$20 Million Endowment For Biomedical Engineering Translational Research

A $20 million endowment to foster research collaboration between biomedical engineers and clinicians, with the ultimate goal to develop new technologies to improve patient care, was created by Duke University and the Wallace H. Coulter Foundation in April 2011.

“The Coulter Foundation’s vision for translating promising biomedical research into practical applications is perfectly aligned with Duke’s commitment to knowledge in service of society,” said Duke President Richard H. Brodhead. “Duke is grateful to the Coulter Foundation for being our partner in this endowment, which will continue to nurture exciting developments in the future of medicine.”

The Duke Coulter Translational Partnership in biomedical engineering is funded by $10 million from the Coulter Foundation, with additional investments from Duke and the Fitzpatrick Foundation, bringing the endowment to $20 million for the Pratt School of Engineering.

“This program started out as a grand experiment to link the relatively new discipline of biomedical engineering to translational research,” said Sue Van, president of the foundation. “With the capabilities and financial sustainability of this endowment, Duke is now a champion at the forefront of translational research and can systematically and successfully move innovation out of the university to benefit humanity.”

Elias Caro, vice president of technology development at the foundation, said, “As a member of the Coulter program, Duke adopted the Coulter Process, an industry-like development process, that includes a thorough commercialization analysis which assesses intellectual property, FDA requirements, reimbursement, critical milestones and clinical adoption. This attracted follow-on funding from venture capital and biomedical companies.”

In 2005, the Coulter Foundation chose Duke as one of nine universities to accelerate the movement of university biomedical engineering projects into commercial products and clinical practices. A key requirement is that each project must be led by a biomedical engineering faculty member and a clinical or medical school researcher. The overall Duke program has been led by BME Chair George Truskey, BME Professor Barry Myers, who is also director of Duke’s Center for Entrepreneurship and Research Commercialization and Melda Uzbil, the Coulter Program Director.

“This program is a highly successful effort to create research collaborations between clinical faculty at the Medical School and biomedical engineering faculty to develop promising approaches that address important unmet clinical needs,” said Truskey. “Not only do the faculty benefit, but students participate in the research and learn firsthand about the process of moving a critical technology from the lab toward clinical application.”

Robert A. Harrington, MD, director of the Duke Clinical Research Institute, a partner in the endowment, said, “We look forward to more great collaborations between our clinical research faculty and the faculty and students of the Biomedical Engineering Department who will ultimately help us meet our mission of improving the care of patients worldwide.”

Since 2005, 19 Duke projects have been funded, focusing on such areas as detecting prostate cancer and esophageal pre-cancerous lesions, treating hemophilia and controlling urinary function for paraplegics. In total, the Duke projects have resulted in three startup companies, several licensing agreements, more than $35 million in venture capital and investments, and another $47 million in federal, state or foundation grants. The new endowment will allow the program to continue to support promising translational projects at Duke in perpetuity, Truskey said.

The start-up companies, all located in the Research Triangle Park, have the potential to grow into thriving companies—thereby providing an economic return to North Carolina. The Duke Coulter program helps continued p. 3...
In September 2010, we celebrated 40 years as a department and an article in this issue describes the day’s events. The department arose from research collaborations that brought together engineers and medical scientists. The range and breadth of activities in which our alumni and faculty are engaged is truly impressive given these modest beginnings.

A few months later we received an endowment from the Coulter Foundation matching funds from Duke University, the Duke Clinical Research Institute and the Fitzpatrick Foundation to continue the Translational Partnership Program. This program has been enormously successful, providing over a 16:1 return on the initial investment from the Coulter Foundation. We will now be able to continue to work with faculty to move basic research advances to improve patient health, a key aspect of the Department’s mission.

This year we also received an NIH R25 grant to improve the design experience of BME seniors. We’ve implemented two key parts of the program already, a new course on Medical Device Innovation, first taught in Spring 2011 and a clinical practicum during the summer. Two teams of four students each did two separate, two-week rotations to identify important clinical needs that would be design topics. The students visited patients, observed surgeries and procedures, and discussed medical device design problems with industry engineers. They presented the most important needs and product requirements to BME and clinical faculty. The feedback from students and clinicians has been very positive and has opened new opportunities for our design projects.

The department is also undergoing some transitions. Professor Wanda Neu succeeds Patrick Wolf as Director of Undergraduate Studies. She has already been very active in revamping the teaching of key concepts and applications of statistics in BME courses. Professor Wolf has overseen a major revamp of the undergraduate curriculum and a successful ABET review. He returns to a thriving research program that uses novel ultrasound imaging for cardiac ablation.

After serving as chair for over 8 years, I will step down at the end of November 2011. I am now serving as Senior Associate Dean for Research in the School of Engineering. I’ve enjoyed immensely serving as chair of the BME department and look forward to working with our new chair, Professor Craig Henriquez.

Please enjoy reading about all of the research advances and student accomplishments.

George A. Truskey
Professor and Chair

New BME Department Chair

Professor Craig Henriquez will become the new chair of the BME department December 1, 2011. Craig is a long-standing member of the BME department at Duke. His appointment was widely and enthusiastically endorsed by the faculty.

Craig earned all of his degrees from Duke, with a double major in biomedical engineering and electrical engineering in 1981 and a Ph.D. in biomedical engineering in 1988. He joined the faculty as an Assistant Professor in 1991. He was awarded a University Bass Chair in 2001 for excellence in teaching and research.

Craig’s research interests focus on computational approaches in biomedicine with an emphasis on arrhythmias of the heart and neuroengineering. His research has been funded by the NIH, the NSF, the Whitaker Foundation, the American Heart Association, and Ethicon, Inc. In 2003, he founded the Interdisciplinary Center for Neuroengineering with neurobiologist, Miguel Nicolelis, to advance brain machine interfaces. He is the author of over 100 publications.

He has served in a range of administrative leadership positions at Duke, including chair of Pratt’s Engineering Faculty Council from 2005 to 2007 and most recently as chair of Duke’s Academic Council and University Faculty Marshall for the past two years. He was also recently appointed as the inaugural chairperson of Duke’s Bass Society of Fellows.

Craig teaches both undergraduate and graduate courses and received the Klein Family Distinguished Teaching Award in 2009 from the Pratt School’s Engineering Alumni Association in recognition of his teaching and mentoring contributions. He holds a secondary appointment in computer science. Craig is a fellow of the American Institute for Medical and Biological Engineering. He has served as an associate editor of IEEE Transactions on Biomedical Engineering and as a member of the National Heart, Lung and Blood Institute Electrical Signaling, Ion Transport, and Arrhythmias study section for NIH.

Craig Henriquez
Gersbach Wins NIH Innovator Award
Assistant Professor of Biomedical Engineering Charles Gersbach is one of 49 recipients of the NIH Director's New Innovator Award which supports exceptionally creative new investigators who propose highly innovative projects that have the potential for unusually high impact. Gersbach uses genetic reprogramming to generate various cell sources for the growing field of regenerative medicine. This involves reprogramming the gene expression of easily accessible cells, such as a patient's own skin cells, to create new cell types, such as those that make muscle, bone, cartilage, blood vessels, or heart tissue. "Conventional wisdom has always held that once the decision was made that determines what kind of a cell a stem cell would become, it was irreversible," said Gersbach. "Now, all that is out the window. We're beginning to see that we can change the fate of cells whose fate would seem to have been sealed."

In the past few years, scientists have figured out how to turn a cell whose fate has already been determined into a cell with the ability to differentiate into another type, much like a stem cell. For example, Gersbach's lab has taken skeletal muscle cells, genetically engineered them to activate a bone-related gene, which led to conversion of these muscle cells into bone-forming cells which could be used to regenerate bone tissue.

"We are currently expanding these studies to develop robust methods for genetic reprogramming of cell types that can be used to regenerate a variety of tissues," Gersbach said. "Regenerative medicine is emerging as a promising approach to repairing diseased or damaged tissues. This strategy uses living cells to regenerate tissues, in contrast to non-biologic tissue substitutes made from plastics, metals, ceramics, electronics, or other materials."

NSF Establishes Triangle Center for Soft Matter Research
The National Science Foundation has awarded a six-year, $13.6 million grant to establish the Triangle Materials Research Science and Engineering Center (MRSEC), led by BME Professor Gabriel Lopez. Researchers from Duke University, North Carolina State University (NC State), University of North Carolina-Chapel Hill (UNC-CH) and North Carolina Central University (NCCU) will focus their collective expertise on facets of soft matter research. The researchers involved in this project will investigate how and why these particles assemble in certain ways, and how this assembly can be manipulated to achieve soft matter with defined characteristics.

"We believe that the Triangle MRSEC will become an important national and international center for innovation in the area of soft matter — including the theoretical generation of new insights, creation of new functional materials, development of new applications, commercialization and education," said López. "The fundamental understanding, design and application of these new types of materials will have implications across diverse fields of science, technology and medicine. We plan to turn these findings into practical realities through relationships with existing companies as well as start-up companies likely to arise from the research."

NC State’s Carol Hall, Camille Dreyfus Distinguished University Professor of Chemical and Biomolecular Engineering, serves as co-principal investigator. "This center is the remarkable result of a convergence of ideas from some of the world's leading soft matter experts at universities right here in the Triangle," Hall said. "Working together, this diverse group will develop new materials that helps solve some of humanity's most challenging problems while jump-starting the careers of the next generation of soft matter researchers and entrepreneurs."

continued p. 5
From Individual Cells To Entire Bodies, Lasers Shine

Laser technology is definitely bringing a bright future to biomedical research and clinical applications, as it is capable of yielding the critical information bridging molecular structure and physiological function, which is the most important process in the understanding, treatment and prevention of disease,” said Tuan Vo-Dinh, an invited speaker at the annual meeting of the American Association for the Advancement of Science to commemorate the fiftieth anniversary of the invention of the laser.

“Lasers could ultimately lead to the development of new tools for early diagnostics, drug discovery, and medical treatment beyond the cellular level to that of individual organelles and even DNA, the building block of life,” said Vo-Dinh, the R. Eugene and Susie E. Goodson Professor of Biomedical Engineering, Professor of Chemistry, and Director of the Fitzpatrick Institute for Photonics.

Vo-Dinh and colleagues developed “molecular sentinels,” metallic nanoparticles attached to small pieces of DNA that can detect early signs of disease at the DNA and RNA level. This optical technique is known as surface-enhanced Raman scattering (SERS), which Vo-Dinh has pioneered its practical application over the past 20 years.

When laser light is directed at a sample, the target molecule vibrates and scatters back its own unique light, often referred to as the Raman scatter. However, this Raman response is extremely weak. When the target molecule is coupled with a metal nanoparticle, the Raman response is greatly enhanced by the SERS effect — often by more than a million times, Vo-Dinh said.

“This technology can be used to directly detect chemical species and biological species with exquisite sensitivity or to monitor inside single cells,” he explains. “In other terms, the nanoprobes play the role of molecular sentinels patrolling the sample solution by switching their warning light on and off when significant event occurs.”

Using this approach, researchers have already been able to “read” the gene sequences of infectious agents like HIV and early biomarkers of other diseases, such as the breast cancer genes known as BRCA1 and ERB2.

Also, researchers have developed optical nanosensors, which can probe physiological parameters such as pH, individual biochemical markers such as cancer-causing agent metabolites attached to DNA, and molecular pathways such as apoptosis, or programmed cell death.

“These nanosensors are leading to a new generation of tools that can detect the earliest signs of disease at the single-cell level in a systems biology approach and have the potential to drastically change our fundamental understanding of the life process itself,” Vo-Dinh said.

New Method for Rapidly Producing Protein-Polymers May Lead to New Types of Therapies

In a paper published in Nature Materials last year, Ashutosh Chilkoti, Theo Pilkington Professor of Biomedical Engineering and graduate students Miriam Amiram, Felipe García Quiroz and Daniel Callahan reported a new method for rapidly producing an almost unlimited variety of man-made DNA sequences. Current methods for producing these DNA sequences are slow or not robust, which has hindered the development of these increasingly important new classes of protein-based polymers.

“A very popular method for making tandem copies of DNA sequences involves inserting them iteratively into a bacterial plasmid,” said Amiram. “After the vector has grown in size, the copies of the sequence are cut out using enzymes and the process is repeated to generate a larger polymer. It is a very time-consuming process. With this new method, you don’t get just one product, but many,” she said. “This should help us to make large libraries of proteins, which we can use to rapidly screen new combinations. This powerful strategy generates libraries of repetitive genes over a wide range of molecular weights in a ‘one-pot’ parallel format.”

The new process, called overlap-extension rolling circle amplification, is a modification of existing technologies. Consequently, other laboratories would not need major investments in new equipment or materials.

The researchers used the system to synthesize genes found in two classes of protein-polymers. In the first, they produced protein-polymer combinations for elastin, a ubiquitous protein found in connective tissue. The researchers term them “smart” protein-polymers because they can be controlled by heat. In the second set of experiments, they rapidly synthesized novel glucagon-like peptide-1 (GLP-1) analogs to show variable pharmacokinetic properties. GLP-1 is a hormone that acts to release insulin in the body.

“This new technique should be very useful in making a practically unlimited number of these protein building blocks,” said Chilkoti.

“Depending on how complicated you want the polymer sequence to be, there are an infinite number of combinations you could make,” Chilkoti said. “We haven’t even begun to look at all the sequences that can be made or the unique properties they might have.” The research was supported by the National Institutes of Health.
In a paper published in the April 2011 issue of the journal Nature Biotechnology, Assistant Professor Jingdong Tian and his research group have designed a 1-by-3 inch chip that can produce custom-made segments of DNA in two days, drastically reducing the time and effort of synthesis.

Creating and copying novel pieces of DNA quickly and inexpensively could have broad implications in the production and screening of new drugs, as well as replacing current technologies for genetic cloning, the researchers said.

"Using current technology, it takes between about 50 cents to a dollar to create each base pair of DNA; using the new chip reduces costs to less than half of 1 cent per base pair," said Tian. "In addition, current methods create many mistakes that must be accounted for," he continued. "The chip-based method is self-correcting, so that whenever an error in copying is detected, it is automatically fixed."

Gene synthesis involves a number of steps, including synthesis, purification and assembly of oligonucleotides, usually less than 50 base pairs. Each of these steps currently takes one to two days to complete. The new chip performs all three of these activities. Because researchers can produce so many oligonucleotides so quickly, they can screen many versions with subtle differences to see which particular version produces the most of a desired protein, Tian said.

Other members of the team were Jiayuan Quan, Ishtiaq Saaem, Nicholas Tang, and Hui Gong and Nicolas Negre from Duke and Kevin White from the University of Chicago. The research was supported by the Beckman Foundation, the Hartwell Foundation, and the Duke-Coulter Translational Partnership.
Assistant Professor Lingchong You and colleagues have used random fluctuation in gene expression to discover important insights into the cues that tell cells when to begin to make copies of themselves, during the cell cycle. The expression of a particular gene, c-Myc, is responsible for launching the cell cycle and it has the capability to tell a cell to go into hibernation or kill itself, like a cellular dead-man’s switch. When mutated, this gene has been implicated in many forms of cancers.

Understanding what flips the switch could provide a new avenue for treating diseases marked by abnormal cell proliferation, such as cancer. Dr. You and colleagues used a commonly observed phenomenon – cell-to-cell variability in virus infection – to deliver increasing amounts of this gene to a population of rat fibroblast cells growing in culture, and observed its effects on certain indicators of proliferation. This variability of gene expression within a genetically identical population of cells is termed noise.

“Over the past 10 years, many studies have looked at this phenomenon of noise, and biologists have often found this variability to be messy,” said You. “Here, we took the opposite approach. When coupled with single-cell measurements and computer modeling, this variability provides an efficient means to measure and understand how levels of gene expression affect signaling dynamics in mammalian cells.”

“The amount, or dosage, is key,” said Jeffrey Wong, a post-doctoral fellow in You’s lab. “We found that as the amount of c-Myc increased, the expression of an important protein also increased, but then subsequently decreased as the amount of c-Myc continued to increase.”

“This response of normal cells to high levels of c-Myc is, depending on the type of cell, either to remain inactive or to commit suicide. It’s like a built-in safeguard against over-proliferation,” You said. However, abnormal cells in tumors might find a way around this barrier. In these cases, amplification of c-Myc and additional mutations may cooperate to upset normal constraints on growth control, You said, which could be a key to the emergence of aggressive cancers.

Results of the research were published as a cover article in the journal Molecular Cell. Wong is the lead author in the study. Other members of the Duke team were Guang Yao and Joseph Nevins. The research was supported by NIH, a David and Lucille Packard Fellowship, and a DuPont Young Professorship.

In another study, published on-line in PLoS Biology, You and colleagues provided experimental and computational evidence for a novel model of cell division. One of the two prevailing models for explaining cell division states that the beginning of division for any specific cell is a random event. The second model assumes that there are intrinsic differences between cells that enable some to enter the process earlier than others.

“While both of these models provide a good fit with the experimental data we have, their lack of mechanistic details limit their predictive power and has furthered the debate among cell biologists,” You said.

You’s team found that a specific gene circuit known as Rb-E2F has the unique ability to tell some cells to start dividing while at the same time telling other cells to not divide. Rb-E2F is a gene circuit known for its “bistability,” which was also demonstrated by the team two years ago. The gene circuit is in all cells and can tell identical cells to live in two states simultaneously, either on or off.

“We have found that a specific gene circuit acts as a ‘switch’ to tell a cell in an identical population to turn on or off — some respond immediately, some don’t,” You said. “Looking at key elements in this gene circuit that are determining when a cell enters the division process can reconcile the two schools of thought and could help us better understand this fundamental aspect of cell biology.”

Bistability is not unique to biology. In electrical engineering, for example, bistability describes the functioning of a toggle switch, a hinged switch that can assume either one of two positions — on or off. You’s team began by taking an identical population of mouse cells in culture, and then starving them of nutrients, putting all of them in the same state. The level of the bistable switch determines whether or not the cell divides.

“We believe that our analysis provides a simple framework reconciling the two schools of thought of cell cycle entry, which has been a source of debate over the past two decades,” You said.

You said that knowledge of the precise role of Rb-E2F switch could be helpful to scientists studying cancer by helping to establish a “library” of cancer-causing pathways. “Using the techniques we developed, scientists can look at an unknown cancer type and by looking at its Rb-E2F profile, and infer what might have gone wrong in the cancer cells,” You said.

The research was supported by NIH, a David and Lucille Packard Fellowship, and the Duke Vertical Integration Program. Coauthors on the study were BME graduate student Tae Lee, and Guang Yao and Joseph Nevins of the IGSP, and Dorothy Bennett, University of London.
Duke BME Celebrates 40 years as a Department

On September 10, 2010, the biomedical engineering department celebrated its 40th Anniversary at Duke's Pratt School of Engineering. Distinguished speakers from around the country gathered to commemorate the occasion with a day of presentations and discussions.

After an introduction by Duke President Richard Brodhead, Duke alumnus Dr. Robert E. Fischell, opened the day's session by telling an audience of students, visiting alumni, faculty and others, “The difference between impossible and possible is perseverance and a desire to overcome obstacles. I have often been told ‘It can’t be done.’” Fischell, the chairman of Fischell Biomedical LLC, has more than 200 American and foreign patents, most of which are for medical devices including approximately 70 percent of the stents sold in the world today. Summing up his approach to all of his inventions, he said, “The most important source of innovation is recognition of a problem. Look for the problem. Invent a solution.”

BME Professor Barry Myers moderated a panel on biomedical entrepreneurship. Inventing a product is often easier for engineers and scientists than bringing it to market.

Associate Professor Adam Wax, who founded the company Oncoscope in 2007, said engineers who want to start companies to sell their products have got to have tenacity. “If this stuff was easy, someone else would have done it already,” he said.

Steve Sullivan, managing director of Skyline Ventures in Palo Alto, CA and the other venture capitalist on the panel, Scott Albert, managing general partner at The Aurora Funds, Inc., talked about some of the ways scientists and engineers could be successful in pitching their ideas to venture firms. Albert earned a BSE in electrical engineering at Duke and also has an MBA degree. Albert said that scientists and engineers who approach his firm with an idea often make the same mistakes.

“It takes immensely more money than you think. It takes immensely more time than you think.” Sullivan earned an undergraduate degree in biology from Duke in 1977 and worked as a physician for 20 years before making the leap to venture capital. He recommended that entrepreneurial hopefuls become an expert in a field of science, medicine, or engineering before branching out into business or venture capital.

Rose Ritts, the executive director of Duke’s office of licensing and ventures, worked as an engineer after graduating from Duke with a BSE in biomedical engineering, and then went on to earn her PhD in electrical engineering. She was attracted to commercialization she said, because “I realized that connecting people and figuring out how to bring money and science together was something I was more interested in than the science.” Much of her business knowledge was self-taught and she said that successful people never stop learning. Her advice: “Cram for the opportunities that come your way outside of classes the way you crammed for classes. Cram to prepare yourself for experiences that could change your life, your career.”

Whether starting a company or licensing a product, professional networks are invaluable for digging up key information, learning new skills, and attracting partners and investors. Steve Sullivan said, “Use every contact you have. Be expert in selling. What’s the first thing you’re going to sell? Yourself. That’s how we all got here.”

During the afternoon, Professor Craig Henriquez described the founding of the biomedical engineering department. “It is a story of chance encounters, faculty pushing, administrators balking, bold visions, turf wars, and some good old-fashioned luck. In other words, business as usual for a university.”

The Board of Trustees officially approved BME as a department on December 11, 1970. But the story began years earlier, Henriquez said, with two important chance encounters. In 1964, Theo Pilkington, a young faculty member in electrical engineering, was approached by John Boineau, a young cardiologist fellow from the School of Medicine. Boineau was interested in the relationship between the heart’s electrical activity and the body’s surface potential, and had been looking all over the university for help with modeling. Pilkington’s expertise in electrical engineering made him a perfect collaborator, and his interest was heightened by the fact that his mother had died at age 57 following a heart attack. He and Boineau began working together, and in 1965, Pilkington published a paper titled “On the electrocardiographic field equation.” That same year, Madison Spach, chief of the division of cardiac physiology, met physics major Roger Barr, who happened to be a roommate of one of

Left to right: Barry Myers, Adam Wax, Rose Ritts, Steve Sullivan, Scott Albert
Spach’s medical students. Barr spent the summer working in Spach’s lab at the medical school, where he met Boineau, who introduced him to Pilkington. Barr decided to pursue a PhD in electrical engineering, doing research combining medicine, engineering and physics, under the mentorship of both Pilkington and Spach. Over the next seven years, Pilkington aggressively built a department by recruiting faculty, obtaining space and starting PhD and bachelor degree programs.

Today, there are more than 90 biomedical engineering departments around the country, and Duke consistently ranks number 2 among undergraduate programs, and number 4 among graduate programs. And according to the Faculty Scholarly Productivity Index put out by Academic Analytics, Duke’s faculty are the most productive of the country’s biomedical engineering departments. In pondering why the department has continued to be successful for 40 years, Henriquez identified six reasons:

- the close proximity of the BME department, medical school and hospital encourages collaboration with scientists and physicians;
- faculty has grown strategically over the past two decades due to nicely spaced NSF and Whitaker grants;
- the faculty are willing to reinvent themselves;
- the department attracts great students;
- the department has had outstanding leadership;
- there is a collegial environment of excellence.

“This is a group that works well together,” Henriquez said. “We write grants together, we go to lunch together, we talk about the curriculum together. Several of us grew up together. BME has retained its faculty for a long time. People don’t like to leave here.”

A series of panels with alumni and BME faculty addressed future opportunities in neural engineering, tissue engineering and imaging. Ananth Natarajan, B.S.E. 1990, noted it’s important to consider clinical needs and let that drive where we are going. This was a theme echoed by the other panelists. Engineers must understand the clinical context of the problem they are called to address said John Chae, B.S.E. 1984. To assist in the process, Beth Winkelstein, Ph.D. 1999, recommended that Duke students be given structured opportunities to interact with clinicians.

Panelists were optimistic about the future of the field. Warren Grill, Addy Professor of BME, noted that the growth in disorders of the nervous system is due in large part to an aging population.

“There is a tremendous opportunity for biomedical engineering to begin solving some of these problems.” “Neuroengineering may provide greater benefit than the intended purpose because neural pathways are so pervasive,” said Adam Cates, B.S.E. 1993, senior principal research scientist at CVRx.

“Imaging will become ubiquitous. Resolution limits will fall. Imagers will have impact in a whole array of new areas,” predicted William Walker, B.S.E. 1990, Ph.D. 1995, who is now a professor of biomedical engineering at the University of Virginia and has started several medical device companies.

Jamie Kemler, B.S.E. 1979, group president at Stryker Corporation, noted that biomedical engineers in this field need to stay current. He recommended that students and entrepreneurial hopefuls read journals, go to conferences, and network.

“It’s a highly networked industry,” he said. “It’s important to stay in touch with friends and colleagues.”

In the final keynote talk, William A. Hawkins, who was CEO of Medtronic, Inc., reviewed the history of biomedical engineering and shared his thoughts about the future. “It’s a fascinating time,” he said. “There are so many things happening as we advance technology. We’re going to be able to change the course of medicine.”

In looking at where the field has been, Hawkins said in the earlier years of biomedical engineering, “We were very focused on discrete technologies.” This specialization led to advances in microprocessing, battery technology, and information transfer. Engineers are now taking advantage of these technologies in combination to design remarkably tiny and reliable devices that improve and extend lives. Hawkins said, “Biomedical engineering today is focused on convergence of technologies—engineering, life sciences, informatics.”

When Hawkins looks to the future, he sees three broad areas of emphasis: personalized medicine, management of disease rather than symptoms, and preventative and restorative care. He believes personalized medical care will make health care much more effective because physicians will have the tools to pick the treatment that’s most effective for each individual, rather than going through a lengthy process of trial-and-error.

Hawkins said the current regulatory environment in the United States is a challenge for biomedical engineering companies. “We really need to work as a university and as a society to advance the field of regulatory science,” he said. “There’s a very important role for the FDA, but the FDA needs better resources. If we can help them understand what we do, it will benefit all of us.”

In his parting words, Hawkins said, “Our real strength is the ability to translate ideas into products.” He emphasized innovation, collaboration, and the importance of public policy and regulatory science to the future of biomedical engineering. “Don’t look local, look global,” he said. “We’re going to be able to impact people’s lives.”
Associate Research Professor Cameron R. Bass received awards from the US Army for projects titled “Assessment of Helmet Sensor Performance,” and “Blast Test Methodology for Head and Thoracic Threats.” Bass is collaborating with Daniel Laskowitz, M.D., associate professor of Medicine on a Coulter Translational Research Project titled “Linearized apoE for Treatment of Acute Brain Injury.”

Laurence N. Bohs, Ph.D. has received a five-year award from the National Science Foundation for a project titled “Student Design Projects for People with Disabilities at Duke University.” The funding will support a course by the same name that has become a signature capstone course at Duke.

Associate Professor Nenad Bursac received a five-year award from the National Institutes of Health (NIH) for a project titled “Function and Integration of Stem Cell-derived Cardiac Tissue Patch” and a two-year award from the NIH for a project titled “Tissue-engineered Autonomous Pacemaker.”

Assistant Research Professor J. Quincy Brown received a two-year award from the National Institutes of Health for a project titled “A Fluorescence Histology System for In Vivo Breast Tumor Margin Assessment.” The project aims to develop and validate a novel apparatus and method for large-field, high-resolution, contrast-enhanced, microscopic imaging of fresh tissues for the detection of microscopic residual disease remaining in patients after cancer removal surgery. Collaborators on the project include Professor Nimmi Ramanujam in BME, Dr. David Kirsch in Radiation Oncology, and Dr. Joseph Geradts in Pathology. Brown presented a talk titled “High-resolution Vital Fluorescence Imaging for In Vivo Detection of Microscopic Residual Disease in Cancer Surgery” at the 2011 European Conferences on Biomedical Engineering in Munich, Germany. Co-authors were Jenna Mueller, Jeff Mito, Zachary Harmany, David Kirsch, Rebecca Willett, Joseph Geradts, and Nimmi Ramanujam.

Ashutosh Chilkoti, Theo Pilkington Professor of Biomedical Engineering, won the 2011 Clemson Award for Contributions to the Literature from the Society for Biomaterials. Chilkoti was selected based on his publication record in technical journals, citations, and significant critical analyses. He specializes in biomolecular materials and surface science for applications that span bioseparations, biosensors, patterned biomaterials, and targeted drug delivery. Professor Chilkoti received a four-year award from NIH for the project entitled “Site-Specific Growth of Stealth Polymer from Peptide Therapeutics.”

Assistant Professor Charles A. Gersbach has received a two-year award from the March of Dimes for a project titled “Genome Editing with Engineered Enzymes for the Correction of Hereditary Genetic Diseases” and a one-year award from Oak Ridge Associated Universities for a project titled “Photoregulated Protein Interactions for Spatiotemporal Control of Gene Expression.” He also received a three-year R03 award from NIH for a project titled “Spatially Controlled Gene Delivery of Morphogenetic Factors from Woven Scaffolds” and a seed grant from Duke’s Center for Systems Biology to study the dynamics of cell differentiation and proliferation.

Warren M. Grill, Addy Professor of Biomedical Engineering, was elected to the Biomedical Engineering Society Class of 2011 Fellows. Fellow status is awarded to Society members who demonstrate exceptional achievement and experience in the field of biomedical engineering and a record of membership and participation in the Society. He was noted for fundamental advances in the basis of neural stimulation and the application of functional electrical stimulation to treat incontinence and improve deep brain stimulation. Grill also received a one-year award from Boston Scientific Corporation for a project titled “Experimental Studies of Vagus Nerve Stimulation.” He is the BME PI for a Coulter Translational Research Project titled “Enhancing Neuromodulation with Transcranial Magnetic Stimulation (TMS).” Clinical Investigators are Sarah Lisanby, Angel Peterchev, and Bruce Luber, in the Department of Psychiatry and Behavioral Sciences.

“Developing Nucleic Acid Binding Polymers as Molecular Scavengers to Control Aseptic Inflammation.” Clinical collaborators are David Pisetsky of the Department of Medicine and Bruce Sullenger and Jaewoo Lee in the Department of Surgery.

Professor Joseph Izatt who holds appointments in the Departments of BME and Ophthalmology, is collaborating with Anthony Kuo, assistant professor of Ophthalmology on a Coulter Translational Research Project titled “Gonioscopic OCT: A Novel In Vivo Glaucoma Imaging Device.”
Associate Professors James MacFall and Cecil Charles of the Departments of Radiology and BME are collaborating with clinical faculty Neil MacIntyre of the Department of Pulmonary Medicine, Richard Moon of the Department of Anesthesiology and H. Page McAdams, Bastiaan Driehuys, Brian Soher, and William Michael Foster of the Department of Radiology on a Coulter Translational Research Project titled “Evaluation of Regional Ventilation in Normal Subjects and Subjects with Airway and Lung Disorders.”

Kathryn Nightingale was promoted to Associate Professor with tenure. She was also appointed the James L. and Elizabeth M. Vincent Associate Professor of Biomedical Engineering as part of the Bass Society of Fellows in recognition of her excellence in research and teaching.

Professor Gabriel Lopez was elected a fellow of the American Institute of Medical and Biological Engineering. He was noted for outstanding contributions in the development of bioanalytical systems and biointerface phenomena with application in biotechnology, medical diagnosis and environmental monitoring.

Nimmi Ramanujam was promoted to full Professor. Her research group is developing and applying optically based tools for the non-invasive characterization of the biochemical and structural properties of human tissues. She has made major contributions to the development of novel optical techniques to detect tumors and has started a company called Zenalux to develop products to assist surgeons identify tumor margins at the time of mastectomy. She received a five-year Bioengineering Research Partnership award from NIH for a project titled “A Novel Optical Spectral Imaging System for Rapid Imaging of Breast Tumor Margins.” Her goal is to develop low-cost miniature optical spectral imaging strategies for intra-operative imaging of tumor margins in patients undergoing breast-conserving surgery. Her collaborators include biomedical engineer Bing Yu, Dr. Gregory Palmer from Radiation Oncology, Nan Jokerst and Martin Brooke from Electrical and Computer Engineering, Joseph Geradts from Pathology, Scott Pruitt from Surgery and William Barry from Biostatistics. She also won a two-year Quick Trials R21 award from NIH for the project titled “Smart Optical Sensor for Detection of Cervical Cancer in the Developing World.” Collaborators are Bing Yu, Assistant Research Professor in BME and David Walmer, Division Chief, Reproductive Endocrinology and Fertility, Department of Obstetrics and Gynecology. And she was also elected as fellow of OSA and has been invited to be a member of the DOD’s breast cancer research program (BCRP) integration panel (IP) that sets the vision of the BCRP program and plans the dissemination of over $100M of funds for breast cancer research annually. In addition, she served as co-editor for the latest edition of the Handbook of Biomedical Optics (publisher Taylor and Francis) and won the Stansell Family Distinguished Research Award at the annual Engineering Awards Banquet in April 2011.

Professor William M. Reichert has received a two-year R21 award from NIH for a project titled “Self-Healing Biomaterials.” The long-term goal of this study is to develop composite biomaterials that have the capacity to repair failure at the microcrack level and thus prolong the use life of cyclically loaded biomaterials. This project specifically tests the feasibility of using acrylic bone cement as a model biomaterial. Reichert was appointed Associated Dean for PhD Education and Diversity for the Pratt School of Engineering and was elected a fellow of the Biomedical Engineering Society in 2010 for pioneering studies of the interaction of proteins and cells at biomaterial surfaces and outstanding commitment to graduate education and mentoring in biomedical engineering.

Professor Barry S. Myers has received an eighteen-month award from the Ewing Marion Kauffman Foundation for a project titled “Entrepreneurship, Immigration and University Research Commercialization Research 2011.”

Professor Robert A. Malkin’s project to prevent the transmission of HIV from Mother to Child was named one of 19 award nominees at the USAID Grand Challenges meeting in DC, July 26-28, 2011. In opening the meeting, Secretary of State Hillary Clinton specifically cited the Pratt Pouch to prevent the transmission of HIV when mothers deliver at home as one of the “great ideas.” Malkin was reappointed Professor of the Practice for ten years. He has received a one-year award from Engineering World Health for a project titled “Curriculum for Biomedical Equipment Technician (BMET) Program” and a ten-month award from the National Collegiate Inventors and Innovators Alliance for a project titled “NCIIA Ambassador Program.”
Assistant Professor Lingchong You organized Duke’s first Synthetic Biology Symposium on April 16, 2011. Co-organizers of the meeting were Professors Charles Gersbach, William Reichert and Jingdong Tian from the Department of Biomedical Engineering, Nicolas Buchler from the Departments of Biology and Physics, Amy Schmid and Chandra Tucker from the Department of Biology. Jay Keasling of the University of California, Berkeley, was the 2011 Kewaunee lecturer and spoke on “Synthetic Biology for Synthetic Chemistry.” Other speakers included Drs. Nicolas Buchler and Justin Gallivan from Emory University, Marc Ostermeier of Johns Hopkins University, Pam Silver of Harvard University, Duke’s Charles Gersbach, Jingdong Tian and Chandra Tucker, and Chris Voigt of MIT. The presentations were followed by poster presentations by students and postdocs.

Tuan Vo-Dinh, R. Eugene and Susie E. Goodson Professor of Biomedical Engineering and director of Duke’s Fitzpatrick Institute for Photonics, won the 2011 Award for Spectrochemical Analysis from the American Chemical Society (ACS). This honor recognizes a researcher who has definitely and uniquely advanced the field of spectrochemical analysis and optical spectrometry. Vo-Dinh’s research contributions have impacted medical diagnostics and health care through the development of optical nanobiosensors, nanostructured plasmonics and nanoprobes for medical diagnostics, near-field scanning and confocal microscopy for bioimaging, optical biopsy for cancer diagnosis, biochips for the detection of diseases at the point-of-care and global health, and photoacoustic ultrasound technologies.

Collaborators include BME Professor Gregg Trahey and Dr. Tristrum Bahnson from Cardiology. He also received a nine-month award from Ethicon, Inc. for a project titled “Computational Model of Vagus Nerve Stimulation.”

Assistant Research Professor Bing Yu in Professor Nimmi Ramanujam’s lab was awarded a two-year R03 grant from the NIH/NIBIB for research titled “A Fiber Optic Sensor for In Vivo Tissue Optical Spectroscopy.” The goal of this project is to develop a compact, low-cost optical device with low power consumption that can be used to obtain accurate and reproducible quantitative measurements of tissue physiology and morphology with applications to global health screening of cervical and oral cancers. The innovative smart sensor integrates together diffuse optical spectroscopy, real-time instrument calibration and an interferometric fiber optic pressure sensor into a very compact system. With this technology Yu is expecting to measure significantly improved contrast in multiple biomarkers between malignant and normal or benign tissues in vivo. Yu was also invited to present a poster with technology demonstration of the smart fiber optic sensor system during the Cancer Detection & Diagnostics Technologies for Global Health Conference at the NIH campus.

Professor Lori Setton received a five-year renewal of her NIH award titled, “Mechanical Stimulation of IVD Cells.” Prof. Setton will work with collaborators Ashutosh Chilkoti of BME and William J. Richardson of Orthopaedic Surgery to develop novel approaches to delivering anti-inflammatory medications to the perineural space for the treatment of intervertebral disc disease. In addition, she received a two-year award from the North Carolina Biotechnology Center with collaborators Stephen Craig of Chemistry and Mansoor Haider of North Carolina State University to optimize biomaterials for cartilage tissue engineering. Finally, Setton was awarded a grant from the North Carolina Biotechnology Center to support her organizing the 2010 Annual Meeting of the NC Tissue Engineering and Regenerative Medicine Society.”

Professor Gregg Trahey won the R. Eugene and Susie E. Goodson Professor of Biomedical Engineering. He received a five-year award from NIH for a project titled “Enhanced Design Experiences for Duke BME Students.”

George A. Truskey was appointed the R. Eugene and Susie E. Goodson Professor of Biomedical Engineering. He received a five-year award from NIH for a project titled “Increased Depth Imaging Using Multiply Scattered Light.”

Assistant Professor Patrick Wolf received a five-year grant from NIH for a project titled “Clinical Evaluation of an Ultrasound Based Imaging System for Guiding Cardiac Ablation.” The goal is to move Force-Imaging Ultrasound, used to characterize ablation lesions in the heart, to ‘first in man trials’ in the medical center. Pat’s industrial partners include Siemens’ Medical and Biosense Webster (a J&K company).

Associate Professor of Biomedical Engineering as part of the Bass Society of Fellows in recognition of his excellence in research and teaching. He received a three-year award from NSF for a project titled “Enhanced Design Experiences for Duke BME Students.”

Adam P. Wax was appointed Theodore Kennedy Associate Professor of Biomedical Engineering as part of the Bass Society of Fellows in recognition of his excellence in research and teaching. He received a three-year award from NSF for a project titled “Enhanced Design Experiences for Duke BME Students.”

Assistant Professor Lingchong You organized Duke’s first Synthetic Biology Symposium on April 16, 2011. Co-organizers of the meeting were Professors Charles Gersbach, William Reichert and Jingdong Tian from the Department of Biomedical Engineering, Nicolas Buchler from the Departments of Biology and Physics, Amy Schmid and Chandra Tucker from the Department of Biology. Jay Keasling of the University of California, Berkeley, was the 2011 Kewaunee lecturer and spoke on “Synthetic Biology for Synthetic Chemistry.” Other speakers included Drs. Nicolas Buchler and Justin Gallivan from Emory University, Marc Ostermeier of Johns Hopkins University, Pam Silver of Harvard University, Duke’s Charles Gersbach, Jingdong Tian and Chandra Tucker, and Chris Voigt of MIT. The presentations were followed by poster presentations by students and postdocs.

Tuan Vo-Dinh, R. Eugene and Susie E. Goodson Professor of Biomedical Engineering and director of Duke’s Fitzpatrick Institute for Photonics, won the 2011 Award for Spectrochemical Analysis from the American Chemical Society (ACS). This honor recognizes a researcher who has definitely and uniquely advanced the field of spectrochemical analysis and optical spectrometry. Vo-Dinh’s research contributions have impacted medical diagnostics and health care through the development of optical nanobiosensors, nanostructured plasmonics and nanoprobes for medical diagnostics, near-field scanning and confocal microscopy for bioimaging, optical biopsy for cancer diagnosis, biochips for the detection of diseases at the point-of-care and global health, and photoacoustic ultrasound technologies.

Collaborators include BME Professor Gregg Trahey and Dr. Tristrum Bahnson from Cardiology. He also received a nine-month award from Ethicon, Inc. for a project titled “Computational Model of Vagus Nerve Stimulation.”

Assistant Research Professor Bing Yu in Professor Nimmi Ramanujam’s lab was awarded a two-year R03 grant from the NIH/NIBIB for research titled “A Fiber Optic Sensor for In Vivo Tissue Optical Spectroscopy.” The goal of this project is to develop a compact, low-cost optical device with low power consumption that can be used to obtain accurate and reproducible quantitative measurements of tissue physiology and morphology with applications to global health screening of cervical and oral cancers. The innovative smart sensor integrates together diffuse optical spectroscopy, real-time instrument calibration and an interferometric fiber optic pressure sensor into a very compact system. With this technology Yu is expecting to measure significantly improved contrast in multiple biomarkers between malignant and normal or benign tissues in vivo. Yu was also invited to present a poster with technology demonstration of the smart fiber optic sensor system during the Cancer Detection & Diagnostics Technologies for Global Health Conference at the NIH campus.
Senior Alessandra (Allie) Speidel is one of three Duke University seniors to win a Marshall Scholarship to continue in their respective fields of study after graduation. Established in 1953 to commemorate the Marshall Plan, the scholarships are awarded each year to a maximum of 40 “talented, independent and wide-ranging” young Americans to finance graduate level studies at a college or university in the United Kingdom. At Duke, Allie was Baldwin Scholar and a Pratt Fellow. Working with Professor Kam Leong, she studied the effects of surface topography on normal human dermal fibroblasts which play a critical role in wound healing. Allie was a member of the women’s varsity swim team and was involved with the Collegiate Athletic Pre-Medical Experience (CAPE) Program, a joint initiative between the Duke University Medical Center and the Preston Robert Tisch Brain Tumor Center which exposes female varsity athletes to various medical clinical experiences. Allie also served as a mentor with the First Year Advisery Counselor Program and as a chemistry and calculus tutor with the Duke Peer Tutoring Program. Allie, who graduated in May, ultimately hopes to become a physician-scientist, performing cardiac regenerative stem cell research and clinical work that could be put into practice by doctors.

Design Team Wins Second Place
A design team in Dr. Larry Bohs’ BME 260 course, Design of Devices for People with Disabilities, won second place in the National Industries for the Severely Handicapped (NISH) national design competition. Members of the team were Michael Chao, Ian King, Esther Lee, and Shengnan Xiang. The project was titled “Easyshrink Heat Gun Safety Device,” and involved constructing a device that enabled workers with disabilities at OE Enterprises located in Burlington, NC to safely apply shrink-wrap to the top of nutritional supplement bottles. The prize consisted of $5000 to be divided among the members and another $5000 for the BME program. The team also was one of the RESNA finalists.

New Staff in BME
Welcome
Kristen Rivers joined the BME MS Graduate program as staff specialist in March 2011 and Annie Louise Stokes recently accepted the position of BME payroll coordinator in June. Donna Boyd, staff specialist hired in July, is assisting the department with AP&T and Visa cases and is also assisting with the collection of information for the BME Newsletter. Please send your comments and/or alumni highlights to her attention, dmboyd@duke.edu.
At the 2010 meeting of the NC Tissue Engineering and Regenerative Medicine Society, held at the NC Biotechnology Center in RTP, two of the four best poster presentations came from Duke. First place was awarded to Bradley Estes for research titled Multifunctional Hybrid Scaffolds for Cartilage Tissue Engineering. Brad is a postdoctoral associate in the lab of Professor Farshid Guilak. Third place was awarded to Professor Lori Setton’s doctoral student, S. Michael Sinclair, for research titled Synthesis of Thermally Responsive Curcumin Conjugate for Treating Intervertebral Disc Pathologies.

Chris Grigsby, a fourth year biomedical engineering doctoral student working with Professor Kam Leong has won a BD Bioscience Research Grant for his project, titled “Oral Delivery of the Factor VIII Gene: Immunotherapy for Hemophilia A.” The BD Biosciences grants are intended to reward and enable research through funding for innovative experience to advance the scientific understanding of disease. Grigsby is working towards an entirely oral-based hemophilia A treatment regimen that accomplishes prophylaxis against bleeds and prevents inhibitor antibody formation. Chris also received a Grant-in-Aid of Research from Sigma Xi.

Maryam Vejdani Jahromi, a second year Ph.D. student working with Professor Patrick Wolf, has won a 2010 Medtronic Fellowship in Biomedical Engineering. Her project is titled “Acoustic Radiation Force Impulse (ARFI) Imaging and Shear Wave Elasticity Imaging (SWEI) in evaluating myocardial mechanical properties and heart failure diagnosis.” The work focuses on developing methods for measuring stiffness and stress-strain properties of the myocardium. The specific aim of this research is to assess the ability of ARFI Imaging and SWEI to evaluate myocardial mechanical properties and thus diagnose heart failure.

BME graduate student Mark Juhas, working with Associate Professor Nenad Bursac, won a National Science Foundation Graduate Research fellowship for his project titled “Role of Integrins in Tissue Engineered Model of Duchenne Muscular Dystrophy.”

Alex Kent, a PhD student working with Professor Warren Grill, was selected as the North American Finalist in the Engineering in Medicine and Biology Society Student Scientific Paper Competition. He will present his paper, “Instrumentation to Record Evoked Potentials for Closed-Loop Control of Deep Brain Stimulation”, at the 33rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC’11) to be held in Boston, MA, USA on August 30-September 3, 2011. Alex’s works is supported by a Ruth L. Kirschstein National Research Service Award for Individual Predoctoral Fellowships to Promote Diversity in Health-Related Research from NIH.

Graduate student Adam Kozak won a National Science Foundation Graduate Research fellowship. He received a BS in 2011 from the University of Rochester with a major in biomedical engineering and a minor in optics. He begins work with Professor Nimmi Ramanujam.

Doctoral student Muyinatu (Bisi) Lediju won a UNCF-Merck Graduate Science Research Dissertation Fellowship for a project titled “Improved Endocardial Border Detection with Short-Lag Spatial Coherence Imaging.” Bisi is a 5th-year student working with Professor Gregg Trahey. She previously spent a year studying in England through the Whitaker International Fellowship Program.

Graduate student Mike Nichols, working with Professor Monty Reichert, Associate Dean for Diversity and Ph.D. Education won a two-year predoctoral fellowship from the American Heart Association for the project titled “Aptamers for Efficient Capture of EPCs in Blood.”

BME graduate student Anand Pai and postdoctoral fellow Rob Smith each won a Duke Infectious Disease Scholarship for 2011-2012. Anand and Rob work in the lab of Dr. Lingchong You.

BME postdoctoral fellow, Pablo Perez-Pinera and graduate student, Tyler Gibson won poster awards at the 2011 Duke Synthetic Biology Symposium. Pablo and Tyler work in the lab of Dr. Charles Gersbach.

BME graduate student, Navid Pourtaheri, was one of five members of the Duke-Durham community selected as 2011 “Sammie” award winners for their volunteer work in the Durham community. The award is named for Samuel DuBois Cook, former Duke political scientist, educator, human rights activist, and the first African American faculty member at Duke. Though not a “traditional” M.D. / Ph.D. student, Pourtaheri finds that a biomedical engineering and medicine combination best fits his true passion — specializing in ear, nose and throat medicine and surgery. He is currently researching blood flow in the brain by measuring the movement of water using functional magnetic resonance imaging (fMRI). The goal is to map exactly where in the brain such events as pain and seizures occur. His true passion is inspiring children to pursue the sciences, as well as promoting healthy lifestyles. As a first-year medical student, Pourtaheri started the Duke Elementary Med program, which initially brought Durham students to the medical center for lunch to talk about science. Through the program, Durham students are now learning about how to keep their heart healthy by studying diet, nutri-
tion and exercise. For this work, he recently received an Albert Schweitzer Fellowship—a gift of support meant to help sustain such health-related service projects to underserved communities. He has also been active in the BOOST program, funded by the Howard Hughes Medical Institute, which develops strategies for making science more fun for youngsters. “I’ve always been interested in community service,” Pourtaheri said. “Duke is a very nurturing place for students with ideas, by supporting us not only financially, but with encouragement.”

Fifth year BME graduate student Ali Saaem was elected as a Graduate Young Trustee on Duke’s Board of Trustees. He will serve a two-year term and can vote in his second year. Ali’s goals are to improve financial aid for students, improve campus safety and to help with Duke’s goal to become more international.

MS student Jainil Shah won the Duke BME Excellence in MS Studies award at graduation in May 2011. Shah, who was advised by professors Martin Tornai and Anuj Kapadia, was selected because of his exceptional academic performance and outstanding research. His research was summarized on a poster titled “Detailed Characterization of 2D and 3D Scatter to Primary Ratios (SPRs) for different geometries of Breast,” presented at the SPIE Medical Imaging Conference in 2011, and the BME Masters Poster Presentation and Duke Medicine’s Research Career Day. Four graduate students received a grant from the Society for Biomaterials to support their plans for a Biomaterials Day, a regional conference planned for the Fall of 2011. The organizers—Suzana Vallejo-Heiligon, Alice Brochu, Cristina Fernandez and Brittany Davis—have dubbed their conference “From Bench Top to Bedside - Linking the Biomaterials Triangle: Academia, Industry, and Medicine.” In addition to bringing together students, faculty and industry leaders from area universities and companies, the group also plans on activities to interest high school students in the field. They are also starting a Society for Biomaterials (SFB) Chapter in the Triangle area. The four students all work in the laboratory of Professor Monty Reichert.

ALUMNI HIGHLIGHTS

Bill Hawkins, BSE ’76, was named to a six-year term on the Duke University Board of Trustees on July 1. Hawkins, a Durham native and Duke engineering graduate, joined Medtronic as senior vice president in January 2002. He was named president and chief operating officer two years later. Hawkins assumed the role of chief executive officer of Medtronic, Inc. in 2007 and became chairman of the board in 2008. He retired in June of this year. Before joining Medtronic, Hawkins worked for four years as president and chief executive officer at Novoste Corp. He chaired the Pratt School of Engineering Board of Visitors at Duke from 2009-11 and is a member of the Minneapolis Institute of Arts Board of Trustees.

Todd McDevitt, BSE 1997, was named to the Most Influential Georgians-Notables List by Georgia Trend magazine for the second year in a row. Todd is an Associate Professor of Biomedical Engineering at Georgia Tech.

Michael Rizk, PhD 2008, currently a Lecturer in the Department of Bioengineering at the University of Pennsylvania, was awarded the Dean’s Award for Excellence in Teaching in the Lecturer and Professor of the Practice Track. The award recognizes outstanding teaching ability, dedication to innovative undergraduate instruction and inspiring students in the engineering at scientific professions. A student noted that “Dr. Rizk has made a difference in my academic career in the way I approach engineering and scientific problems.”
Biomedical Engineering Graduate Degrees Awarded
2010-2011

Doctor of Philosophy

September 1, 2010

Nima Badie
Dissertation: The Roles of Realistic Cardiac Structure in Conduction and Conduction Block: Studies of Novel Micropatterned Cardiac Cell Cultures
Advisor: Dr. Nenad Bursac

Richard Robert Bouchard
Dissertation: Acoustic Radiation Force Impulse-Driven Shear Wave Velocimetry in Cardiac Tissue
Advisor: Dr. Gregg Trahey

John Desmond Finan
Dissertation: The Effect of Osmotic Stress on the Structure and Properties of the Cell Nucleus
Advisor: Dr. Farshid Guilak

I-Chien Liao
Dissertation: Advanced Fibrous Scaffold Engineering for Controlled Delivery and Regenerative Medicine Applications
Advisor: Dr. Kam Leong

Priti Madav
Dissertation: Development and Optimization of a Dedicated Dual-Modality SPECT-CT System for Improved Breast Lesion Diagnostics
Advisor: Dr. Martin Tornai

Janelle Elise Phelps
Dissertation: Diffuse Reflectance Spectroscopy Characterization for Extraction of Tissue Physiological Parameters
Advisor: Dr. Nirmala Ramanujam

Yuankai Kenny Tao
Dissertation: Development of Coherence-Gated and Resolution-Multiplexed Optical Imaging Systems
Advisor: Dr. Joseph Izatt

December 30, 2010

Vivide Tuan Chyan Chang
Dissertation: Exploiting Optical Contrasts for Cervical Precancer Diagnosis via Diffuse Reflectance Spectroscopy
Advisor: Dr. Nirmala Ramanujam

Matthew James Crow
Dissertation: Molecular Imaging and Sensing Using Plasmonic Nanoparticles
Advisor: Dr. Adam Wax

October 28, 2010

Nelita Trotman Elliott
Dissertation: Analysis of the Transport Behavior of Escherichia Coli in a Novel Three-Dimensional In Vitro Tumor Model
Advisor: Dr. Fan Yuan

Molly Kathleen Gregas
Dissertation: Development of Plasmonics-active Nanoconstructs for Targeting, Tracking, and Delivery in Single Cells
Advisor: Dr. Tuan Vo-Dinh

Christina Marie Li Hsu
Dissertation: Three-Dimensional Computerized Breast Phantoms Based on Empirical Data
Advisor: Dr. James Dobbins

Stacy Renee Chiles Million
Dissertation: Metabolic Exogenous Contrast Agents for use in Breast Cancer Detection and Therapy Monitoring
Advisor: Dr. Nirmala Ramanujam

Cheemeng Tan
Dissertation: Bistability, Synthetic Biology and Antithetic Treatment
Advisor: Dr. Lingchong You

May 15, 2011

Weining Bian
Dissertation: Tissue Engineering of a Differentiated Skeletal Muscle Construct with Controllable Structure and Function
Advisor: Nenad Bursac

Alan Thomas Dibb
Dissertation: Pediatric Head and Neck Dynamic Response: A Computational Study
Advisor: Barry Myers

Ashish Nikhil Doshi
Dissertation: Computer Model of Mechanisms Underlying Dynamic Electrocardiographic T-wave Changes
Advisor: Salim Idriss

Carl Dean Herickhoff
Dissertation: Ultrasound Catheter Transducers for Intracranial Brain Imaging and Therapy
Advisor: Stephen Smith

Luke Christopher McSpadden
Dissertation: Electrical Interactions between Unexcitable Cells and Cardiomyocytes
Advisor: Nenad Bursac

Joseph Emmanuel O’Doherty
Dissertation: Brain-Machine-Brain Interface
Advisor: Miguel Nicolelis

John David Stroncek
Dissertation: Use of Human Blood-derived Endothelial Progenitor Cells to Improve the Performance of Vascular Grafts
Advisor: William Reichert

Amorn Wonsarnpigoon
Dissertation: Computational Modeling of Epidural Cortical Stimulation: Design, Analysis, and Experimental Evaluation
Advisor: Warren Grill

Master of Science

September 1, 2010

Jerel Mueller
Brian Selgrade

December 30, 2010

Michael Adams
Se Na Bae
Ling-Chia Chen
Niraj Dave
Innocent Dlamini
Yaoyao Fu
Molly Glauberman
Courtney Jansen
Erick Su
Hersh Tapadia
Anna Wilhelm

May 15, 2011

Alice Brochu
Cindy Cheng
Pallavi Daggumati
Harshwardham Deshpande
Brian Diekman
Sudesna Ray
Andrew Ford
Paul Gardea
Mudit Kalawatia
You Li
Rita Lin
Kedar Pradhudesai
Jainil Shah
Brian Vogler
Rebecca Wilusz
Wangzhi Zheng
BME alumni, faculty and students at the 40th anniversary celebration.