

# BIOENGINEERING BULLETIN

UNIVERSITY of CALIFORNIA, BERKELEY  
DEPARTMENT OF BIOENGINEERING

SPRING 2009

## Inside this issue:

- Big little research by Bioe Faculty
- Undergrad research, the experience edge?
- Chair Chat with Dorian Liepmann
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## BioE by the numbers

### Spring 2009

419 undergrads  
148 Ph.D. students  
17 core faculty  
11 joint faculty  
2 emeritus faculty  
1 adjunct professor

We have the third largest undergraduate program in the College of Engineering!



1292 Freshmen applied for Fall 2010 admission to BioE, compared to 387 in 1999.

The Bioengineering Department was founded in 1998.

The UC Berkeley - UCSF Bioengineering Graduate Program turned 25 years old in 2008!



## Tiny research, big results

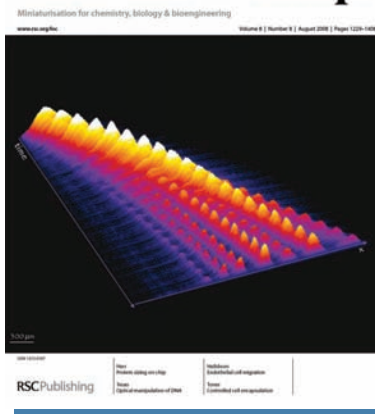
Two of our newest faculty members have been attracting big attention for work at small scales.

Assistant Professor **Seung-Wuk Lee** is working on a genetically engineered virus that could help repair injured spinal cords, by creating scaffolds that mimic supportive nerve tissue.

The phage virus M13 was engineered to display nerve-cell friendly proteins on its outer coating. Quantities of the virus were put into a solution of neural-progenitor cells, where the viruses aligned themselves like liquid crystal. When injected into a simple culture medium they form long, nerve-like fibers, where progenitor cells multiply and grow the long branches characteristic of neurons. Next steps include animal trials for safety and efficacy.

"Viruses are smart materials," he says. "Once you construct the genome, you can make billions of phages, and they're self-replicating materials."

## Lab on a Chip



Herr's work covers *Lab On A Chip* in August 08

**Amy Herr**, Assistant Professor, also works with tiny components, forging microfluidic tools for the future of biological research.

Herr is pioneering methods to create chip-sized microfluidic devices that are able to reliably sort proteins by size using linear and non-linear gradient gels. Her diffusion-based photolithographic fabrication method offers sensitivity

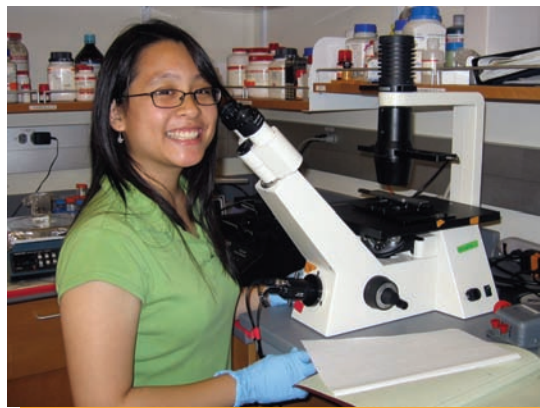
and speed improvements over current methods, and allows an assay to be optimized for proteins of interest — especially complex samples. Potential applications include portable high throughput bioanalytical instruments designed for uses such as point-of-care diagnostics for sampling in the field.

## Does experience make the difference?

### Lab research gives undergrads a leg up

We talk a lot in academia about training the next generation of bioengineers, but is Berkeley's great classroom education enough? Many researchers say the experience of actually working in a laboratory had the most impact on their career.

Early lab experience can help students refine their focus, boost practical skills, help them land jobs and admissions to top graduate schools, and even steer students toward a career in research that they had never considered.



Michelle Tsai, Berkeley Summer Bioengineering Research Program

"I can't overestimate the importance of undergraduate research," said BioE alum Cary Opel (B.S. 2004), now an R&D Engineer at Genentech. "It helped me get my job, and the publication I co-authored as an undergrad is definitely helping me get into top grad schools now."

BioE programs that offer hands-on training include the new BioE 192, Capstone Design Project. In the intensive class, taught by Amy Herr, students are paired with UCSF clinicians to design, test and prototype new or improved medical technologies.

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Bioengineering and Chemical Engineering Professor **Jay Keasling** was named one of *Rolling Stone* magazine's 2009 Agents of Change.

Jay also made a guest appearance on Comedy Central's *Colbert Report* on March 10, promoting synthetic biology research to produce biofuels. Colbert and Keasling joked about producing gasoline from "microbe poo".

Keasling was also featured in *Newsweek* in December 2008 as a "Person to Watch".



Three **BioE PhD students**, Adam Mendelsohn, Lily Peng and Kayte Fisher, won 1st prize at the 2008 UC Berkeley Business Plan Competition last May, AND the high stakes Venture Lab Competition in October. The plan: NanoFlow, a low-cost, precision system to deliver therapeutic treatments for chronic diseases.



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# Chair Chat

Greetings Friends, and welcome to our first department newsletter. I'm glad to have this new opportunity to update you on all of the developments at Berkeley Bioengineering. There's never a dull moment here!

The BioE Department is now ten years old, and 2009 is proving to be an exciting and challenging year to be a young department. Recession and state budget shortfalls make growth difficult, but we are committed to continuing to develop a distinguished and vibrant bioengineering community at Berkeley.

As you look through this newsletter, I think you'll agree that with the incredible quality and energy of our students and faculty, nothing can stop us!



Our people have been doing some outstanding work and garnering recognition in many areas, from biophysics to nanotechnology to synthetic biology. I'm especially impressed by the hard work our students put into everything they do, whether it be a course project, a research poster or an international competition.

I'm also so proud to see our alumni succeeding and putting the skills they learned here to use out in the world, and looking forward to more stories of the great things our graduates are doing

Even though this is our first newsletter, it's my last Chair Chat — I'm very pleased to announce that Dr. Matt Tirrell, currently Dean of

Engineering at UC Santa Barbara, will be joining us as our new Chair in July. Welcome Matt!

Have a great summer,

**Dorian Liepmann**

## News Briefs

In 2008 Bioengineering welcomed our newest faculty member, Professor **Gerard Marriott**, from the University of Wisconsin-Madison, where he was a Professor of Physiology and Director of the Graduate Physiology Program. Marriott is a leader in nanobiology and a renowned researcher in biological optics, who was tapped as a "Top Innovator of 2008" in *The Scientist* magazine in December for his work on FRET technology.

Assistant Professor **Sanjay Kumar** has been awarded a 2008 NIH Director's New Innovator Award! This grant is the most prestigious NIH award for junior investigators, designed to enable them to pursue exceptionally innovative approaches that could transform biological science. Dr. Kumar's proposal was one of 31 selected from 2,000 submissions.



Research by Assistant Professor **Mohammad Mofrad**, on the biomechanics behind the eightfold symmetry of the nuclear pore complex, graced the August 08 cover of *Biophysical Journal*.

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## Undergrad Research...

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We've also just launched the Bioengineering Co-Op Program, which gives students a semester off school to do six-month industry internships.

The Berkeley Summer Bioengineering Research Program, originally known as the Guidant Program, is now entering its tenth summer. The summer program offers paid, full-time internships in faculty labs to some of our most advanced students.

This successful program, which gets over 150 applicants competing for only about 20 spaces each summer, has been praised by alumni for the intensive experience and great mentoring.

"I was washing glassware in a biology lab when I applied to the Guidant Program," said Opel. "It set me up to do research, to apply to other scholarships and fellowships, and was a launching point for all of the things that I was able to do later."

Unfunded since the Guidant Foundation dissolved, the summer program has been in jeopardy lately, kept alive with research grants and department funds. Even that was unsure this year until we received a \$5,000 donation from an anonymous donor. For small programs like BioE, even a modest gift can make a huge difference in the lives of our students. Thank you donors!

# “I didn’t know how hard I could work”

We interviewed BioE alumnus Dino Di Carlo,  
new Assistant Professor of Bioengineering at UCLA

Dino was a student in our first freshman BioE class in 1999. He received the B.S. in Bioengineering in May 2002 with High Honors, and went on to obtain a Ph.D. from our joint graduate program with UCSF in May 2006, completing his thesis work in Luke Lee's lab on "Microfluidic Technologies for Single Cell Analysis". Di Carlo was hired as UCLA faculty in August 2008.

## **Hi Dino! Tell us about being a professor - what is your favorite part?**

My favorite part is being able to pursue your ideas with less constraints — being able to use your creativity and getting people to come along.

## **What was the most surprising or unexpected thing about it?**

The big adjustment is the amount of things pulling you in different directions. I knew about it, but the number of different commitments was surprising. I've had to become much, much more organized than I was before.

## **What is exciting about bioengineering as a field?**

This is where a lot of new things are happening because it is at a crossroads. I think innovation and advancement happen when you take ideas from different fields and mix them together.

## **Why did you decide to stay in academia?**

As a professor you can pursue things that you think are important, and that's something you don't get in many industry jobs. A place where you can really see the cutting edge of what's being done and you can drive that further, that's the ideal job for me. Also, the people here are fantastic, I get to interact with students and have an impact on them, that's very rewarding.

## **Have you been teaching?**

I've taught one course so far, our BioE capstone design course. It's a challenge, to get the right balance, but I think the students appreciate what we are trying to teach them. It's a lot of work.

## **You have your own lab now! What are some of your projects?**

One of newest things we're working on is using inertial forces in fluid flows. Those are usually

considered not usable at the microscale, but we are learning to use them to very precisely manipulate cells. We're working toward making diagnostics more economical, miniaturizing really expensive equipment like flow cytometers.

We are also exploring using the automation of microfluidics to evolve cells for particular behaviors — we call it Microfluidic Directed Cellular Evolution. It's like selectively breeding horses, only we are breeding cell populations for therapeutically useful properties, such as cells that move very quickly for wound healing.



## **How does it feel to go from being a mentee to a mentor?**

At Berkeley I was lucky to have the opportunity to mentor a lot of younger students. Dealing with a lot of different people can be challenging, you have to find the best way to motivate or interact with each different type. There is no class in school on how to manage people, you just have to learn it as you go along.

## **Any success tips for current or prospective students?**

Get all the equipment you need to do what you need to do. Don't use not having something as an excuse: try to get it. Explore new areas — go to seminars that are not in your specific field, they might give you new ideas, help you find a solution, or inspire you to see things differently.

Keep in contact with all the people you spend time with, those people will be your network in the future. I'm in some form of contact with almost everybody I worked with at Berkeley.

## **Is there anything you wish you did while at Berkeley?**

Now that I think about it, I could have worked harder in school. I could have done more with my time and learned more. I don't think I knew how hard I could work, but I'm doing it now and could have done it then.

## **What do you miss most about Berkeley?**

The first thing that comes to mind is actually the food near campus. I was at Berkeley for so long, and I met my wife at Berkeley. I miss a lot of the people — Luke Lee was a great mentor for me and a great person. I miss being in Hearst Mining Building, it's beautiful. I don't miss Evans Hall at all (please quote me on that).

I stayed there so long, it's pretty obvious I thought Berkeley was a great place to be.

## **Did you know?**

BioE undergrads have won the last NINE College of Engineering poster sessions **in a row!!**



In 2008 - 2009 Bioengineering had a higher percentage of undergraduate women than any other Engineering department: 35%! And 37% female graduate students!



Berkeley produces more Ph.D.s and more Peace Corps volunteers than any other university in the nation.



Berkeley admits more low-income students than all Ivy League schools combined.



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## More News...

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Bioengineering Associate Professor **Dan Fletcher** is in Washington, D.C. for the 2008-2009 school year as one of 14 White House Fellows.



Dave Schaffer is also in the news for his recent success evolving adeno-associated virus into a form that is an ideal carrier of gene therapy. In its first test, the therapy completely cured cystic fibrosis in lung tissue in culture.



The symmetry, common across most organisms from yeast to humans, maximizes the bending stiffness of each spoke. This work holds promise for a better understanding of nucleocytoplasmic transport, of central importance in cell biology.

BioE Associate Professor **Steve Conolly** and BioE and Chemical Engineering Professor **David Schaffer** have received the only two new Berkeley grants from the California Institute for Regenerative Medicine. Conolly and Schaffer were awarded for their proposal to develop and test a new scanning method to track the location and viability of stem cells in the body. Schaffer is also co-author of the other proposal with Biology professor Robert Tjian, a plan to develop new tools for high-efficiency gene targeting in stem cells.

Two Berkeley teams headed to **iGEM**, the International Genetically Engineered Machine competition this year, along with over 100 other participants from 21 countries. Both teams were mentored by BioE Assistant Professor **Chris Anderson**.

The Tools Team took the Best Software Tool Award, while the “Wet Team” was one of six finalists for the Grand Prize.

The iGEM competition is an international undergraduate Synthetic Biology competition, where students use standardized parts to build biological systems and operate them in living cells.



Both teams at the iGEM Jamboree at MIT in November

The Berkeley tools team designed the award-winning *Clotho*, an integrated software toolbox for organizing, sorting and editing the collection of biological parts available for assembly. The “Wet Team” designed and constructed *Clonebots* — a genetic self-lysis device and a Gateway cloning device.

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Need help at work?  
**Hire a student!**  
Contact the BioE department for help with recruiting graduating students, summer interns, or 6-month Co-Op interns.

### Alumni tips:

Cal alumni can get a free lifetime email address at [alumni.berkeley.edu](mailto:alumni.berkeley.edu)



BioE alumni! Keep us updated on your life at [bioeng.berkeley.edu/alumni/ugradupdate.php](http://bioeng.berkeley.edu/alumni/ugradupdate.php)

