Message from the Chair

It has been a year since I joined the Department of Biomedical Engineering, and I thought it was time to reflect on the accomplishments within our department. The following serve as examples of many accomplishments achieved by our faculty and students over the past year.

Successful recruitment of two new faculty — Drs. Rouzbeh Amini and Yang Liu (see page 2 to read more).

Dr. Mary Verstraete received the “Outstanding Faculty-Mentor of First-Year Students” award (see page 3).

MS student David Petrak was selected as the inaugural recipient of the Dr. Glen O. Njus Graduate Scholarship in Biomedical Engineering.

Renee Calderon, a double major in biomedical engineering and chemistry, was named a 2013 Goldwater Scholar by The Barry M. Goldwater Scholarship and Excellence in Education Program.

Dean’s Scholarships awarded to two of our outstanding students: Spencer York and Kunal Patel.

Two new federal grants received – from the Veterans Affairs (for a prosthetics project) and the National Science Foundation (for a tissue engineering study).

Thirty three students graduated with a BS in biomedical engineering in 2013. This reflects a graduation rate (in the minimum time) of 68%!

Overall enrollment in our undergraduate program continues to rise sharply — reflecting the interest in medical innovation in NE Ohio. This increase is depicted in the chart below.

As we look forward to a new semester, please look for updates and news on our revamped department website— www.bme.uakron.edu. As always, I welcome feedback and ideas as to how we can (i) improve the experiences of students in our programs, (ii) better understand mechanisms of disease, and/or (iii) develop improved technologies for diagnosing or treating disease.

Brian L. Davis, Ph.D
Professor and Department Chair
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Outstanding Sophomore Award

Melissa Boswell, now a junior in biomedical engineering, was presented with Omicron Delta Kappa Outstanding Sophomore award in April 2013. The Outstanding Sophomore Award, a LIFE Achievement award, is only given to one sophomore each year that shows exemplary academic work, involvement in extracurricular activities, and a broad base of awareness and leadership. All applicants must also have between 32-63 credits at the time of submission and a minimum 3.5 cumulative grade point average. Some of Melissa’s activities include being a member of a UA research team led by Dr. Brian Davis, Secretary of the Biomedical Engineering Society, volunteering through multiple alternative spring break trips, a variety of UA clubs, and working in the nursery at her church.

Biomedical engineering student
Melissa Boswell
Dr. Rouzbeh Amini completed a PhD in Biomedical Engineering at the University of Minnesota in the field of ocular biomechanics and biotransport. He continued his research work as a postdoctoral fellow in the University of Pittsburgh's Bioengineering Department where he studied biomechanics of the mitral valve. His overall research aim is to solve medical problems by advancing the field of experimental and computational soft tissue biomechanics. Dr. Amini uses a multi-scale approach to address key issues related to ocular, cardiovascular, and other soft tissue biomechanics. Examples of his research include models to better understand the pathophysiology of glaucoma, cardiac valve repair failure, and pelvic organ prolapse. Although such organs noticeably differ in terms of function, abnormal mechanical milieu may lead to permanent and often detrimental outcomes in all cases.

Dr. Yang Liu received his PhD degree in biomedical engineering from Washington University in St. Louis. From 2009-2013 he conducted translational bioinstrumentation research within the Radiology department of Washington University School of Medicine. His research program focuses on optical instrumentation, surgical technologies and medical devices. He develops interdisciplinary approaches at the interface between optics, electrical engineering, systems engineering, materials science, molecular imaging and medicine to solve challenging medical problems, with the overall goal being to bring novel medical technologies from "bench top to bedside."

Biomedical Engineering Professor Elected as “Frontiers in Bioengineering Young Investigator”

Dr. Hossein Tavana, biomedical engineering assistant professor, was selected as one of 20 young investigators to attend the Frontiers in Bioengineering Workshop at Georgia Tech in February 2013. The young investigators were chosen through a competitive process from universities across the U.S. and invited to present a research poster.

The goals of the Frontiers in Bioengineering Workshop are to bring together leaders of bioengineering to discuss the cutting-edge research in the field, with a focus on bio-imaging, bio-materials and cellular/molecular bioengineering, and to identify critical issues, challenges and future directions.

Speakers from around the world presented their latest research and talked about future trends in their research area.
Biomedical Engineering Student Named Goldwater Scholar

Renee Calderon, a double major in biomedical engineering and chemistry at The University of Akron, has been named a 2013 Goldwater Scholar by The Barry M. Goldwater Scholarship and Excellence in Education Program.

The program was established by Congress in 1986 to foster and encourage outstanding students to pursue careers in the field of mathematics, the natural sciences and engineering. Scholars are selected on the basis of academic merit from a field of mathematics, science and engineering students nominated by the faculties of colleges and universities nationwide.

Calderon is a member of a UA research team led by Dr. Yang Yun, associate professor of biomedical engineering, whose research is funded by the National Science Foundation. As part of Dr. Yun’s team, Calderon is investigating nonviral gene therapy and has contributed to the development of biodegradable nanoparticles in Dr. Yun’s lab.

“I am impressed by Renee’s ability to quickly understand complex scientific and engineering theories, ask thoughtful questions and apply her knowledge,” says Dr. Yun, who has mentored Calderon for the past two years. “She has a great future in biomedical research.”

Calderon is a member of Increasing Diversity in Engineering Academics (IDEAs) Program, Society of Women Engineers, and Biomedical Engineering Society student chapters.

Dr. Verstraete receives Outstanding Teacher/Mentor Award

Dr. Mary C. Verstraete, Associate Professor and Associate Chair of Biomedical Engineering, received the “Outstanding Teacher/Mentor of First Year Students Award” from UA in recognition of exemplary commitment to scholarly teaching and to first-year students’ academic success.

“I am thrilled to be selected for this award,” says Verstraete. “I know how hard many individuals across campus work to ensure the success of first-year students. It is an honor to work with the exceptional students in Biomedical Engineering and to see the class sizes grow. We are thrilled to have 50% of our students in the Honors program, and I personally am thrilled that close to half of our students are female.”

Dr. Verstraete spearheaded the development of the undergraduate program in BME and has taught the lecture portion of the freshman Tools for BME class since 1998, now reaching over 600 students. For the past several years, she has also coordinated the Orientation Program for all incoming freshmen in the College of Engineering.
Lithuania Trade Mission to Akron

From February 17-22, two groups from Kaunas University of Technology (administration and academic), one company (Integrated Optics), as well as representatives from the Lithuanian Trade Office and the Lithuanian Health Science University visited Akron. On the 21st, the Department of Biomedical Engineering hosted these visiting delegations. Drs. Davis and Zhang gave overviews of the department, including descriptions of tissue engineering research being conducted at The University of Akron.

As a result of this visit, the College of Engineering now has a signed Memorandum of Understanding with Kaunas University of Technology to enhance relations between the two universities and to develop academic and cultural interchange in the areas of education, research, and other activities.

It is expected that this relationship will include (i) student internships, (ii) joint research projects, (iii) hosting visiting delegations, and (iv) opportunities for academic faculty exchanges.

BME Professor’s Technology is the Basis for a New UA Spinoff Company.

Dr. Dale Mugler, dean of the Honors College and Professor of Biomedical Engineering, has led efforts to develop two software packages with significant benefits to healthcare. As a result of this research, a new company has been formed — Akron Software. Akron Software’s innovative parallel implementation of the Fast Fourier Transform (Akron FFT) could greatly increase the speed with which computed tomography scans, magnetic resonance imaging (MRI), and ultrasound imaging can be conducted. The FFT is performed dozens of times in a wide range of imaging applications. Because the Akron FFT could lead to a three-fold increase in the speed with which the FFT is performed, this technology could enhance imaging for cancer patients and even provide real-time cancer imaging to guide surgery and radiation therapy.

The second breakthrough is that Dr. Mugler’s team discovered how to create digital “Hermite functions” and use them to represent physiological signals. Their method is extremely fast and can easily be integrated into a real-time application to monitor heart signals (ECGs). This can be done as they are received, either at a patient’s bedside or nurses’ station, or even at an in-home healthcare situation where the data are transmitted back to a central monitoring location.

Akron Software currently utilizes office space on the Akron Innovation Campus, which is located adjacent to The University of Akron’s (UA) main campus near downtown Akron.
Recent Grants

Dr. Marnie Saunders: Commercial Product Developments, Firestone Grant, $10,000
Dr. Marnie Saunders: A Novel Invitro Platform for Correlating and Quantifying Mechanical-induced Bone Cell Microdamage Effects, National Institutes of Health, $462,311
Dr. Hossein Tavana: Configuration of Microprinted Stem Cell Colonies in Heterocellular Niches Regulates Neural Differentiation, CBET– Biomedical Engineering National Science Foundation, $310,000
Dr. Brian Davis: Synergistic improvements for transfemoral prosthetic sockets. Department of Veterans Affairs, $338,000
Dr. Nic Leipzig: Adaptable hydrogel oxygen delivery platform for wound care, NIH, $358,275
Dr. Nic Leipzig: Transcriptional profiling and µCT assessment of an experimental syringomyelia rat model for the development of new neurorestorative treatments, Conquer Chiari Foundation, $67,234
Dr. Nic Leipzig: 2013 Cellular and Molecular Bioengineering (CMBE) Conference, NIH, $10,000

Recent Events

Dr. Brian Davis and Bob Anthony (Director of Entrepreneurial Services: Akron Global Business Accelerator: Life Sciences) discuss the day’s agenda at the Aachen Biomedical Conference held in Germany, June 18-20.

The Biomedical Engineering Department had its retreat on May 25, 2013.
This year, BEST Medicine hosted 115 students in grades 6-12 from 28 schools across Northeast Ohio at its third annual BEST Medicine Engineering Fair at the National Inventors Hall of Fame® School Center for STEM Learning in Akron. Projects were placed in several categories including: sensors/imaging, medical devices, musculoskeletal, biomaterials/polymer medicine and clinical trials. One of the grand prizes presented this year was a $1,000 summer education internship at The University of Akron, sponsored by Women in High Places. Isabella Sparhawk, a senior at St. Vincent-St. Mary High School, was awarded the prize and she spent 4 weeks in Dr. Rebecca Willits’ laboratory in the Department of Biomedical Engineering. Another grand prize – covering the costs of a student attending the Intel International Science and Engineering fair in Phoenix, Arizona -- was sponsored by the Burton D. Morgan Foundation. Kanithra Chandra Sekaran, of Solon High School, was selected for her project “Analysis of the Antagonistic Characteristics of the Extract of Centella Asiatic, a South Asian Herb on the growth of Cancers Cell Lines”.

Daniel Anand, shown on the above left with one of the judges – Prof. Bing Yu, won 1st place in the “Medical Device” category for 7th graders at the 2013 BEST Medicine event. His project “Ergonomic Power-Assisted Wheelchair Transfer System” featured a full-scale prototype that incorporated a motor-driven mechanism with pulleys to allow the user to slide forward easily, as well as counter-weights to prevent wheelchair tipping.

The “BEST Medicine” engineering fair is a joint initiative of The University of Akron and the Austen BioInnovation Institute in Akron.

Biomedical Engineering Students Tour Acro Tool and Die

Students Ryan Kenyon and Jonathan King won a raffle organized by our Biomedical Engineering Society student chapter. Acro Tool and Die, a local company, provided tickets to this year’s Bridgestone Invitational World Golf Championship and also arranged for a tour where they showed the students their latest 3D printing system for making metal prototypes. BMES President Daniel Gerber helped coordinate the event and subsequent tour.

Matt Oldham (left) and Terry Ellis (center) show their company’s latest 3D printer to UA biomedical engineering students and Dr. Yang Liu (far right). The system is used to manufacture biomedical prototypes and other devices from cobalt chromium and stainless steel.
Recent Publications


Opening a New Biophotonics Laboratory

BME’s Biophotonics Laboratory develops various optical imaging, spectroscopy and sensing technologies for medical diagnostics and therapeutics. The goal is to create new technologies that are portable and cost-effective, yet accurate and reliable.

As an example, Dr. Yu’s group has developed a fiber-optic surface sensor based on diffuse reflectance spectroscopy that can be easily taped on to the skin. The sensor has successfully recorded natural tumor cycling hypoxia in xenograft models of head and neck cancers noninvasively. The team is collaborating with researchers from Ohio State University to use the sensor to study the effectiveness of anti-hypoxia drugs in improving the tumor oxygenation in animals. The team is also investigating the feasibility of surface sensors for wound healing assessment.

In another project, Dr. Yu is developing a multifunctional fiber-optic needle probe for performing laser induced thermal therapy (LITT) or photodynamic therapy (PDT) for cancer treatment.

Dr. Bing Yu in the process of moving into his new Biomedical Instrumentation Laboratory. In the foreground is a high-power laser system used for his cancer-related research program.
Innovation Practice Center: Seeking a Director for the Proof-of-Concept Center

Proof-of-Concept (POC) Faculty – Appointing Unit: College of Engineering

A POC Faculty member will be hired within the College of Engineering. The POC Faculty will be a tenure track or tenured position depending upon candidate’s qualifications. The secondary appointment for the POC Faculty will be within the College of Business Administration or School of Law.

Duties:

In coordination with the College of Engineering Dean and the other College of Engineering faculty, the candidate will engage in relevant scholarship on the innovation process, teach courses in the general area of the relationship of intellectual property, engineering, innovation, entrepreneurship, and commercialization, and provide appropriate service to the university community. For each of the first 2 years, the candidate will teach a 50% course load, assist in the development of additional course material for students and faculty, serve on Masters and Doctoral review committees, and work collaboratively with other University of Akron faculty to help faculty understand and utilize the University of Akron innovation process. Depending on level of funding and research, this 50% course load could continue beyond the first 2 years.

The candidate, in coordination with the relevant deans and faculty, will create and implement a project solicitation system that allows University of Akron faculty, students, and external sources to apply for grant money through the IPC to complete a proof-of-concept. The candidate will be responsible for developing and implementing a review, evaluation, and award process. The candidate will help coordinate and be responsible for the other elements of the IPC, including the Grant Program, identifying and assigning Catalysts, planning Events, and forming Innovation Teams. Additionally, the candidate will coordinate efforts on fundraising through foundation, organization, and individual donations.

Required Qualifications:

The candidate must possess a terminal academic degree in engineering, such as a Ph.D., D.Phil or D.Eng. degree. The candidate’s education or experience in law or business (e.g., a MBA) must be sufficient to obtain a secondary appointment in either the School of Law or the College of Business. The candidate must have significant experience working with entrepreneurs, inventors, and companies on legal, business, and technical matters. The candidate must have managerial and administrative competence, experience in coaching and guiding start-up company creation and launch, and experience in working in an interdisciplinary environment. The candidate will work closely with other IPC faculty and must be a team builder.

For more information on this position, see: Professor, Director Proof of Concept Center - College of Engineering The University of Akron, http://www.uakron.edu/hr/jobs.dot
Industry/University Partnership to Advance Prosthetics for Veterans

As part of a Department of Veterans Affairs (VA) Innovation Initiative (VAi2) competition, The University of Akron has joined forces with WillowWood, an industry leader in design, manufacturing and distribution of prosthetic products, as well as The Ohio State University to secure a contract to develop a more comfortable and useful prosthetic system to help patients at VA medical centers who have a transfemoral amputation (above-knee amputee patient). The contract, which was signed August 10, 2012, was publicly announced by the U.S. Department of Veterans Affairs on February 20, 2013.

Last year, WillowWood, The University of Akron, and The Ohio State University jointly entered an industry competition to work with the Department of Veterans Affairs. The annual VAi2 Industry Innovation Competition, first held in 2010, invites industry leaders, start-ups, non-profits, and academic institutions to submit their ideas to improve health care and services for veterans.

The project, which spans 26 months, is intended to provide transfemoral amputees with a more comfortable and durable prosthetic socket system that maintains fit and performance across a wide range of activities.

“The core of this project—to find an optimal polymer for a medical condition—taps into our proud history of innovation in this area,” says Dr. Brian Davis, chair of the Department of Biomedical Engineering at UA and Akron’s lead investigator on this project.