ON THE COVER: Courtesy of the laboratory of Dr. Melissa Skala ~ cellular metabolism (color-coded as the fluorescence lifetime) and extracellular matrix structure (yellow fibers) of a breast duct and a breast tumor from the same patient (Alex Walsh, VU BME).
Many of you may have mothers, grandmothers, or friends who have fought or are currently struggling against breast cancer. The sad and alarming fact is that, apart from skin cancer, breast cancer is the most common cancer among women, accounting for nearly 1 in 3 cancers diagnosed in US women. Knowing a young man whose mother passed away after fighting breast cancer for many years has given me an even greater understanding of the need for improvements in this field. Every day, researchers work tirelessly toward improved diagnosis and treatment of this devastating cancer and look to eventually discovering a cure.

Here, in the BME Department of VU, professors investigate optical technologies for diagnosing cancer and monitoring cancer therapy. Recent studies have tested the effects of optical redox imaging. This technology has the potential to gauge cancerous tumors and their responses to targeted breast cancer therapies.

Acting as integral parts of this research team at VU are Alex Walsh, a BME graduate student, and Dr. Melissa Skala, an Assistant Professor of Biomedical Engineering. Their research interests center predominantly around cancer diagnosis and therapy. Dr. Skala’s lab focuses on optical imaging, which is revolutionary in its affordability and speed. In the long run, this technology has the potential to cause immense changes in the realm of cancer diagnosis and therapy.

How can this research directly help breast cancer patients? With the assistance of this technology, those in the medical field will be able to make more informed decisions. It will enable them to better determine what particular types of therapies will be most effective in treating and fighting breast tumors on a patient-by-patient basis. This technology could increase the number of breast cancer patients who receive effective treatment and make successful recoveries.

So this October, let your pink shine through for Breast Cancer Awareness Month. Take a moment and think about every inspiring woman in your life and how you might feel if you lost that very important lady. Attend an event, run a Breast Cancer Awareness 5k, or simply make a donation. Remember that funding will go towards research like that currently being conducted in the biomedical engineering labs at VU. Commodores for the cure!
On Thursday, September 27th, VU Engineering students put on their business attire and congregated in the Student Life Center for the Engineering/IT Fall 2012 Industry Career Day. This opportune event is hosted biannually by the VU Center for Professional Development. Attendees included students, as well as VU faculty and representatives from over fifty companies including National Instruments, Northrop Grumman, ExxonMobil, BrainLAB Inc., Microsoft Corporation, and Chevron.

While most of the students attending Career Day were juniors and seniors, there were still quite a few freshmen and sophomores in the crowd. For the upperclassmen, this event was a critical opportunity to find an internship or job. For underclassmen, however, this event was more of an introduction to the world of industry. Many students carried with them a folder filled with resumes, which they were ready to hand out to any interested employer. Justin Paul, a freshman planning to major in Computer Science, saw Career Day as a great way to get his name out there, even if he didn’t get an internship position.

Many of the employers at Career Day were searching for students who could intern during the summer, while others were searching for full-time employees. For example, BrainLAB, Inc. did not offer internships, but were willing to hire seniors who are graduating this year. Companies such as TRANE, Education Network of America, Chevron Human Energy, and Intergraph were looking for interns during the summer, fall, and spring. Having over fifty diverse companies attending, Career Day will undoubtedly include at least one job opportunity that piques the interest of a BME student.

A common theme was noted among skills that employers were looking for in a potential recruit. Many companies favored individuals with some sort of computer programming skills. That means for someone like Justin Paul with a major in Computer Science, the chances of getting an internship are much greater. This fact is not to discourage those with no computer programming skills, but it does make one consider taking a higher level computer science course in order to gain a competitive edge. Of course, having previous internship experience is also a great way to impress these companies.

Associate Dean of the School of Engineering, Dr. Cynthia Paschal, acts as a liaison between the School of Engineering and the Center for Student Professional Development in order to facili-
tate this phenomenal opportunity for students. From past experience with this event, she has discovered that connections between the VUSE faculty and the employers are key. To ensure a successful Career Day, VUSE professors and deans maintain a solid relationship with these companies. As a result, companies often return and continue to send representatives. Additionally, this mutual relationship ensures the employers that plenty of VU students will attend the fair. High turnout of prepared students demonstrates genuine interest in the companies’ unique goals. Dr. Paschal emphasizes that Career Day is “an incredibly focused and high yield opportunity that should be a part of the portfolio of events” that students use to find jobs and internships. While stressing the importance of this event, she also believes that Career Day should only be a “gem in the crown” of opportunities that students take.

Here are some ways parents and alumni can assist Vanderbilt students in their career endeavors:

- Volunteer to assist the BME department with design project sponsorship, guest lecture in classes, or provide industry insights. Contact the BME office at 615-322-3521.

- Facilitate on-campus recruiting for your company at Vanderbilt’s next Career Day. Contact Nancy Sibole at nancy.sibole@vanderbilt.edu.

- Engage with our student-run Biomedical Engineering Society. Contact Dr. Michael Miga at mike.miga@vanderbilt.edu.

- Serve as a resource to current students by joining or updating your information in our alumni database, VUConnect, at vuconnect.com
An integral part of the BME curriculum is BME 272, Design of Biomedical Devices, in which students enroll during their final two semesters at Vanderbilt. This unique course introduces students to the design process and provides hands-on design experience. Currently, the course is instructed by Dr. Matthew Walker III, an addition to the VU BME faculty in 2011. Dr. Walker received his doctorate in Cardiovascular Biophysics and Pharmacology from Tulane University. He continued his post-doctoral education at Harvard Medical School and MIT in the Division of Health Science and Technology. Dr. Walker has a wide range of design experience including work for Merck &Co, one of the largest pharmaceutical companies in the world. I had the opportunity to sit down with Dr. Walker and discuss changes in the design course over the past couple of years, in addition to noteworthy design projects that were presented in the spring of 2012.

Each design team has access to the Senior Design Loft, located on the 8th floor of Stevenson 5. The Loft is conducive to brainstorming for the design projects. It is equipped with multiple touchscreen desktop computers, whiteboards, SmartBoards, bean-bag chairs, a chemical hood, and ample desk space. The Loft was one of Dr. Walker’s first additions to BME 272 and he helped convert the previous storage room into the room we see today. The following 2012 design teams generated their projects using the space and resources that the Design Loft provides:

**Low-Cost, One Lead ECG Device (Team: H. Pauly, S. Hollabaugh, C. Majors, C.Peak)**

Motivation for this device stemmed from the ever increasing need to screen for cardiomyopathies. These BME students decided to create a device which was low cost, easy to use, and which screened for the most frequently occurring cardiac problems. The team worked with Rice 360, an institute for global health technologies. Through their work with Rice 360, they recognized that cardiovascular disease is the deadliest disease for Africans over the age of 45. They also recognized how a 10-electrode ECG can be too data-intensive for many technicians. Their solution: an ECG device mounted onto a chair with two hand-gripped electrodes on each armrest, an electrode on the leg rest, and a blood pressure cuff for the right arm.
Bioresorbable IVC Filter (Team: K. Garvey, M. Gadebusch, V. Kumar, M. Oliveira, R. Singer)

As of January 2011, pulmonary embolisms are the number one cause of patient death in American hospitals. In order to stop occlusion of blood flow into the pulmonary vasculature, the thrombus must be stopped before it enters the heart through the inferior vena cava (IVC). As with any implantable device, researchers and engineers must consider adverse immune responses to the material. This team proposed a filter which would initiate radial degradation once the thrombus is trapped within the device.

Novel IV Catheter for Delivery of a Variety of Fluids (Team: S. Doust, A. Grubbs, O. Hendley, M. McDonald, A. Palmer)

An important concern for doctors and nurses is to deliver medicinal fluids while maintaining patient comfort. Due to the possibility of shear, more viscous fluids require larger diameter catheters than less viscous fluids. This team of BME students recognized that constant rotation of catheters of varying diameters causes the probability of infection at the site of injection to increase. The team worked with Mac Cath LLC to find the solution in the form of the Mac Cath catheter that has multiple ports allowing the injection of a variety of fluids, including blood.

After talking about the 2012 projects, Dr. Walker and I spoke about a lecture Dr. David Owens gave in a senior engineering seminar at the end of August. Dr. Owens is a Professor for the Practice of Management and Innovation. His lecture to the senior undergraduates began by posing a question to the lecture hall: “What is the most important aspect of the design process?” After discussing potential answers to this question, he began to stress the importance of thought and split the lecture hall into two groups—convergent and divergent thinkers. Dr. Owens explained that while convergent and divergent thinking are both important in the design process, the management of the thoughts of a group becomes vital under a time constraint; without group consensus on the goal for the meeting, the discussions can turn into never-ending arguments.

I asked Dr. Walker about his thoughts on Dr. Owens’s speech and he echoed many of the same ideas. He explained that he has always believed in the importance of what he calls “mental oscillation”—the ability to move between divergent and convergent thinking. Due to the variety of people and ideas within a group, time management for the groups could prove
to be difficult. A critical aspect of a strong design group will be the will power to switch between divergent and convergent thinking.

The class of 2013 will receive project ideas from Dr. Walker over the next few weeks. The design experience will be new for many students and proper planning and an early start will be essential in order to design quality products. Using the advice of Dr. Walker and Dr. Owens, the BME students will be able to recognize the differences between convergent and divergent thought, plan out times of brainstorming and decisive action, and ultimately create a device to proudly present in the spring of 2013.

Being a BME at Vanderbilt is tough, but being a BME who is also premed definitely has its unique challenges. This duo is very manageable, however, if you put the necessary time and dedication into your work and activities. To succeed, you have to demonstrate a passion for medicine, while still excelling in engineering coursework. In addition to the BME curriculum, the only required courses are Organic Chemistry, English, and possibly Biochemistry. Requirements vary based on the specific medical school. As premeds, we also need to participate in numerous extracurricular activities in order to be competitive applicants. By following these steps, you will have a head start in preparing to be a strong applicant for medical school.

**Do not reinvent the wheel, learn from others.** You are not the only student who is taking or has taken the BME/premed path to medical school. Talk to Senior BMEs who are applying this cycle and seek advice. Peers are your best resources. We have taken all of the courses you will be taking, while also juggling different activities on campus.

**Be active on campus.** Medical schools are not just looking for students who can academically handle their curriculum, but rather they are looking for the complete package. A complete package describes an applicant with volunteering, leadership, research, and scholarship experiences. However, do activities because you enjoy them and not simply to pad your resume. With a genuine passion, you will naturally play a greater role in that organization.

**Show your interest in medicine.** Medical schools seek students who are genuinely interested in medicine. Admission committees look for students who understand what being a doctor entails. You can demonstrate understanding by shadowing doctors, volunteering in clinics, and participating in health-related programs.

**Personally know your professors.** When applying to medical school, you need to send in Letters of Recommendation (LORs). LORs typically consist of professor evaluations (from 2 science courses and 1 non-science course) and Dr. Baum’s Committee Letter. Additional letters should be included from people with whom you work: research PI, advisor for an extracurricular activity, or volunteer coordinator. You really want these LORs to be personal rather than generic.

**Stay motivated.** Don’t lose hope as you travel on your journey to become a doctor, because those that work hard will get to where they want to be. Be inspired, not discouraged, by other applicants and their accomplishments. Everyone has unique strengths to play on.
During 2012, the Vanderbilt Biomedical Engineering Society (BMES) has volunteered twice with the Nashville Technology Access Center (TAC). Founded in 1989, the TAC is a non-profit organization dedicated to promoting the independence and participation of any individual with a disability in daily activities such as work, school, or recreation through assistive technology. The center offers a plethora of services: adapting toys or educational materials, augmenting communication (with speech generating devices, low vision aids, adapted computer or telecommunications access), and providing electronic aids for daily living. Many of the employees at the TAC hold degrees in BME with a focus on rehabilitative technologies, making involvement at the center a rewarding way to explore career opportunities.

BMES activities with the TAC have been oriented around adapting toys for handicapped children. First, wires are stripped and soldered to a jack, which is then attached to a large switch that the handicapped child can easily access and operate. After the jack has been successfully created, the volunteers can pick a toy that they want to help adapt. If the toy is a plush, seams are ripped out near the activating button and the wires connected to the jack are soldered onto the wires of the plush. The toy is then re-stuffed and sewed back together. If the toy is plastic, the screws are removed so the toy can be disassembled. Then, the circuit board is located, and the wires are soldered onto the points which cause the toy to activate. Afterwards, the toy can be reassembled and activated via the switch.

Are you interested in becoming involved with activities at the TAC? Future events include a service activity on November 1st, in addition to the Center’s annual toy adapting day in December. The TAC has also expressed interest in loaning soldering kits to BMES for a toy adapting event that could be held on campus. For those that enjoy toy adapting, the Center does send kits home so that volunteers can work on toys in their spare time.
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

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