So, you must be wondering why there is a UC Davis fire truck as the cover of our Spring Issue, and as much as I am tempted to say it has something to do with this being our hottest issue yet, the truth is much more poetic than that.

The picture of the fire truck was actually taken by me even before I transferred to UC Davis. It was Picnic Day 2012 and I wasn’t even thinking about transferring to UC Davis yet! I remember arriving home that day and was surprised by the lasting impression Davis has left with me; ‘what a great place!’ I remember thinking. Fast forward a year later and I am transferring to UC Davis! The feelings I felt when I first visited Davis has left such a great impression on me that my transfer really felt like a dream come true.

Now here we are, my last quarter as the Senior Editor-in-Chief for the BMESsenger. It has been quite the year and I am humbled to have worked with possibly the best biomedical engineering community. As I reflect on my journey from Community College to University, I can’t help but think about how much growth and self-improvement I have made with the help of all my peers and mentors.

So, as my final issue here at BMESsenger, I have decided to go out with the biggest one yet! Now featuring 10 articles, we have pretty much doubled the usual size! I have also asked my writers to write articles under the theme of ‘self-improvement’, mostly from experiences they’ve experienced here in Davis. Just to give you a sneak peek, we’ve got articles highlighting our distinguished BMES Seminar Series, Interview Articles, Perspective Articles, Event Articles, and more!

Just like the fire truck makes me reminiscent of my humble aspirations to be an engineer, I hope our spring issue leaves a lasting impression on you, our beloved reader, that your passions are reinvigorated and your ambitions sparked!

Enjoy!

Philip Domondon
Senior Editor-in-Chief
Throughout my extensive education within the BME department, some of the most rewarding experiences I’ve had the pleasure of receiving were through the BME Distinguished, Departmental and Alumni Seminar Series; offered usually every Thursday at 4 P.M. within the GBSF auditorium, these enlightening, inspirational talks provide students and faculty with the unique opportunity to learn about state-of-the-art research being conducted at the top universities around the world. In addition to granting students a glimpse into the fascinating research current biomedical engineers are performing, the diverse disciplines covered by the seminar series ensures that undergraduates can benefit from attending and interacting with the brilliant graduate students, professors and lecturers. Although there were plenty of wonderfully insightful talks throughout the year, this article’s intention will be to give a taste into this mesmerizing world of research and to encourage aspiring undergraduates to attend.

To begin our journey into the captivating seminar lectures, we had the pleasure of hosting the brilliant Dr. Nancy Allbritton – professor and chair of the Department of Biomedical Engineering at the University of North Carolina and North Carolina State University -- on October 30th, as she delved into the innovative construction of microengineered platforms for the recapitulation of organ physiology; dubbed “Organ-on-a-Chip”, Dr. Allbritton’s novel microfabricated systems allow scientists to seed pluripotent cells in such a manner that mimics the in vivo environment of the native organ. In addition to this revolutionary work, Dr. Allbritton’s lab has also contributed to the advancement of single-cell biochemical assays and construction of microraft arrays; the highly sensitive biochemical assays that are under development have the ambitious goal of identifying multiple aberrant pathways that would give physicians the specific disease condition they are treating. The microraft arrays the Allbritton lab is currently working on utilizes cell-array platforms for the analysis, monitoring, and isolation of cells without disrupting their microenvironment; applications of the technology include efficient cloning of embryonic stem cells and the purification of tumor cells from blood samples. All in all, Dr. Allbritton’s innovative lab combines principles of biochemistry, biosensors, materials science, and microfluidics in order to tackle complex problems in the field of biomedical engineering.

Our next enthralling speaker was none other than the Neely Endowed Chair and Regents’ Professor of the Woodruff School of Mechanical Engineering at GIT, Dr. Andres Garcia, who examined the use of bioartificial hydrogels and mechanobiological technologies for the advancement of regenerative medicine. On this January afternoon, Dr. Garcia’s engaging lecture focused primarily on establishing the cell-scaffold and cell-matrix importance in the formation and repair of various tissues. Dr. Garcia highlighted the use of PEG-MAL hydrogels for the delivery of therapeutic growth factors and stem cells; in one particularly impressive experiment, Dr. Garcia’s lab embedded pancreatic islet cells and VEGF into PEG-MAL hydrogels, coupled with the appropriate proteases required for efficient breakdown, to treat diabetic mice within 10 days after administering the treatment. What they found, after 10 days since inserting the hydrogel treatment, was that the mice exhibited stable weight control and great IP-glucose tolerance, however, the Garcia lab didn’t stop there; Dr. Garcia examined the effectiveness of encapsulated BMP-2 for the repair of bone tissues. Using an effective peptide tag, GFOGER, Dr. Garcia demonstrated that, when coupled to a PEG hydrogel, the amount of BMP-2 required for efficient therapeutic use was 20 times lower than current collagen sponge doses; in addition, bone defects treated with his lab’s hydrogel exhibited equivalent mechanical characteristics as native bone tissues and showed better stem cell recruitment to the site of injury. Finally, Dr. Garcia touched upon, in further detail, his magnificent invention known as μSHEAR; eloquently described as his “spinning disc device”, μSHEAR provides label-free, rapid, high-survival isolation of different cell phenotypes simply based on their unique adhesion characteristics. In conclusion, Dr. Garcia’s amazing research firmly cements the importance of biomechanics within the human body and demonstrates the complex interplay between cells and their environments.
For our next distinguished guest lecture, the BME department had the pleasure of hosting the A.N. Pritzker Professor of Radiology/Medical Physics at the University of Chicago, Dr. Maryellen Giger, who gave an interesting lecture about quantitative radiomics and using qualitative imaging analysis to decipher cell phenotypes for the efficient elucidation of breast cancer on February 12. Dr. Giger began her fascinating lecture explaining how the combination of medical images, histopathology, and genomics ultimately stimulated the formation of imaging genomics, which seeks to construct predictive CAD (computer-aided diagnosis) models of the particular breast tissue based on the features gleaned from the medical images. In one particular study, Dr. Giger highlighted the characteristics that distinguishes a benign breast tumor from a malignant one and elaborated on the various physical characteristics that are usually observed in malignant tumor cells, which she hopes will assist in improving cancer diagnosis, patient care, and determining the relationships between the images and the genetic machinery within the cells. Ultimately, Dr Giger’s groundbreaking work into establishing the relationship between image phenotype and the genes and pathways controlling the expression of the phenotype highlights the importance of biomedical imaging modalities in the diagnosis, prognosis and treatment of patients with a variety of different debilitating ailments.

Although there were plenty of inspirational talks throughout the quarter that I have personally enjoyed, none received quite as much attention than the Maroney-Bryan distinguished seminar by Dr. Joseph DeSimone and his absolutely astonishing lecture concerning imprint lithography and 3D additive fabrication techniques. Of the various, equally awe-inspiring innovations discussed during his lecture, the ones that caught my attention were the novel CLIP 3D printing technique. For this particularly stunning technique, Dr. DeSimone began by explaining the current limitations with 3D printing, citing specifically that it takes too much time and ends with a mechanically inferior print; next, he introduced his continuous liquid interface production technique and ascribed his inspiration of the idea to the Terminator 2 end fight scene. This absolutely revolutionary technique harnesses light and oxygen to rapidly and accurately construct parts and features to a 3D mold; essentially, CLIP works through the introduction of a persistent liquid interface below the ultraviolet image projection plane via an oxygen-permeable window. This persistent liquid interface inhibits photopolymerization, which allows for the continuous production of complex solid parts, as long as the control parameters are properly delineated. As a prolific inventor and a brilliant scholar in the fields of polymer chemistry and chemical engineering, Dr. DeSimone continually pushes the boundaries of what’s currently capable and serves as an inspiration for engineers in any profession to follow through with any idea, no matter how absurd or improbable it may initially appear.

Although there are a plethora of different tracks one can embark on as a biomedical engineer, what these seminar talks hope to instill is a sense of wonder and awe of the capabilities, and challenges currently facing these world-class scientists. As a future top-notch engineer, one of the most important lessons we can learn from our professors, as well as these lecture series, is the value of continued education; even after we’ve graduated from this illustrious university and have chosen either graduate or professional school, industry or some other career path, we never stop learning and it would behoove each and every one of us to continue absorbing information, learning all we can about what truly motivates us. In conclusion, in order to create a lasting positive impact on this wonderful sphere we call home, we must go forth in our quest for knowledge with an open mind and be willing to attempt new experiences.
Any college student or prospective employee should already know about the significance of networking. You are advertising yourself to future employers, putting on display exactly why you are perfect for the position that they want to fill. Naturally, this is a very competitive process so students should be establishing networks that can help extend the amount of job opportunities available to them and should be consistently updating their career profiles. No worries though, you have a wide array of tools here at Davis to help you connect with and make your best self known to fellow peers, professors, and employers.

LinkedIn - LinkedIn has been established as one of the leading social media services that help users create profiles that reflect their work and school experience, internships, and track record as a prospective employee, all the while helping them connect with other people of similar career interests, making networking all the easier for users. You can choose who you connect with, as all of your connections are in one place. In addition, you can search for companies that you may be interested in working for as well as visual projections and graphs of where most employers in that company went to school. There’s a wide range of valuable statistics that you can access and use to give you a general idea of how to boost your chances of becoming a real candidate in working for your dream company.

BMES / Club Facebook pages - If you are a part of BMES or any club, you should already know that they are a great way to get involved and stay connected with events pertaining to your interests. Whether you are an advocate for social media or not, you should know about the club Facebook pages, including our own BMES Facebook page, keeping you up to date and informed about all the important programs happening on campus so you can go out and interact with others to keep your networking skills sharp!

EUREKA! - Here at UC Davis’ College of Engineering, we have an in-house developed program aimed at helping students create concise résumés and display their skillsets through a simple and streamlined interface. This program also makes it much easier for participating companies to access these students’ user profiles by allowing companies to adjust certain parameters like GPA range and specific majors when searching for students. Like the name suggests, there’s a gold mine of student talent here at our school and the service will have your future employers screaming “Eureka!” when they use it to discover you.

To help explain the service further, I interviewed Kelly Scott, one of three main developers of EUREKA!, and asked about why and how they created it, and why our campus’ College of Engineering students should be using it.

Me: Hi Kelly, it’s great to get a chance to ask you a few questions. First off, what is your role here at UC Davis?
Kelly: I am the assistant director of corporate relations at the College of Engineering here at UC Davis.
What is your mission statement / what is the purpose of your service?
The corporate relations team is here to create good partnerships with companies that are looking for student talent that want to connect to the College of Engineering for research opportunities with our faculty members.

How long does it take to create a user profile on EUREKA?
If you sign in and authenticate your profile with your Kerberos login information, it could take you as quick as thirty seconds. Then, at any time, you can spend an additional 10-15 minutes to add more information about yourself to fully complete your user profile.

What kind of information about you will be displayed if you opt-in for the service?
So one of the things that is unique about EUREKA is that it connects directly to the central student information system and it pulls your name, your contact information, your major, and displays your GPA in a 0.25 point-wide range. By doing this we can maintain a degree of privacy for students using the program, while still providing companies enough information to indicate generally where the student academically stands. So for instance, if you have a 3.3 GPA, EUREKA will display it as a ranged 3.25-3.50 GPA. Beyond that, you can enter in any industry relevant student projects, research/work experience, programming skills, and clubs that you’ve participated in. If you have a strong opinion about what industry you’re interested in working in, for example, in tech startups or the medical industry, there is a filter that you can use to indicate that information to companies on your user profile. On the other end, companies can use that same filter to narrow down and find which students express an interest in working in their respective industry.

What kind of businesses can access your EUREKA profile?
Right now, there are 25 active companies in the system using EUREKA, and any number of them may have varying numbers of hiring managers, for instance, 1 to maybe 8, all looking for students that meet certain criteria to work for them. We want to make it clear that the businesses using EUREKA are ones that we’ve met with personally and vetted to ensure that the jobs that they’re providing are high-quality engineering jobs for our students. We want to establish long-term relationships with these companies so that the students can see the value in using our program.

What other service do you think would be useful for students to utilize in their search for a job?
Well you mentioned LinkedIn, and that is definitely a great resource. The Internship and Career Center has Aggie Job Links where you can view job postings and you can submit your résumés with them as well. We also advertise to EUREKA users first about off-campus tours of various businesses, so that they are given an early opportunity to get involved. These tours are very popular, as they give students a feel for a company’s culture and work environment, which in the long-run is probably one of the most important factors to students in looking for a place to start their careers. We’ve had some students finish tours saying, “I can never see myself working there, it’s way too sterile and quiet,” and other students after tours find themselves loving the company culture and the people there even more. When it all comes down to it, the question you should be asking yourself is whether or not you would enjoy working at the company you are applying to, because you are (ideally) going to be working there for a long time.
Why do you think it is important for students to stay connected and network with others?

I’d say that in more than half of our company tours, you are usually meeting with alumni that have had successful careers that want to connect with students to contribute back to the school. This just really gives a little bit more value to your degree, and if you eventually assume that same position, you could continue the cycle of giving back to establish a communal synergy that will help you, now, and future students later.

What skills do you think are most useful in trying to find a position in a field of work you want to be a part of?

When we were given feedback from the companies that use EUREKA, they said that Davis students undoubtedly stand academically toe-to-toe with other schools like Cal Poly, Berkeley, Stanford, and San Jose State. However, the major difference was that, in general, Davis students were more lacking in internship and industry experience. We want to get this information out there, so that we can let our students know that this is what stands out on a résumé and just exactly how valuable that experience is to a hiring manager when they’re sifting through a stack of potential employees’ résumés.

What role do you think social media sites such as Facebook and LinkedIn play in a prospective employee’s search for a job?

To tell you the truth, I’m not sure how many companies are using LinkedIn to find college students because I haven’t received much feedback from students saying that companies have actually found them through using the site. However, I do think it is important to be present there and to use the site, because it provides easy networking tools for students to reach out to Davis alums at the companies that they may be interested in working for. You can quickly look up important connections to set up a meeting or to email them with questions about more on working in your desired career field. People are generally receptive to the fact that you’re showing interest in their industry and they’re more than likely to be willing to help out students who reach out to them.

So, do you have any advice for first year students and incoming freshman in terms of maybe finding a job, looking for undergrad research, and/or staying involved in school activities?

As far as finding a job, start early. If you haven’t zeroed in on what you want to do yet, be open and receptive to a variety of options. Join the off-campus tours, and look into a wide number of industries, like startups or large companies. Compare and contrast the two environments, see what you like and what you don’t. You should often be taking advantage of on-campus resources, whether it’s the EUREKA system, events that your department is hosting like career fairs and socials, making sure that your resume has been reviewed, going to the internship and career center, and having the experience of doing both an on-campus and industry internship. There are so many avenues for students to explore during their years here at college that I think it’s almost overwhelming! I think, however, developing persistence is very significant for a new student to do. Stay at it and start early, don’t wait until the last quarter of your senior year to be doing these things. Starting as early as possible doesn’t hurt, and can really help you in the long run.

Thanks so much for your time, Kelly. I’m excited to let more students know about the many accessible career and résumé polishing tools available to them now online and offline, here at UC Davis.
Discovering Your Passion Through Research
by Elaine Cho

One of the most frequently asked questions among undergraduates is “what am I passionate about?” This is a valid concern for many students, considering the tremendous amount of pressure revolving “turning your passion into a paycheck,” as the saying goes. But luckily for you BME’s reading this, there is a plethora of opportunities that you can explore, one of which includes research! I talked to the future BMES Vice President of Research, Lydia Lui, to get her two cents on her experience and advice on research.

Lydia is a junior biomedical engineering student specializing in tissue engineering. She decided to pursue biomedical engineering because she viewed this field as a unique science that encompasses a variety of disciplines and challenges and allows for critical thinking across endless applications. Lydia explored her passions within BME by getting involved with research.

“Research is a great way to gain experience in the field you are interested in—not just for potential employers, but also for deciding which subjects you want to pursue. I became involved with research because I wanted to find something I could be passionate about enough to dedicate my life to.” In the past, Lydia interned for a pharmacology lab, where she replicated favorable DNA (running PCR) and using IR spectroscopy to analyze neural proteins. She explained that it taught her a great deal of skills that she normally wouldn’t find in a classroom. “I met and learned from some great people in the industry. I understood how to operate in a professional workspace. I figured out exactly what I want and do not want to do. Most importantly, I learned that I am capable of being passionate enough to fully immerse myself in a project.”

Many students wonder how to stand out amongst tens of thousands of other bright students in such a prestigious university as well as how to improve themselves not only as students, but as future employers and leaders. Becoming involved with research is a fantastic way of taking the first step towards fulfilling these ambitions. In addition to developing research skills, getting involved with research enables enhanced communication skills, a better understanding of research topics, and most importantly, a boost in self-confidence. When equipped with these tools for success, self-improvement is a very realistic and rewarding achievement.

To anyone interested in looking for research opportunities, Lydia suggests skimming through various departments’ faculty pages and selecting a few professors whose research focuses seems intriguing and potentially an area that you could see yourself working with. “Read up on past and current projects to get a sense of where you can fit in and contribute to the lab. Take the time to get to know your professors, and then ask them if you can get involved with their lab. However, don’t be afraid of asking: I used to be so intimidated by my professors and TA’s that I even had trouble asking for help at office hours! It took time for me to realize that they are just regular people who are passionate about their work. The worst that can happen if things don’t work out as planned is that you have to spend a little more time looking for another lab to join.”

Above all, realize and remember that you are capable of accomplishing any goal you dream of as long as you set your heart and mind to it.
“Biotechnology entrepreneurship is the sum of all activities necessary to build an enterprise through the melding of both scientific and business disciplines,” writes Craig Shimasaki MD PhD in his book, Biotechnology Entrepreneurship: Starting, Managing and Leading Biotech.

Managing the intricacies of this cross-discipline enterprise can be difficult, even for the seasoned entrepreneur. Many new businessmen/women mistakenly start with the belief that “completing scientific research is equivalent to success.” This is not so. In fact, Shimasaki states, the difficulty is often underestimated, especially in comparison to general entrepreneurship activities. Biotechnology has unique challenges that other entrepreneurial endeavors do not face, such as stiff regulatory requirements, the need for enormous amounts of money to make incremental progress, inherent scientific uncertainty, longer delay of results, and addressing symptoms of unknown conditions or causes of disease… etc. On top of all this, “no matter how great a product idea or technology concept may be, without continued and uninterrupted funding, it is nearly impossible for any biotechnology product to reach commercialization.”

Thus, a biotechnological entrepreneur must be able to navigate the duplicity of both business and scientific aspects atop of other innumerable start-up issues. Between an idea and the market, the need to remain appealing to investors is a delicate balance between scientific progress and the necessity of capital. A casual survey of existing startups reveals clear correlations between success and very specific personalities. To name a few, these individuals tend to have a driving passion for their work, an innate ability to inspire and communicate their vision to others, the ability to take calculated risks, and acceptance of responsibility as well as ownership of failure. The understanding that all responsibilities and experiences have an impact on personal success is most integral. In addition, biotech entrepreneurship requires an awareness of the “Unknown-Unknowns,” an understanding of the purpose of negotiation, good core values and the capacity to be a multidiscipline translator with “the ability to speak and understand the language of business and science.” Unsurprisingly, the most crucial skills for great commercial outcomes are also those that new leaders struggle the most with. Most significant of all dangers is the unknown-unknowns, where leaders lack knowledge of an integral subject but proceed without recognizing or acknowledging these limitations. Simply put, there are things you know and things you do not know and then everything else that you were not even aware of not knowing.

However, aside from necessary and anticipatory caution, Shimasaki emphasizes that there is no reason to fear. Not one entrepreneur enters the field fully prepared. In fact, the vast majority may not have initially intended to start a biotechnological enterprise. Nonetheless, irrespective of position or goal, he encourages every individual, or “intrapreneur,” to endeavor to the same standards of humility and desire to learn. Biotechnology entrepreneurship- or intrapreneurship- can perhaps be best described as “a journey down a challenging path to a satisfying and rewarding destination,” where “the better-equipped entrepreneurs have a less-challenging journey than their counterparts,” but are not necessarily guaranteed success.

There is no principle model for integrating and managing business and science, but all individuals can equip themselves with the tools to be successful, be they an entrepreneur, intrapreneur or both. For students and fledglingpreneurs, this may sound familiar. Education is but one of the stepping stones to success. The next is entirely up to you.
As a second year student, I am in the process of deciding which specialization I want to pursue. After looking at what UCD professors and researchers were doing in the different fields—biomechanics, cellular/tissue engineering, imaging, systems and synthetic biology, and medical devices—I narrowed my search to the three topics that interested me most. Cellular/tissue engineering first caught my attention with the possibility of being able to engineer new tissues and organs for people in need of transplants from their own cells, eliminating the risk of organ rejection. Medical devices like the pacemaker always fascinated me with their ingenuity and ability to drastically improve the lives of patients. Finally, as the granddaughter and the niece of breast cancer survivors, specializing in imaging would allow me to help improve the process of diagnosis for cancer patients. After deciding that these three options were the most exciting to me, I did the obvious thing: I took to the Internet in pursuit of more information. With that, here are a few exciting news stories I found in my search.

**Cellular/Tissue Engineering**

One of the biggest issues in tissue engineering is how to develop a way to build organs that patients’ bodies won’t reject. In ten years, we may have a solution. Cardiovascular Innovation Institute and University of Louisville researcher Stuart Williams has announced that he anticipates being able to 3D-print a complete bioficial heart in ten years. “It took ten years to put a man on the moon,” says Williams. “We think that we can do it in ten years—that we can build from a patient’s own cells a total bioficial heart.” The process involves using a 3D printer that prints using the patient’s cells. This would ensure that the body would not reject the new organ, and it would essentially serve as a cure for cardiovascular disease. The printer uses Cartesian coordinates, which means that the printer does not simply extrude a structure layer by layer, but can add cells to any place in the structure. Currently, small parts of organs are produced from patient’s adult stem cells from fat, gathered via liposuction. The same process would be used to build whole organs, with collagen as the main “glue” holding the cells together. Williams and his team have printed small capillaries, so they are able to develop structures that are pre-vascularized to keep the cells alive. They are working on small and large blood vessels, as well as muscle cells. The ultimate goal is to be able to extract a patient’s fat cells and print a new heart within an hour, and then perform a heart transplant surgery with the patient’s own new heart. Williams estimates that the cost of printing a bioficial heart will be less than that of a typical heart transplant in today’s terms, especially because there would be no cost due to anti-rejection drugs. This project, if successful, would change the way we look at heart disease and would likely reduce the large death toll to which it contributes. Looking to the future, Williams wants to get as far as making a pancreas that creates insulin, which will be an immense benefit to diabetic patients.
Medical Devices

A team of Stanford engineers recently developed a working prototype of a tiny, electronic chip to be implanted in the body in order to monitor processes in the body, treat illness, and/or relieve pain. The team, led by Amin Arbabian, built the chip, which is the size of the tip of a ballpoint pen, to be able to convert beams of ultrasound into electricity, carry out a command, and confirm completion of the command via radio antenna. The electricity the chip uses is “piezoelectricity,” or electricity produced by pressure from the ultrasound waves. The use of ultrasound waves allows for the small size of the chip—direct power from wires or batteries would have made the device much larger and bulkier. Arbabian’s team operated the device in chicken meat to emulate human tissue. Even with such a small size already, the next step is to make the chip smaller. The hope is that this device will be used for a wide array of medical applications, such as in-depth study of the brain and the nervous system, possible treatment of Parkinson’s disease, and delivery of therapeutic electric jolts to points of pain in a patient.

Imaging

In patients with breast cancer, breast conservation surgery (BCS) is increasing in popularity over mastectomies due to advances in cancer screening and chemotherapy. BCS involves taking out the tumor and a margin of surrounding non-cancer cells, in order to avoid taking the whole breast. However, often there are cancer cells remaining in the patient, resulting in a second surgery needed to remove the smaller mass, with higher risk to the patient. Therefore, studies have begun using near infrared (NIR) light to image cancerous specimen removed from the patient to confirm that all the cancer cells have been removed. The goal is to analyze images of the specimen during the surgery in order to prevent multiple surgeries. However, surgeons mark removed specimen to preserve the orientation of the specimen when it was in the patient, in case further excision is required. These surgical inks used to mark the specimens interfere with the NIR imaging process, rendering the images useless. Fortunately, engineers at Dartmouth’s Thayer School of Engineering have developed a way to obtain a better image of specimen while still allowing surgeons to mark the specimen orientation. The group, led by Brian W. Pogue and Keith Paulsen, found that molecular dyes, especially FD&C (FDA approved) food dyes, could be used to mark the specimen without ruining the images. This will aid in making intraoperative NIR imaging clinically feasible, and will ultimately reduce the number of follow-up surgeries in breast cancer patients.

As I researched these different areas of BME, I realized that there are a million possibilities in this field; the future is wide open, so we just have to take the baton and run with it. I know that when I chose to become a biomedical engineer, I made the right choice.
What is the event and its purpose?

Every year the Biomedical Engineering Society (BMES) collaborates with the Biomedical Engineering Student Association (BESA) to present the annual BME Research Expo. The BME Research Expo is a poster session, where various BME graduate students from the Department of Biomedical Engineering come together to present all the different types of research that occurs within this interdisciplinary major. It is through the help of BESA, which is the Biomedical Engineering group for BME graduate students, that many current graduate students are recruited to present their research at BME Research Expo. The audience of this poster session event was the BME undergraduate population. For them this event is an excellent opportunity for undergraduates to be exposed to what types of research occurs within their department. Additionally, this event also becomes a gateway for the undergraduates to potentially get a position in one of the BME labs, as many of the presenting graduate student presenters do accept resumes.

What happened at the event?

The BME Research Expo was held on Wednesday, May 6, 2015. The event began at 5:10pm with a presentation from one of the BME Associate Professor and Principle Lab Investigator: Dr. Yamada, who studies cell-to-cell interaction, adhesion and movement. Dr. Yamada’s presented the essence and importance of participating as an undergraduate in research. He also explained how to get a research position and what he personally looks for when he recruits undergraduate students; which are students who have a dear passion and interest in the research that occurs within the lab, and also a having a good GPA. He said he does not really look for students who already have lab experience, as he understands most undergraduates have just begun their academic career. After Yamada gave his presentation, the poster presentation began where the graduate students presented their work to the undergraduates.

The outcome of the event was amazing. Many undergraduates learned so much about what opportunities were available in biomedical engineering. Also the graduate students were also pleased about the event. Fellow Graduate Student, Timonthy Kwa, said “The BME Research Expo was a great event enjoyed by grad students and undergrads alike. The grad students had a wonderful time engaging with the undergrads about their research. It also helps to get a bit of perspective! Sometimes grad school can be tough and research can be slow, but by talking to undergrads and getting them interested, we get a little hyped up for our projects as well!”.
What Was Presented?

No matter what specialty you plan to pursue as a Biomedical Engineering at the University of California, Davis there are many exciting research opportunities to get involved with. At the Research Expo, labs from every specialty came to present their work to the undergraduate population. Though the expo didn’t include all BME labs, it did a pretty good job of exposing undergraduates to the research opportunities available within their intended specialties.

For example, the Biomechanics lab of Maury L. Hull was available at the expo presenting their work on orthopedic biomechanics. This research group is working to develop new surgical techniques for total knee replacements by designing a procedure for more natural replacements. They are looking to develop a new technique that would increase the success rate of knee replacements by changing the standard procedure to a more personalized procedure. Through the help of advanced imaging techniques, they could design better replacements that can replicate the patient’s natural alignment. Also present was the Eduardo A. Silva Tissue Engineering lab. This research group is designing and testing revolutionary methods for blood vessel growth. By taking advantage of the ability of stem-cells to differentiate into any bodily cell, this research group is developing an implantable, biodegradable scaffold that can be used to promote blood vessel growth. There was also a Systems and Synthetic Biology research group from the Revzin lab presenting their new method in analyzing cell-cell interactions. Modern methods for analyzing how cells interact with each other are performed by putting two different cells into the same cell medium and observing the changes. Cells do not interact in this manner within the body so this is not the best method for analyzing cellular interactions. To address this, the Revzin research group is designing a new compartmentalized device which contains a permeable membrane where only cellular signals can pass through. This is a more realistic approach to analyzing cellular interactions. The Simon R. Cherry Imaging lab was also present at the expo. This lab is focused on the design and development of new and improved imaging technology and contrasting agents for use in diagnostics and therapeutics. Their particular technology of interest is positron emission tomography (PET) and its integration with magnetic resonance imaging (MRI) and X-ray computed tomography (CT). In addition, a Medical Device lab led by Dr. Syed K. Khaderi was at the research expo. Dr. Khaderi’s research focuses on the development of innovative technologies for the diagnosis, monitoring, and rehabilitating the human visual system. This lab is working to develop a new method to establish a non-invasive baseline using existing technology to analyze for possible traumatic brain injury (TBI).

These labs were not the only labs presenting at the research expo but they are perfect examples of the diverse opportunities available to BME researchers. Next time, drop by, take a look, and you could possibly land a position in any of these exciting labs, and others!
‘Girls Night Out’ is a renowned outreach event that BMES always look forward to each year! This year BMES had the pleasure of hosting it and it was, yet another, great success and fun-filled night at GBSF on Friday, April 3rd. Girl’ Night Out is an annual outreach effort designed to encourage the study of STEM (Science, Technology, Engineering and Math) fields to young girls within the local community. This year, we had 60 “Brownie” Girl Scouts (GS) of the second and third-grade from our very own Davis community. "Brownies" are at their 2nd level of the GS Journey and includes activities of discovery in the outdoors, science, health, and philanthropy.

BMES Vice President and Outreach coordinator, Natalya, shares why Girls’ Night Out is such an established and important event, “First, women in STEM fields are severely under-represented, and we want to encourage as many females as possible to consider such careers. Second, studies have shown that getting children involved with science at a younger age, has a greater impact on their long-term involvement and success with STEM topics...We want to give these girls a chance to discover that science and engineering aren’t only accessible, but also can be fun!”

The excitement and enthusiasm from our BMES volunteers, 60 GS, and their chaperones turned our subtle GBSF lobby into an active and innovative science laboratory for the night. The BMES Outreach committee, including officers, Matthew Ho, Manny Sandhu, Natalya A Shelby and Rose Hong Truong constructed a rotation of 5 ‘maker-activity’ booths, all relevant to the STEM field. And it’s no surprise the “Brownie” GS knew to perform each experiment with imagination and creativity. And when needing assistance, the GS knew a little teamwork and optimism can pull them through any complications.

BMES President, Rose Truong, acknowledged that BMES had facilitated the event ‘a bit differently... rather than formally ‘telling’ them about STEM topics, we’re hoping to inspire their interest in science, technology, engineering and math, via the ‘maker’ stations.”

The STEM ‘maker-activity’ booths included: Strawberry DNA Extraction, Edible Lip Gloss, Invisible Ink, Resistor Jewelry, and the oh-so-messy, but fun non-Newtonian fluid, “Oobleck slime”. For dinner, BMES even provided the girls a booth with drinks, snacks, and an assortment of ingredients to ‘Make-Your-Own sandwich,’ allowing the girls to further their STEM mindset so that they may constantly use their ‘noggins’ in everything they do.

The night finished off with an informative STEM presentation by, Ms. Marianne Jackson, a High Performance Computing Business Developer at Intel Corporation. She encouraged the Girls to do their best in their future endeavors and to keep the STEM fields in mind even after the momentous Girls’ Night Out.

Great job, BMES, in hosting our first Girls’ Night Out!
Oftentimes, in the hectic whirlwind of academic and social obligations, the desire to apply our knowledge towards teaching younger students the awe-inspiring wonder of what we engineers do simply evanesces from consciousness; yet, however preoccupied we may be in our arduous journey, we must remember that not only do we inspire future innovators but these outreach events afford us the unique opportunity to learn from the students. In addition to introducing young minds to the marvelous world of biomedical engineering, the outreach events we organize strengthen our leadership abilities and grant us access to an invaluable network of educators and administrators. This is the ambitious goal of the UCD BMES outreach committee and, over the past year, we’ve conducted various successful outreach events that captivated and encouraged young engineers from all walks of life. With this in mind and under the leadership of our newly elected STEM Outreach Coordinator, Mandeep Sandhu, the six of us enthusiastically embarked on our journey towards Heritage Peak Charter School in Elk Grove. As we gleefully passed through the front doors of the charter school, we were welcomed by the warm administrators and were led to the biotechnology class. From the moment we stepped in, we were confronted by inquisitive, engaged students that eagerly tackled our wonderfully simplistic project for the day. Cleverly titled “One Helmet of an Activity”, this creative activity encouraged students to collaborate in teams to design and develop a safety helmet that would comfortably envelop, without restricting the field of vision, our subject’s head: a water-filled balloon. After Mandeep delivered a succinct list of design constraints, we distributed the materials and began walking the room, offering helpful advice and engaging in humorous conversation with the design teams. Throughout the activity, we collaborated amongst ourselves about the particular ways we could shake things up and ultimately decided to introduce a last-minute corporation change that would require the utilization of a new plastic material – a red Solo cup – within their helmet design. As the timer wound down to completion, the students retained their cool and finished their designs with smiles on their faces; we then asked each team to give a brief description of their individual designs, their motivations behind its construction and why they believed their designs were optimal. After capturing each team’s thoughts and pictures, we transitioned to the delightfully exciting part of the activity: design validation via testing.

Throughout my extraordinary BME experience, one of the most enjoyable, eye-opening, and, often, wonderfully messy, segments of the design process would have to be the physical testing phase of the project. For this portion of the activity, we headed outside and gave the students a chance to prove that their helmet design would protect their obviously anxious water balloons; for the phase 1 trial, we asked a representative member from each team to place their contraption at a height of 3 feet and to subsequently drop it onto the concrete pavement. Of the four teams that began the phase 1 validation trials, all four successfully protected their precious balloon subjects, with a notably hilarious ejection of team 1’s balloon. Next, we increased the drop height to 6 feet and repeated the trials and, this time, team 2’s design couldn’t withstand the forces exerted as their balloon erupted onto the concrete. Phase 3 rose the stakes even further when we decided to elevate the drop height by approximately 3 inches; we discovered that the remaining three teams all successfully passed this trial, so we decided to alter the testing conditions by conducting the balloon helmet drop over an area of tanbark. Astonishingly, two of the original teams survived all four validation trials and it was left to us to decide which design was the winner; after discussing amongst ourselves the design criteria, manufacturing and profitability of the two durable constructs, we ultimately chose team 3’s fantastically simple design, thus confirming the principle of Occam’s razor: the simplest concept is oftentimes the correct one.

Our last BMES outreach event for the year ended with a heartfelt, honest and humorous exploration of who we all were and our ambitions and aspirations; we imparted practical advice about selecting colleges and financing higher education while highlighting the plethora of opportunities that biomedical engineering can offer students. We stressed the fact that community involvement and working for the improvement of society were the cornerstones of the BME profession and dispelled any negative notions of community college. In conclusion, this was an absolutely wonderful outreach event that, I believe, left a lasting impression on everyone involved and reinforced the notion that we all have the ability to help someone in need, no matter where we are in our education or how miniscule the improvement.
Can’t decide what classes to take? Want to take the first steps to getting involved in research labs? Don’t know which is the best Thai restaurant in Davis? Sometimes college can seem overwhelming, especially for freshmen and transfer students. Thankfully, BMES has a unique Mentor-Mentee Program that can help students receive guidance from upperclassmen and graduate students! Mentors and mentees are paired together based on their similar interests, whether it is in research, industry, or electronic dance music. Mentors provide their mentees with all kinds of social and professional advice that can go beyond academics and into advice on future careers. Having the assistance of a mentor can be very valuable for getting through college, since they have a few more years of helpful wisdom. Life tips are always useful for surviving the undergrad years, and can make the college experience easier and possibly more enjoyable.

My mentee is a pre-med freshman student and has to take several extra classes, so I always help her plan her schedule around registration time. I’ve given her advice on how to space out her required classes so she doesn’t overload herself, as well as telling her my experiences with certain professors. Having taken all the core classes already, I have been able to give her a good idea of how difficult certain classes are. I gave her some of my old textbooks so she wouldn’t have to buy them from the bookstore. Sometimes I run into her at the Dining Commons, which lets us catch up and chat for a bit. She also didn’t realize freshmen can stream free movies in the dorms, so it seems I also helped provide her with some entertainment for her study breaks.

Mentor-mentee interactions can provide good networking opportunities for both parties. Getting to know grad students is a good way to connect with a lab and find undergraduate research experience. Throughout the year there are multiple social events geared towards bringing mentor-mentee pairs together to do fun games and schedule planning, such as the Super Smash Bros. tournament earlier this quarter. With so many social and professional opportunities, it’s no wonder that the Mentor-Mentee Program serves as the heart of our BMES chapter.
Traveling with Nickie
by Nicolette Sarmiento

I have always been fascinated with maps. I like tracing the borders between countries or pinpointing the capital cities, identifying famous landmarks, and penciling them in my world atlas. I never expected to reach a milestone I didn’t know was ahead.

Growing up as an only child, I was fortunate enough to have parents who both loved to travel. We would go on trips across the country to either visit family or to just cross some place off their list. For instance, by the time I was five, we had visited all of the Spanish missions in California, a random, yet satisfying feat for any tourist. When I turned seven, my mom and I began a new tradition of going annual trips to new places together. We started out in the United States, taking trips with family (Oahu, 2003), road-tripping from state to state (The Grand Canyon, 2005; Yellowstone, 2008), going on school trips (Washington, D.C., 2007), and even splurging a little at Disney World (Orlando, 2002). We covered a lot of ground stateside before I started high school, but my mom and I thought it was time to set a new goal.

The summer before my first year of high school, my mom surprised me with a two-week trip around Italy. For Italy to be the first European country and culture that I experienced at such a young age was a big deal considering how obsessed I was with its history, language, and, most especially, the food. Not to mention that an Italian vacation isn’t something the average fourteen-year-old gets to do.

This was the trip that started it all. Seeing ancient landmarks like the Coliseum and the Vatican in Rome, going on gondola rides in Venice, and eating pizza and gelato Sorrento. From then on, I fell in love with everything about traveling from the airplanes to the numerous stamps on my passports. However, the best thing about traveling was not only the exotic places, but also the people I met along the way. I would hear stories from surgeons from India, chefs from Australia, to students from all over the world. Hearing about their lives and struggles challenged me to set and shape my own goals to contribute to the world that seems both endless and small.

After traveling for the past 13 years, I realized that new places intrigue me because being in a new place both satisfies and feeds my curiosity about humanity. I often have a tendency to have a very singular point of view but experiencing new places has forced me to widen my perspective and see the world and the people in it for their flawed beauty. It also pushes me to transcend the goals for myself and share what has been shared with me.

I’m twenty now. I’ve been 25 of the 50 United States, 22 countries, and 4 continents. I know that that’s more than some people ever get to accomplish in a lifetime. I also know that I still have a long way to go!
As a fourth year biomedical engineering student, a member of the Biomedical Engineering Society (BMES), and the president of the Society of Women Engineers (SWE), Shalini Majumdar is quite a busy woman; and her final year at UC Davis is quickly coming to a close. During her last year as a biomedical engineering student, Shalini has been part of the Senior Design class, in which groups of BME students design and build a medical device in order to apply the knowledge they have gained and get hands on experience in the medical industry. Shalini’s design team has been working on a device to measure the amount of pressure that a cerebral palsy patient puts on their walker as they walk; an idea given to one of her group members per request of a colleague of UC Davis’ Dr. Tran. Shalini initially was on the pre-med track but soon decided that she enjoyed her engineering classes more than biology and that biomedical engineering was the right field for her. Shalini is specialized in medical devices and upon graduating will be working with electrical engineering company, National Instruments.

How has BMES impacted your education, has it helped prepare you for your future as an engineer?
BMES has been extremely helpful over the years; it provides many resources and opportunities for aspiring biomedical engineers. Lab and industry tours were especially impactful for me, since they show what working as a BME will be like and how labs operate, and introduce us to people who we could potentially work for.

What is the purpose of SWE on the UC Davis campus?
SWE has three main goals: to increase diversity among the engineering field as a whole; to make young women feel welcome in STEM fields if it is something that interests them; and to provide a network for women engineers at UC Davis.

How has the senior design curriculum impacted your education as an aspiring engineer?
Senior design project makes us apply everything that we have learned throughout college and has had a huge influence on me. It is a great experience to work in groups, as we often will on a real job; I wish we had it before senior year! I feel much more prepared for my career after learning how to document lab reports, revise designs and apply for FDA approval, which are crucial aspects of biomedical engineering. The whole process has made me so glad I stuck with biomedical engineering; it is extremely rewarding to work on projects that have the potential to help so many people.
What have been the most challenging parts and best parts of your college experience?
In the beginning of college it was hard at times to stay focused on the big picture and keep motivated while I was taking core classes that were not directly about biomedical engineering. The best part of college for me has been meeting so many incredible people through BMES, SWE, and social activities outside of class.

Do you have any advice for younger BME students?
I would say my best advice is to never give up. I have seen so many people throughout the years who hit a roadblock and then just quit. There are so many resources available at UC Davis for students who are struggling, and it is important for us to learn how to ask for help and recognize when we need it. Do not give up on your passion just because it is hard, if you really love something then you will find a way to make it work.

As for me, being a first year biomedical engineering student and a young woman, it was amazing for me to have the opportunity to speak to Shalini. She has been through many of the same situations that I am now going through and has had so much success at UC Davis. It is encouraging to see that all the work and stress of core classes is worth it once you become more involved in engineering classes and begin to specialize in what you are truly passionate about. After talking to her, I cannot wait for all the great things to come and I hope to have the same amount of success and joy that she has now. Her passion about the field of biomedical engineering and excitement about both UC Davis and her future is evident and it is clear that she is ready to take the next step into her career as a biomedical engineer.
It never quite struck me that college would actually be difficult. I’d heard stories about how engineering was brutal and how college in general was stressful, but my high school experiences had misguided me.

Graduating with a 3.9 unweighted GPA and as Red Cross Club president and band section leader, high school had been good to me and for me. I was more than happy with all that I’d achieved and did not think that college would be any different.

However, right at the start of fall quarter, I felt the difference between high school and college that I should have expected and prepared myself for months earlier. My grades were not near what they were in high school, though I was studying harder and longer.

The fear that my grades would only drop further deterred me from joining campus organizations. My lack of involvement prevented me from meeting new people with shared interests, and my friend group was stagnant. Winter quarter came and went, and my academic and social lives saw only negative change and I was more discouraged than ever.

I received multiple bad grades that made me feel as if I wanted nothing more than to go home, and what hurt and appalled me the most was that everyone around me seemed to be having fun. College was not panning out to be everything that I hoped it would be and I was mad at myself for not allowing it to be “the best time of my life.”

Despite my less than desirable grades, I decided to put myself out there. I joined BMESsenger and tried to become more active in other organizations. My friend group both solidified and expanded over the course of winter and spring quarter, and I built more meaningful friendships.

I realized that a big part of not liking UC Davis was not having friends that I felt close to. Making myself feel at home was a key component of creating an environment in which I could flourish academically. Sure, I wanted to do well and succeed but I could not find success without happiness. In essence, my dislike of life at Davis prompted my poor academic performance.

By midway through spring quarter, I had joined a couple organizations, and was doing better academically than I had since the beginning of fall. I received A’s on multiple midterms and was able to prioritize better than I had been since college started.

Maybe my fall and winter quarter failures were because of the shock of the quarter system, or maybe school was just plain difficult, but my third quarter at Davis really made me feel like I had a grasp on my life. I turned over a new leaf and slowly adjusted, with the help of my new friends.
As it turned out, many of my friends, whether pursuing engineering majors or not, went through the same initial slump. We all had our share of failures but were able to bounce back from them. I now know that engineering will be difficult, but I am ready to improve any aspects of myself that will help make this extended transition to college one that will go over more smoothly next year. This year has taught me that there is truly more to life than academics and that enjoying my life is what will really help me do well. The competitive academic environment of Davis will never ease up, but I am prepared to involve myself and create an environment for myself that I feel comfortable in so that academic success simply follows.

Transfer Student Perspective

Upon transferring to Davis, I didn't know anybody within my major. I had a lot of friends who transferred with me, but being in a quarter system, school got busy pretty quickly. Prior to transferring, I had a study group for each of my class, but this time I was alone. It kinda sucked. I knew that in order for things to get better, I needed to step of my comfort zone. I mean I am paying 25 G's to be here so what reason did I have to be shy.

In order to meet more people, I joined the Biomedical Engineering Society (BMES) and Synthetic Biology Club on campus. For BMES, I joined the outreach committee whose purpose is to teach young kids what amazing things biomedical engineering can accomplish. I volunteered to go out to elementary schools teaching kids how we could manipulate DNA, and it was amazing what these kids took away from it. I was never exposed to anything like this as a kid, but if I had the same opportunity as everyone in that classroom then I would have been dead set on BME a long time ago. In Synthetic Biology, we had long discussions regarding the future and ethics of genetic engineering. I find it exciting hearing about how close yet still far away we are from achieving miraculous depths in science.

In order to improve my night life more, I decided to take salsa lessons at the Graduate. I have two left feet when it comes to dancing and I can't keep a beat to save my life. I was really out of my comfort zone, but I was totally down to learn how to dance as I read on an online study that women find men who can dance more attractive than those who can't. I was really glad that I had gone to those lessons. Everyone was super friendly, and all the professional were totally willing to help out novices like me. Unfortunately, Tuesday nights were not an ideal time for me to commit to dance, as a life of engineer could get a bit hectic.

To make my stay here at Davis more life changing, I got a badass cook book called “Thug Kitchen.” I don’t want to think back about my days here in Davis remembering that all I ever ate was top ramen. I wanted this period of time to be defined as where I learned to cook at least half as well as my mom. This book has taught me a lot of cooking hacks, and I feel like a chef after every meal. I try to make at least one new recipe a week.

I can very honestly say that I am excited for next year. I found my study groups, senior design team, hang out buddies, and even some mad scientist. To top it all off, I was also elected to be next year's STEM Outreach Chair. Next year will be full of challenges and mixed emotions as graduation will be around the corner; however, I will be ready and take on whatever forms of adversity life throws at me. I do not know how successful I will be, but I will keep moving forward. It's when you are on your last lap that you sprint faster so that you run across the finish line with everything you got. So long as I give it my best, I can end my race with my head held high.