Dr. Ayman El-Baz, Professor and Chairperson

I am excited to share with you some of the activities of our faculty, students, and alumni in this issue of BE-connected. The BE Department leads the Speed School and the Medical School in the area of Big Data in Medicine. Our faculty secured a grant from the EVPR for Big Data and an NSF grant to help women and minority faculty, staff, and student innovators to commercialize their inventions. Our department has successfully negotiated and signed Letters of Understanding with three international Universities (University of Chiang Mai, Thailand, Dalian University of Technology, China, and University of Abu Dhabi, UAE) to establish Joint Master of Science programs. In this issue, we highlight the success of BE Faculty in translational research, successes of our current and former students, and the activities of our BMES chapter.

Brooke Barrow, winner of the Judi Olsen Endowed Scholarship award, is a graduate bioengineering student at the University of Louisville. She worked as an intern at Ethicon Endo-Surgery (Johnson & Johnson) which specializes in endoscopic medical devices. After graduating with her master’s degree, Brooke plans to attend medical school.

Kelly Millay, winner of the Jerry and Pat Sturgeon Academic Excellence award, is from Northern Kentucky. She is an active member of the Society of Women Engineers (SWE), Tau Beta Pi, Campus Interfaith Center, and volunteered in the prosthetics department of the Veterans’ Hospital. She plans to pursue her Masters in Prosthetics and Orthotics from the University of Texas Southwestern.

Yitzhak Gebru, winner of the Joseph Henry Award in Translational Bioengineering, completed his MEng and is planning to start his own company to commercialize the technology he developed as part of his Master’s thesis.

Connor Smith, winner of the Rolando “Chip” Cheng Jr. Memorial Scholarship award, is a senior Bioengineering student. He is the President of the local Sigma Pi Fraternity chapter. He completed his co-op rotations conducting cardiovascular research with the Advanced Heart Failure Research team. Connor plans to complete his Masters of Engineering degree and then continue onto medical school.

Lee Sims, winner of the Mickey R. Wilhelm Achievement award, is a graduating senior in BE and will be moving this summer to the M.Eng program. While at UofL, he is focusing on applied nanotechnology towards oncology and microbicide research. In addition to academic and research endeavors, Lee holds several elected positions on the executive board of the Biomedical Engineering Society. Lee plans to further his education and focus on the field of oncology research.

Your continued support is vital to the success of our department. You may designate your support towards the BE department, student awards, or to support a specific research lab. For more information about how your donations can help transform the BE Department, please contact Chris Day at chris.day@louisville.edu, or call (502)852-1541.
Dr. Gina Bertocci is the Director of the Injury Risk Assessment and Prevention (iRAP) Laboratory, established in 1997. The iRAP is a multi-disciplinary team consisting of engineers, physicians, veterinarians, and therapists who conduct research in injury biomechanics, early child abuse detection, pediatric injury, veterinary orthopedics, wheelchair accessibility and safety, rehabilitation and assistive technology.

Dr. Bertocci is an internationally recognized expert in injury biomechanics and has worked with prosecutors throughout the US and United Kingdom as an expert witness. Her team has combined computer simulation, test dummy experiments and in-depth accident investigation to better understand injury risk in children. This improved understanding of injury risk in pediatric falls (falls are falsely claimed as the reason for injuries in child abuse), and has aided clinicians in distinguishing between abusive and accidental trauma. Dr. Bertocci has translated her passion for dogs by studying canine orthopedic and musculoskeletal biomechanics. She has collaborated with veterinary orthopedic surgeons and neurologists to improve surgical techniques for canine knee ligament repair, and to study naturally occurring canine spinal cord injury.

Training the next generation of bioengineers in forensic injury biomechanics is an important goal of the iRAP Lab. Dr. Bertocci mentored a high school student, Stevan Kriss, on a project titled “Incidence and Location of Abusive Skeletal Injuries in Infants and Children: Does Perpetrator Handedness Matter?” This placed among the Top 30 Finalists in the Americas and Top 100 Finalist Worldwide in the Google International Science Fair. Stevan also presented his work at the International Pediatric Radiology Conference in Chicago IL last May; we believe he was the youngest presenter!

Lindsay Strotman-2010 BE Grad
I had the opportunity to conduct research at UofL while studying bioengineering, which solidified my desire to pursue it as a career. This led me to obtain my doctorate in Biomedical Engineering in 2014 at the University of Wisconsin-Madison. I was awarded a National Science Graduate Research Fellowship during graduate school, which enabled me to work on building microscale diagnostic devices and tissue relevant cell culture models for cancer. One of my main projects was focused on isolating tumor markers from blood for early cancer detection and to enable better monitoring of cancer progression. This work led to several patents and publications and also led to the creation of a new biotechnology company. After obtaining my Ph.D., I took a position at PGX technologies, a small clinical laboratory start-up out of the University of Louisville to translate the diagnostic devices I was working on into a clinical setting. We recently received a federal small business grant and matching funds from the state of Kentucky focused on furthering this work for the detection and diagnosis of brain cancer using a simple blood draw. But everything has really come full circle as I am now teaching a bioengineering class I took long ago, hoping to help the next generation of bioengineers to go out and pursue their passions.

Patrick McClure -2013 BE Grad
Since I was interested in both mathematics and medicine, I chose to major in Bioengineering in 2009. During my sophomore year, I became interested in machine learning and artificial intelligence in the medical field while volunteering in Dr. El-Baz’s lab. My interest led me to attend an NSF Research Experience for Undergraduates in Computational Sensing and Medical Robotics at Johns Hopkins University. My project focused on machine learning for computer vision (understanding what objects are in an image). I was awarded the Barry M. Goldwater Scholarship and the Jerry and Pat Sturgeon Academic Excellence Award due to the work I did in Dr. El-Baz’s lab. After graduation, I decided to pursue my Master’s degree in the CECS department focusing on machine learning and optimization, while continuing to conduct research in medical image analysis under Dr. El-Baz. In 2014, I was awarded the Cambridge Trust International Scholarship to pursue a PhD in Computational Neuroscience at the University of Cambridge, researching on deep neural network models of human visual perception and decision making under the supervision of Dr. Nikolaus Kriegeskorte. I will graduate with my Ph.D. during the summer of 2017 and continue my career as a Research Scientist in Machine Learning at the National Institutes of Health. The Bioengineering Department at the University of Louisville was instrumental in my educational and career success.

The BE Department is grateful for the service of our External Advisory Board (EAB). The EAB members are:

Jonathan B. Gabel, P.E., is a Staff Engineer & Technical Lead at Becton, Dickinson & Company. He is a licensed Professional Engineer in NJ and holds a B.E. in Mechanical Engineering from Stevens Institute of Technology (1983) and an M.S. in Biomedical Engineering from Columbia University (1991). He has 33+
years of medical device design and development experience. He has 25 US Utility patents, 2 US Design Patents, and numerous worldwide patents. He is an Adjunct Professor at Stevens Institute of Technology, currently teaching graduate courses on the Design, Development and Manufacturing of Medical Devices.

Brenda K. Mann, PhD, is Vice President for Research & Development at EyeGate Pharmaceuticals, focused on ocular therapeutics and drug delivery. Dr. Mann holds a BS and PhD in chemical engineering from Iowa State University and Rice University, respectively. Dr. Mann is an adjunct faculty in the Department of Bioengineering at the University of Utah. She co-founded SentrX Animal Care (veterinary biomaterials), where she was VP for R&D for 10 years, and Metis Therapeutics (biomaterials for women’s health). Dr. Mann was a founding faculty member of the Keck Graduate Institute of Applied Life Sciences, and continues to serve on its Advisory Council. Dr. Mann has received several awards including the Rice University Outstanding Woman Award in 1996, and the Teacher Tribute Award from Stanford University in 2015.

Ruth Voor is a 1983 graduate of the US Naval Academy. During her Navy tenure Ruth received numerous leadership awards including Supply Service Warfare Officer Qualification. Ruth began her medical device / biotechnology career in 1989 when she joined Johnson and Johnson. She started in operations and R&D and culminated this phase of her career by successfully bringing the first drug eluting stent to market: CYH-PER™. She then transferred to strategic marketing and worked with identifying L&A opportunities for the portfolio. In 2008, Ruth became President/CEO of Vi-vorte, Inc., an implantable orthopedic device company. Vivorte has two licensed and patented technologies focused on bone strength. The first received FDA clearance in 2014 and has been successfully launched into the US Market.

Don Rodda is currently a Sr. Engineer and also served as Engineering Manager Strategic at Cook Medical, Bloomington, Indiana. Don graduated with a BSME and MSME from Purdue University. At Cook, he has established a year round co-op/ intern program and created the training systems and programs to develop Cook's outstanding technical staff. As an Engineering leader, Don's group guided the development of multiple Cook products for the cardio-vascular system including the Coda Balloon, Zenith ReNu and Flex endografts. As President of Dover's Midland Manufacturing and Weldcraft Products divisions he initiated world-class/ lean manufacturing principles, and his teams achieved record sales, earnings and cash flows, and won numerous awards.

Justin Volz is an engineer in the medical device industry, working for Atricure in Cincinnati, Ohio. He enjoys having a direct impact on people’s lives by developing breakthrough products and processes. He is a Speed School alum and still prefers Kentucky to Ohio.

Micheal Golway is an American entrepreneur, engineer and inventor. In November 2000, at the age of 31, Michael acquired his first technology company, IDS Engineering. He is the President & CEO of Advanced Solutions, Inc., which is a privately held company he acquired in November 2004, and parent company to an aggregate of technology businesses, including IDS Engineering. Michael's passion is building and acquiring great technology companies, while growing market share through value innovation. He is the lead inventor for the integrated solution of BioAssemblyBot® and TSIM®, a 6-Axis Robotic 3D Printing System for Human Tissue Structures. Michael has over two decades of experience leading multi-disciplined engineering, consulting and technology firms.

Paul Spence is a cardiothoracic surgeon with more than 15 years’ experience. Dr. Spence completed his baccalaureate and medical degrees at Queen’s University, Kingston, Ontario, and received his Master of Science degree from the University of Toronto. Dr. Spence left his full-time academic medicine role in 2003 after having achieved the rank of professor of surgery at the University of Louisville. He has over 50 peer-reviewed publications and 30 U.S. medical device patents. He founded five medical and medical device companies in the United States and abroad and translated several of his patents including the Xpose system (Guidant), Circulite system (HeartWare), and Symphony counterpulsation device (ABiomed).

Vivorté was founded in 2008 by Dr. Michael Voor and his sister, Ruth Voor. Dr. Voor has a Ph.D. in Biomedical Engineering (Tulane University 1992) and is the Director of the Orthopaedic Bioengineering Laboratory. Vivorté was founded through the licensing of two platform technologies developed by Dr. Voor in the Orthopaedic Bioengineering Lab. Vivorté has commercialized Trabexus and Trabexus EB, which are composite synthetic/biologic bone graft substitutes that be injected through a cannula. They have a compressive strength similar to bone tissue after hardening and remodel into living bone over time. Vivorté is finalizing a second family of products related to preventing hip fractures in older adults. Vivorté currently has six full-time and two part-time employees in their offices and labs and was featured in a recent front page article in the Louisville Courier-Journal.

Click here for the C-J story.
Failure in SV patients. Single ventricle (SV) support devices to treat Fontan failure are chronic calculations. Currently, there are no chronic supports for providing cavopulmonary support: Drs. Guruprasad Giridharan, Steven Koenig and colleagues received a patent for a long-term, mechanical circulatory support device (CPAD) to augment cardiac output and support patients with single ventricle (SV) failing Fontan circulations. Currently, there are no chronic mechanical circulatory support devices to treat Fontan failure in SV patients. Single ventricle (SV) heart disease is the leading cause of death from any congenital defect in the first year of life and is the most expensive to treat, with an average cost of $250,000 per patient.

U.S. Patent #9,409,023, Spinal Stimulator Systems for Restoration of Function:
Spinal cord injury results in not only paralysis, but also secondary complications related to cardiovascular, respiratory and bladder dysfunction to name a few. Electrical stimulation of the spinal cord has been shown to improve patient outcomes in these areas. Dr. Robert Keynton and colleagues received a patent for a device consisting of a plurality of electrodes that are placed below a spinal cord lesion. These devices can be configured to provide stimulation to a select group of electrodes, or a combination thereof, to evoke a specific desired physiological responses.

U.S. Patent #9,463,019B2, Trocar Site Closure Assembly:
Following laparoscopic surgery, there is a need to close the trocar sites to prevent hernias. Current technologies for trocar closure are difficult and time consuming. Dr. Robert Keynton and colleagues received a patent for a device that employs a passive design consisting of multiple cinching arms with an array of barbs extending from a central collet. The array of barbs on the cinching arms engage the peritoneal layer of the inner abdominal wall once deployed. The central collet simply blocks the trocar site opening and the cinching arms hold the collet in place. The entire assembly is constructed from biodegradable materials to enable elimination of the device without requiring a secondary surgical removal procedure.

US Patent #9,230,320, Computer Aided Diagnostic System Incorporating Shape Analysis for Diagnosing Malignant Lung Nodules:
Dr. El-Baz and colleagues received a patent for an algorithm to analyze lung magnetic resonance imaging (MRI) data. The algorithm utilizes a spherical harmonic analysis for the diagnosis and classification of pulmonary nodules as malignant or benign by their shape.

Patent Number 9,230,321, Computer Aided Diagnostic System Incorporating 3D Shape Analysis of the Brain for Identifying Developmental Brain Disorders:
Dr. El-Baz and colleagues received a patent to characterize anatomic abnormalities between autistic and normally developed brains using structural Magnetic Resonance Imaging (sMRI) based on the 3D shape analysis of their brains. This approach is an important step towards personalized medicine, as it enables a more accurate diagnosis of each subject along the autism spectrum.