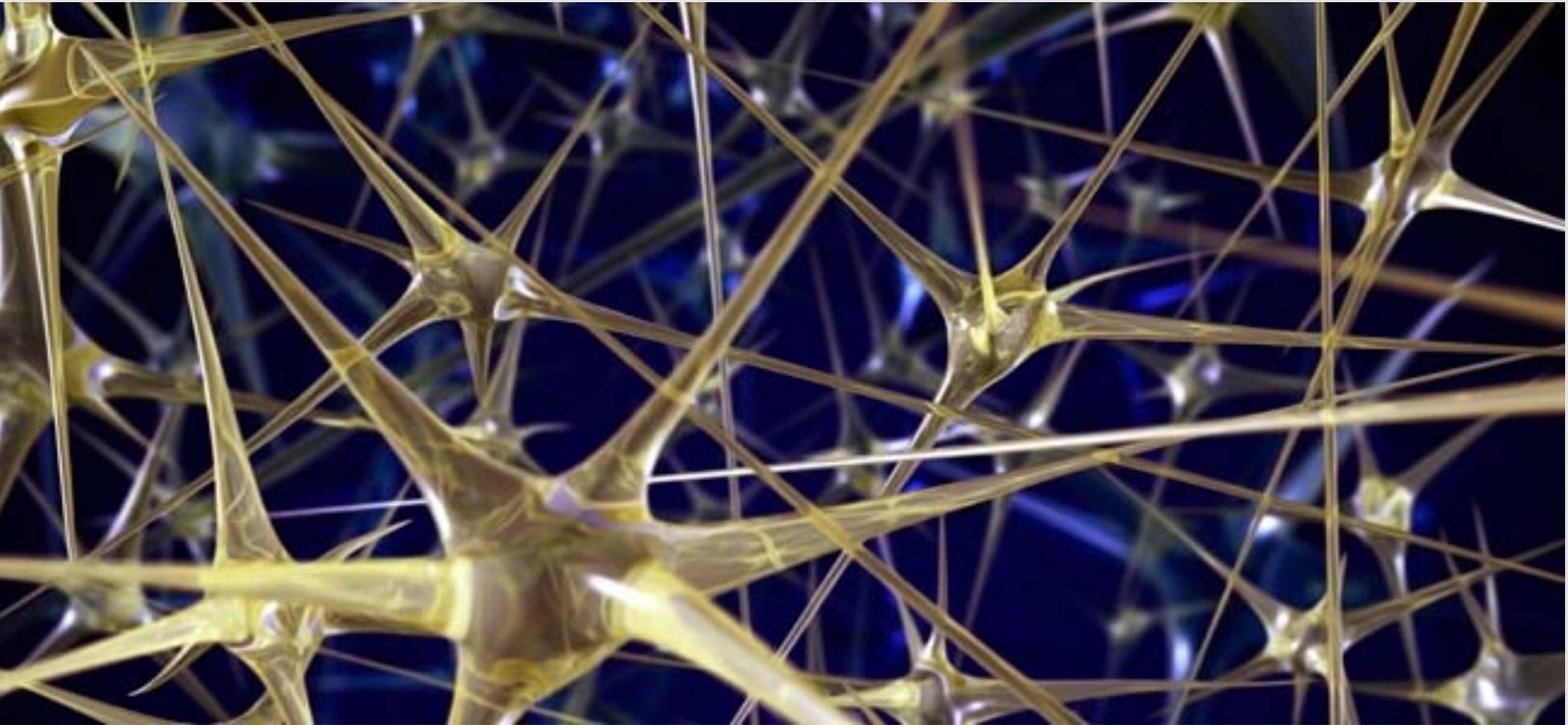


BME PULSE

OPPORTUNITIES IN OUR MAJOR



The OFFICIAL UNDERGRADUATE NEWSLETTER OF THE VANDERBILT BIOMEDICAL ENGINEERING DEPARTMENT

Volume 7-1 Fall 2014

Vanderbilt University

Faculty Advisor Dr. Miga

INSIDE THIS ISSUE

1

THE INTERDISCIPLINARY APPROACH

AMY HWANG

3

LIFE AFTER COLLEGE

PLANNING YOUR FUTURE: CHECKLISTS

RYAN SPEARS

5

LETTER FROM BMES

NIKITA THOMAS

6

SyBBURE's NEW DIRECTOR: DR. CHRISSY MARASCO

ORLANDO HOILETT

7

GET INVOLVED: RESEARCH

8

SUPPORT VU BME

EDITORS: DIONNE BLACK, JENNIFER DUAN

DESIGNER: JENNIFER DUAN

THE INTERDISCIPLINARY APPROACH

AMY HWANG

In recent times, the lines between traditional disciplines have begun to blur. As new questions and challenges arise in science, engineering, medicine, and society, new collaborations form to address them. Vanderbilt embraces this spirit of innovation. Chancellor Nicholas Zeppos' "One Vanderbilt" philosophy seeks to unite all of Vanderbilt's 10 schools behind four major and overlapping themes: the undergraduate residential experience, education technologies, healthcare solutions, and trans-institutional programs. Current Vanderbilt students are able to explore a spectrum of programs and majors that would have seemed odd just decades ago: Medicine, Health, and Society; Neuroscience; and Women's and Gender Studies are a few that allow students to learn about an overarching theme that oftentimes translates into a passion or career. Biomedical engineering (BME) is a prominent example that fuses engineering, biology, and medicine to form a modern discipline that advances health care treatments.

The nanoscience and nanotechnology minor and scientific computing minor have been recently introduced to the undergraduate curriculum. They are jointly offered by the School of Engineering and the College of Arts and Science. Facets of biomedical engineering shine in both minors: *Nanobiotechnology* and *Principles and Appli-*

cations of BioMicro ElectroMechanical Systems (BioMEMS) are electives in the Nanoscience and Nanotechnology minor, and *Modeling Living Systems for Therapeutic Bioengineering* is an elective in the scientific computing minor. The Vanderbilt Institute of Nanoscale Science and Engineering (VINSE) supports the nanoscience and nanotechnology minor by providing a specialized laboratory facility containing state-of-the-art instrumentation used for research. Professors affiliated with the minors teach students the practical skillsets needed as aspiring scientists and engineers. These skillsets are oftentimes difficult to obtain at the undergraduate level and are attractive to many employers and graduate schools.

ranging from the Curb Center for Art, Enterprise, and Public Policy, to the Institute for Space and Defense Electronics, and to the Vanderbilt Initiative in Surgery and Engineering (ViSE). This wealth of resources is in part what makes Vanderbilt's BME program so unique, for the close proximity of both the Vanderbilt Medical Center and these institutes provide educational and research opportunities for students. Faculty associated with the Vanderbilt Institute for Integrative Biosystems Research and Education (VIIBRE), the Vanderbilt University Institute for Imaging Science (VUIIS), ViSE, and VINSE teach BME elective courses that illuminate current topics in medicine and biomedical engineering.

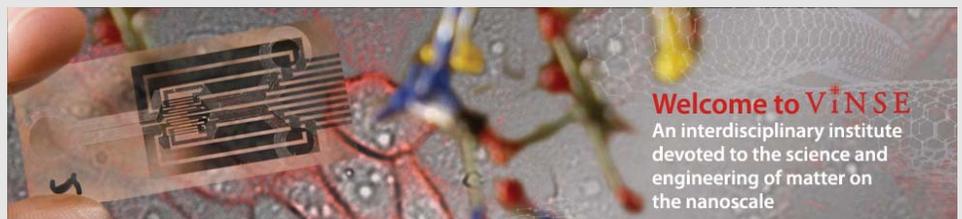


Image courtesy of: VINSE website

The VINSE supports the nanobiotechnology and the BioMEMS minors by providing a special laboratory facility for research.

As a research institute, one of Vanderbilt's core values and missions is to "actively promote research and teaching that crosses disciplines, departments and institutional lines through a multitude of centers and institutes." There are over one hundred of these interdisciplinary centers and institutes,

Students are able to conduct research with BME professors that collaborate with faculty not only from the medical center, but also from the departments of electrical engineering, mechanical engineering, and the interdisciplinary institutes.

THE INTERDISCIPLINARY APPROACH

AMY HWANG

The interdisciplinary motif not only draws in students, but faculty as well. Dr. Craig Duvall, assistant professor of biomedical engineering, accepted his faculty position at Vanderbilt in part because VINSE offered free and complete access to its core instrumentation and infrastructure for nano-related research that usually mandates hourly fees to use.



Photo courtesy of: Duvall Lab Website

Dr. Craig Duvall, Assistant Professor of Biomedical Engineering

He utilizes a variety of VINSE's characterization instruments for his research lab's goal in finding "smart", environmentally-responsive polymers to develop novel approaches for overcoming pharmacological barriers. When a novel polymer is constructed, its structure and functionality need to be character-

ized, optimized, and confirmed before examining its effects on biological systems. This polymer integrity is verified using VINSE's instruments such as the Malvern Zetasizer, which measures nanoparticle size, weight, and charge. Electron microscopy imaging is conducted with VINSE's scanning transmission electron microscope (STEM) and transmission electron microscope (TEM) to determine the appearance of synthesized nanostructures and its chemical properties.

Dr. Duvall and his team have recently developed a thermally responsive hydrogel comprised of self-assembled, polymeric micelles. These micelles enable loading of the hydrogel with drugs such as anti-oxidant molecules. The final hydrogel degrades and releases the drug cargo in response to reactive oxygen species in the tissue, providing "on demand" anti-oxidant drug release that is triggered by oxidative stress. They have been able to verify the process's success by imaging the micelles with TEM and STEM and now look to possible usages of this type of drug delivery system in ameliorating damaged and ischemic tissues. His long term goal is to produce drug delivery systems that have higher efficacy, more precise mechanisms and prolonged administration.

Much of Dr. Duvall's research is in collaboration with labs within BME and in

other disciplines. The Duvall lab works closely with Dr. Hak-Joon Sung's lab at their shared biomaterials laboratory in the Stevenson Center and with Dr. Giorgio and Dr. Skala, who are also members of the BME department. Dr. Sharon Weiss, a faculty member of the electrical engineering department, works with his lab in synthesizing the porous silicon used in one of his drug delivery systems. As a result of his collaborations over the years, he believes that Vanderbilt fosters a rich, collaborative environment between academic disciplines that leads to seamless interactions that many other colleges do not have.

In the spirit of innovation and collaboration, Chancellor Nicholas Zeppos launched the new \$50 million Trans-institutional program (TIP) initiative on November 3rd of this year as a part of the 2014 Academic Strategic Plan. The goal is to "create partnerships that interweave diverse perspectives, features, methods, and information to foster creativity in both discovery and learning" and address questions that lie on the intersection between disciplines. This is the next step from the 2002 Academic Strategic Plan that formed the Martha Rivers Ingram Commons, the no-loan policy, and many of the interdisciplinary institutions that exist today. Over the next five years, hopes are high that the TIPs will further bolster the collaborative "One Vanderbilt" philosophy.

LIFE AFTER COLLEGE

RYAN SPEARS

What are you going to do after you graduate?

It's a question we've all been asked enough times to form something of a stock answer, and yet it deserves more attention than that. It's easy to put the question off to another day, or month, or year. It's easy to settle into the whirlwind routine of college, which is enough to keep the hardest working of us busier than we've ever been. It's easy to assume we're doing enough, that all we have to do is strap in and make it through these four years to come out on the other side, ready for the real world.

Unfortunately, though, that's not how it works. Preparing for life after college takes work, and only doing what's required won't be enough. But that's the great thing about college, and Vanderbilt in particular: everything you need to prepare is somewhere on campus. Yes, it isn't always easy to find. Yes, it's not the most fun thing to search for. And yes, there are plenty of other things you could be doing. But planning for your future is something you certainly won't regret doing, no matter what year you're in, and no matter how pestering or irrelevant it may seem now.

So what are some things you should be doing now regardless of your intended path?

A good place to start is the Center for Student Professional Development. After talking to Dr. Cynthia Paschal,



IMAGE COURTESY OF THE CENTER FOR STUDENT PROFESSIONAL DEVELOPMENT

*The Vanderbilt Center for Student Professional Development's Walk in Hours.
The Center is located on the 2nd floor of the Student Life Center.*

Associate Dean of Engineering and Professor of Biomedical Engineering, it is painfully clear the center is underutilized. There, you can get career coaching, interview coaching, resume critiques, and much, much more. A good place to start is career coaching, which is available in seven industry clusters. Before you go in, you should have a basic understanding of what you want to do and how you're going to do it, but you don't have to walk in there with everything figured out. The coaches are there to answer your questions, help fill in the gaps of your plan, and elaborate on what's already there. You will only benefit from going.

In addition, each industry cluster has a listserv that sends out information on relevant opportunities that consist mostly of job or internship listings and on-campus events, the latter of which provide chances to network. In the modern day and age, networking is often equated to manipulative, insincere social interaction with the intention of using peo-

ple for personal gain. Even writing this, I feel the need to justify myself to keep from sounding too utilitarian, but the bottom line is that creating, fostering, and maintaining relationships with people in your career field will be invaluable to whatever line of work you pursue, and that starts now.

So back to the question, what are you going to do after you graduate?

Statistics say you're going to choose medical or dental school, graduate school, or industry. Of the 184 people who graduated from Vanderbilt with biomedical engineering degrees in the past three years, 36 chose medical or dental school, 46 chose graduate school, and 91 chose industry.

(*Note: Statistics taken from future plans surveys, YES, commencement programs and student records)

LIFE AFTER COLLEGE

RYAN SPEARS

So what does each path require?

Medical/Dental School

No career path is set in stone, but medical and dental school are the closest. Every school you apply to will have different requirements, but in general you will need to complete prerequisite courses, take an entrance exam, and get letters of recommendation. The courses required are typically an array of introductory sciences and writing classes, but others like biochemistry and introductory sociology and psychology are typically recommended, at least as preparation for entrance exams (MCAT for medical school, DAT for dental school). As for letters of recommendation, most schools require at least one or two to be from STEM professors, leaving the rest to cover other facets of your life. Getting those letters, however, is not something you should leave until the last minute. It is in your best interest for your recommendations to come from professors who know you well enough to give you a fair, honest account, and these relationships will often be fostered in office hours.

In addition to the explicitly stated requirements, these schools' criteria for a qualified candidate implicitly tend to include research and shadowing experience, both of which can be accomplished without leaving campus. Finding a research position may seem like an imposing task, but a large portion of professors who do research are open to taking undergraduates in their labs, especially those within the BME department. It is recommended that you in-

vestigate a professor's research interests before popping the question, but from there a simple introductory email with your resume attached is an acceptable means of doing so. It might not work out on your first try, but if you are persistent you will more than likely find something that fits you.

As for shadowing, the Vanderbilt University Medical Center (VUMC) provides incredible opportunities, though you can shadow anywhere you want over summers or breaks or whenever fits your schedule. The pre-health society, Alpha Epsilon Delta (AED), provides shadowing opportunities at the VUMC every semester, but you can also contact the medical center or individual physicians directly.

As a final point for medical and dental schools, the Health Professions Advisory Office (HPAO) is an invaluable resource. The advisors there know the ins and outs of the process and will be able to answer any questions you may have. Similar to the Center for Student Professional Development, go in for a meeting once you know enough about the process to have some questions. In addition, you have to get a special recommendation from the HPAO called a committee letter, so the sooner you go and make an impression the better.

Graduate School

Graduate school and industry present far more variable paths. Since graduate programs are more focused on research than undergraduate programs,

your choice will depend largely on the lab you want to work in, and it will fall to you to determine what that field is. As far as requirements go, you will have to get letters of recommendation and take an entrance exam, the GRE, and you are all but required to do research as an undergraduate (see the medical/dental school section for further details on recommendations and research).

Industry

Industry is even less set, with no set requirements to meet before applying for positions. Internships and research experience are highly recommended, but the world of industry is run through networking. Investigate companies large and small within your fields of interest, and interact with them as much as possible. One great resource here are Vanderbilt's on-campus information sessions, which are run through the Center for Student Professional Development. Attending these, you can learn about individual companies interested in hiring Vanderbilt students and meet employees who are typically active in the hiring process.

As a final point, this is a lot of information to take in, but you should take this seriously. It can be easy to be complacent and let planning for your future slide to the bottom of the to do list, that it can feel like the farthest thing from imperative. But it is important, and you can never start too soon. The worst that can happen is that you'll just learn more about what you want to do. So go ahead: make a plan and take that first step. Future you will thank you for it.

PLAN FOR YOUR FUTURE: CHECKLISTS

RYAN SPEARS

Medical and Dental School:

Make an appointment at the HPAO

Know prerequisite courses for schools:

Typically include:

Biology

Organic Chemistry

Calculus

Physics

English

May also include:

Psychology

Sociology

Biochemistry

Genetics

Entrance exam: MCAT or DAT

Letters of Recommendation:

2 STEM

1 Humanities

1 Committee Letter from the HPAO

1 From a Dentist/Physician
(Optional, but recommended)

Highly recommended

Research

Shadowing

Volunteering

Leadership positions



Photo courtesy of: VUSE

A Vanderbilt career fair. Photo taken fall 2012.

Graduate School

Entrance exam: GRE/GRE Subject
Tests

Letters of Recommendation

Highly recommended

Research—consider BME 240; try
and work towards paper publication

Industry

Networking: it's on you

Career Fairs

Healthcare Fair

IT Fair

DoreWays

Highly recommended

Internships

Research

General

Networking

Center for Professional Development

Resume critiques

Interview coaching

Career counseling

Listservs

On-campus visits

Information sessions

Company luncheons/dinners

On-campus interviews

LETTER FROM **BMES**

NIKITA THOMAS

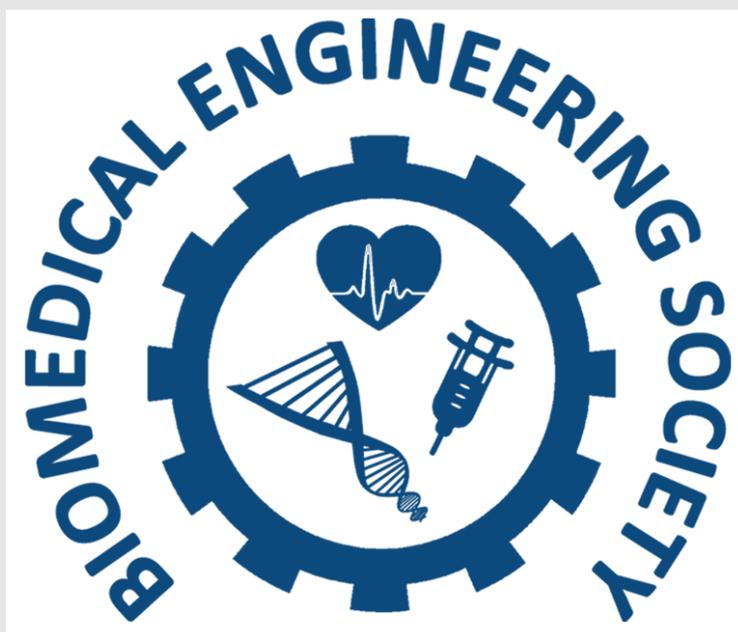
The Vanderbilt Biomedical Engineering Society (BMES) has hosted a number of different events this semester to aid BME students in their professional endeavors. The following are examples of what we've accomplished this semester:

Discussion of Future Opportunities – We gave a presentation on summer research options available for undergraduates and discussed the many different career paths a BME student can pursue and how to start that search at Vanderbilt.

Q&A With Texas A&M Graduate Student - Madeleine Durkee, a Vanderbilt alumna and former BMES President, is currently a graduate student at Texas A&M. She discussed her experience so far at Texas A&M and answered students' questions about what to expect and look for in graduate school.

Presentation on Job & Internship Resources – Cathy Weisbrodt from the Center for Student Professional Development gave a presentation on tools and resources that are essential to finding a job or summer internship.

If you are interested in getting more involved with BMES or if you have any comments or suggestions for BMES events, contact Nikita Thomas at nikita.c.thomas@vanderbilt.edu.



SyBBURE's New Director: Dr. Chrissy Marasco

ORLANDO HOILETT

“ I truly want to help guide students...I believe [SyBBURE] will lead students to develop creative solutions to problems in science, medicine and technology.”

The Searle Systems Biology and Bio-engineering Undergraduate Research Experience (SyBBURE) has given more than 200 undergraduates the opportunity to be immersed in cutting edge research with some of Vanderbilt's talented faculty. The program is graciously funded by Gideon Searle, a Vanderbilt alumnus, and has given students the opportunity to take part in summer and year-round research during its eight-year history. SyBBURE is coordinated with the Vanderbilt Institute for Integrative Biosystems Research and Education (VIIBRE) led by Dr. John Wikswa. Many students in SyBBURE engage in research as a part of VIIBRE's Organs-on-a-Chip projects. But, as SyBBURE's focus is on providing a meaningful research experience, it allows students to pursue their research interests across the university, the medical center and even internationally.

This past Spring, SyBBURE said farewell to long-time director, Dr. Kevin Seale, who has been pivotal in the SyBBURE success inspiring wonderful creativity over his tenure with the program. His departure will be missed but Dr. Seale will be continuing in children's education, undoubtedly guiding them to academic excellence as he did in SyBBURE students. With the program in

need of a director, Dr. Seale and Dr. Wikswa enlisted Dr. Christina (Chrissy) Marasco, who is no stranger to VIIBRE or SyBBURE. After spending over three years working with SyBBURE students, Dr. Marasco graduated from Vanderbilt with a Ph.D. in Biomedical Engineering. She has spent the last few years as the Assistant Director of the Office of Medical Student Research at Vanderbilt's School of Medicine and is eager to return to SyBBURE as our new director.



Photo courtesy of: VIIBRE Website

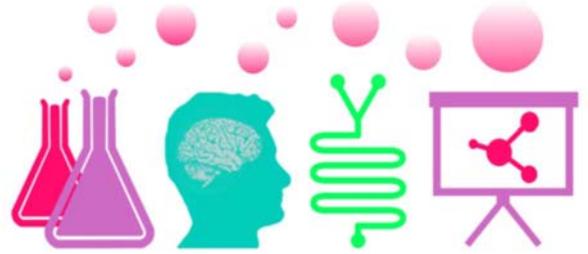
Dr. Chrissy Marasco—SyBBURE Director

When asked what she looks forward to the most, Dr. Marasco says, “I truly want to help guide students in their research and provide the opportunity for them to explore their interests and build

their skill sets. I believe this will lead students to develop creative solutions to problems in science, medicine, and technology.” When asked about the most influential part of her decision to accept, Dr. Marasco responded by saying, “the opportunity to work with a group of very talented students” was paramount in her decision, in addition to, “the chance to get back to the pursuit of [her] scientific passions.”

In speaking with Dr. Marasco about the future of SyBBURE, I was filled with excitement. Dr. Marasco hopes to take steps to promote discovery, creativity and entrepreneurship within the group. “In the past, I have been amazed at the insightful, clever ideas SyBBURE students have developed. Within the right environment, I believe it is possible to cultivate these ideas into groundbreaking discoveries and marketable products. With its commitment to students and excellent program staff and faculty, SyBBURE is a great model of such an environment. Activities slated for the summer include using social media outlets to explain cool things about science to the general public and brainstorming sessions which will give students experience in developing innovative ideas to problems in medicine, science and technology.”

GET INVOLVED: RESEARCH



WHAT IS SyBBURE?

- Research projects at the intersection of systems biology and bioengineering
- Provides a year-round immersive research experience and an opportunity to work with Vanderbilt faculty researchers
- Directed by Dr. Christina Marasco

HOW TO APPLY

- Apply online at <http://sybbure.org/application.php>
- Admissions are rolling, but are generally made prior to the Summer, Fall and Spring terms
- Qualified applicants will be contacted by the SyBBURE admissions team



WHAT IS VIIBRE?

- Interdisciplinary research between systems biology and systems engineering
- Mission is to invent the tools and develop the skills needed to perform systems biology research
- Directed by Dr. John Wikswo

AREAS OF RESEARCH

- Biophotonics
- Microfluidics
- Mass Spectrometry
- Organs on a Chip
- Structural Mass Spectrometry

SUPPORT VU 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

My/Our gift commitment to the Biomedical Engineering Department is \$_____ over the next _____ years.

Year 1 \$_____ \$_____

Year 2 \$_____ \$_____

Year 3 \$_____ \$_____

Year 4 \$_____ \$_____

Year 5 \$_____ \$_____

To start my/our commitment, I/we have provided \$_____.

Please send annual reminder notices in the month of _____.

Signature: _____ Date: _____

Please make checks payable to Vanderbilt University.

I/we wish to put my/our first gift to work by placing it on my credit card:

___ VISA ___ Mastercard

Gift Amount: _____

Card Number: _____

Exp. Date: _____

Name as it appears on Card: _____

Signature: _____

NAME: _____

PREFERRED ADDRESS: _____

PHONE: (h) _____ (w) _____

(fax) _____

EMPLOYER: _____ TITLE: _____

VANDERBILT DEGREE(S) or AFFILIATION(S): _____

EMAIL: _____

Please Remove Back Page And Mail With Your Contribution To :

Gift Processing, Vanderbilt University, PMB 407727,

2301 Vanderbilt Place Nashville, TN 37240-7727

ASK US ABOUT CORPORATE SPONSORSHIP (Email: Michael.I.Miga@vanderbilt.edu)