Next quarter, BIM 167: Biomedical Fluid Mechanics will be offered for the first time. The class will explore the in depth applications of fluid mechanics to biomedical engineering, with things like the design of fluidic diagnostics devices, the pharmacokinetics of drug delivery, and the dynamics of cardiovascular systems. The class will also include a project where teams of students will design a biomedical device using their newly acquired knowledge.

This course is not the first time Dr. Tan has taught a biomedical subject, having taught Biotransport classes during his time at Duke University. For BIM 167, he expects students to be able to use what he will teach them to formulate models to analyze fluid mechanics in biomedical systems.

Fluid mechanics is not a topic solely in the domain of the biomedical engineer. It is a familiar topic among all engineers, and indeed, there is a general fluid mechanics course offered, ENG 103. However, while the topics may be the same, their focus is different. ENG 103 focuses on the general principles of fluid mechanics for application in all engineering fields. So for those interested purely in how fluid mechanics can be applied to BME, then BIM 167 is the course for you.
For those wondering why there is an entirely separate course, the department has good reasons to do so. First, classes offered by another department can be oversubscribed by students. Everybody has heard the horror stories of not having enough space in a class, and the long waitlists that come as a result. Secondly, the course can be integrated with other course offerings, and can focus on specific topics that are related to biomedical engineering.

New courses are always an interesting prospect, but the process and work that happens behind the scenes to create a new course in the first place is exciting in itself. Course needs are first assessed by the Undergraduate Affairs committee and the Vice Chair of Education, and new course proposals are presented at faculty meetings for their comments. New course recommendations can also be made by students or the faculty. Then, the new courses are sent through a committee approval system and then reviewed at the college and university level. Every new course must be approved by the Committee on Courses of Instruction at the campus level before a course number is assigned and it can be offered to students. Furthermore, a professor will have to be assigned to teach the course as well. The department looks at individual faculty expertise, the needs of the curriculum, and the current teaching loads, maxed at three classes per year per faculty, before assigning someone.

BIM 167 promises to be an exciting new course in the Biomedical Engineering curriculum and if you are interested in the many topics mentioned that require fluid mechanics, you should definitely sign up.

**FACULTY SEMINARS**

**BY: DAICY & LIZA**

**Dr. David Kaplan**

On February 27\textsuperscript{th}, we were happy to invite David Kaplan of Tufts University to come discuss his research on different kinds of biomaterials and their applications to various academic fields. Although his research encompassed the study of resilins, elastins, and collagens, the main focus of this seminar was the discussion of his lab’s research on silk and how its myriad of properties could be altered to fit biomedical applications—thus functioning as a true biomaterial. Silk is not one of the first materials one would consider when discussing biomaterials, but because we can change its morphology, chemistry, and properties, the application of this material is endless. Inside the silk worm, the material is kept in a liquid meta-state (of proteins) inside the glands. As it is spun by the animal, the pH of the material goes from high to low, protein concentration increases, and water loss allows the silk to form into the solid, fibrous structure that we see from the cocoons. In addition, because silk is a tough material and has physical cross-links, it has a formidable protein backbone for sequence manipulation. Professor Kaplan’s research also involves testing the efficiency and sufficiency of the material on tumor cells. From his data, he showed that silk’s stable transport mechanism coupled with the drug delivery of a cancer medicine was effective in treating tumors and not affecting the heart weight of the specimen.
Despite that success, he was quick to note that the silk’s structure was an important factor in effective drug delivery because when the silk was in an unstable liquid form with the drug, it was not as helpful and caused considerable heart weight loss in the mouse specimen—something quite deadly!

Professor Kaplan ended his seminar in discussion through various biomedical applications from bioink that allowed antibiotics, growth factors, enzymes, and even gold particles to be expressed to optical systems via degradable silk mirrors to electronic systems that he tested with creating a conformable silk plate that attached onto a cat’s brain. Coming to Davis, he even brought in a few agricultural applications of the silk material from recording the ripeness of a banana through an attached silk plate that conformed to the skin to testing the bacteria of cheese!

Who knew that the smooth material made for ties and other clothing could provide such a revolutionary insight into different biomedical applications? We thank Professor Kaplan for his engaging discussion on how his research has allowed such a breakthrough of silk as a biomaterial.

Dr. Mariam Maghribi

On February 20th, Davis alumni Dr. Mariam Maghribi returned to campus to give a seminar about her career pathway and outlook on a scientific lifestyle. She was a guest speaker in the Alumni Speaker series held earlier this year, and presented herself with the purpose of exposing students to opportunities in the field of biomedical engineering.

With both a B.S. from Georgia Institute of Technology and a Ph.D. in biomedical engineering from UC Davis, Dr. Maghribi has over fifteen years of experience ranging from bench work in the laboratory to commercial industry. Additionally, she holds dual MBA degrees from Columbia and Berkeley. With her hand in over twenty-two patents and thirty-six pending, Dr. Maghribi’s career boasts of success and fulfillment.

At the seminar, presented in the Genome and Biomedical Sciences Facility, Dr. Maghribi outlined her journey, discussing each monumental change that eventually brought her to where she is today, the Vice President of Business Development at Shifamed, a medical technology incubator company located in the Bay area.

The first aspect of her career in which she felt a strong impact was when she worked for Lawrence Livermore National Laboratories – there, where she worked heavily on a retinal prothesis research project. She discussed how difficult the work was, noting that it took almost a decade before the project was completed and ready to enter the market, with over 200 million dollars invested. Dr. Maghribi noted that at this point in her life, it was “difficult to find a problem to fit alongside [my] solution, and that’s never good.” At some point, the technology implemented into the research project was taken into a new direction, leading to the company Johnson & Johnson approaching Dr. Maghribi and offering her a place in their company.

At J&J, she was a principal engineer and there, she received exposure to business due diligence, the act of pitching sales and gaining approval for her research. The job involved lots of prototyping, and she commented that “I wanted to take my ideas and run them from start to finish, but that was something I didn’t get.” With that in the back of her mind, it was the tipping point for her when J&J rejected her proposal to actively work on the production of an “active band-aid,” an innovation that would promote wound healing by stimulating the affected area via micro-currents. Struggling
Dr. Maghribi returned to school to obtain her dual MBA degrees and it was here that she found her next calling, DeltaDOT.

DeltaDOT was a start-up company, and as it expanded, she had the opportunity of a lifetime to start a company from scratch in Qatar. While it was meant to be a company to stimulate the healthcare industry, Dr. Maghribi found herself leading the company to new frontiers, such as environmental issues.

Her work at Qatar eventually streamlined her to Shifamed, where she works in Business Development, though she still admits to occasionally jumping into the lab to help with research. As a company backed by multiple credentials, Shifamed's mission is to help find solutions for well-recognized clinical problems. To do this, the company holds its own IP (intellectual property, the “copyright” of an idea), and runs each viable idea into an exploratory phase where prototypes are made, before pushing it into a research & developmental phase. Finally, the product enters the exit phase, in which it is ready to be placed into the market for consumers. One example is Maya Medical, a company that innovated the standard usage of renal denervation, a treatment used to reduce hypertension.

With a net gain of over 20 million dollars, Maya Medical is a shining example of the impact that Dr. Maghribi has had in the scientific community and a display of her successful career.

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**BME WORLD NEWS**

**BY: NATALYA & PHILIP**

Hey BMES!! Natalya and Philip coming at you again in this quarter’s edition of BMESSENGER! This time, we’re writing about world news related to each of the specializations in our major! So kick back, relax, and check out what’s going on out there in the “real world”!

**Biomechanics**

Every four years the World Congress of Biomechanics (WCB) brings together scientists from disciplines as diverse as chemistry, computer science, biology, and math (just to name a few) to discuss biomechanical applications to the fields of medical devices, basic biology, and the latest technologies. The 7th WCB event will be held this year at the John B. Hynes Veterans Memorial Convention Center in Boston, July 6th-11th. The conference will include presentations from a bevy of speakers of the field and will showcase an undergraduate design project competition in rehabilitation and assistive devices!

**Cell & Tissue**

The future has arrived! Adult retinal ganglion cells from rats have successfully been printed for the first time using an inkjet printer. The printed cells were ‘indistinguishable’ from cells which hadn’t been printed, according to Dr. Keith Martin, one of the coauthors of the study. This innovation is an important step towards curing some types of blindness; eventually researchers hope to be able to print replacement
retinas for humans with blindness that is a result of nerve loss in their retinas.

**Imaging**

Brain imaging just got a whole lot clearer thanks to the work of Kwanghun Chung, a new assistant professor in MIT's Department of Chemical Engineering. Current methods of neural imagine can only render 3-D images of about 10 biomolecules at a time; with Chung's newly developed imaging technology CLARITY, he's hoping to be able to show images of all of the hundreds of thousands of biomolecules across the entire human brain. Chung's method involves preserving the brain cells while at the same time making them transparent and permeable. Chung says, “The good thing about CLARITY is that it’s not destructive. You can use it over and over again, adding and removing molecular probes until you extract out all the information you want.”

**Systems & Synthetic Biology**

The International Genetically Engineered Machine (iGEM) Competition is a global competition between students working on projects concerning synthetic biology. There are 3 divisions (graduates, undergraduates, and high school students) and with a total of 156 teams last year (from 5 teams during iGEM’s inception in 2004!). UC Davis, among various other institutions, gathered their primary competing team mid-February this year! Our team will be order a kit of biological parts from the Registry of Standard Biological Parts, and will be working over the spring/summer to build biological systems to present in the giant jamboree in October-November! UC Davis has done very well in past iGEM competitions, so there’s no doubt in my mind we will do great this year as well! No pressure guys!

**Medical Devices**

If your interest is in Medical Devices, keeping in the loop with news about the U.S. Food and Drug Administration (FDA) is essential because they are responsible for a lot of regulations for current and upcoming medical devices. Earlier this year the FDA admitted that their current tools in approval are ineffective and need change. They want to create a faster pathway for medical devices to ensure there is timely access to those technologies, while promoting innovation. For example, several makers of cardiac devices are turning towards other countries because of barriers the FDA has put for approval, such as the requirement for post-approval studies. Drug-approval pathways have faster review processes and still require post-approval studies, so perhaps we can create something analogous for medical devices. However, we must understand that limiting the standards at which medical devices are approved can backfire. Less data will be produced, thus patients and physicians will have less to base judgments on.

**Pre-Med**

There are always new and exciting news coming out in the field of medicine. The biggest buzz right now has been actor Seth Rogen’s Senate hearing on the funding of Alzheimer’s research. Mr. Rogen spoke before a Senate Appropriations Subcommittee on the current state of research on Alzheimer’s disease (AD). In 2006, 26.6 million people had AD, and are predicted to affect 1 in 85 people globally by 2050. Mr. Rogen pointed out that AD research has not been getting the attention it deserves due to the stigma associated with the disease. Despite the low turnout of senators, the video generated an internet buzz and has been shared through various social media sites. In the case for any disease, we won’t get far if the general public (and especially pre-med students like yourself) aren’t informed or proactively generating interest or awareness for the disease. We hope you keep this in mind as you are starting on your career!
INTERVIEW: VAISHALI MITAL
BY: DAICY LUO

Ever wondered what’s possible for you after you get your degree? Confused on the classes you have to take and how to get the most out of your undergraduate career? Have questions? Well we have answers.

For this edition, we are interviewing a BME grad of 2013: Vaishali Mittal. From her time at Davis, she had been involved in undergraduate research in Leach lab to now present-day and post-graduate life as a Systems Engineer at Volcano.

DL: Why and how did you ultimately choose going into industry than graduate school? Do you still have plans for graduate school?

VM: I actually was in the process of doing both, applying to grad school and industry. After a long and hard discussion with my advisor and thinking about it myself, I chose industry. I needed a change and I wanted to apply the skills I had learned to figure out a gap that I could go back and fill with a Masters. I had done research for 4 years in college and felt that I learned more while actually doing things versus in the classroom. After all, graduate study is all about doing research in one very specific area in which you are really interested in and eventually becoming an expert in that one area. I do have plans for grad school but for a masters because ultimately I want to be in industry.

DL: Did you think GE courses were a hassle or a good break from course work? Any recommendations for GE’s?

VM: Both. I think some of them, like the social sciences, were a hassle but others, like the humanities, were useful and a good break from engineering coursework. I loved my comparative literature classes because they forced me to think in a different way. I would recommend any of the comparative literature classes.

DL: What do you consider to be the most important class(es) you took and why?

VM: Biotransport Phenomena (BIM 106) and Senior Design (BIM 110ABL). Senior Design is what we work towards throughout those four years. It is an ultimate culmination of your way of thinking, your creativity, your engineering principles, and your teamwork skills. It tests everything and helps you figure out what you are really good at while still learning more every step of the way.

DL: What do you think is the biggest misconception of BME majors? And why?

I think the biggest misconception is that the major is easier than others. It really isn’t. It’s essentially electrical, mechanical, chemical, and computer science all jam packed into one major. So, when you join the major you have to then decide which emphasis you want to do otherwise you won’t be getting the most out of your education or classes.
DL: Discuss your activities in BMES and what you think was one of the things you were able to take/learn from the club?

VM: I think the Mentor/Mentee Program is great because everyone has questions about what they should be doing and what they should do next, so having someone to give advice is great! I also really enjoyed the Research Fairs. They allowed everyone to learn about the new research happening right there in our department.

DL: What advice would you give to a student still trying to get through the first 2 years of lower division course work?

Stick with it and remember that it does matter. Yes you may not ever have to do a triple integral ever again but the persistence, the intangible skills that lower division coursework also teaches you is important and should be mastered. The lower division work teaches you time management; it really prepares you for the upper division classes with just two problems for homework that take five pages and two hours to do.

DL: If you could do one thing differently in your 4 years in Davis, what would it be and why?

I would have tried harder to land an industrial internship each summer rather than do summer research. I would have tried to try more things in different areas to lock down what I wanted.

BME MENTORING
BY: DON

E-Mentoring With the Outreach Committee

Ask any professional, teacher, or college student to describe a high school student and listen to the responses: adjectives such as naïve, rebellious, immature, or any synonym for headache tend to be acceptable responses. People tend to view high school as a time to make mistakes, grow up, and prepare for the next stage in life, whether that be college or work, and they would be partially right. High school is a time to make mistakes. It is a time to grow. It is a time to prepare. However, it is not a time to be reckless, a time to disregard responsibilities, and justifying living young, wild, and free because high school is “just” a stepping stone to the future. Graduating high school does not guarantee anything, and the actions people do today will affect their future tomorrow. That is the reason why Biotechnology students at Vallejo High School have paired up with 8 BME students here at Davis to seek guidance and advice to better prepare themselves for the future.

The Biotechnology Academy mentoring program at Vallejo High School is originally designed to match 11th grade high school students with industry practitioners and graduate students to give the students a real connection to the biotechnology workforce and related fields. The mentor would explain the ins and outs of their career to give a better grasp of what work in this field really entails for the mentee. The mentor and mentee would correspond via email, going over things such as each others' hobbies, high school experiences, day to day life, challenges, and more. However, due to shortage of volunteers, the e-mentoring program was offered to undergraduate junior and senior BME students, where 8 BME students stepped up and shared their advice to mentees.

The BME students shared their stories to their mentees, hoping to inspire them, guide them,
and affect them.

BME, students still in college and unable to share detailed work experience in the industry, have to get creative and share their future goals instead. They all share what they are doing in college now and how it relates to what they have planned for the future. This simple, yet effective, outreach event helps the mentor/mentee pair grow. This relationship teaches both parties responsibility, initiative and proactivity in attaining their goals. This program offers many possibilities for both mentors and mentees to benefit them. Mentors and mentees are scheduled to meet face to face at the beginning of April and have the opportunity to finally talk in person.

**BMES Mentor/Mentee Program Events**

Every year, the BMES’s Mentor/Mentee program seeks to pair compatible students and foster critical relationships between upper and underclassmen and industry workers. Pairings are matched based off answers provided by all applicants. During the course of the year, a bonfire event was planned for the initial meeting between the mentor and mentee, where mentors and mentees could bond over s’mores and meet face to face.

Afterward, mentors and mentees were given weekly tasks to accomplish. These tasks could be done via email, in person, or however the mentors and mentees decided to communicate. Mentors were also given tasks, such as asking why their mentees chose Biomedical Engineering as their major, finding out their mentees goals, and more. These tasks allowed mentors and mentee to have a weekly subject to talk about and continue to work towards a better relationship.

Outside of weekly tasks, mentors and mentees are encouraged to build on their relationship through events. One big event was the BMES Thanksgiving Progressive dinner. This event was held on a weekend where Thanksgiving dishes were offered to members. Each dish was at a different location, meaning mentors and mentees would start at one location, eat a dish, talk, and then walk to the next location. This allowed the mentors and mentee to enjoy a meal together in a unique and creative way, as well as let them further get to know and understand each other as this took time as well.

Another event that BMES hosted for the mentors and mentees was a game night. This night entailed getting together and playing classic games such as UNO, Hearts, Cards against Humanity, and more. This mid-quarter event allowed mentors and mentees to relax after midterms, catch up, and enjoy some pizza and games with one another. Other events not directly related to mentor and mentee, but definitely helped them bond were final study sessions, where mentees could get help from their mentors and professors, and Engineering Joint Council’s MU game night, where mentors and mentees could go and play some bowling, billiards, and arcade games.

The BMES mentor/mentee program is far more than a formal relationship, bounded by BMES events. It is a relationship that is academically, professionally, and socially beneficial to both parties involved. It is a relationship in which textbooks and notes are shared, where professional advice is given, where mentors and mentees can feel comfortable talking about anything and just having fun at times. It will only continue to flourish and grow in Spring quarter.
Dr. Sharon Aviran is a computational biologist, an applied mathematician, and an engineer who has just joined the Aggie family as both a genomics scientist and biomedical engineering professor. We recently had the opportunity to talk to her about her past work and research as well as about her future plans at UC Davis. She also shares some keys to success for both undergraduate and graduate students in the engineering field.

Q: Where are you from?

A: I grew up in Israel, but after undergraduate work, Master’s studies and several years of working in industry, I came to the U.S. to pursue my PhD at UCSD. I then moved to Berkeley for post-doc research and now I’m here at Davis.

Q: What did you study?

A: My background is in Applied Math. After my Master’s studies, I worked in the software and telecommunications industry and then went back to school to get my PhD in Electrical Engineering. But, under Electrical Engineering, there are many sub-disciplines—mine were Information Theory and Signal Processing, so again it’s essentially Applied Math with practical applications in systems engineering. I then switched to Computational Biology for my postdoc and have been working in this field ever since, where I am developing mathematical and statistical methods for applications in Genomics. It’s always been Applied Math and Statistics, but the applications have changed over the years.

Q: Why did you decide to study this? Why were you interested in these disciplines?

A: I always loved math, but at some point, after doing highly theoretical and abstract work, I wanted to do something practical with it. So initially, it made me go and explore industry jobs, and so I worked as an algorithms developer. But I wanted to pursue my work in much more depth and in industry, I felt that things moved too fast and that I didn’t have the time to go deeply into topics, so I decided to go to grad school. But since I wanted to do something practical and since my last job in industry was in a telecommunications company doing signal and image processing, I enrolled in the Signal Processing Track of an Electrical Engineering program.

Q: Where have you worked in the past?

A: The time I worked in industry was in between my Master’s and PhD studies. I lived in Israel then and worked first for a big company and later for a start-up.

Q: Why did you choose Davis?

A: The BME department is very vibrant and has been on an upward trajectory for a while. From my days in industry, I knew I preferred the start-up environment over the work mode at big and established companies. For this reason, a fast-growing department that is young and ambitious was attractive to me, and I wanted
to take part in its growth. Another reason I chose Davis was that it has traditionally put strong emphasis on building broad genomics and population genetics communities and these are both topics I am interested in. Being here allows me to connect with many people on campus who share similar research interests. And the third reason was because I wanted to continue living in California.

Q: Will you be teaching any courses at UC Davis?

A: I will start teaching next fall. It will be a new graduate course that I will design from scratch. It is called Special Topics in Computational Bioengineering and will focus on the topic of Genomic Signal Processing. Genomics Signal Processing basically means applying signal processing methods to process data coming from a range of genomics experiments. The course will be about my research as well as on other related topics.

Q: What is your favorite thing about your work in academics?

A: The thing I like best is that our work has many elements to it. I don’t like routine jobs and in academia we get to teach; do research; train and interact with students, present our work in multiple venues, write papers and proposals; and sometimes even do some interesting service tasks for our school. Our responsibilities and duties are diverse and often intellectually stimulating. Also, it’s a leadership role - you set the research direction of your lab and you mentor young people, typically at early stages of their career, which means you could have significant impact on them and their professional future.

Q: What advice would you give to undergrads in the Biomedical Engineering field?

A: I would advise them to go and ask people who work in industry about their work, what they like or don’t like about their jobs. That may help them focus on what they want to do. If there are internship opportunities, I would jump on them too. It’s good to get an idea of what’s going on outside as well as to explore as many courses as they can.

Q: What advice would you give to the graduate students?

I would advise them to allocate some of their time to exploring what they want to work on, so that they find a topic they are passionate about, because it’s so important to be passionate about what you do. That’s a good starting point and is quite critical to having a satisfying career in the long term. This is also essential for doing great work as opposed to simply good work.

Q: Will there be any future research opportunities for either or both undergrad and grad students?

A: I am currently seeking highly motivated grad students. As for undergraduates, the ones who have already taken BIM 105 (Probability, Random Processes, and Statistics from BME), liked it, and were really good at it, are very welcome to join my group and give it a try. This generally applies to mathematically inclined students, who would like to do something impactful with their math or computational talents.

Q: When you’re not working, what is it that you enjoy doing in Davis?

A: I like spending time with my family. One of my hobbies is traveling, though I haven’t been able to do it in recent years as much as I’d like to. I also love biking with my kids.

The engineering field is so broad and diverse, overflowing with a variety of opportunities in math and the sciences. Dr. Sharon Aviran is an excellent example of how being passionate about your work leads to a satisfying career. Learning about yourself is the key to not only being successful, but also to doing something great in your career.
This academic year the BME department hired two new professors. One of whom, Dr. Cheemeng Tan, has already gotten a feel for both the city of Davis and the campus itself. I interviewed Dr. Tan recently to get an idea of his perspective of our BME department and Davis in general.

**CBP: Tell me about your academic history.**

Dr. Tan: I grew up in Malaysia and attended the National University of Singapore, where I received a degree in Civil Engineering. Later, I went on to get my Master of Science in High Performance Computing for Engineered Systems in Singapore-MIT Alliance. After doing more research, I received my Ph.D at Duke University, where I wrote a thesis in synthetic biology.

**CBP: You have quite the varied history; why is this the case?**

Dr. Tan: I know it's quite the jump from Civil Engineering to Bioinformatics to Synthetic Biology. I learned many core concepts in civil engineering that helped establish my engineering perspective on academic problems. With my experience in Bioinformatics, I found that I was dissatisfied dealing with pure theoretical studies and wanted to be able to test and verify hypotheses. This realization brought me to Synthetic Biology and my current research.

**CBP: What brought you to Davis?**

Dr. Tan: I found that there were many prominent scientists here in Davis, and I was drawn in by the university’s prominent biology and BME department. UC Davis’ BME department was strong, despite having a relatively young faculty, and that drew me in as well. I found the faculty to be exceptionally friendly and inviting. Furthermore, BME’s involvement in various scientific fields meant lots of exciting opportunities for collaboration in research. Davis as a city is also ideal for raising a family in my opinion.

**CBP: Tell me about the class you’re teaching Spring Quarter.**

Dr. Tan: BIM 167, Biofluid Mechanics, was actually always offered, but never taught. I am excited about teaching the class that focuses on the applications of fluid mechanics in biomedical systems. In addition, I plan to incorporate a project to enhance learning experience of students in the class.

**CBP: Tell me more about your current research interests.**

Dr. Tan: My research lies in the general area of Synthetic Biology, with a specific focus on creating artificial cellular systems for use in biosensors, drug delivery, and biological studies. My research also delves into improving antibiotic treatment to combat bacterial resistance using synthetic biology approaches. Along a similar vein, I am looking at the underlying mechanisms of cellular heterogeneity because it is known to decrease efficacy of drug targeting and proper treatment. My lab is currently in progress of being set up in Ghausi Hall. I’d say it’s about
halfway through development. There are already some students and postdocs working in the lab. I will be considering taking on more students in the near future. I am impressed by the high caliber of BME students in Davis and will be looking for independent and motivated candidates who want to contribute to research in my lab.

CBP: What’s your favorite part of Davis so far?

Dr. Tan: I’d say that my favorite part about the campus is the energy level demonstrated by the students. There is a strong sense of vibrancy that comes from the activity of the campus, and I love that biking is so widespread here. I am also particularly impressed by the Biomedical Engineering Society at UC Davis and appreciate the enthusiasm in welcoming new faculty like myself. Thanks a lot for coordinating the interview!

HISTORY OF BME

BY: NATE

Biomedical engineering is one of the fastest growing fields in the scientific world today. Thanks to biomedical engineering, prominent advancements have been made in human health, and the field’s achievements continue to accumulate today. But first, what exactly is biomedical engineering? Biomedical engineering, or BME for short, is a field involving the application of engineering principles and disciplines to biological and medicinal systems, essentially serving as a crucial link between engineering and medicine. The practice of these principles together go back centuries in the past.

The oldest known usage of BME principles lay in the sands of Egypt. In the year 2000, archaeologists uncovered a 3,000 year old mummy in Thebes. This mummy had a wooden toe tied to its foot with string, making this the very first (discovered) instance of prosthesis, a hallmark invention of BME. Even centuries back the human race pushed forward in attempting to improve the quality of human life through scientific means. Even though “biomedical engineering” did not exist as a defined field until recently, the core ideas behind it have been in practice for thousands of years.

Since the first instance of engineering on the human body, biomedical engineering has increasingly progressed in making improvements to human health. Older creations such as crutches to modern-day instruments such as pacemakers have promoted and celebrated human health. The nineteenth century particularly saw a grand number of developments in the field. One creation was the stethoscope, a device still used by doctors today. About 200 years ago, a French doctor was in the process of diagnosing a woman, but he did not feel comfortable with bringing his ear to her chest in order to hear her heartbeat. He found a way around that situation by using a rolled-up newspaper to amplify the sound of her heartbeat, which while crude, made way for the stethoscopes used today.

Another revolutionary discovery in the nineteenth century was the discovery of x-rays by Wilhelm Roentgen. In 1895, Roentgen noted that when cathode-ray tubes were in the process of operating, some materials outside the tubes shone or glowed. He found this to be the result of radiation emitted by the cathode-ray tubes. The unknown nature of this ray led him to call it an x-ray. Today x-rays are used in order to diagnose medical problems through imaging devices, among other uses. It is thanks to these advancements that biomedical engineering continues to flourish today.

Despite all of these improvements and developments, there are still many problems regarding human
health left to face. With each following year, scientists and engineers are creating new solutions and methods to treat physical and physiological conditions bringing harm to an individual’s life. Because the number of problems is infinite, there is no telling where the future of biomedical engineering is headed. However, it is almost certain that with technology improving everyday, biomedical engineering will continue to find solutions to the everyday maladies of the human body.

Biomedical Engineering is still a fairly new field and is perceived as the most current and innovating field focusing on research and inventions for advancing healthcare. However, sometimes we forget that not all individuals get the benefits of our biomedical services and facilities, such as the underserved communities across the globe.

Our featured organization is the Engineering World Health Organization, which was established by Bob Malkin and Mohamad Kiani in 2001. Both were engineering professors who had a motive to bring engineering aspects to improving the clinics and hospitals of developing countries. The founders and their group of volunteers were able to grow in size and developed their programs enough to transition into an independent and professional NGO (nongovernmental organization) in 2008. This transition was supported by the Wallace H. Coulter Foundation and allowed the organization to diversify to following two main objectives: 1) to build capacity for equipment and repair in developing countries and 2) to design and develop appropriate technologies and methods for objective 1.

EWH has grown tremendously, always accepting new ideas and volunteers to help them with their mission. They have developed several programs such as the EWH Summer Institute, an EWH Design Competition, and is very successful with their EWH Kits Program.

EWH also supports and recommends motivated students to start an EWH Chapter at their own institutions. Chapters will gather students to raising awareness of healthcare challenges in developing countries, yet also allows members to contribute solutions to these healthcare problems. Members can evaluate and repair medical equipment to be donated to developing world hospitals and can start projects and design appropriate technologies. And to experience the real effect of how technologies can make a difference, there are traveling opportunities for members to provide engineering support at needed hospitals and schools of developing countries.

For more information, visit their website, www.ewh.org to see how you can participate with EWH! Perhaps you can be the one to start UC Davis’ first EWH Chapter!
As 2014 continues, our knowledge and applications of biology have dramatically advanced to the point of creating many complex issues. In response, the advent of computer processing initiated a surge of technological innovations that allowed complex biological phenomena to be carefully analyzed and modeled to guide experimental work through the use of programming. Hence, “bioinformatics” became nascent field of study in many universities. Yet, programming has been understated in biomedical engineering here at UC Davis, and the only required programming course has been ENG 6 (MATLAB). As a result, many BME students who pursue graduate studies have been ill-prepared to utilize programming for future research and hands-on experience. Furthermore, the University of California Davis only recognizes Bioinformatics/Quantitative Biology as a minor. To address this issue, Gregory Del Rosario, a 4th year BME student, proposed a new specialization track known as bio-computation. Here, he shares his plan to develop the new specialization.

Q: Specifically, what made you start off biomedical engineering with programming applications?

G: Originally, I was a Computer Science (CS) major, but during my freshman year, I started to find a liking towards biology and of course, CS. After taking BIM 001, I started to think that maybe, JUST maybe, that I could apply CS into the biomedical field, so then I officially decided to explore biomedical engineering while taking several ECS courses.

Q: How did your experiences in BME shape you to think about proposing this major?

G: While taking CS courses and understanding the terminologies in BME, I was able to become a research assistant at the UC Davis Medical Center under programming of biomedical devices for trauma. In fact, when I applied for this position, my researching professor, Dr. Khizer Khaderi, told me that it was really “phenomenal” and fascinating to see a biomedical engineer also specialize in CS.

Q: If the research position at the Med Center shaped your decisions, what was your decision?

G: While researching at the Med Center, I began to comprehend something that felt “outside the box;” I really wanted to bridge the gap between BME and CS. What’s more, at the Medical Center, so many research positions are needed for those who can apply programming into their biomedical devices while being able to fully understand the concepts and terminologies of BME that the researchers state. By that time, I could take into fact that biomedical engineers CAN and WILL provide major feedback to work with the real-world large scale industries.

Q: How do you propose putting bio-computation into a new track while keeping the BME requirements consistent?

G: After taking ECS 10, 20, 30, and even 40, I noticed that these courses were only Pass I restrictive to only a few majors. More worrisome was that after taking these courses, they didn’t even apply into the engineering elective credits at all! More problematic is that for those who plan on minoring in CS with BME have no overlap whatsoever under 24 units. As for bioinformatics/computational biology minor, only a possible 4 unit overlap works in the current conditions. However, just recently, I was able to plan an outline into the course requirements for bio-computation, and if this specialization passes into BME here at UC Davis, BME will be included as one of the few majors into the Pass I restriction. My plan is that by allowing ECS 30 a part of the lower-division engineering and have the ECS core classes into the upper division engineering
elective credit, this will greatly benefit BME majors. Additionally, I also intend to add ECS 20 and ECS 40 in the upper division credit requirement as a bio-computation route. This addition not only gives them experience in CS beyond MATLAB, but if they have no desire into upper division courses, they can count as engineering elective credits.

Q: How will this new specialization contribute greatly for many undergraduates and even to our society?

G: At this point, much of the research conducted here at UC Davis requires experience in programming for biological computation/modeling. What I perceive is that bio-computation works greatly in conjunction with two of our specializations: synthetic/systems biology and medical devices. As we develop more advanced biomedical devices, more programming background will need to be implemented to run these devices. Because of the importance of programming, this would enable bio-computation to open further opportunities for BME such as data analysis, programming bioinstrumentation, and developing our own device. For an undergraduate student, bio-computation allows students to utilize computational biology in research when they pursue further graduate studies. I could see that these opportunities correspond directly to my experiences of the ECS courses that I took. In fact, in direct relation to these beneficial opportunities, by having the ECS subjects integrated into the upper division credit, these classes promote and/or enhance software design/architecture, common scripting languages & object oriented programming, and bioinformatics/big data.