Graduate student Anne Marion Taylor (Advisor: Noo Li Jeon) is creating novel microfluidic microchambers for studying neurons.

BME Discovery

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BME Discovery

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THE HENRY SAMUELI SCHOOL OF ENGINEERING

UNIVERSITY OF CALIFORNIA IRVINE

DEPARTMENT OF BIOMEDICAL ENGINEERING

Welcome to the Department of Biomedical Engineering and our inaugural issue of our semi-annual newsletter – BMEDiscovery. Each issue (Fall and Spring) will bring you news of the Department of Biomedical Engineering, including profiles of our faculty, developments in our undergraduate and graduate programs, news of our Corporate Advisory Board and recent awards and honors. In this first issue, I would like to take the opportunity to provide a brief overview of biomedical engineering at UC Irvine.

The growth of biomedical engineering at UCI has been very rapid, beginning with the formation of the Center for Biomedical Engineering in 1998. The center was funded by a $3 million Development Award from the Whitaker Foundation to accelerate the growth of the formal educational and research opportunities in The Henry Samueli School of Engineering. In 2002, three major milestones were achieved, including the formation of the Department of Biomedical Engineering, the establishment of two undergraduate degree programs and the expansion of the graduate program, leading to the M.S. and Ph.D. degrees in biomedical engineering.

The department offers a stimulating array of research and training opportunities with world-renowned researchers. Included in these opportunities are major campus resources at the Beckman Laser Institute (biophotonics) and the Integrated Nanosystems Research Facility (nano-fabrication and microfabrication). Additional research partnerships are available in the Center for Biomedical Engineering. The three focus areas for the M.S. and Ph.D. are biomedical photonics/optoelectronics, biomedical nanoscale and microscale systems/fabrication and biomedical computation/modeling, but opportunities also exist in tissue engineering and biomechanics. The undergraduate program offers two programs leading to a bachelor's degree in either Biomedical Engineering or Biomedical Engineering: Pre-medical (please see recent developments inside).

The future of biomedical engineering at UCI is bright. In the next two years, we will expand our research horizons to include teams of scientists in two major clinical areas: neuro-rehabilitation engineering and cardiovascular engineering. We invite you to explore the opportunities in biomedical engineering with us.

Steven C. George
William J. Link Professor and Chair, Department of Biomedical Engineering, UCI

BME Discovery

Faculty Focus: Zhongping Chen

Zhongping Chen is an associate professor in the Department of Biomedical Engineering. His current research directions include: (a) investigating light/tissue interactions; (b) developing medical diagnostic and therapeutic devices and instruments using advanced optical, microfabrication and biomedical technologies; (c) applying these technologies for the early diagnosis of cancer and other diseases. He and his group have developed a noninvasive technology, known as functional optical coherence tomography, which allows cross-sectional imaging of tissue structure, blood flow, and birefringence simultaneously with high spatial resolution.

Very recently, Zhongping was awarded a $2.9 million, five-year grant from the National Institutes of Health (NIH) to develop a miniature device for the early diagnosis of lesions and tumors in internal organs like the lungs and in the digestive tract. The tiny endoscope will use advanced optical and microfabrication technologies to create 3-D images of tumors. In addition to Zhongping, team members include: G. P. Li and Mark Bachman, both from UCI electrical engineering and computer science, Kenneth Chang, head of gastrointestinal oncology at UCI Medical Center, and Norman Tien, from electrical and computer engineering at UC Davis.

"The early diagnosis of cancer is the key to cancer treatment," said Zhongping. "The imaging technology we are developing has the potential to non-invasively screen cancer in the early stages, which will bring significant benefit to cancer patients."

The new imaging system will be comprised of hardware systems and image processing algorithms to enhance the clarity of images to a resolution one hundred times better than ultrasound. The project will use state-of-the-art microfabrication equipment in the Integrated Nanosystems Research Facility and the California Institute for Telecommunications and Information Technology, both located at UCI. When complete, the device promises to offer high-speed imaging at a low cost, and require little power to operate. The team hopes the device will be ready for clinical testing in the next two to three years.

In addition to this project, Zhongping currently has several active research projects funded by the National Science Foundation, NIH National Institute for Biomedical Imaging and Bioengineering, NIH National Cancer Institute and Defense Advanced Research Projects Administration. Most of these projects are interdisciplinary, involving research in fiber optics, lasers and optoelectronics, MEMS, signal processing and biomedical instrumentation.

Zhongping's laboratory is located at the Beckman Laser Institute, and he holds joint appointments in the Department of Electrical Engineering and Computer Science, Department of Surgery, and Materials Science and Engineering Program.

Department Funding Nears $20 Million Mark

The department currently has extramural funding of more than $18 million. Major funding comes from the Whitaker Foundation, National Institutes of Health (NIH) and National Science Foundation. Corporate funding of more than $2 million includes donations from Allergan, Hitachi, Stradling Yocca Carlson & Rauth and Edwards Lifesciences. We also have received private donations from William J. Link, Don Milder, Olav Bergheim and Donald Kannenburg.

Additional extramural and non-extramural funding comes from the Defense Advanced Research Projects Administration, Concern Fund, American Heart Association and from various programs at the University of California.

Recently funded projects of particular relevance include: $2.9 million grant from the NIH (PI: Zhongping Chen) to study optical biopsy using MEMS technology; $1.8 million grant from the NIH (PI: Steve George) to study tissue remodeling in the lung using a tissue engineered model of asthma; $1.5 million grant from the NIH (PI: Ghassan Kassab) to study remodeling of coronary vessels induced by pressure and flow; and a $240,000 grant from the Whitaker Foundation (PI: Noo Li Jeon) to study design and fabrication of microfluidic devices for investigating migration of metastatic cancer cells.

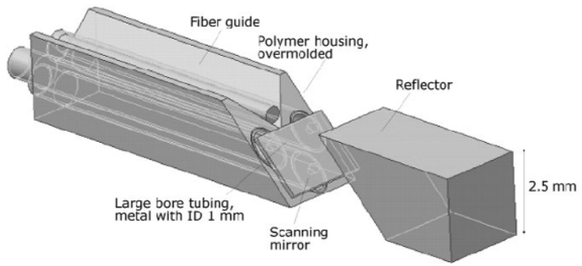
Awards to our students include a $90,000 graduate fellowship from the Army Medical Research & Development Command for Wajeeh Saadi (Advisor: Noo Li Jeon) to develop a microfluidic device for the study of breast cancer cell migration. Another student, Nishant Mittal (Advisor: Ghassan Kassab), was awarded a $43,000 graduate fellowship from the American Heart Association to use micro-CT technology to reconstruct the 3-D coronary vascular system of the mouse heart.

BME Attracts Top Students

The BME graduate program continues to attract students from some of the top engineering undergraduate schools. Graduate students entering the BME program this fall hail from around the world. Four international and 17 domestic students have accepted admission offers. The international students are coming from Sweden, India, China, and South Korea. Domestic students that were educated out of state have B.S. degrees from Columbia University, University of Rochester, University of Michigan, Johns Hopkins University, and the Rose Hulman Institute of Technology. We also have four students who graduated from UCSD, three from right here at UCI, two from UCLA, one from UC Berkeley, one from San Diego State University and one from Stanford University.

Three of our current graduate students are being supported by external fellowships. Joel Martinez was awarded a Ford Foundation fellowship. Nishant Mittal was awarded an American Heart Association fellowship, and Wajeeh Saadi was awarded a fellowship from the Army Medical Research & Development Command.

This concept drawing shows a micro-rastering optical probe about 2 mm in size that will fit on the end of an optical biopsy needle. The probe moves a mirror at high speeds to direct a laser back and forth across the surface of the gastrointestinal tract, resulting in a three-dimensional image of the cells within the tissue.



Undergraduate Update

Two majors were implemented in the fall of 2002: Biomedical Engineering and Biomedical Engineering: Premedical. The B.S. in BME will prepare students for careers in the biomedical industry or for further education in graduate school. BME students will learn engineering and principles of biology, physiology, chemistry and physics. They may go on to design devices to diagnose and treat disease, engineer tissues to repair wounds, develop cutting-edge genetic treatments, or create computer programs to understand how the human body works. The programs and curricula of BME emphasize education in the fundamentals of engineering sciences that form the common basis of all engineering subspecialties. Education with this emphasis is intended to provide students with a solid engineering foundation for a career in which engineering practice may change rapidly. In addition, elements of biomedical engineering design are incorporated at every level of the curricula. This is accomplished by integration of laboratory experimentation, computer applications and exposure to real bioengineering problems throughout the program. Students will also work as teams in senior design project courses to solve multidisciplinary BME problems suggested by industrial and clinical experience.

The B.S. in BME: Premedical is designed to meet the requirements for admission to medical schools and is also suitable for those planning to enter graduate school in bioengineering, physiology, neurosciences or related fields. It incorporates less engineering content but more biological sciences than the BME major. It is one of many majors that can serve as preparation for further training in medical, veterinary or other allied health professions.

Demand for these majors has been high. During the fall 2002 initial offering of both programs, a total of 58 freshman students were enrolled (32 BME and 26 BME: Premedical) and 41 sophomore students (23 BME and 18 BME: Premedical). The incoming fall 2003 class will be the second admitted class for both undergraduate programs. As of May 31, 2003, 139 students have accepted admission to these programs (45 BME and 94 BME: Premedical). The incoming freshman are the strongest in The Henry Samueli School of Engineering, as indicated by average math SAT scores (BME: 660, BME: Premedical: 640), verbal SAT scores (BME: 600, BME: Premedical: 580), and grade point averages (BME: 3.78, BME: Premedical: 3.80).