“At the Cutting-Edge of Surgical Innovation for the Kidney”
A good source of information for your story might be press releases, sales or market reports, or brochures you have created. It is important to maintain the integrity of this publication as a newsletter, rather than a means of advertisement. In other words, your readers should feel that you're informing them about what you offer, as opposed to selling it to them.

This story can fit 100-150 words. This is a good place to write a small story featuring a new product, service, or program you're offering. Remember to make the information useful to your reader. Explain any features that distinguish what you offer from that of your competition. You may also want to describe the history of the product, service, or program or highlight persons responsible for it.

‘Shown on cover is volume rendering of a kidney CT, with green segmented tumor, and tissue-colored laser range scanner being used in robotic image-guided kidney surgery research’

– Bob Galloway, Ph.D., Mike Miga, Ph.D., & Duke Herrel, MD.
Letter from the BMES President:

A part of the national Biomedical Engineering Society (BMES) mission statement reads: “Promoting the education and diversity of the next generation of biomedical engineers, providing guidance for their career path...” Our student society’s vision runs parallel to this declaration. Our mission is twofold: to promote the growth of biomedical engineering knowledge and its utilization and to bring together students and industry leaders to develop key contacts and relationships for the future.

The Biomedical Engineering Society at Vanderbilt University is a student-run undergraduate organization open to all undergraduates studying or have an interest in biomedical engineering. With national chapter recognition, we provide members with online access to multiple scientific journals, access to job and resume posting on the BMES Career Center, as well as facilitate participation and access to scientific conferences; all in an attempt to provide our members with optimal research material and networking options for pursuing future careers in biomedical engineering.

Our organization strives to benefit students of each class. Past efforts have provided underclassmen invaluable advice concerning BME courses through electives seminars with professors. As one of the most highly regarded research groups in the world in the area of biomedical imaging, we toured the VU Institute for Imaging Science, giving members an opportunity to network with professors and acquire research positions. As many of our members intend to acquire medical degrees, we offer a shadowing program between BMES and physicians at the Vanderbilt Medical Center. In recent events, we sponsored interactive seminars with Medtronic Inc. concerning Core Spine Product Engineering and with representatives from Accretive Health concerning healthcare provider reform.

Along with the continuation of these benefits, we just began a mentorship program in which upper-classmen counsel freshman on courses and career paths. In addition, we will be working with the Career Center in planning career fairs and visits with employers interested in hiring our members. With respect to goals this year, we hope to establish a more refined budget and stronger fundraising in order to annually send a couple members to the National BMES Meeting to promote our society to others across the country. With an exciting road ahead, I welcome you and invite you to join the Biomedical Engineering Society at Vanderbilt University and take advantage of the benefits it has to offer. Contact me any time with comments, questions, or concerns at troy.e.brown@vanderbilt.edu.

Best,
Troy Brown
President
Undergraduate Biomedical Engineering Society at Vanderbilt University
Rosie the Riveter’s message endures. Her “We Can Do It” attitude is directed toward modern young women in math and science classrooms; her message is more important than ever as worldwide technological requirements increase and high school students’ scores on comparative assessments decline. Vanderbilt’s Dr. Stacy Klein is spreading pro-STEM (Science, Technology, Engineering, and Math) endorsement. Director of STEM Outreach for the School of Engineering and a popular biomedical engineering professor with a research interest in engineering education, Dr. Klein is a leader in BME. She has been piloting efforts to guide girls to be successful in science and math classrooms, as well as recruiting young women into engineering.

Young women need the support of educators like Dr. Klein. Biomedical Engineering (BME) has one of the largest relative proportions of women enrolled in an engineering major at Vanderbilt. This reflects a national trend: The American Society for Engineering Education reports that 39% of all bachelor’s degrees and 32% of all doctoral degrees in biomedical engineering were awarded to women in 2000, more than any other engineering discipline. However, the Vanderbilt Undergraduate School of Engineering consists of only 30% females overall, which is about the national average. So, why aren’t more girls committing to engineering, in general?

The National Institute of Health (NIH) is hoping to answer such questions. In October, they announced they would be funding 14 grants totaling $16.8 million over the next four years. The grants will be dedicated to examining factors that influence the recruitment of women and advancement of their careers in the behavioral and biomedical sciences, including BME. The role of family, funding, mentoring, social, and cultural issues will particularly be examined.

The Society of Women Engineers (SWE) is renowned for their mentorship of young girls and STEM professionals. At the local level, the Vanderbilt SWE Chapter offers their mentorship to students at local K-12 schools. The SWE 2009 National Conference in Long Beach, California saw a record number of attendees, growing from 4,000 to 6,000 in the past four years. The Women’s Networking Luncheon at the National BMES Conference also had a great turnout this year in Pittsburgh, PA.

Although a support group exists at the professional level to retain women in engineering fields, this targeted support decreases at the collegiate level and is especially lacking for K-12 girls. The National Academy of Engineering issued a report this past September stating that engineering, in general, is often totally absent in K-12 curricula. This has prompted the attention of educators like Dr. Klein, who was previously a teacher at Harpeth Hall, an all-girls school that proudly sponsors the National Coalition of Girls’ Schools STEM Think Tank every year.

The Vanderbilt BME Department has strong female role models although only about 14% of their professors and 14% of their affiliated faculty are women. These teachers and numerous other female research associates conduct innovative research, often welcoming undergraduates into their laboratories. This past November, Dr. Klein hosted K-12 educators for a day at Vanderbilt during the STEM Think Tank where attendees participated in laboratory tours and seminars. Panel discussions focused on collaboration with university faculty and students to develop efforts that would encourage female students to sustain interest in the STEM fields. Early mentorship and challenge-based learning with real-world, interdisciplinary examples that utilize verbal skills were identified as key elements of programs that should be assimilated into the classroom. Kitty Burn, special project coordinator for Engineering at the National Coalition of Girls’ Schools, praised the Think Tank: “It was a pleasure and privilege to hear the stimulating conversation of professionals who are on the cutting edge of teaching for the 21st century. [This dialogue] really could lead to a curriculum revolution.”

Dr. Sharon Weiss, assistant professor of electrical engineering at Vanderbilt, was recently recognized by President Obama with one of 100 Presidential Early Career Awards for Scientists and Engineers for her research on detection of biological and chemical materials using portable equipment. Her work has great medical signifi-
Meet Melissa Skala, PhD

By Erica Von Stein

Arriving at VU on June 1, Dr. Melissa Skala is the newest addition to our Biomedical Engineering faculty. She will be teaching Quantitative Physiology fall semester. Dr. Skala is the principal investigator of the Biomedical Imaging and Optics Lab.

Path to becoming a BME

As an undergraduate, Dr. Skala focused her studies on physics. She loved taking physics classes and was intrigued by many of the theoretical concepts. During her sophomore year, Dr. Skala began research in particle physics. Research investigations continued over the next 3 years.

Despite her passion for learning physics, Dr. Skala found that the corresponding research simply “didn’t click”. Biomedical engineering, however, encompassed more applicable and rewarding areas of research. This revelation led Dr. Skala down the biomedical engineering track.

After receiving a BS ’02 in physics from Washington State University, she continued on to receive an MS ’04 in BME from the University of Wisconsin and a PhD ’07 in BME from Duke University.

Duke vs. Vanderbilt

Dr. Skala finds both universities to be comparable academically, especially in the Biomedical Engineering department. Strong medical schools on campus provide immense opportunities to students. Athletic ability and the weather on campus are also eerily similar. Dr. Skala admits that she prefers the brick architecture of Vanderbilt over Duke’s dreary Gothic stone. Additionally, Nashville offers much better dining options than Durham. 12 South Taproom and Grille is her favorite restaurant.

Dr. Skala has a one-year-old son. If given the opportunity to choose between Duke and Vanderbilt for college, his mother believes Vanderbilt would prevail.

College experience and advice

Dr. Skala urges involvement in extracurricular activities throughout college. During sophomore year, she studied abroad in Swansea, Whales. Coincidentally, fellow VU BME faculty member Dr. David Merryman was also studying in Swansea. Dr. Skala remains close friends with people that she met and recently had a reunion in Paris. She participated in various student organizations such as Sailing Team, Club Volleyball, and Astronomy. Additionally, Dr. Skala was a Teacher’s Assistant and tutor for physics. Several summers were dedicated to conducting research, which allowed her to realize that BME, as opposed to physics, was a more suitable career path.

Dr. Skala praises the BME major for strengthening students’ ability to be quantitative and for developing students’ critical thinking skills.

Research Interests

Dr. Skala emphasizes a devout interest in the study of optics. Optics was a mutual topic, allowing for a smooth transition from Physics to Biomedical Engineering. Current research employs optics as a tool in cancer diagnosis and therapy. Dr. Skala focuses on the innovation of imaging tools to monitor the physiology of tumors. Optical coherence tomography is a 3D tissue imaging technique being used to monitor blood flow and microvessel morphology. Photothermal microscopy uses optical changes caused by heat in order to locate a molecular target. Multiphoton microscopy is a 3D fluorescence imaging ...
technique ideal for thick samples. Fluorescence lifetime microscopy applies the concept that change in fluorescence lifetime is correlated to early cancer development; kinetics can be used to diagnose cancer and monitor metabolic changes associated with cancer therapy. Optical spectroscopy is being applied to quantify blood content and oxygenation, as well as protein content and metabolic status.

Dr. Skala is extremely interested in any undergraduates who would like to work in her lab.

Research Spotlight: The Summer Research Program for Engineering

By Meher Juttukonda

There are many opportunities available for engineering students who are interested in engaging in research at Vanderbilt during the summer. One of these programs is the Summer Research Program for Engineering Undergraduate Students; it is organized by the School of Engineering and each project is funded in part by the VUSE. A research project is placed into a category based on the engineering major that it most closely relates to. The program currently lists projects from 5 departments of the VUSE: the BME, CEE, ChBe, EECS, and ME departments. The following is an interview in which a participant, a Junior ChBe major, talks about his research experience through the program.

Interview with Nabi Nizamidin, Participant, Summer 2009

Question: Can you describe what the application process was like?
Nabi: The application process was fairly simple; I had to fill out a form with basic information (GPA, etc…) and answer a few questions about why I was interested in the program. However, it is very important for to at least speak with the professor to whose project you are applying prior to submitting the application. This will show them that you are interested in their project and you can also get a good understanding of what the project entails.

Question: What is expected of an undergraduate that is selected and participates in this program?
Nabi: I was expected to write a paper on everything that I had accomplished over the course of the summer. Also, I was asked to give a poster presentation at the end of the summer both to members of my own lab in an informal setting and to faculty members in a formal setting.

Question: How was your research experience through the program?
Nabi: For me it was a good experience because I am deciding whether or not to go on to graduate school. Being around graduate students in the lab gave me a pretty good idea of the requirements of graduate school and the rigorous schedule that the students have.
The possibilities for Biomedical Engineers through this program are very diverse. They range from projects that deal with MRI and SPECT Imaging to those that involve Biomechanics and Instrumentation. The following is an interview with Dr. Mark Does in which he highlights projects that undergraduates in the past have worked on in his lab and about the Summer Research Program in general.

The duration of the program is 10 weeks during the summer, usually starting June 1st and continuing into the first week of August.

**Associate Professor,**

**Dr. Mark Does**

**Interview with Dr. Mark Does, Associate Professor of Biomedical Engineering**

**Question:** What would be a typical project that an undergraduate in your lab would work on?

**Dr. Does:** Typically every year the projects fall into one of two categories. One category is coding in MATLAB and analysis of data or simulation and analysis. The other category is dissecting tissues and making NMR spectrometer measurements that the coding projects may use. What is available from one year to the next just depends on what is going on in the lab at the time.

**Question:** Can you describe the impact that undergraduates have had on your projects in the past?

**Dr. Does:** I have had 3 undergraduates who have had articles published from working in my lab. Two of them worked on projects that involved dissecting frogs and running NMR experiments on frog nerve tissue and analyzing the data. Since one summer is usually not enough to get much done, some continue on in the fall. The undergraduate that was working here during this past summer was working on analyzing the NMR relaxation characteristics of cortical bone samples.

**Question:** What is your opinion of the Summer Research Program?

**Dr. Does:** I think it is a very good program. All of the undergraduates that I have had work in my lab, either through the program or not, have been pretty good students. The Dean supports it and I think it is a good incentive for faculty to get involved. My only problem with it is that the summer is not long enough. If we had some more time, we could get a lot more done.
Who is Medtronic VP Tommy Carls?

By Alexander Grubbs

In late April, members of the Biomedical Engineering Society were offered the chance to meet and engage in a question and answer session with Tommy Carls, the Vice-President of Engineering for Medtronic. Medtronic is the world’s largest medical technology company. Over 41,000 employees span divisions in Cardiac Rhythm Disease Management, Spinal and Biologics and Diabetes. As the VP of Engineering in Medtronic’s Spinal and Biologics sector, Mr. Carls is responsible for leading the research and development of all spinal fusion and motion products. Examples of such developments are artificial disc replacements and bone stabilization/fusion products. The Spinal and Biologics sector is headquartered in Memphis, TN and is Medtronic’s second highest division in revenue.

A brief history about Tommy Carls: He received his BS in Mechanical Engineering from Tulane in 1986 and worked for General Dynamics before going to work for Smith & Nephew where he designed and marketed total knee and hip arthroplasty (joint replacement) systems. In 1998, he joined Medtronic while attending the University of Memphis where he received his MBA in 1999. During his talk, Mr. Carls was adamant that we attempt to finish all our schooling as soon as possible as he found it very difficult to go back to school after being away for ten years. His job assignments have varied from technical engineering, general management and marketing, illustrating the value of combining a Bachelor’s degree in Engineering with a Master’s degree in Business Administration.

Tommy Carls began our Q&A with a PowerPoint presentation outlining his career and the many fields he worked in. He explained how his engineering background allowed him to understand the complex issues facing surgeons and patients and then translating those issues into product solutions to improve the patient’s lives and surgical outcomes. Along with the slideshow, Mr. Carls brought with him examples of some of Medtronic’s products, an artificial cervical disc and a wide variety of screws and rods used to fix/correct spinal pathologies. The screws ranged in length and diameters to address different load environments and were composed of a wide variety of materials, such as titanium, PEEK (polyetheretherketone) and stainless steel for biocompatibility. To illustrate their use, Mr. Carls showed before and after photos of various spinal conditions such as trauma and deformities, some congenital, and how using Medtronic’s products, surgeons can treat a wide variety of patient conditions and improve their quality of life.

We then moved on to questions from the audience. Most of the questions involved what types of schooling and training were necessary for positions at Medtronic. Mr. Carls emphasized that a graduate level education was comparable to a similar amount of time spent as an engineer in the field. The members of the audience who were planning on going into graduate school after graduating at Vanderbilt seemed relieved, as their desire to avoid the poor job market and continue this education would not prevent them from entering higher-level positions at companies such as Medtronic.
This semester, I decided to learn more about my fellow Biomedical Engineering classmates. Whenever I tell someone that I am studying Biomedical Engineering, the most frequent response is, "So what can you do with that…prosthetics?" To discover how BME majors planned to utilize their degree, I polled my Vanderbilt colleagues (36 freshmen, 16 sophomores, 25 juniors, and 32 seniors). This survey asks about their plans after graduation, as well as how they spend their time during school.

I started with the most relevant question, **what do students plan to pursue after graduating?** Seen below, the response varies a bit between years. While medical school or graduate school is a top choice for many students all four years, industry seems to be significantly more popular amongst upperclassmen. Reassuringly, data indicates that incoming BMEs are more certain of what they want to pursue.

As busy as BME students are, most are able to maintain heavy involvement in extracurricular activities all four years. As expected, students become more focused on BME related work with each consecutive summer.
Career Day

Every year there is an Engineering and IT Industry Career Day for seniors to meet business representatives. I decided to ask how many seniors attended the fair this year. According to the survey, about 28% of BME seniors were present at the career fair. This is expected since approximately 25% of seniors had reported interest in pursuing a career in industry. The average rating for the event, however, was a mere 2.5 out of 5.0. Based on the comments provided by seniors, many were not satisfied with the small number of companies present and apparent shortage of job offers. This is likely a result of the recent recession; hopefully next year’s seniors find the career fair even more helpful in their hunt for a job after graduation. If you are interested in hiring BME grads, be sure to contact Dr. Miga (see last page).
Three Vanderbilt University School of Engineering (VUSE) alumni recount their journey from academia to the workforce as young engineers at one of VUSE’s major industry recruiters.

The Interviewers:
Chelsea Samson: BME, Class of 2011
Catherine Ruelens: BME, Class of 2011

The Interviewees:
Vanessa Luckman: BME/EE, Class of 2007
Noah Reding: EE, Class of 2007
Derrick Snyder: CE, Class of 2007

All images in this article courtesy of National Instruments.

Samson: What draws National Instruments’ (NI) recruitment efforts to the Vanderbilt University School of Engineering?

Reding: When we recruit, we look for certain technical abilities that engineers have that allow them to fill an important role within our company. However, the unique thing about Vanderbilt engineers is that they not only have technical ability, but also present and carry themselves extremely well in social situations, whether that is with engineers or non-engineers.

Luckman: Vanderbilt is a smaller private university and we tend to find that their students have a lot of initiative, drive, and leadership capabilities. Our company values entry-level employees who are technically strong, but also have the communication skills and leadership potential that will take them farther.

Ruelens: What kind of entry-level positions can NI offer to Vanderbilt BMEs?

Snyder: The positions that we are recruiting for belong to the same program that we all started at within NI. It is called the Engineering Leadership Program. The key word in that title is “leadership.” We understand that the engineers graduating from Vanderbilt have the technical abilities we are looking for, but not everyone has the leadership capabilities. The program is designed to breed and train the future leaders of our company, because we promote from within. Twelve out of our fourteen vice presidents made their start through this program!

The participants’ responsibilities are twofold. Half of the time is spent supporting customers. NI sells thousands of different products, hardware and software, with lots of applications. It is impossible to know immediately how all of them are used in terms of technical function and application. So, the program participants spend time learning about the products in order to become technical experts. They can then answer customer concerns addressed over the phone or by email. The other four hours of the day are open to pursue anything you are passionate about. For example, I like marketing and public speaking, so I am pursuing a future career with the company in Product Marketing. Noah is becoming a Manager and Vanessa is a Web Product Marketer. She designs systems for our website to help people more efficiently learn about and purchase our products. So, though it is an entry-level position, it is meant to train you for a future position in the company. You gain technical knowledge and apply it to an area you are passionate about, like management or marketing or web design or devices.
Samson: Your presentation today was focused on Innovation in biomedical devices. Do you think there is some correlation between hiring younger students and fostering innovation and risk-taking?

Reding: I think there definitely could be. In terms of the average age of our employees, we are a pretty young company. I think what is cool about getting college-aged kids is that they bring fresh eyes and fresh opinions. Being right out of college allows you to learn easily and pick up new things so that you can really understand and help our customers. Creativity and an open mind help us to continue to develop and evolve our products and be on the cutting-edge of where we want to be as a company.

Ruelens: As former Vanderbilt Engineering School undergraduates, are you happy with your decision to enter the job market straight out of college?

Luckman: I think it is really good to get some industry experience first. Even if I do decide to go to graduate school later, having knowledge of what is going on in the industry will definitely help me. I had double majored as an undergraduate and wanted to try something different.

Snyder: If you choose the right company, and I think NI is a really good candidate, then they will continue to train you. You should never be stagnant in your career. The end of school shouldn’t be the end of your learning. The cool part about NI and one of the reasons that the company has been named one of the best places to launch your career is that we invest $40,000 in every employee for training in the first month and a half. In that time, I learned comparable to what I learned in about a year of school. You don’t have textbooks anymore and you don’t just look at a lecturer; you have to apply your knowledge.

Samson: Vanessa, how did your BME background at Vanderbilt help you in your current job?

Luckman: When I was in the NI Applications Engineering Program, I found that my background really helped me. There are a lot of customers who call us and are trying to use our products for biomedical purposes. Having the knowledge from the classes I took at Vanderbilt helped me understand their needs better. One of the biggest challenges is not being able to see in-person what the customers are doing in order to grasp the entire realm of their desired application. But, I already had exposure to the tools through BME labs like Instrumentation.
Ruelens: Were there any classes you wish you had taken while at Vanderbilt? Did you feel unprepared in any way for the transition from college to work?

Luckman: I cannot really remember any particular elective classes that I wish I had taken. The thing that was unique about my major was that I didn't get very many choices because I was a BME/EE double major. I found that my electrical knowledge made some of my BME classes easier. Your engineering jobs are often so broad that you will be using general concepts from your classes and relying on your entire engineering curriculum to understand problems.

Snyder: When I graduated, they handed me my diploma and I was so scared because I thought I didn't know anything! I had gone through 4 years of schooling, I had paid attention, and got good grades, but I felt like I knew nothing! And that is OK. That diploma from Vanderbilt Engineering says: "This student can learn." That is what we like at National Instruments about the Vanderbilt education—we know that anything we throw at their students, they can learn, they are passionate about it, and they have technical abilities. When you pick up the phone for customer support, you never know what you are going to get. I have talked to people anywhere from NASA to people in hospitals. You have to be able to learn on-the-fly.

Samson: We use LabView for some of our courses, specifically Instrumentation Lab. I think it would get students more enthused to use the product if we knew how it translates from the laboratory to the real world. Can you tell us some of your favorite LabView applications?

Reding: I love the mind-controlled wheelchair!

Snyder: I like that LabView is used to test the Xbox 360 wireless controllers. None of the controllers leave the Microsoft plant before first being run through a LabView application to make sure that a signal is being generated.

Luckman: Once, I got a call from someone using LabView to test diapers. They wanted to make sure that each one had the right size and proportions! I have often received requests for help with temperature and pressure measurements, but that was an unusual application.

Snyder: I had a call from someone using LabView in a cherry-processing plant. The cherries would come down the line at a high speed and the LabView system would detect using a special camera. Quickly and deterministically, the program would surized air to knock the cherry off the line. LabView is everywhere from the Lunar Lander!

For more information about National Instruments, the Engineering Leadership Program, or the Medical Device Grant, please visit: www.ni.com
The Official Newsletter of the Undergraduate Biomedical Engineering Program at Vanderbilt

Supporting BME

The Biomedical Engineering Program at Vanderbilt is continually striving to be the very best biomedical engineering program in the country. Your support will help us achieve that objective. Please consider donating to the program—this will directly impact the resources for our undergraduates, the quality of the cutting-edge research taking place here in our laboratories, and ultimately the visibility of this very unique program.

- Todd D. Giorgio, Ph.D.
Chair of Biomedical Engineering

A Contribution to the Biomedical Engineering Department at Vanderbilt University

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