University of Minnesota
Department of Biomedical Engineering
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University launches new Medical Devices Center

The new Medical Devices Center launched this summer aims to strengthen medical devices research among faculty in the health sciences and engineering. Art Erdman, a recognized medical devices expert and the center's first director, remarked "This center is the culmination of dreams of many faculty across the University."

The center is part of the new Institute for Engineering in Medicine, an initiative jointly sponsored by the University's Institute of Technology and the Medical School. The primary mission of the new center is to accelerate interdisciplinary research and development of medical devices across the University. This effort will be achieved using a competitive grant process funded by $1 million in recurring support to the center from the University.

Another important mission is supporting educational and training programs, such as short courses geared to benefit company employees, the two-semester course New Product Design and Business Development that is popular with BME graduate students, and the annual Design of Medical Devices conference, which was attended by more than 800 participants last spring.

Center will promote discovery of next-generation life-saving medical devices.

The center will also seek interactions with the vast, vibrant medical device industry that surrounds the Twin Cities. It includes the leaders Medtronic and Boston Scientific as well as more than 500 other companies.

A first-class medical device prototyping lab is under development, including CAD and virtual design equipment, rapid prototyping machines, and comprehensive measurement instrumentation. A distinctive and exciting feature of the lab will be a SimPortal connection, which allows design teams to view surgical procedures in real-time as they take place in surgical suites on campus. The lab will be accessible to campus researchers, local companies that lack such resources, and to student teams in the BME senior design course that assemble and characterize a prototype medical device by the end of the second semester.

The center is expected to catalyze major proposals for external funding from federal agencies, companies, and foundations so as to leverage its budget into a much larger activity that establishes the University of Minnesota as the leading academic institution for medical devices research, education, and technology transfer.

"Our partnerships with medical device companies and the University's Medical School are critical to the success of this new center," said Dean Steven L. Crouch. "With these important collaborations, I think our program can achieve

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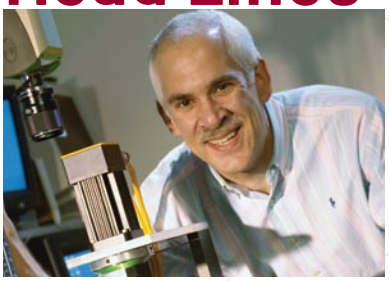
Head Lines



The University's initiative in medical devices will enhance the department in several ways, most importantly, through hiring additional faculty members. More people means a need for more space. The department plans to expand from its current space -- one floor of Nils Hasselmo Hall -- to two floors in 2009 and three floors in 2011, resulting in 50,000 net square feet of prime research/office space. It will allow the entire department to reside within the same building, located at the intersection of the Medical School and Institute of Technology, an aspiration since its inception in 2000. The Medical Devices Center will also reside in Nils Hasselmo Hall, providing for an exciting nexus of activity. Our academic programs continue to grow, with 74 seniors expected to graduate this year, up from 52 last year. BME seniors continue to be sought out by local companies in Minnesota's famed "Lifescience Alley," which have hired more than 50 percent of our graduates to date. As evidenced in the News Lines inside, our graduate students and postdocs, as well as our faculty members, continue to be recognized for their research achievements. We look forward to more talent joining our department this year!

student spotlight

Anthony Braun - Brains and Braun

The pathway to your current studies has been described as unorthodox. In what ways is that so?

I started at the "The U" in Fall 1996, having just graduated as valedictorian. However, by my sophomore year, I found myself on academic probation. I decided to leave school and pursue a management position. After six years, I decided it was time to redirect my focus toward finishing my degree. My first few semesters I juggled a 55 hour manager work week and 12-18 credits of calculus, chemistry, and physics at a community college. Since transferring back, I've successfully removed myself from academic probation with a 3.96 GPA while taking the core BME classes and engineering electives. With one year left, I hope to maintain this intensity right into graduate school.

What motivated you to redirect and focus on academic excellence in BME?

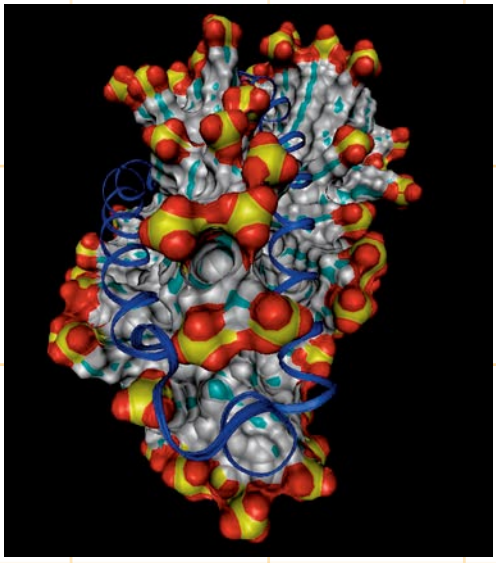
I have always wanted to work in the medical field. My first stretch at "The U" was working toward a nursing degree. When I began to learn about BME I realized it had everything that interested me. The more I understood that BME involved cutting-edge science and research applied to solving problems and questions related to biological systems, the greater my desire was to complete my degree.

What led you to choose your research project and what do you find most exciting about it?

I have had the opportunity to participate in three different research projects with Dr. Jonathan Sachs: two undergraduate research opportunity (UROP) projects and a summer internship program at the Minnesota Supercomputing Institute. The most exciting aspect of these projects has been the process of learning how the intricacies of computer simulations can be applied to understand the events occurring at the biomolecular level, to validate experimental results, and provide insight into new directions of research.

Is there any advice you would like to pass on to other BME majors?

The BME program can be a very rewarding endeavor. Very few programs involve the wide breadth of course material that BME does. This requires a certain level of intensity and work ethic to truly excel. To get the most out of your BME experience get involved early. There are many opportunities through UROP, internships, or volunteering to get valuable research experience. Ask your professors questions, go to their office hours, try to understand their passion for BME and it will help you discover yours.



A snapshot from an all-atom molecular dynamics simulation of a peptide involved in Parkinson's disease (alpha synuclein) bound to an SDS detergent micelle (water molecules not shown for clarity).

news lines

Faculty

Professor **David Odde** has been promoted to a full professor, joining professors Bischof, He, Siegel, and Tranquillo as a full professor in the department. He has also been chosen to serve as Co-Editor-in-Chief of the new BMES journal Cellular and Molecular Bioengineering.

Professor **Chun Wang** recently received the Coulter Foundation Early Career Translational Research Award. This award is designed to support biomedical engineering research that is translational in nature, and to encourage and assist eligible biomedical engineering investigators as they establish themselves in academic research careers that involve translational research. Wang's successful proposal is titled "Translational Development of Novel Biodegradable Polymer Platform for Genetic Vaccine Delivery."

Professor **Bin He** has been appointed interim director of the Center for Neuroengineering. The center is part of the Institute of Translational Neuroscience, another major University initiative complementing the Medical Devices Center. The center will enhance neuroengineering activities on campus and foster interdisciplinary research collaborations among faculty and industrial researchers.

Research Trainees:

Lei Ding, a doctoral student advised by professor Bin He, was appointed as a tenure-track assistant professor at the University of Oklahoma, starting August 2007. Ding's dissertation research was on electrophysiological neuroimaging.

Shramik Sengupta, who received his Ph.D. under the advising of professor Victor Barocas, was appointed as a tenure-track assistant professor at the University of Missouri - Columbia, starting August 2007. Sengupta completed his Ph.D. on microfluidics and microdevices for protein crystal growth.

Lauren Black, a postdoctoral researcher advised by professor Robert Tranquillo, received an NIH NRSA Postdoctoral Fellowship for a project titled "Engineered

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alumni achievement

Katie Gerbensky - B.Bm.E. Career Path to NIH

For 2004 graduate Katie Gerbensky, a bachelor's degree in biomedical engineering has opened the doors to a diverse range of experiences in international, industrial and government settings.

"I saw the program as the perfect opportunity to combine my interest in learning technical engineering skills with my curiosity about biology, particularly human physiology," Katie said. "The University of Minnesota prepared me to apply my skills in a variety of applications by helping me develop a broad understanding of the field. In addition, I was exposed to different paradigms through my course work, as well as other opportunities that included undergraduate research in professor David Odde's lab and a summer manufacturing engineering internship at Boston Scientific Corporation."

Katie's initiative to enrich her undergraduate education further helped her earn the Katherine E. Sullivan Scholarship, which funds a year-long study abroad program for University of Minnesota students. She used the scholarship to participate in the Minnesota Studies in International Development program in Quito, Ecuador. There, she completed seminars on international and sustainable development issues, as well as a five-month internship with the Ecuadorian Ministry of Health's National Program for HIV and AIDS. "I was responsible for designing and implementing an STD and HIV surveillance system in clinics that work with high-risk individuals, and the problem-solving and technical skills I learned in the BME program were invaluable to my work on this project," Katie said.

After returning home from Ecuador, Katie accepted a full-time position with Boston Scientific in Maple Grove as a Regulatory Affairs Specialist. As part of both core engineering and clinical teams supporting the corporation's vascular surgery division, she was involved in the development of global strategies to launch new products, the initiation of clinical trials, as well as the management

of product line extensions worldwide.

Katie is currently a biomedical engineer at the National Institute of Biomedical Imaging and Bioengineering (NIBIB) with the National Institutes of Health (NIH) in Washington, D.C. In her current position, she works with the Division of Extramural Science to assist in the management of innovative biomedical research grants. Her position also allows her to look globally at the biotechnology industry in order to identify gaps and promote opportunities for scientific collaboration.

"I feel fortunate to have had such a variety of fantastic opportunities to develop my skills and learn even more about the field of biomedical engineering," Katie said. "That's why it is important for me to remain involved with the IT Alumni Association and to take advantage of opportunities to mentor undergraduate students so that they can have similarly positive and enriching experiences."

For ways to stay involved as an alumnus, please visit www.it.umn.edu/alumni. Mentors for students majoring in biomedical engineering are always needed. Alumni can also send news to share with other BME alumni via the Web by visiting www.umn.edu/bme/alumni.html.

News Lines *(continued)*

Cell Alignment for Improved Beating in a Fibrin-Based Heart Patch."

Kunlun Liu, a postdoctoral researcher advised by professor Victor Barocas, received an AHA Postdoctoral Fellowship for a project entitled "Dynamic Simulations of Tissue-engineered Heart Valves."

Julie Whitcomb, a doctoral student advised by professor Victor Barocas, received a Fulbright Fellowship to study in Munich this year. She will be studying retinal blood flow with an ophthalmology group.

Katie Ahmann, doctoral student advised by professor Robert Tranquillo, received an AHA Predoctoral Fellowship for a project titled "Mechanical Conditioning of Fibrin-Based Media-Equivalents."

Archived news can be found at www.bme.umn.edu/news.html.

New Medical Device Center, cont.

some real prominence in research that could lead to new life-saving medical devices."

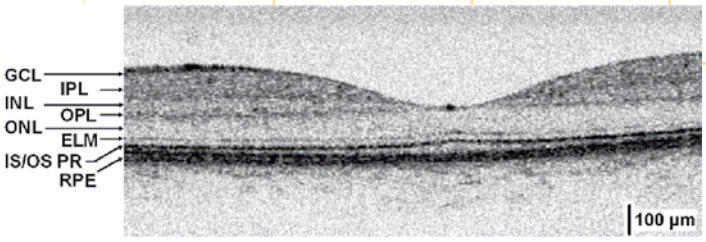
The medical device companies are also optimistic about the University's initiative. "The center is uniquely positioned to serve an invaluable role in the translation of scientific discovery to commercial products that address unmet clinical needs," said Bruce H. KenKnight, vice president of Research and New Business Development at Boston Scientific and a member of the Biomedical Engineering External Advisory Board. "The Center is uniquely positioned to serve an invaluable role in the translation of scientific discovery to commercial products that address unmet clinical needs."

faculty profile

Professor Taner Akkin - Driven to Discover

When light is focused on a tissue, some of the photons reflect back and scatter from small particles or tissue boundaries. Professor Taner Akkin and his students use these photons to image depth-resolved microstructure and function of tissues.

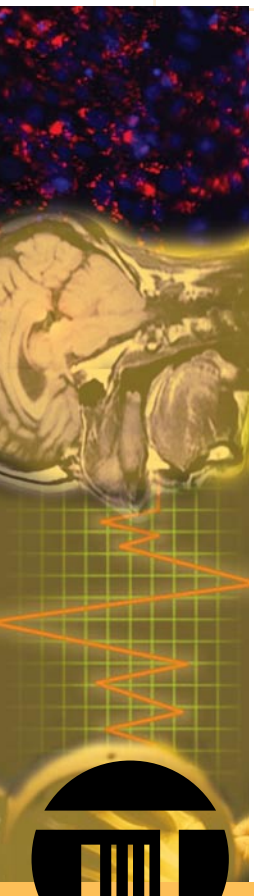
The technique, known as optical coherence tomography (OCT), produces 3D tissue images with micron scale resolution in real-time. The interferometric differential phase sensitivity of OCT allows detection of sub-wavelength changes in optical path length that can be utilized for mapping refractive index variations or measuring nanometer scale movement of the micrometer size features within the tissue. Since exogenous chemicals or reflection coatings are not required for OCT, non-invasive or minimally invasive applications in medicine are possible.



The cross-sectional image shows the retinal layers of the fovea region of a healthy human eye that are acquired by spectral-domain OCT.

In his earlier pioneering work, non-contact optical measurements in a crustacean nerve model showed that fast (~1 millisecond) and small (~1 nanometer) transient structural changes accompany action potential propagation. Professor Akkin and his team currently explore the origin of this transient swelling/shrinkage and its contribution to the optical signals of neural activity. Effects of the environmental and physiological factors are being investigated using the squid giant axon model.

The ultimate goal of this research is to understand the mechanical aspect of the action potential propagation to develop a measure of neural functionality: functional disorders in neural tissue must be detected prior to any structural loss, since functional recovery is possible only when the structure is intact.



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