BME Discovery

SPRING 10

The Henry Samueli School of Engineering

University of California, Irvine

Department of Biomedical Engineering

Dear Friends,

The Department of Biomedical Engineering (BME) continues to experience exciting developments while weathering the economic storms in California. I am excited to share with you that Professor **Abraham P. Lee**, Ph.D., a world-renown expert in microfluidics and Micro-Electro-Mechanical Systems (MEMS), has been named the next BME chair, effective July 1, 2010. Please take a moment to read about Dr. Lee in the "Faculty Briefly" section.

Also, in this issue's Faculty Profile, we are detailing Assistant Professor **Michelle Khine's** exceptional and innovative accomplishments. Khine, Ph.D., joined BME on July 1, 2009.

On the infrastructure front, we are establishing the Engineering Analytical Lab Research Facility (EARF) in the new Engineering Hall building, housing a vast set of analytical equipment from Beckman Coulter, Inc. The facility will enable and advance the forefront in a broad range of biomedical research that critically depends on automated complex biomedical testing. We anticipate bringing the facility online before summer, and it will be available for both on- and off-campus researchers.

Finally, for this coming academic year, we are admitting 17 Ph.D. degree students, 21 M.S. degree students, and 386 undergraduate freshmen, continuing the commitment to our educational mission in spite of the unfavorable economic climate. I invite you to take a moment and read through the rest of the newsletter, including the "Outstanding Student Highlights" and "Upcoming News" sections.

Best Regards,

William C. Tang, Ph.D.

Professor and Acting Chair, BME

Associate Dean for Research, The Henry Samueli School of Engineering

FACULTY PROFILE

Michelle Khine, Ph.D., assistant professor of biomedical engineering and chemical engineering and materials science, conducts research on small-scale technologies. Her laboratory's projects include: Single Cell Electro-poration; Shrinky Dink© Micro-fluidics; Microsystems for Stem Cell Differentiation; Canary on a Chip; and, Quantitative Single-Cell Analysis of Receptor Dynamics, and Chemotactic Response on a Chip.

Her Shrinky Dink research earned her a spot on the MIT *Technology Review's* 2009 "TR35," a prestigious honor identifying a unique group of young innovators under 35 who exemplify the spirit of innovation in business, technology and the arts.

Khine drew upon the hours she spent playing with Shrinky Dinks — thin plastic sheets that can be colored with paint or ink and then shrunk with heat — to solve a problem in her research on how chemical cues affect cell activity.

After earning her doctorate from UC San Francisco and UC Berkeley in 2005, Khine joined the founding faculty at UC Merced in 2006. The fledgling campus didn't have the sophisticated lab equipment of her graduate school days, so Khine had to find a way to create fluid channels thinner than a human hair on the biochips she employed in her research. She wondered if she could pattern the pathways on a Shrinky Dink sheet with her desktop laser printer and then miniaturize them in a toaster oven. It worked.

As the plastic shrank, the ink particles on its surface clumped together and formed tiny ridges. After removing it from the oven, Khine applied a flexible polymer called PDMS to the cooling sheet. The ink ridges created channels in the PDMS, and when Khine peeled the polymer off the Shrinky Dink mold, she had a completed microfluidic device.

The use of PDMS to construct miniscule features on wafers is called soft lithography, and it typically involves several days of turnaround time and considerable infrastructure, operating expenses (such as for a clean room), and equipment.

With the Shrinky Dink method, Khine explained, researchers can easily and cheaply design and develop custom microfluidic chips within minutes, "and all they'll need is a laser printer and a toaster oven," she said.

This simplified fabrication process could revolutionize the way engineers conduct experiments and manufacture products, Khine believes, and could be used in stem cell research, to create cardiac patches for heart attack sufferers, and to significantly improve the detection sensitivity of bioassays, which are utilized in pharmaceutical development and point-of-care diagnostics.

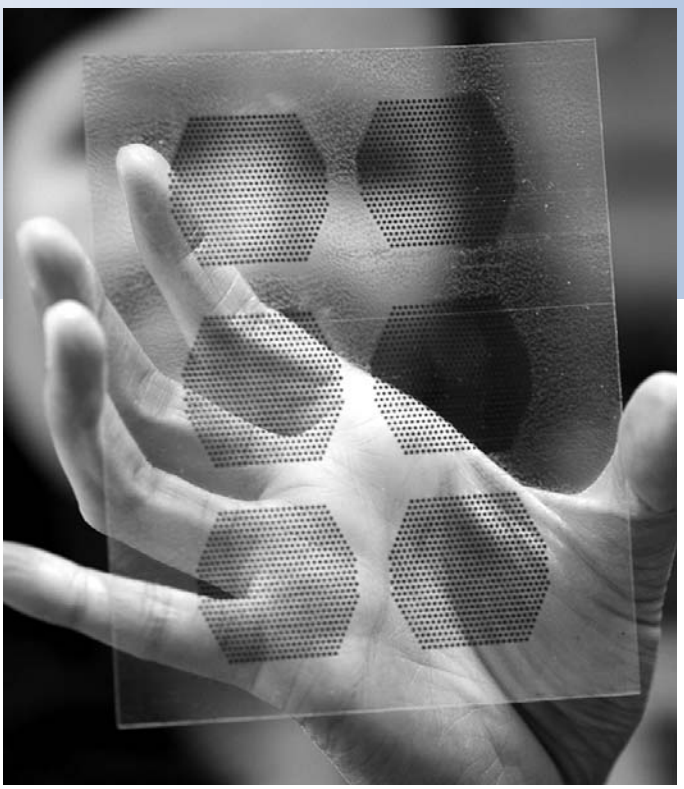


Photo Credit: Dave Lauridsen for Technology Review

Khine received B.S. and M.S. degrees (1999 and 2001, respectively) in mechanical engineering from UC Berkeley. She received her Ph.D. in bioengineering from UC San Francisco and UC Berkeley in 2005. In the Berkeley Sensor and Actuator Center (BSAC), under Professor Luke P. Lee, Ph.D., Khine focused on developing microfabricated polymeric devices for cellular manipulation and analyses. As a Microsystems and Engineering Applications (MESA) Institute Fellow, she also concurrently worked at Sandia National Laboratory. While at UC Merced, Shrink Nanotechnologies Inc., the first start-up company from the newest UC campus, was spun out of the research developed in Khine's lab.

Faculty **Briefly**

Abraham (Abe) P. Lee, Ph.D., a pioneer in micro- and nanofluidics technology, and professor of biomedical engineering and mechanical and aerospace engineering, has been named the new chair of the Department of Biomedical Engineering (BME), effective July, 1, 2010.

Currently, Lee directs the Micro/Nano Fluidics Fundamentals Focus (MF3) Center at UC Irvine, a Defense Advanced Research Projects Agency (DARPA)/Industry supported research center that studies micro- and nanofluidics – the science and technology of preparing and handling small amounts of fluids on microchips. MF3 recently had its DARPA contract renewed for another three years to enter the second phase of the program, which will emphasize microdiagnostics platforms and the development of manufacturable microfluidics. It will also involve 20 faculty from UC Irvine and other universities around the country working toward micro/nanofluidic technologies.

Lee was also recently elected a Fellow of the American Society of Mechanical Engineering, and is also a Fellow of the American Institute for Medical and Biological Engineering. In 2009, he was awarded the prestigious "Pioneers in Miniaturisation Award" for his excellent research, academic achievements, and major contributions to moving the "Lab on a Chip" community forward.

ACADEMIC NEWS

BME recently established an Educational Advisory Board to better guide the development of the undergraduate program. The Board has 30 members, and nearly half are recent graduates from the program who are working in industry as biomedical engineers. Other members include senior engineers at area biomedical companies who would hire and manage recent graduates of the program.

The graduate committee recently finished the graduate admissions process, and after reviewing 254 applications - the second largest in department history - 17 Ph.D. degree and 21 M.S. degree students were sent admission offers. BME also hosted a recruitment visitation day on March 5 to introduce admitted students to the graduate program's curriculum, degree requirements, rotations, and research facilities.

OUTSTANDING STUDENT HIGHLIGHTS

BME Undergraduates Recognized for Innovation in National BMEidea Contest

Seven project teams from the BME180 class (BME Senior Design) were awarded $500 stipends to support their projects to participate in the National Collegiate Inventors and Innovators Alliance's (NCIIA) BMEidea competition, a nationwide contest for BME student projects that aims to identify and recognize innovative, commercially promising medical devices and technologies developed by entrepreneurial student teams. Student teams were judged on their complete commercialization strategy—product innovation, market need, regulatory pathway, sales strategy, and economic issues.

The UC Irvine BME projects that were awarded stipends are:

Circular Ablation Catheter for Atrial Fibrillation (AF) Treatment

Mentor: David Chi, Product Manager, St. Jude Medical, Inc.

Student Team Members:
- Ashkan Hajirasooliha
- Seyed Mohammad Khalessi Hosseini
- Justin Lin
- Nazila Norouzi-Bazaz
- Andrew Ramdhani
- Jennifer Tao Fang Yuan

Design of a Minimally Invasive Endoluminal Suturing Device

Mentor: Ralph Schneider, Principle Engineer, Edwards Lifesciences, LLC

Student Team Members:
- Eric Christopher Clough
- Andrew Emon Aeh Heidari
- Travis Jameson Kruse
- Geraint Levan
- Sam Manoucheri
- Jennifer Michelle Taylor

Determine the Hardness of Cataract

Mentor: Tibor Juhasz, Ph.D., LenSx Lasers Inc.

Student Team Members:
- Kendrew K. Au
- Jacques Domange
- Richie Jason Han
- Kevin Ming-Kit Lukito
- Stanley Ng
- Shiyi Xia

Developing Point of Care Diagnostics for Acute Myocardial Infarctions

Mentor: Michelle Khine, Ph.D., assistant professor, biomedical engineering and chemical engineering and materials science, The Henry Samueli School of Engineering, UC Irvine

Student Team Members:
- Allison Christine Baker
- Maelin Mao Hickman
- Mulyadi Juwono
- Meenal Nachiappan
- Scott Gregory Strayer
- Douglas Cosgrove Taylor

Low-Cost Blood Analyzer for Malaria Detection

Mentor: William C. Tang, Ph.D., acting chair and professor, biomedical engineering and electrical engineering and computer science, The Henry Samueli School of Engineering, UC Irvine

Student Team Members:
- Robert Yang Diehl
- Ling Xuan Kong
- Transon Van Nguyen
- Kun Qian
- Timothy Quang

Medical Diagnostics on a CD: Applications in Centrifugal Microfluidics

Mentor: Lawrence Kulinsky, Ph.D., BioMEMS Laboratory, UC Irvine

Student Team Members:
- Richard Rodriguez Agbulos
- Kelvin Ian Kao
- Suleyman Ali Kazmi
- Takeaki Morikawa
- Victor Kelvin Sun
- Derek Wai Tam

Therapeutic Wheelchair for Arm Movement Training

Mentor: David Reinkensmeyer, Ph.D., professor, mechanical and aerospace engineering and biomedical engineering, The Henry Samueli School of Engineering, UC Irvine

Student Team Members:
- Aaron Michael Jimenez
- Stephany Lugardo
- Saam Ostovari
- Andre Daniel Paredes
- Eric Z. Somogyi
- Danny Adrian Spampinato

Dhonam Pemba, a fourth-year graduate student in the laboratory of William C. Tang, Ph.D., acting chair and professor of biomedical engineering, won the 2010-11 Pedagogical Fellowship from the Teaching, Learning and Technology Center at UC Irvine. Fellows receive a $2,000 award and advanced pedagogical training in preparation for mentoring new teaching assistants (TA) for the annual TA Professional Development Program during Welcome Week.

Claire Robertson and **Sean White**, both graduate students in the lab of Steven C. George, M.D., Ph.D., professor of biomedical engineering and chemical engineering and materials science and director of The Edwards Lifesciences Center for Advanced Cardiovascular Technology, were awarded the National Science Foundation's Graduate Research Fellowship Program (GRFP), which recognizes and supports outstanding graduate students in NSF-supported science, technology, engineering, and mathematics disciplines who are pursuing research-based master's and doctoral degrees in the U.S. and abroad. Both students will receive three years of support, including a $30,000 annual stipend. Robertson conducts research on the multiscale mechanics of the respiratory mucosa; linking optical (multi-photon microscopy and optical coherence tomography) and mechanical properties of tissue. White, who is co-advised by Bernard Choi, Ph.D., assistant professor of biomedical engineering, studies wide field functional imaging of blood flow in prevascularized tissues following implantation, including laser speckle and spatially modulated imaging. **Peyton Elizabeth Paulick** and **Bruce Yang** also received honorable mentions from the GRFP.

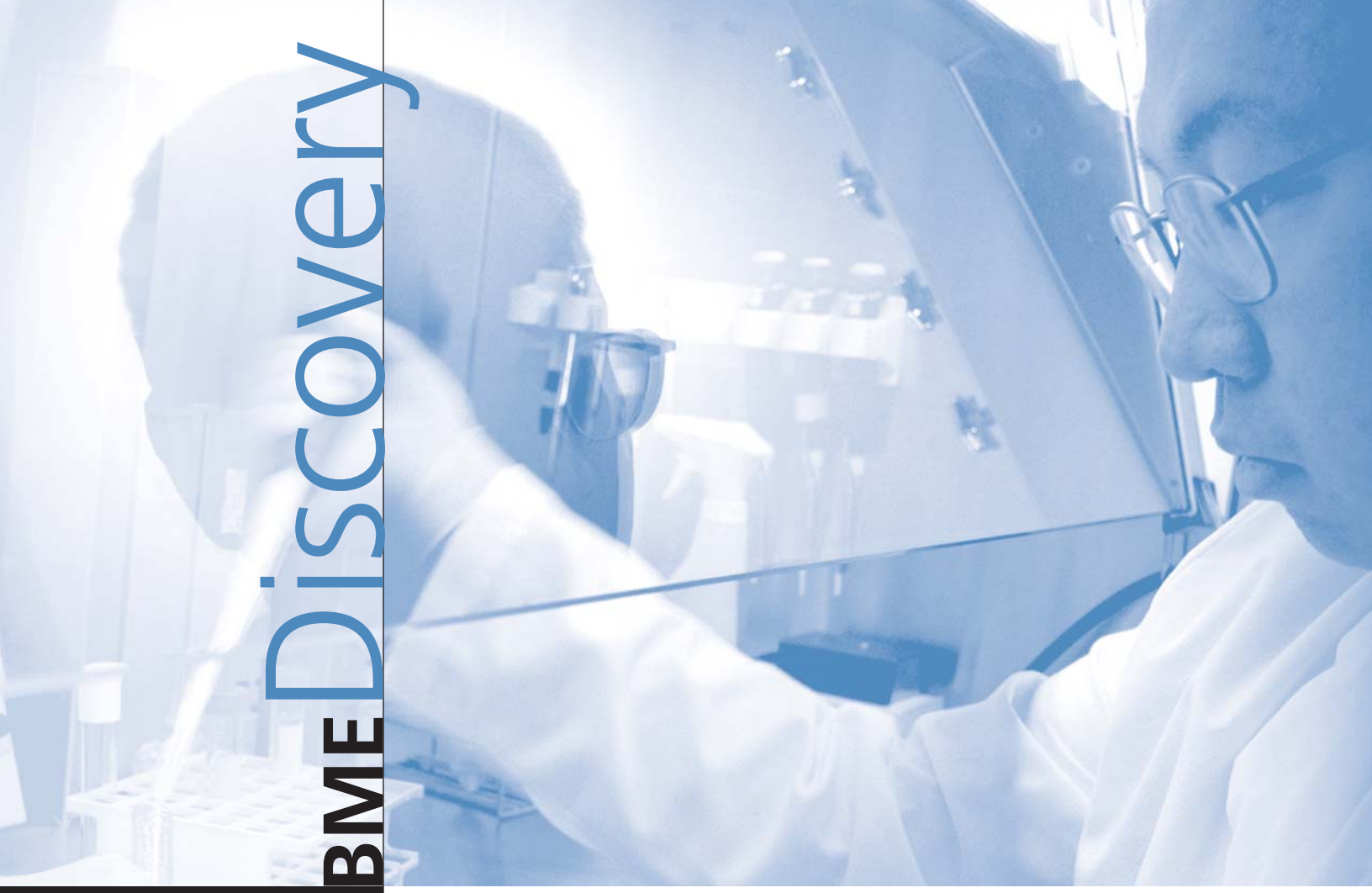
Vivien Shi, a second-year Ph.D. student in the laboratory of Professor Steven C. George, M.D., Ph.D., had her abstract, titled, "Correlation between eNO, Spirometry and the Asthma Control Test in a Longitudinal Study of Pediatric Population," accepted for a podium presentation at the American Thoracic Society International Conference on May 14-19, 2010, in New Orleans, La. Less than 10 percent of abstracts submitted were chosen for presentation. Shi will present her research on predicting the control of mild asthma in children.

Victor Sun, a BME undergraduate student who works in the laboratory of Wangcun Jia, Ph.D., an assistant researcher at the Beckman Laser Institute and Medical Clinic, is co-author on the paper, "Long-term blood vessel removal with combined laser and topical rapamycin antiangiogenic therapy: Implications for effective port wine stain treatment," which was published in Volume 42, Issue 2 of *Lasers in Surgery and Medicine*.

The current treatment for Port-wine stains is laser irradiation of the birthmark areas. This requires multiple treatments to completely remove the Port-wine stain. Jia and Sun's research combines laser irradiation and a topical antiangiogeneic drug to biologically inhibit the re-growth of the treated blood vessels, which would improve the outcome of each treatment.

Shia-Yen Teh, a fifth-year Ph.D. student, was awarded the President's Dissertation Year Fellowship (PDY) by the UC Irvine Graduate Division. The fellowship, worth more than $33,000, assists graduate students with the completion of their dissertation and enhances their qualifications as candidates for university faculty teaching and research appointments. Teh, who works in the laboratory of Abraham P. Lee, Ph.D., conducts research in liposome and particle formation using microfluidics for artificial cell and drug delivery applications.

BME Discovery



University of California, Irvine
The Henry Samueli School of Engineering
Department of Biomedical Engineering
3120 Natural Sciences II
Irvine, CA 92697-2715

INSIDE THIS ISSUE: