley Bioengineering Alumni & Students

Moving? Update your contact information at
http://alumni.berkeley.edu/membership/update-your-contact-info

Strategic Plan

Our mission as a department is to drive advances in biosciences and improvements in health through engineering research and education.

Our Plan

The Department of Bioengineering recently completed a year-long strategic planning process. We have developed a three-point strategic plan to guide our research, teaching, and community-building efforts over the next five years:

Research

Play an international leadership role in:

- cellular engineering for human and environmental health,
- technology development for personal and precision medicine.

Teaching

Expand our faculty and courses to create a curriculum that redefines the intellectual core of our field.

Provide educational experiences that prepare students for career success.

Community

Foster a diverse, engaged, and inclusive community by building our internal and external communities.

Our Challenges

- » Growing demand for bioengineering
- » Increasing student population
- » University financial constraints

Our Goal:

In the next five years we aim to increase our international recognition and impact to become one of the top three U.S. Departments of Bioengineering.

Our Reward

Cellular engineering: Current efforts to understand and manipulate cells through engineering approaches are opening up exciting new opportunities to engineer cells at the molecular scale.

- Building tissues: biomaterial design, tissue-on-a-chip
- Reprogramming cells: regenerative medicine, stem cells
- Harnessing synthetic biology: pharmaceuticals, microbiome engineering

Technology for precision medicine: New technologies are needed to identify and measure health indicators and identify individual differences that can lead to more effective, customized treatments.

- Enabling hospitals: medical imaging, patient monitoring
- Empowering communities: point-of-care devices, Health@Home
- Advancing research: biomarker identification, high-throughput screening, computation

Expanded courses to redefine bioengineering education: New courses build on each other to prepare students for deeper discovery in upper-division courses, and teach biology and chemistry from an engineering perspective.

- Engineering Molecules 1, Engineering Molecules 2, Engineering Cells, Basic Principles of Drug Delivery, Intro to Data Science for Bioengineers

Prepare students for career success: We aim to provide our students with hands-on experiences, skills valued in the job market, and opportunities to build their careers.

- Expanded opportunities to participate in capstone projects, laboratory and research experiences.
- More frequent interaction with local industry to connect for internships and jobs
- Plan for growth in student population

Build our internal community: Improve and formalize professional development, mentoring, and promotion of our faculty, staff, and students. Increase the diversity of our community.

- Annual town hall meetings and formation of an Engineering Engagement Committee
- Aim for all faculty to participate in at least one research opportunity program
- Broaden the reach and exposure of our faculty searches

Build our external community: Deeper industry and alumni engagement through student activities.

- More student–industry events
- Structured mechanisms for undergraduate research
- Alumni mixers and invitations to speak on campus

Undergraduates

Student comments from our annual survey of undergraduates:

"BioE is very collaborative and has a strong sense of community."

"I have honestly found my family at Cal in BMES"

"I think I felt very accepted in the bioengineering department because the classes were more focused on learning the subject rather than competition or getting the best grade."

"great mentors and great opportunities to actually think and contribute to projects and have personal ownership."

The undergraduate program in bioengineering attracts talented students and provides a hands-on environment for exploring an engineering approach to biological systems. Our curriculum provides a strong foundation in science and engineering and the ability to specialize in practical areas of interest in the growing field of bioengineering.

Berkeley offers a wealth of opportunity for learning, research, service, and community involvement. Our graduates have found great success in industry careers, as well as admission to top graduate and medical schools.

Concentrations:

- Biomaterials, Biomechanics, and Cell & Tissue Engineering
- Biomedical Devices
- Biomedical Imaging
- Computational Bioengineering
- Pre-med
- Synthetic Biology

First annual BioE Town Hall

Our first undergraduate Bioengineering Town Hall Meeting was held on September 16, 2016. The event featured a State of the Department update from Professsors Fletcher and Kumar, an overview of new curriculum changes from Teaching Professor Johnson, and an update on our new engineering engagement efforts from Professor Herr, followed by small group breakouts of students and faculty and general networking over snacks.

Moving up the US News rankings

BioE keeps climbing! Our undergraduate program has moved up a notch in the annual US News & World Report ranking to #8 in the nation!

Ongoing curriculum enrichment

The department is always striving to update and optimize our program to better serve students.

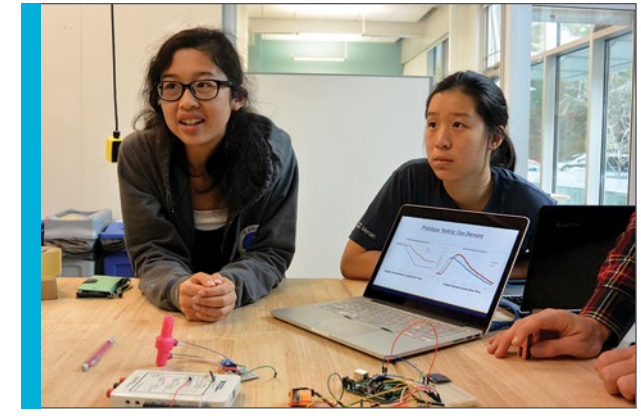
New Engineering Molecules 1 & 2 courses have recently been introduced to provide bioengineers with a molecules-first approach to biology. Bioengineering-oriented introductions to cells, tissues, data, devices, and systems are being planned.

Professor Irina Conboy and Lecturer Hayley Lam were also awarded a ***2016-2017 Presidential Chair Fellows Curriculum Enrichment Grant*** to fund integrating research skills into the curriculum.

Their project aims to embed three "evaluating evidence modules" across courses in the Cell and Tissue Engineering concentration to enhance undergraduate research skills.

The modules guide students in analysis of primary research papers, applying scientific evaluation skills to a current biomedical problem, and presenting the outcome in a public poster session.

The long term goal will be to implement the modules in all other concentrations of the Bioengineering curriculum.



Capstone design course and summer biodesign immersion

The undergraduate capstone course is one of the highlights of our program, providing students with the opportunity to address real-life engineering problems in collaboration with clinical faculty at hospitals and clinics around the Bay Area, as well as with international partners.

Teams from this course have gone on to found startup companies, and three former capstone projects are now in clinical trials.

The semester-long course is supplemented by an optional ***Summer Biodesign Immersion Experience***, supported by a National Institutes of Health R25 grant.

Professor Amy Herr founded and directs the summer experience, an innovative 8-week program that concentrates on needs-finding skills to prepare bioengineers to connect engineering innovation and unmet clinical needs.

The NIH has recently renewed the grant, funding the program through 2021.

This summer the students blogged their immersion experience, check them out at http:// medium.com/berkeleybie.

The Master of Translational Medicine (MTM) and Master of Engineering (MEng) in Bioengineering programs are one-year professional degree programs designed for students planning careers in industry. The MTM focuses on the unique aspects of innovation in healthcare, while the MEng more broadly approaches bioengineering in industry. Both programs attract students of high quality with backgrounds and career goals distinct from the Ph.D. program, who are looking for an intensive experience beyond the undergraduate and without the academic focus of the Ph.D.

These programs appeal to a unique set of students focused on productive careers in industry and clinical translation, with the MTM, especially, drawing a growing proportion of students already enrolled in a clinical medicine program.

MEng team wins Fung Institute Mission Award

Master of Engineering capstone team Alison Burkland, Daniel Campo, Dragos Puscalau, and Gregory Wohlleb—working with bioengineering professor Kevin Healy—received the 2016 Fung Institute Mission Award for their work on a Point of Care Low-Cost Approach for HIV Monitoring.

MTM student wins UC Berkeley Global Health Case Competition

MTM student Tyler Schmeckpeper was a member of the winning team in the first UC Berkeley Intramural Global Health Case Competition, and went on to compete at the international competition in Georgia in April.

Improving the odds for kidney transplant success

An MTM student team was recognized by the Clinton Global Initiative University for their low-cost kidney transplant monitor.

Professional Masters

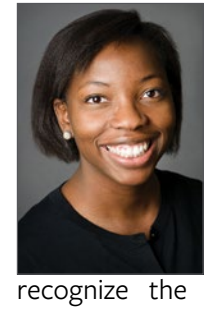
Doctoral

Our PhD program is joint with UC San Francisco, one of the best clinical universities in the nation, and encourages cross-disciplinary collaboration. We offer students unparalleled opportunities for basic and applied bioengineering research in a wide variety of related fields, with access to the full breadth of resources and courses on both campuses.

Top PhD and Hospital rankings

Rankings from US News & World Report place the UC Berkeley – UCSF Graduate Program in Bioengineering tied for **6th best in the nation**, up from 7th for the past two years.

Our affiliated UCSF Medical Center ranked **7th best hospital in the nation** in U.S. News & World Report's 2016-2017 Best Hospitals survey, its 15th consecutive year among the best.



Soros Fellow Lindsey Osimiri

The Paul and Daisy Soros Fellowships for New Americans recognize the promise of young people who are recent Americans. Congrtulations to PhD student Lindsey Osimiri, a 2016 Fellow.

Andrew Bremer (Lloyd Scholar), Stacey Lee (Lloyd Scholar), Judy Savitskaya (Lewis Scholar), Ben Adler (Craven Scholar), Sally Winkler (Brodie Scholar)

Fellowships fund academic freedom and excellence

Independent fellowships allow students to work on pioneering research not yet funded by faculty grants, and to pursue their interests and passions.

In 2016, 39 of our students have active NSF Fellowships, and 18 have other prestigious external fellowships, including our Ford Fellow, Hector Neira.

Our heartfelt thanks to the generous donors who have endowed these fellowships, and congratulations to the recipients of the Brodie, Craven, Lewis, and Lloyd graduate fellowships in bioengineering.

Song in Forbes *30 Under 30*!

Shang Song co-founded Rynm health, which will aggregate chronic disease data to create meaningful pictures of community health in developing countries.

Faculty

New faculty: Streets and Vandsburger

Two new faculty joined the Department of Bioengineering this year!

Dr. Aaron Streets received his Ph.D. in applied physics from Stanford University, and has recently been working on advanced imaging technologies for microfluidic platforms at the Biodynamic Optical Imaging Center at Peking University. Dr. Streets is known for developing advanced imaging technologies for microfluidic platforms that allow him to isolate, interrogate, and analyze individual cells.

Dr. Moriel Vandsburger received his Ph.D. in Biomedical Engineering from the University of Virginia, Charlottesville, and has been an assistant professor in Physiology and Biomedical Engineering at the University of Kentucky. Dr. Vandsburger is a pioneer in combining advanced MRI techniques with the use of "reporter genes" that enable MRI to detect tissue properties at the molecular level.

Herr elected to NAI

Professor Amy Herr has been elected a 2016 Fellow of the National Academy of Inventors. She joins only eleven other Berkeley faculty ever elected.

Election to NAI Fellow status is the highest professional distinction accorded solely to academic inventors who have demonstrated a prolific spirit of innovation in creating or facilitating outstanding inventions that have made a tangible impact on quality of life, economic development, and the welfare of society.

Yartsev's very good year

In 2016 Assistant Professor Michael Yartsev was named a 2016 Pew Scholar in the Biomedical Sciences. This prestigious program provides funding to young investigators of outstanding promise in science relevant to the advancement of human health.

Yartsev also received an NIH New Innovator award for his research studying the "First Mammalian Model System for Studying Vocal Learning: A Behavioral and Neurophysiological Approach."

He was named a 2016 Searle Scholar, a program which supports the independent research of exceptional young faculty in the biomedical sciences and chemistry, a Klingenstein-Simons Fellow in Neuroscience, and received a $1.2M grant from the Human Frontier Science Program to study vocal learning in bats.

Kumar named BMES Fellow

Professor Sanjay Kumar was elected to the Biomedical Engineering Society Class of 2016 Fellows.

Fellow status is awarded to members who demonstrate exceptional achievements and experience in the field of biomedical engineering, and a record of membership and participation in the Society.

Research

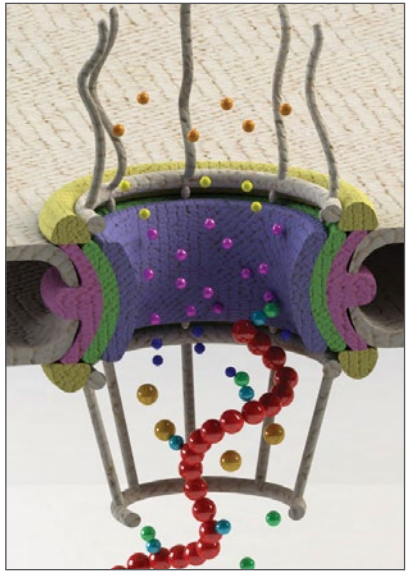
Messersmith's mussel-inspired fetal surgery glues

Professor Phillip Messersmith is designing better glues for medical procedures, applying knowledge about the underwater superglues made by mussels.

Due to their extreme delicacy, special new adhesives are needed to seal the amniotic sac after *in utero* surgical interventions. The amniotic sac is not so different from the ocean, where the mussel successfully glues itself in place for life. Messersmith is collaborating with UCSF pediatric surgery pioneer Michael Harrison, and his new bio-inspired glues may be the answer.

Conboy finds young blood alone does not reverse aging

A study from Professor Irina Conboy's lab found that tissue health and repair dramatically decline in young mice when half of their blood is replaced with blood from old mice. This adds further detail to the complex and controversial study of aging, and suggest that young blood alone will not reverse the aging process.



Mofrad Lab explains gatekeeping proteins of the cell nucleus

New research from Professor Mohammad Mofrad's lab has shown how gateway proteins can recognize and block aberrant strands of genetic code from exiting the nucleus—a form of quality control for the transport of genetic information.

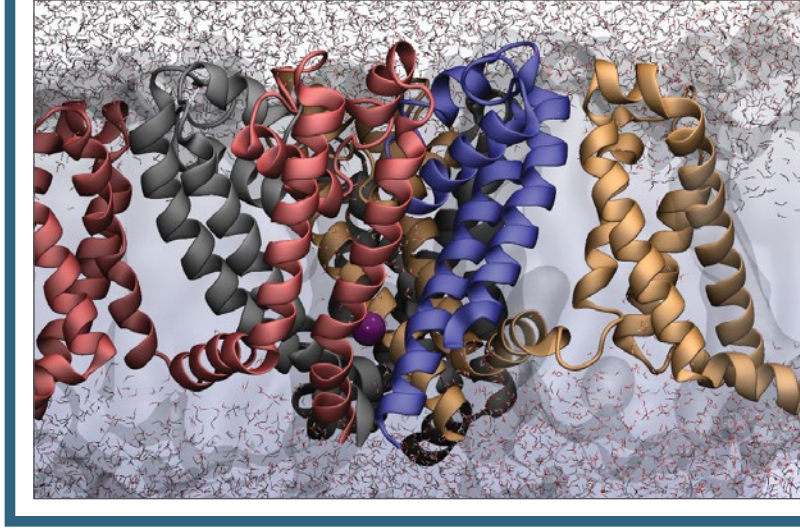
Using a computer model, they found that regulation of the interaction between RNA-binding proteins and export receptors is the key for nuclear basket proteins to distinguish aberrant mRNAs and retain them inside the nucleus.

Understanding how bad codes escape the system and exit the nucleus may be important in treating and preventing cancers and other diseases.

Head-Gordon leads scientific software partnership

The National Science Foundation has announced a major award to establish the Molecular Sciences Software Institute as a partnership of Virginia Tech, UC Berkeley, Rice, Stony Brook University, Rutgers, USC, Stanford, and Iowa State.

Teresa Head-Gordon, Chancellor's Professor of Bioengineering, Chemistry, and Chemical & Biomolecular Engineering, is the lead scientist at UC Berkeley.



Alumni

Two BioE alumni named to TR35

Bioengineering alumni Kelly Gardner and Heather Bowerman were named top innovators under 35, a list compiled each year by the *MIT Technology Review*. Gardner, PhD 2013 in Amy Herr's lab, was recognized for her lean biotech startup innovating in single-cell protein analysis. Bowerman, BS 2005, was honored for inexpensive hormone-level tracking technology.

BioE alumnus Connor Landgraf (BS 2013, MEng 2014) received the 2016 Mark Bingham Award for Excellence in Achievement By Young Alumni!

LYGOS

BioE startup Lygos raises $13 million

Lygos Biotech, founded by PhD alumni Jeffrey Dietrich and Eric Steen, has raised $13 million in Series A funding to continue their work producing high-value specialty chemicals through synthetic biology.

It also won the "Bio-Based Chemical Innovation of the Year" award at the inaugural Bio-Based Live conference in San Francisco, California, for its method to produce malonic acid. Their process uses domestic sugars instead of petroleum for chemical production, and was featured in the *New York Times* in December.

Where do BioE alumni go?

Cepheid • Genentech • Gilead • Bayer • Illumina • Zymergen • Vortex • St. Jude Medical • Berkeley Lights • Whole Biome • Amgen • Siemens • Sangamo Biosciences • Counsyl • Accenture • Nike • Lumosity • GE Healthcare • Medtronic • Vortex Biosciences • EMD Millipore • Scanadu • Proteus Digital Health • 23andMe • Zeiss Medical • Abbott Vascular • NIH • Biogen • Novartis • Roche • Google • Apple • NIST • Life Technologies • Kaiser Permanente •Pfizer...

Medical students and residents at UCLA • Northwestern • Indiana U • UCSD • UCSF • UC Davis • Duke • Harvard • Boston U • Case Western • UCSF • UC Irvine • Maryland • UCLA • NYU • Washington University, to name a few.

Founders of Bolt Threads • Magnetic Insight • Nano Precisicion Medical • Zephyrus • Privail • Eko Devices • Knox Medical • Diassess • Nodexus • BD Genomics • Cor Medical • NanoNerve • DeviceFarm • Lygos • Ventrix • Exogen • Correlia Biosystems • ThruFocus Optics • Valitor • Cortera Neurotechnologies • Decisive Health • and more!

Faculty at UNC • UC Irvine • UCLA • UC San Diego • Stanford • OHSU • UCSF • Brown • CCNY • Dartmouth • UOP • Occidental • Texas Tech • Hanyang U • USC • SUNY • Temple U • Emory • Univ of Toronto • Univ of Pittsburgh • Johns Hopkins • UW • Seoul National Univ • Georgia Tech • UIUC • University of Michigan • Tsinghua Univ • CSUMB • Rice • UC Davis • Marquette • Virginia Tech • Rutgers • and on!

Magnetic Insight installs first scanner, raises $3Mil in funding

magnetic INSIGHT

BioE startup Magnetic Insight will install their first Magnetic Particle Imaging scanner at the Stanford School of Medicine, where researchers will explore using MPI to solve challenges in cell therapy and vascular imaging. The company, led by PhD alumnus Patrick Goodwill and BioE professor Steven Conolly, has also recently secured an oversubscribed seed funding round of $3M.

Alumnus Di Carlo wins PECASE

BioE BS and PhD alumnus Dino Di Carlo, now a professor at UCLA, was awarded the Presidential Early Career Awards for Scientists and Engineers, the highest honor bestowed by the United States Government on science and engineering professionals in the early stages of their independent research careers.

Herr Lab invention 2016 Top Innovation

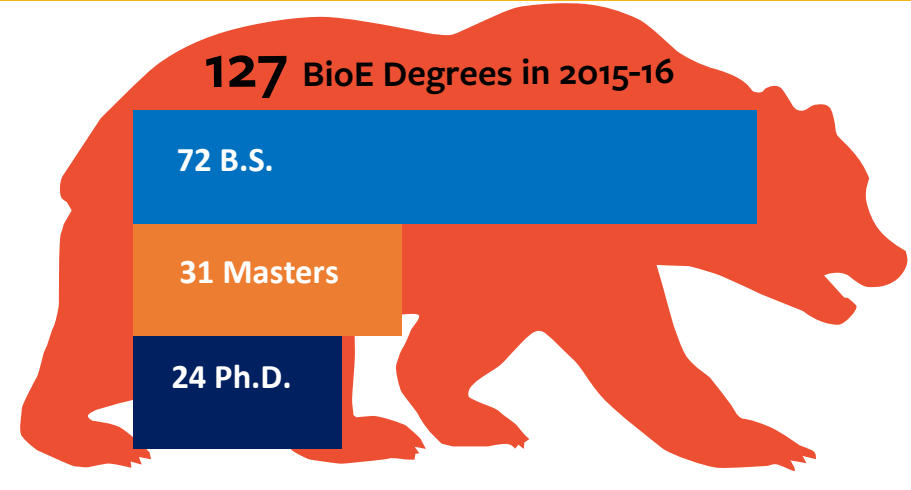
2016 TheScientist TOP 10

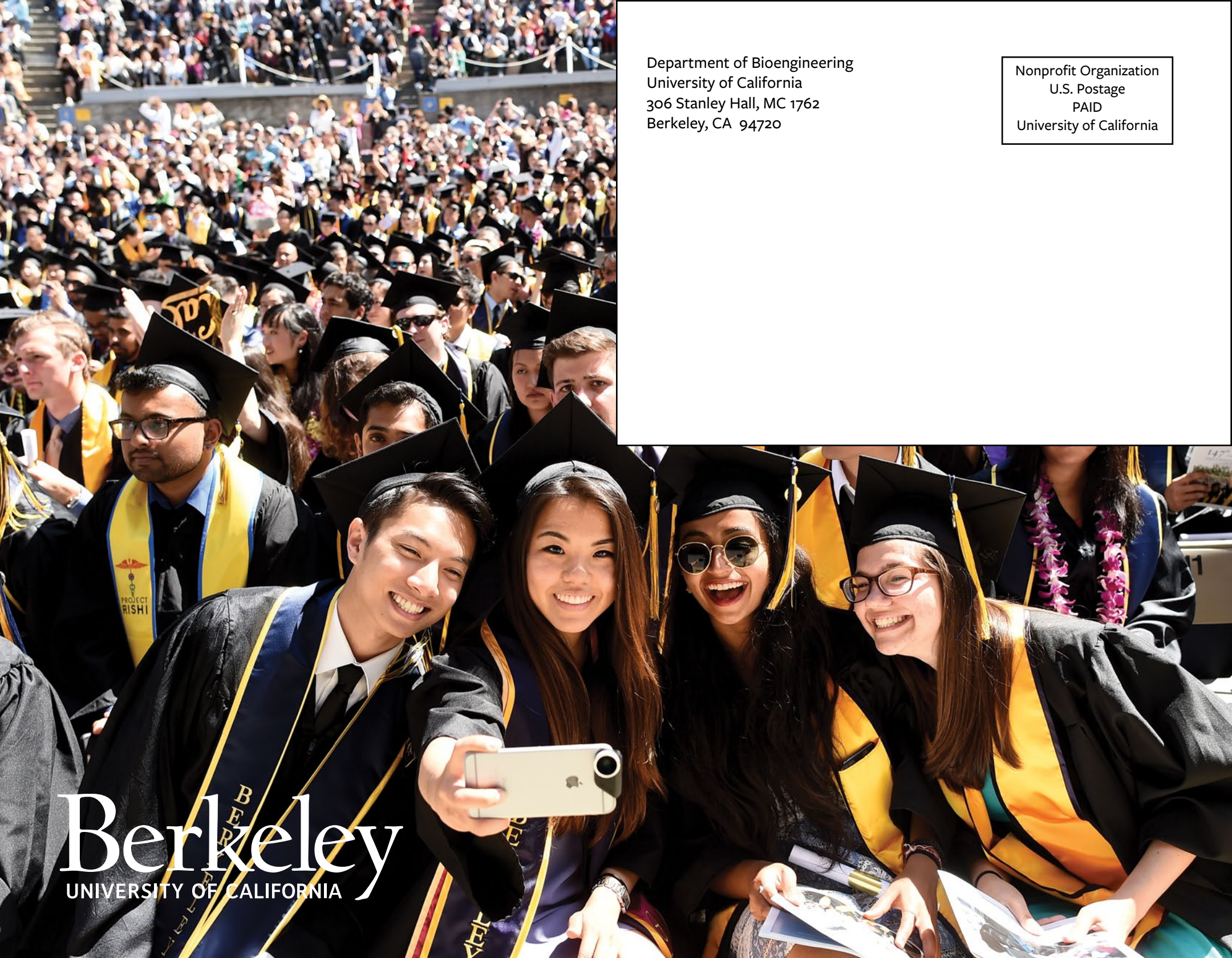
The Scientist magazine chose Milo, the commercialized version of the single-cell Western blot technology invented in Professor Amy Herr's lab, for the #1 spot in their annual Top 10 Innovations of the Year. Originally developed for market by BioE PhD alumna Kelly Gardner for their startup Zephyrus Biosciences, acquired by BioTechne, Gardner now runs commercialization of the product at ProteinSimple.

Graduates

A few of the 2016 BioE PhD dissertation titles:

Strategies for Metabolic Pathway Optimization in Saccharomyces cerevisiae
Assays and Tools for Biomolecular Analysis in Remote and Low-Resource Settings
System Hardware and in vivo Cell Tracking in Magnetic Paricle Imaging
Precise Spatiotemporal Control of Voltage-Gated Excitability in Neural Dendrites
Directing electrical energy across the cell membrane for precise bioelectronics
Microbial Lactam Biosynthesis and Biosensing
Tissue mechanics drive breast cancer malignancy
Polymer Thin Film Devices for Controlled Drug Delivery
Mechanobiology of TGFb receptors and downstream signaling in cartilage
High-throughput molecular binding analysis on open-microfluidic platform
Polycaprolactone Thin Film Devices for Drug Delivery





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