Department of Biomedical Engineering
...to promote learning and discovery
that integrates engineering and life sciences
for the advancement of human health...

Letter from the Chair

Dear Biomedical Engineering Alumni and Friends:

I am pleased to send our second newsletter from the Department of Biomedical Engineering at The Ohio State University. Since I wrote last Spring, we have continued to grow into our new role as a Department. Our proposal for a new undergraduate major, with its central theme of integrating engineering and life sciences, continues in the review cycle that will take it over the next 6-18 months to the University Senate, to the Board of Trustees, and finally to the Board of Regents for final review and approval.

Following last year's planning for our undergraduate major, we have revised our graduate course offerings that emphasize the focus areas based on our research domains and the planned undergraduate teaching domains: Biomaterials; Biotransport and Biomechanics; Molecular, Cell, and Tissue Engineering; Bioimaging; and Biomedical Micro- and Nano-Technology. This planning has also allowed us to target the areas of expertise we seek with two faculty positions that we hope to fill this year: multi-scale modeling of physiological systems, and bioengineering of vision systems.

We are also nearing completion of renovations in Bevis Hall that were planned several years ago. In addition to new space for faculty offices, we have upgraded space for more research labs and for undergraduate teaching labs. Despite these improvements, we are actively seeking space to relocate the department to the main campus. Proximity to collaborators in the College of Medicine is a key factor that will shape our ability to achieve our mission of integrating engineering and life sciences at Ohio State.

In order to help us achieve our mission we will also continue to depend on help from our alumni and friends. As I wrote last year, there are many ways that you can help to fuel our successes. Most obvious is financial support that can be specifically targeted to the department. Gifts can help us achieve our strategic goals, and could include opportunities to endow a named professorship, a named scholarship, or laboratories and facilities. More modest gifts help with our operations and events. In addition to financial support, I am hoping that the network of alumni and friends will be able to help our students find internship and employment opportunities.

In this newsletter, we continue to introduce our faculty members, describe an aspect of the innovative, collaborative research in the department, and list some recent student achievements. Additional information is available on our website: http://www.bme.ohio-state.edu/.

I continue to meet many new people on campus, and would especially like to meet our alumni and friends. Please stop by if convenient to get a firsthand look at our progress. Thank you, in advance, for your continuing support of our efforts.

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Winners of the Biomedical Engineering Year-End Academic Poster Session held June 1, 2007 included Natalia Higuita-Castro (pictured) and Mark Elias. Higuita’s entry was titled Fabrication of Biocompatible Portland Cement Porous Scaffolds for Bone Tissue Engineering Applications and was co-authored by BME student, Daniel Gallego-Perez, and BME faculty, Derek Hansford. The event was organized by student planning committee, Becky Jansen, Theo Nicholson, and Ryan Pavlovicz.
What do you hope to bring to BME? My goal is to establish a moderate-sized research group that has a disproportionately large impact on the field both by the discoveries we make and the long-term success of individuals after they leave the group. I look forward to helping to shape the Molecular, Cell, and Tissue Engineering tract in the new BME undergraduate curriculum. 

Tell us about your research. We explore the interaction of biological micro- and nano-structures (cells and biomolecules) with surfaces and engineered structures through micro- and nano-fabrication of diverse materials, and the development of new tools for microbiologists and surgeons. We have developed complete fabrication techniques for polymer microdevices and microstructures that we apply to measuring cellular forces, delivering targeted drugs into confined spaces within the body, taking advantage of biological responses to microtopography for tissue engineering scaffolds, and developing diagnostic devices that either greatly improve resolution and diagnosis time or enable completely novel diagnostic techniques. We try to keep fabrication techniques as general as possible in terms of materials, so we can produce microfeatures out of most polymers (from water soluble to biodegradable to fluorinated piezoelectric polymers), slurries of small particle ceramics (from inert alumina to degradable hydroxyapatite), and composites of ceramics in polymer matrices. We are also looking at material processing techniques developed by Nature, such as templating the growth of nanomaterials by using peptide catalysts (similar to biomineralization).

Tell us a little about your life. I grew up in Northeast Ohio in a small town with my parents both working as high school teachers. I have two brothers. We all grew up playing instruments (I play piano and could probably still play sax), so we were destined either to become musicians, engineers, or scientists. I like getting out and enjoying Nature. I take a lifelong approach to learning. Learning doesn't stop at the classroom door.
BME REACHES OUT TO COMMUNITY YOUTH

In June 2007, Assistant Professor, Yi Zhao, in collaboration with The Ohio State University Women in Engineering program, hosted a seminar in the Engineering in Motion workshop series. “Meeting with the Small: Biomedical Micro & Nanosystems” was presented to 34 ninth- and tenth-grade students from the Columbus community. The interactive seminar, designed to introduce fundamental engineering research skills to high school students, featured a classroom lecture on Micro-Electro-Mechanical Systems (MEMS) and Nanotechnologies for Biomedical Applications and was followed by a hands-on laboratory session. Working in Dr. Zhao’s lab, students were given a chance to fabricate polymeric microstructures and to characterize the structures using optical microscopy. Kudos to Dr. Zhao for providing the high schoolers with experiences they described as “remarkable”, “entertaining”, and “priceless.”

BME ALUMNUS, FACULTY HAS DEEP ROOTS AT OHIO STATE

Cynthia Roberts, Professor of Ophthalmology and Biomedical Engineering and Martha G. and Milton Staub Chair for Research in Ophthalmology, has been a part of the Department of Biomedical Engineering (BME) since 1983, but her roots with Ohio State go much deeper than that. Dr. Roberts’ father held the Zollinger Chair of Surgery -- the first endowed chair awarded at Ohio State -- from 1967 to 1972. She’s a Buckeye alright.

Dr. Roberts’ career path was to her own admission “a bit circuitous”. She chose early on to pursue a career in nursing; her father thought this was “a good job” for her. After taking a job at the University of Iowa Hospitals, it became quickly apparent that nursing was not the right path for her. “I had tremendous problems separating myself emotionally from my patients,” Dr. Roberts admits. “I saw my patients suffer through cancer, and participated in unsuccessful efforts, though intense, to save lives in a coronary critical care unit.”

Intrigued by Biomedical Engineering and interested in building on what she already knew, she enrolled in undergraduate engineering classes and loved them. At last she could use her AP calculus credit! She spent two years taking undergraduate engineering courses, most of the time working from 3 p.m. to midnight as a nurse. “It was truly a schizophrenic existence” she quips.

By the mid-1980’s, Biomedical Engineering was not well known in the medical community. Many physicians thought a biomedical engineer simply fixed equipment in the hospital. It was a challenge to establish herself as more than a “super-technician”. Says Dr. Roberts, “I found that a good way to encourage people to listen was by challenging their basic assumptions, and showing how a new perspective could make a difference in patient care.” Dr. Roberts recalls fondly the time she was invited to give a presentation in Italy at a medical meeting that also involved live surgery for teaching purposes. Upon her arrival there, she discovered that she had been scheduled to perform live LASIK surgery on a satellite feed to 20 cities in 10 countries! “I had to tell the meeting organizer that I was not a surgeon,” laughs Roberts. His expression of shock remains for Dr. Roberts memorable proof that she successfully had achieved the goal of communicating her ideas to physician colleagues.

Many have heard her infectious laughter echoing down the Bevis hallways. Few can find a more passionate advocate of BME, particularly when the conversation turns to her research, imaging applications in ophthalmology. Additional areas include laser-tissue interactions in refractive surgery and glaucoma, and more recently, ocular tissue response to intraocular pressure variations in glaucoma. “I have been fortunate to have good timing that allowed me to be on the leading edge of understanding fundamental relationships between corneal properties and response to surgery.” The “most exciting” of her current projects is in the area of one of the world’s leading causes of blindness. “We are pursuing new avenues of research that have not previously been explored to improve our understanding of structural influences on the development and severity of glaucoma,” Dr. Roberts explains.

Her husband, Robert Small, M.D., is an electrical engineer and BME alumnus who had 10 years of experience in flight controls at Boeing before entering medical school. He is now on the Ohio State faculty in Anesthesiology and advises BME students. One of her nieces is currently an undergraduate in pre-dental study, and another is a graduate student in molecular genetics here at Ohio State. Although those are the only two (of her 14 nieces and nephews) that she has been able to successfully indoctrinate into coming to Ohio State thus far, she anticipates more in the future.

Her pride in Ohio State is evident in all she does, and it can be traced back to her father. “My father started the first hospital-based helicopter rescue program in the country, and the new heliport on top of the hospital is dedicated to him...” He chaired the committee that developed the very first paramedic manual, which was later adopted nationally.” He also served one year on active duty in Vietnam as Chief of Surgery in 1970.

"His vision was that the lessons of battlefield medicine would be transferred to saving civilian lives,” says Dr. Roberts. “My hobby, and personal duty, is to compile the historical records, so the story is not lost.”

How does she view her own legacy in BME after all these years? “I would like to inspire young faculty to explore research applications in vision,” she says. “I hope to bring knowledge and experience to contribute to both the graduate and undergraduate programs in BME.”
ACHIEVEMENT AND RECOGNITION

**B. Rita Alevriadou**, Associate Professor of BME and Internal Medicine was awarded a two-year $409,500 NIH R21 grant starting on 1/1/08 entitled "Mechanoregulation of endothelial mitochondrial function".

**Phil Barnes, David Holman, Mihaela Jekic, Jiachao Liang, Ryan Pavlovicz, and Jessica Sparks** were invited to join the Phi Kappa Phi honorary. National guidelines allow for the selection of the top 10% of Graduate Students. Congratulations, BME students!

**Charles I. Jones III** (MS ‘05), Z. Han, T. Presley, G. Ilangovan and B.R. Alevriadou,"Endothelial cell respiration is affected by the oxygen tension during shear exposure", presented at the BME Society Annual Meeting, September 26-29, 2007 (Los Angeles, CA).

**Cynthia J. Roberts**, Professor of Ophthalmology and BME and participating BME faculty **Larry Leguire** presented at a Vision Research Scientific Forum featuring Prevent Blindness Ohio’s 2007 Recipients of the Young Investigator Student Fellowship Award for Female Scholars in Vision Research, November 28, 2007 (Columbus, OH). Participating BME faculty, **Petra Schmalbrock**, Associate Professor of Radiology, presented the Keynote Address: “Bringing Research from the Lab Bench to the Public: A Challenge for Women in Science”.

College of Engineering

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