A Note From the Editor:

Dear Alumni,

We here at the BME Pulse would like to thank you for your continued interest in the Vanderbilt Biomedical Engineering Department, as well as your commitment to fostering connections between Vanderbilt and the various companies and institutions which you represent. It is very encouraging and we are quite grateful.

As always, it’s a pleasure to provide you with updates and news from the goings-on of the Vanderbilt BME Department from the undergrads’ perspective. This issue contains a look at the new facility known as the Wond’ry, as well as an introduction of Dr. Michael King, the new Chair of the BME Department.

We hope you enjoy the issue!

-Kelly J. McGee, Editor and rising senior in BME

Cover Image: The new Engineering and Science Building, which houses the Wond’ry

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The Wond’ry

By Katie Henderson

Covering a total of three stories and 13,000 square feet, Vanderbilt’s newest center for innovation and entrepreneurship, the Wond’ry, is hard to miss. Even more impressive than the size of the building itself is what makes up its inside; from modular furniture to lights that can be individually programmed to the sounds of Vanderbilt’s fight song, everything in this center has been hand-picked to foster creativity and exploration of new ideas. Importantly, all the tools and equipment within the Wond’ry are free for students to use, making it an easily accessible resource.

The facility is home to two “Makerspaces” that provide the materials and equipment necessary to turn abstract ideas into physical manifestations. One of the Makerspaces focuses on electronics, circuits, and robots and even has a non-flammable floor to ensure the safety of those using it. The second Makerspace specializes in physical prototypes and boasts a 3D printer, sewing machine, and equipment for woodworking, fiber arts, and mold making. Both Makerspaces are open to any members of the Vanderbilt community who complete a mandatory safety seminar.

The Wond’ry is unique in that it promotes collaboration among students and faculty across all disciplines, bringing together people with many different ideas and skill sets. The space holds classes, workshops, and meetings for student organizations, all meant to encourage innovation of thought and learning beyond the classroom. Even informal meetings in study rooms provide excellent opportunities for students to learn from like-minded peers and teachers.

Mentors in Residence serve as additional resources for students to ask questions about specific fields they hope to enter. One-on-one walk-in-meetings with these Mentors are available for students to gain unique insight into what it takes to turn dreams into reality, serving as just one of many ways that the Wond’ry promotes its culture of innovation.

Left: the entrance to the Wond’ry

The spiral staircase of the Wond’ry
The Wond’ry offers four “Pillar Programs” to the Vanderbilt community: the aforementioned Innovation Culture, Entrepreneur PreFlight and PostFlight, Social Ventures, and the Innovation Garage. The PreFlight and PostFlight programs teach aspiring entrepreneurs the management, financial, and life skills necessary to start their own businesses. A faculty panel even awards a $3,000 grant to each of five chosen teams in the PostFlight program. The Social Ventures program focuses on developing solutions to timely issues such as public transportation, waste management, and affordable housing in Nashville. Finally, the Innovation Garage allows professionals from a variety of fields to work alongside Vanderbilt students to solve real-world problems in their corporations or non-profit organizations, extending the reach of the Wond’ry beyond campus borders.

The Wond’ry drives Vanderbilt (and its faculty and students) further into the future of teaching and learning while preserving its mission to serve its community and society at large. The building itself represents this merger of old and new ideas, as a great amount of the wood that visibly lines the building’s inside was taken from the trees that used to cover the ground where the Wond’ry was built. One of the major, long-term goals of Vanderbilt is to become to Nashville what Stanford is to Silicon Valley: An innovational hub with an impact that extends throughout the entire city and beyond.

Below: The Wond’ry (front) and the new Science and Engineering Building
Introducing
Dr. Michael King
By Amy Hwang

Dr. Michael King, along with his wife Dr. Cynthia Reinhart-King, joined the Vanderbilt biomedical engineering faculty last December. He is a J. Lawrence Wilson Professor of Engineering, Professor of BME, and Professor of Radiology and Radiological Sciences; he also inherited the BME department chair in January.

Dr. King graduated with a B.S. in chemical engineering at the University of Rochester, obtained a Ph.D in chemical engineering at the University of Notre Dame, and conducted a post doc on cell engineering. Both he and his wife taught at Cornell, him teaching classes such as biotransport, drug delivery, and numerical methods and statistics. He also wrote his own textbook: “Numerical and Statistical Methods for Bioengineering: Applications in MATLAB.”

He runs the King Lab, which has moved with him from Cornell University. Dr. King’s research interests began with the environment inside blood vessels and how blood and immune cells stuck to each other and to vessel walls, then transitioned towards cancer cells. Currently, the King Lab’s research corresponds to the intellectual neighborhoods of regenerative medicine and nanoscience and technology, studying the biology of cancer cells that metastasize and enter the bloodstream. They are working on developing drug delivery strategies on attacking cancer cells and prevent rampant tumor growth.

On a personal note, Dr. King is excited to join Vanderbilt. He is currently getting his research lab up and running in the Engineering and Science Building, as well as forming new collaborations in the Vanderbilt Medical Center, which was a strong factor in attracting Dr. King to Nashville. Near instant accessibility to blood samples, for instance, is difficult if the hospital was not immediately near the lab. He has also enjoyed Nashville itself. As a huge spice fan, he’s already tried the famous Nashville Hot Chicken at Prince’s and Hattie B’s. In his free time, Dr. King takes his son to lacrosse practices and tournaments and has done several marathon with friends, including the Nashville marathon this year.
As the BME department chair, Dr. King has a portfolio of responsibilities, among which include allocating departmental resources, hiring faculty, and having an overall vision for the department. He aims to expand the department in the upcoming years, which includes hiring new faculty as soon as next year, and increasing the academic and individual diversity of the department. There are also plans for overhauling the BME undergraduate curriculum, spearheaded by professor Mahadevan-Jansen. For example, in the next year or so, a new lab course sequence will be integrated with the pre-existing BME courses to impart research skills to undergraduates. Other changes currently in the works include the introduction of BME-specific medical instrumentation courses to replace the electrical engineering courses, and the creation of an optional first-year course where experts in the field will speak about clinical innovations and research, in order to generate more interest in BME. This will be the first major redesign since 1993. Vanderbilt has historically been a leader in education and the hopes are that the institution will continue this tradition far into the future.

Finally, Dr. King plans on increasing Vanderbilt’s presence at the national BMES conference from October 11 to 14, 2017, in Phoenix. He invites any alumni who will be in the area to Vanderbilt’s reception, which is on Thursday night of the conference.

Amy Hwang is a graduating senior in Biomedical Engineering

VISE Symposium

By Derek Doss

I was given the unique opportunity to attend the fifth annual Surgery, Intervention, and Engineering Symposium in December. This annual symposium is put on every year by the Vanderbilt Institute for Surgery and Engineering (VISE) to show the ongoing work in VISE labs and allow the community to reconnect.

The keynote of the symposium this year was given by Dr. Christopher P. Austin, Director of the National Center for Advancing Translational Sciences (NCATS) at the National Institutes of Health (NIH). His presentation was titled “Catalyzing Translational Innovation” and focused on the idea of translating innovative biomedical research into meaningful healthcare outcomes. He pointed out the gap between bench and bedside, and how NCATS was attempting to remedy it.

Dr. Austin was particularly interested in VISE, because of how it tackles this exact problem through collaboration between engineering, intervention, and surgery.

Left: A device displayed at the symposium.
An example of the collaboration between researchers and physicians was seen after the keynote, when we were released to the poster session. Many VISE labs participated in the symposium. There were posters that ranged from tumor growth modeling to image guided procedures. In addition, there were several demonstrations set up to show what many of these labs have created, even the chance to take a surgical robot for a test drive.

From the symposium, I learned about the different creative strategies many labs were taking to solve complex problems. However, one of the best parts of the VISE Symposium was the people. The symposium wasn’t just filled with biomedical engineers, it was also filled with electrical engineers, mechanical engineers, computer scientists, and physicians. The symposium showed the close collaboration that VISE breeds as well as the outcomes of when physicians and engineers work together.

An Interview with Dr. Scott Guelcher

By Hannah Kang

Dr. Scott Guelcher is professor of both Biomedical Engineering and Chemical and Biomolecular Engineering and was recently named director of the Vanderbilt Center for Bone Biology in early February.

Dr. Guelcher’s laboratory does research in the area of bone tissue engineering and healing. His work includes developing injectable polyurethane scaffolds for wounds that conventional medicine would otherwise ineffectively treat. As injectable bone cement for the healing and remodeling of bone is not yet commercially available, Dr. Guelcher saw this as a field with much potential for innovation and cutting edge research.

Growing up in northern Virginia, Dr. Guelcher was first introduced to chemical engineering while working at Fort Belvoir, an army base research lab in Washington, D.C. He worked with chemical engineers his junior and senior summers in high school to design water purification units for contaminated lakes and went on to pursue an undergraduate degree in Chemical Engineering at Virginia Polytechnic Institute.
After completing his masters from University of Pittsburgh and a Ph.D. from Carnegie Mellon University, he became interested in the integration of biomedical sciences with engineering. He accepted a position as a post-doctoral researcher in a new training program sponsored by the National Institute of Biomedical Imaging and Bioengineering designed to prepare engineers for careers in biomedical research. Tissue engineering was the hot new field and post-doctorates were paired with mentors from each discipline, life sciences and engineering, in an effort to bridge the gap and aid the transition into their new careers. Chemical engineering at the time was a mature and established field and Dr. Guelcher was ready to jump into biomedical engineering where areas of growth were limitless and changes were dynamic.

Dr. Guelcher believes right now is an exciting time for students in biomedical engineering as we begin to see a lot of the things people 20 years ago only dreamed of, like manufacturing human tissue, becoming a reality. Patient specific precision medicine is advancing and will give rise to therapy effectiveness, efficiency of the healthcare system, and improvement in the lives of patients. According to Dr. Guelcher, many thought leaders believe we are on the cusp of non-incremental change. He is excited for the public to see the value of biomedical research when visible improvements in the quality of life are attributed to the work of engineers.

Transitioning from a career in industry to the university, Dr. Guelcher appreciates the energizing and creative environment of Vanderbilt students and fellow faculty members. Since working with students, he is encouraged by students’ new ideas, ambitious attitudes, and fearless eagerness to try new things. Dr. Guelcher takes pride in being a part of what he calls the “inspiring academic collaboration of engineers and life sciences” at Vanderbilt. Dr. Guelcher merits intellectual curiosity and the tenacity to get find solutions to unique and successful students. “It is not about your innate abilities, but your ability to collaborate, recognize your strengths and weaknesses, and work with people from other disciplines,” he said. “Take advantage of opportunities like research, clinical volunteering, internships to get an idea of what you might want to do next. These are things you just can’t answer in the classroom. Get the experience as a student to make informed decisions about what you want. When you are young, there isn’t a decision you can’t recover from. Don’t be afraid to make a mistake. Be flexible and resilient, ready to take on challenges that come your way.”

Hannah Kang is a rising senior in Biomedical Engineering
BME and Art

By Tori Chitwood

*Tori Chitwood is a double-major in Biomedical Engineering and Art. She graciously agreed to share about her experiences at Vanderbilt.*

Most people believe that the combination of art and engineering is very strange. After all, it does cross the border of ‘left brain’ and ‘right brain.’ However, there is more similarity than people think. At the risk of sounding cliché, Leonardo Da Vinci was both one of the greatest engineers of all time and a phenomenal artist. He was a dreamer. Both biomedical engineers and artists are dreamers, at least in my opinion.

People are quick to assume that a good engineer is a technical person who comes pre-wired with analytical thinking. Few recognize that an artistic or creative side is a tremendous complement to engineering. Many great artists are capable of visualizing from bare-canvas to end product. When you pare it down to the basic equations, it takes visualization to rearrange them to fit one’s purpose. Any sort of design aspect of engineering involves this same visualization. I grew up surrounded by engineers, all of whom have a very hands-on approach. They were more willing to try and do things, to imagine new possibilities, and to see how it all fits together than those who only want to stick with what they know. This ability to explore, to visualize, and having a hands-on approach is the same type of mental activity that makes people good artists. There are a number of engineers, BME or otherwise, just in my graduating class that love art and are great artists.

Just like engineering, art has its process of analytical thinking that few people outside the art world are aware of. Mixing paint is like an equation, throwing a pot on the wheel is knowing how much pressure to apply without it falling over, and knowing the strength of the material, etc. Each form of art has a list of steps that are followed in order to produce something. True, there is a lot of feel and creativity involved, but those same requirements are often needed to solve a difficult engineering problem. One needs to be able to look at it in a different light or visualize a solution before acting on it.

The difficulty is that both majors take an extraordinary amount of time. Each art class is 6 hours a week, and most require additional time outside of class to finish the projects. BME, on the other hand, does not have such long classes but sometimes requires even more outside time to complete projects and problem sets.
Other students play sports, do community work, and find other ways to balance their life. Art is what gives me my balance. And while I believe that the two fields complement each other significantly, the work required for each are different enough that it provides me a much-needed change of pace. Finishing my engineering assignments and problem sets early allows me to go to the art building later at night and finish projects. Vanderbilt’s art building is a beautiful, comfortable space. While I’m there, I can relax and immerse myself in whatever I’m working on at the time, whether it’s a painting, sculpture, or film.

*Artwork by Tori Chitwood*

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**Image References**

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https://www.vanderbilt.edu/thewondry/about/

Page 5:
https://engineering.vanderbilt.edu/bio/michael-king

Page 6, top of 7:
Courtesy of Derek Doss

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Pages 9 and 10:
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