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THE BIO-E QUARTERLY

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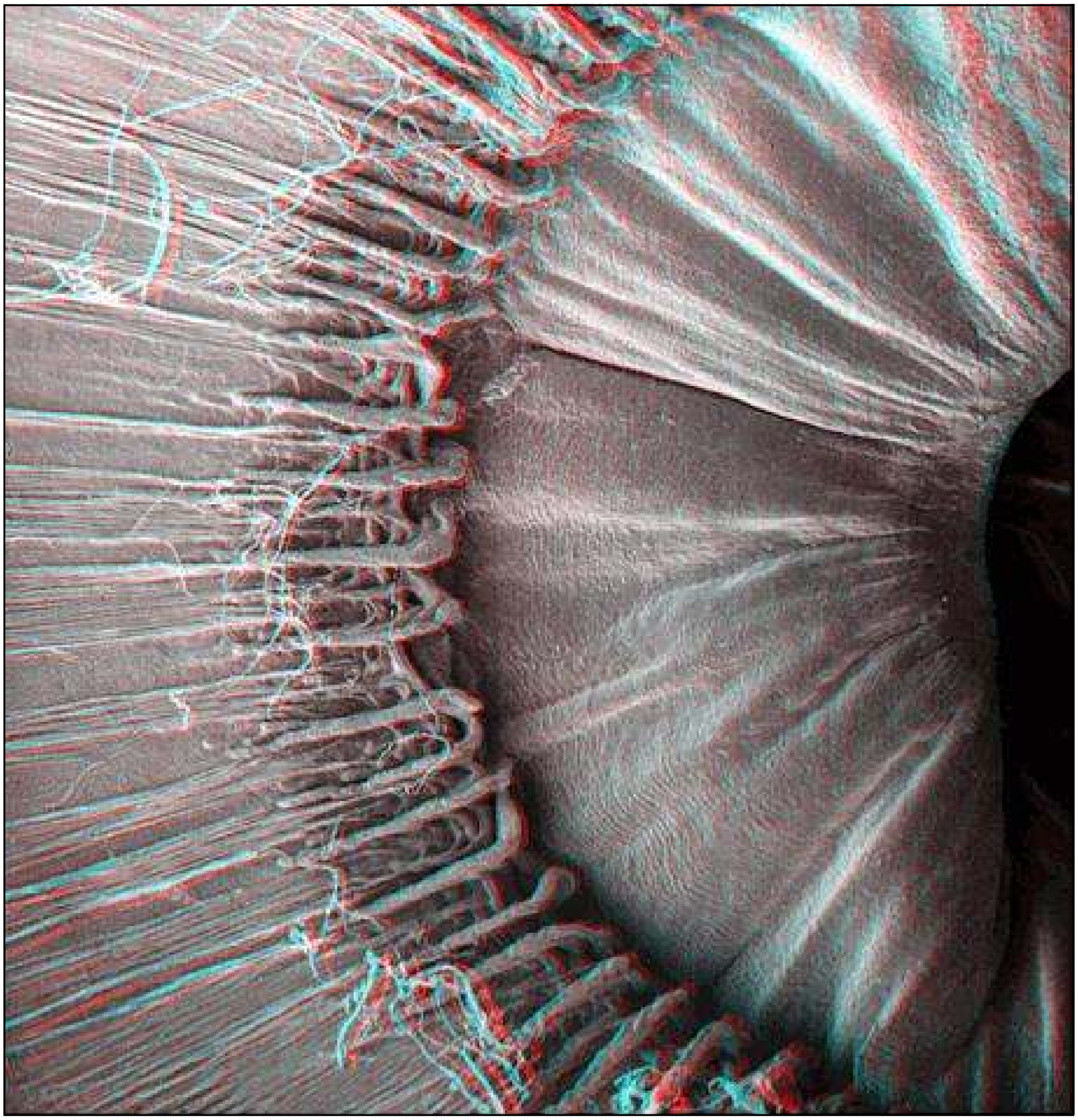

THE BIO-E QUARTERLY

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Inside this Issue:

The BEQ - Volume VI Issue II

Welcome to the Biomedical Engineering Society!

The BMES at UCSD is an organization that promotes social, academic, and professional development for its members.

What does this mean exactly?

It means that if you want to meet others interested in bioengineering, find out if graduate school is right for you, and learn about successful Bioengineering companies - then this is the place for you!

Our Faculty Advisors

Dr. Robert Sah

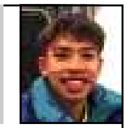
Dr. Melissa Micou

And articles on BMES activities...

Interview with Professor

Professor Shyni Varghese

Justin Tse



Q: Can you give me a brief description of your educational background?
A: I earned my undergraduate degrees in physics and chemistry with a minor in mathematics. I earned my PhD from Chemical Engineering department, National Chemical Laboratory, India. I did a post-doc at Johns Hopkins University in biomedical engineering and worked with stem cells. I just got to UCSD this year.

Q: Why Bioengineering?
A: Bioengineering allows me to do both engineering and biology. I have expertise both in biomaterials and stem cells. I am interested in developing novel biomaterials with characteristic structure-property-function relationship to control stem cell activities such as self-renewal and tissue specific differentiation. If we can control the behavior of polymers, we can learn more about how cells interact with the matrix or how to differentiate stem cells into functional musculoskeletal tissues such as cartilage, bone and muscle and integrate them with the host tissue. This is important because some tissue, such as cartilage have very limited self-repairing abilities. Ultimately, we hope to develop stem cell and biomaterial based clinical strategies to treat debilitating life threatening diseases.

Q: What are your current goals?
A: Right now I am looking into regenerating functionally active skeletal muscle, cartilage, and bone from stem cells. I would like to develop stem cell based therapies for various life threatening diseases. My lab is also aiming to develop novel biopolymer based artificial implants. My source of stem cells come from the umbilical cord, the human embryo, and committed cells. I also use biopolymers, oscillating hydrogels, hydrophobic sponges, and self-organizing polymers. In the case of skeletal muscle tissue, we are trying to treat catastrophic diseases such as muscular dystrophy. Our question right now is how can we engineer tissue to integrate with the human body to prolong the life of patients?

"I love working with students.."

We are also trying to develop multi-functional smart scaffolds to culture three dimensional tissues. Our goal is to put cells in a scaffold that has biochemical properties (they respond and communicate with cells) and provides mechanical stimuli to the cells.

With time in mind, I hope to see substantial research in 4-5 years to make proposals and clinical applications after 5 more years.

Q: What do you think are your most significant accomplishments?
A: Well, during my doctoral studies we first demonstrated the self-organization and self-healing in synthetic hydrogels. Our work has also demonstrated that novel environmental sensitive hydrogels can be developed via molecular tailoring. i.e. balancing hydrophilic and hydrophobic balances. We also have a patent on how hydrogels can be used as fuel. At Johns Hopkins University, we showed that cell matrix interactions play a big role in muscular differentiation of stem cells.

Q: What brought you to UCSD?
A: The department. It is a top department and I really like the faculty in the department. The school of medicine is also very close by and I like the interactions between the bioengineering department and the school of medicine. This is very similar to Johns Hopkins University, in which the bioengineering department is closely integrated with the school of medicine.

Q: Who is the most influential person in our life? Is there a scientist you look up to?
A: I look up to my PhD and post-doc advisors. They played a big role in my career choice. They always maintained a close interaction with their students and I hope to do the same.

Q: Is there any particular reason you chose to go into academia rather than working in industry?
A: I love working with students. Part of the reason I decided to come here was because of the close interaction between the faculty and the students at this university.

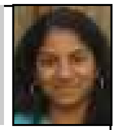
Q: Do you plan on teaching?
A: Yes, I am teaching a course this winter on BENG 130 (Molecular physical chemistry).

Q: What advice do you have for undergraduates pursuing this field?
A: Be curious, motivated, and dedicated.

Qualcomm Innovator Challenge

Bioengineering Freshmen Place 2nd

Priya Sundaramurthy



The Qualcomm Innovator Challenge was a contest put together by Qualcomm and UCSD for all the engineering students of the Jacobs School. The challenge requires an engineering team of three to five students to envision an eye-opening device that – here comes the main part – employs creative use of a new Qualcomm platform (a chip), the Snapdragon. The prizes: First place - $5000, Second place - $3000, Third place - $2000.

A total of 23 engineering teams took part, after which about 3 teams dropped out. The remaining 20 teams fought hard to come up with the best design – in 30 hours. The kick-off was held on Saturday, October 13th, at 9 AM, when the teams were required to register and sign in, attend a presentation on the Snapdragon, and brainstorm ideas with their team members. After lunch at 12 PM, the teams continued their laborious by fun-filled process of coming up with a device that leverages as many technical capabilities as possible, with practical real-world applicability.

After all this arduous work in such a short period of time, the teams report back at 3 PM on Sunday, October 14th, to present their ideas in a mere 5 minutes to a panel consisting three Qualcomm and 2 UCSD representatives. After the judges convene to discuss the ideas and decide upon the top three winners, the prizes were awarded during dinner at 5:30 PM.

The challenge has ended, but for Qualcomm this is only the beginning of a possibly new project with Snapdragon. The following is an interview of a winning team.

Team ATHENA, with Bioengineering ABET majors, Jonathan Rewter and Vincent Wong, and Bioengineering: Premed majors, Rachel Nguyen and Jasminé Nourblin, placed second in this innovator challenge. Yes, this is a Bioengineering team, and that they are a freshman group just makes this team altogether more awesome.

Q: How did you hear about this challenge?

Jonathan: I first found out about the Qualcomm Innovator Challenge by emails sent by the Biomedical Engineering Society.

Rachel: There was a TESC meeting that I attended a couple weeks ago, and they were announcing this challenge with Qualcomm. Flyers were handed out and involvement was greatly encouraged. It was, after all, a very cool way to earn some money!

Q: Why did you want to partake in this contest, though Qualcomm was not even a Bioengineering company?

Jasminé: It was really a chance to see what we could do and accomplish.

Jonathan: Not too many opportunities of this scale come about, so I wanted to make good use of what I can get my hands on. But mainly, I wanted to participate here, largely due to the fact that we will be gaining so much experience and exposure to the real-world. With Qualcomm representatives, we have a chance to build our network in the industry. Also, this is definitely a place to get more experience with team work, especially with one made of those with a lot of enthusiasm and different skill sets.

Jasminé: Unlike Jon's view on having few opportunities, I find that we have plenty of opportunities at this university. It is a matter of getting involved in something worthwhile, and this is a great place to start.

Q: How did you form your team?

Vincent: We didn't know each other personally. Through a Facebook group called "UCSD Bioengineering '11" that I had made in the summer, I had apparently randomly "friended" Jasminé. (*Chuckles*) I knew Jasminé and Jonathan, and Jonathan knew Rachel. Eventually we all met up at El Mercado to formally form our team, and Athena was born.

Bioengineering Freshmen Place 2nd

Priya Sundaramurthy

Q: What was the device you guys came up with?

Jonathan: Ours was the Canvas – it was pretty much all the recent technological developments incorporated into just a flat, thin, and small collapsible screen. When you collapse the screen, it looks like a paper scroll. It's made of OLED – organic light-emitting diode – for excellent resolution and great response time, and has alterable plasticity. For example, when an electric current runs through it (as in when being turned on) the screen flattens out of the scroll form and hardens into a plate-like device. It's has a touch screen, iPhone-like-capabilities, and pretty much functions like a laptop.

Q: How was the presentation formatted?

Rachael: We made a power-point presentation, but had a few other interesting elements to make it memorable to the judges and audience. I filmed and edited our presentation video and we displayed a Photoshop version of our canvas model.

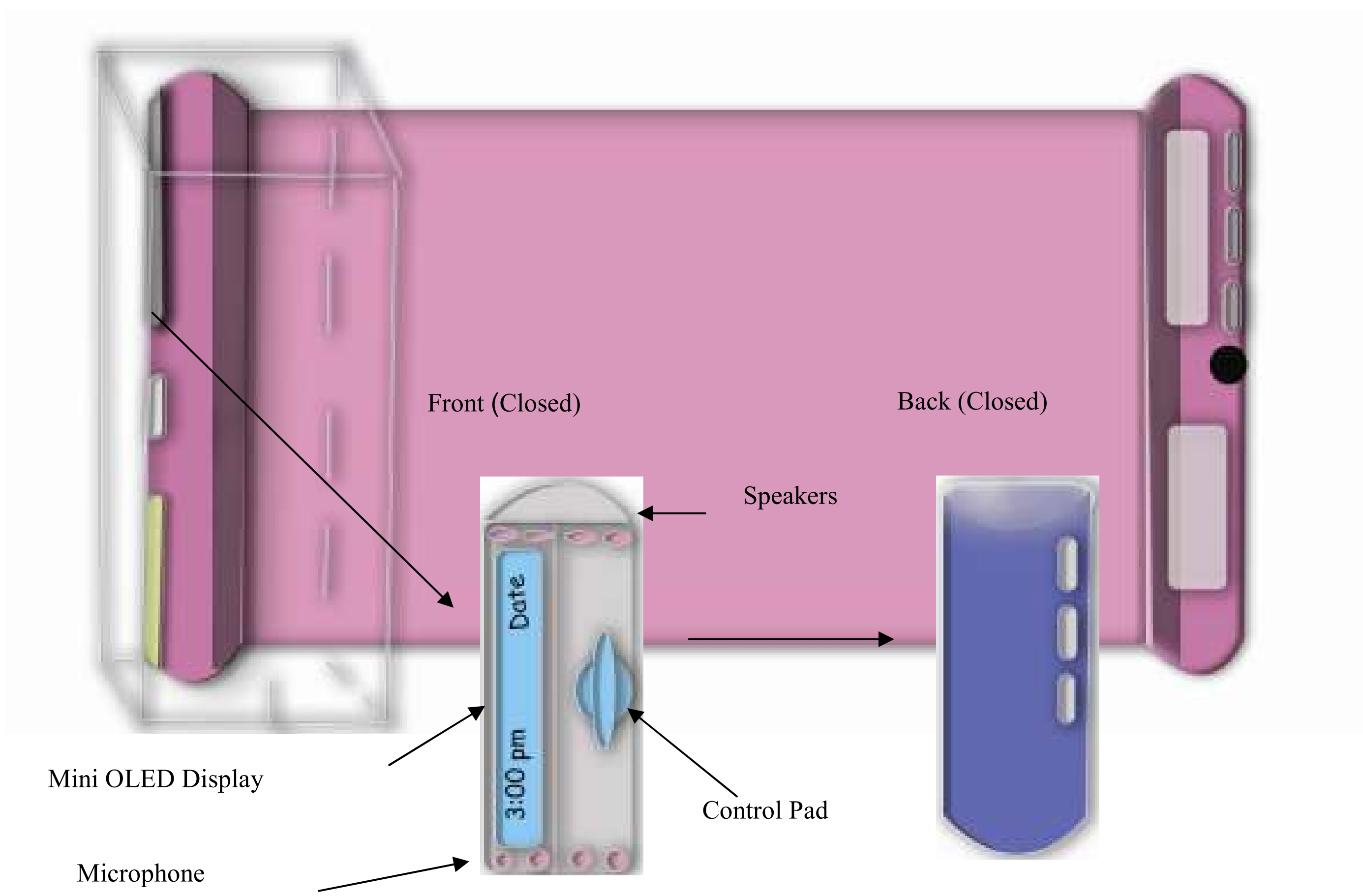
Vincent: Rachel and Jasminé had a long and wide, rectangular piece of fabric. They stood on either side of the stage in CSE 1202, and wrapped themselves in the cloth from their sides. During the presentation, they showed how it unwraps.. it was pretty cool.. and funny!

Jasminé: It was fun. We had pictures of us working and having fun while coming up with our design. We had music in the background, too.

Jonathan, Vincent, Jasminé, and Rachael, thank you very much for your time. Again, congratulations on winning second prize! Would you like to say anything else?

Rachael: Glad I did it.

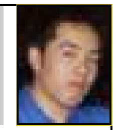
Vincent: It was really fun, and it was a great jump-start to our academic careers! Definitely.



Artificial Heart

The Recent Advances

Derrick Li



One of the greatest inventions of modern times is the artificial heart. Recently, a company named AbioMed created the very first “implantable replacement heart” called “AbioCor.” This artificial heart differs from those of the past significantly. The AbioCor ran on an internal battery that can last 1 hour on a charge. Running on an internal battery allows the user to have greater mobility than a stationary heart pump in the hospital. The AbioCor had no wires protruding out of the users. It recharges based on a wireless energy transfer system similar to the induced electrical current used to charge electric toothbrushes. The expected life expectancy of a user with the AbioCor is 18 months. Although this may not be much, it allows the user to spend their last days on earth with their loved ones.

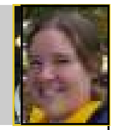
In the 1950’s, the very first machine that was developed to help patients move blood through their body was called a “heart-lung machine.” Although it is not technically a replacement heart, this machine helps the patient breath and pump blood while patients undergo heart surgery. This machine is still used today for various heart-related surgeries to maintain oxygen levels of the brain and such.

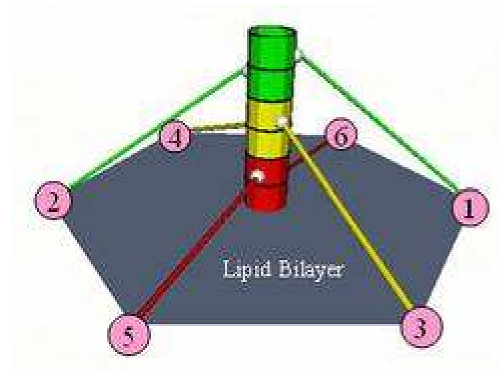
What followed for the next four decades were a series of mechanical artificial hearts that proved to be ineffective. Various complications were found with these artificial hearts. Patients would die soon within a year after the implant of these mechanical hearts. Eventually these artificial hearts were discontinued due to its ineffectiveness. Only recently, the AbioCor was developed. Even then, the AbioCor can wear down from the constant motion to keep blood flowing in the body. However, the future of this technology will grow. Human hearts are always in short-supply for those who need a heart transplant. As researchers understand our body more, artificial hearts will be designed better; possibly to a point to have fully-tissue engineered heart so the user can enjoy life renewed.

Post-Doc Researcher

Dr. Carlos Vera

Caryn Urbanczyk





Above: Three dimensional mechanical model of junctional-complex in erythrocyte membrane skeleton

The office is full of three dimensional models of molecules, hanging from the desk and the walls. Most paperwork neatly organized, while some others appear to have escaped, lying somewhat scattered. It appears exactly as one would expect to find the office of active lab researcher and professor.

Currently a postdoctoral fellow working in the Molecular Bioengineering lab, headed by Amy Sung, Carlos Vera works on the mathematical modeling of human body structures, specifically the red blood cell. In junction with the mathematics and structural engineering departments he and his teammates are developing a hybrid model to explain how the microscopic architecture of the cells explains its macroscopic properties and functions.

Dr Vera received his bachelor's of science in Electrical Engineering from the Instituto Tecnologico de Tijuana, with a specialization certificate in Computational Mathematics from Centro de Graduos in 1987. With a federal grant from the Mexican government he continued on to receive his Medical Degree from Universidad Autonoma de Baja California in 1995. Before coming to UCSD for a Ph.D. in Bioengineering (2002) Dr. Vera spent time volunteering with the Red Cross in Mexico. As part of his federal grant, he worked for 1 year as an unpaid service physician, serving as an emergency medical technician, working in hospitals and ambulances throughout northern Baja California. He also worked as a director of Emergency Management, with an emphasis on bioterrorism, at a hospital in Tijuana.

Working as a physician Vera had the opportunity to see many different lifestyles. While the ability to help others was fulfilling, he said that at times it was frustrating, to see such lack of resources. "The people have no money, no tools, and no insurance."

Dr. Vera still works as a full professor at the School of Medicine in Tijuana. He spends his mornings lecturing classes in biophysics and biochemistry then crosses the border to teach his classes and run experiments here at UC San Diego. Vera is scheduled to lecture Beng 140B (Human Physiology) this spring and oversee the Biotechnology Lab (Beng 162) next fall.

His profile on the bioengineering webpage reads "I am interested in the molecular basis of erythrocyte membrane skeleton biomechanics, specifically the contribution of tropomyosin and tropomodulin to junctional complexes architecture and their implication on the erythrocyte functional properties." Perhaps on a strictly laboratory level this is his area of specificity, but Vera says that what really made him go into bioengineering and pursue a professorship was the intellectual and emotional reward that comes with teaching and sharing with others his passion for micro-architecture. "Teaching, the ability to affect others and open their eyes to microscience is rewarding. It is easy and fun because the students are motivated."

Professor Vera is looking forward to finishing up his post-doctoral in the next few months. After that, he says, he will divide his time between his family and work. (With some more time devoted to family.) He says that hopefully soon he will have some more time for scuba diving and kayaking, and playing with his nine dogs.

Professor Carlos Vera is one of those rare people who thoroughly enjoys his work, in all its multifaceted glory. Even when the NSF acceptance rate is less than 10% and any significant breakthrough or trials could be 10-20 years away. He loves that he gets to work on the very edge of science, advancing new techniques and discovering new properties.

Focus on the Future

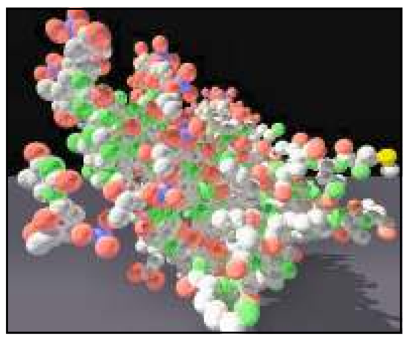
Nanoplastics and Molecular Imprinting

Trevor Scheck

Biotech companies may soon be able to make drug development faster and safer as a result of molecular imprinting, a process in which molecules are implanted in nanoplastic material, and then released, to form molds identical in shape and structure to the molecules used to create them. Such molds then can be used for filtration, to purify substances, such as blood. The bloods might even be exploited to "cast" mimic biomolecules made of chosen chemicals.

As researchers continue to develop these applications of nanotechnology and biochemistry, the potential results hold promise for improving diagnostic processes and biomedical therapies. Researchers all over the world are working to develop new techniques, and the potential looks bright. As well as using plastic coated imprints as molds for creating biomolecules, they might also be used to screen out toxins from serum or to entrap other components, such as those involved in the production of drugs.

The process of making an artificial biomolecule, which can be used as an enzyme inhibitor among other things, is quite simple -- in theory. It's much like casting resin models: make a mold for a desired shape, fill the mold with chemicals, induce the chemicals to coalesce and then empty the mold to release the final "cast."



However, despite the simplicity of the idea, the actual process took decades to develop. More that 30 years ago, chemists began to work on creating nanoscale structures that could capture molecules and tiny biologic products, like antibodies. The structures acted as "filters" or "nets" that could trap a particular molecule or molecules that a researcher wanted to isolate. Soon bio-companies and pharmaceutical manufacturers started to use the new technique for purifying samples or removing contaminants from products.

Researchers could also embed particular entities into the structure by washing solutions containing that entity across it. This allowed labs to create sheets of Escherichia coli, for example, rather than relying on colony growth on Petri plates to harvest the bacteria. This technique is still used today by the food industry, drug companies, and it continues to find many medical applications.

The Evolution of Technique

Molecular imprinting evolved from a previous technique, in which molecules literally were trapped in the plastic; if a molecule was trapped, it stayed trapped. Then, researchers began to wonder if they could create structures that could trap an entity and then release it. If they could release a molecule from the structure, the cavity where it had been trapped would keep the shape of the molecule, thus making an imprint of the original template molecule. Using this principle, filters could be able to specifically target molecules of the same shape. Soon research went underway to develop the concept.

Originally, it was mostly chemists working on the new imprinting concept, but as research continued and the success of the technology became more evident, other scientists began taking an interest as well. Materials science industries and biotech companies started doing research into molecular imprinting. As nanoscale science advanced, so to did the research. Now, molecular imprinting is poised to make a big difference in the science community.

It only takes a few days to create plastic imprints of molecules, and it has stayed relatively simple. A technician first mixes the molecules of interest—which will be used as templates—into a solution of monomers. The monomers act as plastic building blocks that form plastic webs around the molecules. Then by using a solvent, the technician dissolves the molecules and washes them away. What results is a material dotted with plastic-coated cavities that have a memory for the shape of the template molecule. The plastic imprints, called molecularly imprinted polymers (MIPs), are usually created as beads or thin films with hundreds of thousands of the molecular imprinted cavities.

The plastic imprints are made quickly and easily with relatively cheap monomers and they stay functional for a long time, some for as long as a year. This makes them very attractive to biotech companies.

Imprint Copying Has Potential

One potential use of MIPs is removal of toxins from the blood. Imprints of a specific set of substances can be manufactured as beads packed in tubes. The tubes could be connected intravenously to a patient, and as the patient's blood is run through the tube, the MIPs capture toxins, thus filtering the blood. This process, if used continuously in some sort of medical device, might one day reduce the need for hemodialysis in patients suffering from kidney failure.

MIPs might also one day be used as implants, inserted into a patient's gastrointestinal tract to screen out toxins or unwanted substances before they are absorbed into the blood stream.

Nanoplastics and Molecular Imprinting

Trevor Scheck

Many companies and governmental agencies are developing much more robust and accurate sensor equipment that might use MIPs as recognition matrices to detect such harmful substances as anthrax spores, sulfur mustard and sarin nerve gas, along with other potential biological warfare threats. Multiple MIPs could be part of electronic devices that would signal the presence of a particular threat. Government agencies and other environmental groups have also expressed interest in using MIPs to detect environmental contamination and as a possible means in cleaning up waste.

Use of MIPs as filters is also being looked at by drug companies. MIPs might prove to be more efficient and accurate at filtering out potentially harmful mirror images of a drug molecule or contaminants in a sample of synthesized drug molecules. MIPs have proven to be very effective in chromatographic processes and would be used in much the same way current chromatography techniques are used in isolation proceses.

Along with these applications, an even newer idea is being developed now: molding artificial biomolecules using MIPs.

By injecting chemicals into the cavities in an MIP, they are used as a sort of “mold” to create mimic copies of the original template molecules. This application might one day revolutionize the biotech and pharmaceutical industries.

Like casting a resin model, “casting” a molecule is simple in theory as well. A technician creates an MIP of the desired molecule, such as an antibody or an enzyme, and then fills the empty cavities with chosen chemicals. After inducing the chemicals to coalesce, the new combined chemical compound is released. The result is an artificial copy of the original, composed of different chemicals.

Antibodies are often used by makers of diagnostic tools. When the immune system detects the presence of a foreign substance, or antigen, the body manufactures specific antibodies that bind to that specific antigen. The specificity of antibodies makes them like a “lock and key”. For this reason, diagnostic tool manufacturers use antibodies in their processes for determining if a patient is infected with a specific disease or has a certain substance in their blood.

Currently many companies that create diagnostic tools use animals to create the antibodies they use in their tests. By using MIP technology, biotech companies can potentially create antibodies more efficiently and without the use of animals.

Possible Use in Making Enzyme Substitutes

The same principles can be exploited by the pharmaceutical industry, which has expressed great interest in MIPs, to create long lasting substitutes for enzymes. Research is underway by several groups to perfect this process so that a molecule’s three-dimensional shape can be more accurately modeled to create more efficient artificial enzymes. Some small success has already been achieved along these lines, however more research and development is needed.

What makes MIPs so attractive for this type of application is the process itself. When molds are made, the charges of the nanoplastic line up with the template molecule. When chemicals are placed in the molds, their charges line up to match those of the nanoplastic. The result is a molecule with the same shape and arrangements of charges as the original template.

Technology along these lines might be used to make improved versions of already available drugs and replace the current cumbersome method of testing combinatorial libraries for effective compounds, speeding up drug discovery.

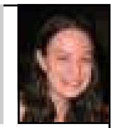
A newer concept being researched by a few research groups is the idea of using an enzyme’s active site as the mold for an artificial enzyme. A major leader among the research groups is the Center for Molecular Imprinting at Lund University, lead by Dr. Klaus Mosbach, a longtime pioneer of MIP technology. Much like injecting MIP “molds” with monomers or other chemicals to create mimic enzymes or antibodies, scientists are trying to inject chemicals into the active site on a biological molecule and use the site as a mold for creating a “plug” that might serve as an enzyme inhibitor. Dr. Mosbach’s teamed has coined the term “direct modeling” to describe the process. If successful, the technology could greatly speed drug discovery and possibly even lead to the development of enzyme inhibitors that otherwise might not be able to be created.

The potential for MIPs is bright, and in the near future the biomedical and biotech industries are going to become more efficient and effective at treating patients and creating novel therapies. Already, startup companies are developing the technology of MIP and hoping to commercialize it. With applications like faster drug discovery, novel enzyme and enzyme inhibitor creation, better immunoassays and improved medical treatments, it looks as if molecular imprinted plastics and the products they make will significantly change our future.

Internship Spotlight

BREG, Inc.

Carolyn Schutt



A Spring Quarter tour of the BREG, Inc. facility with UC San Diego's BMES left me intrigued. This orthopedic medical-device company's expansive, maze-like building housed multiple departments, from the telephone buzz of marketing and customer service, to the din of metal-cutting machinery and pneumatic fixtures on the production line. My main interest, however, lied with the work done on the benches of the Engineering lab, strewn with catheters, strain gauges, flow meters, and various medical and mechanical equipment. How exactly did the Engineering Department fit into this organization? What exactly is the 8-to-5 job of a medical product engineer at BREG?

This curiosity, along with a desire to see bioengineering concepts at work and to gain design experience, led me to apply for a summer internship for the Engineering Department of BREG, Inc. at their Vista, California headquarters. BREG specializes in a variety of products including orthopedic and athletic braces, cold therapy products, and drug delivery devices for pain management. Reflecting back, my internship experience at BREG proved valuable in a number of ways, providing me with product and testing design experience as well as insight into the working environment of a biomedical engineering department in industry.

As an intern, I was given several projects, most of which were focused on the pain management product line. I was surprised and encouraged by the freedom I was given to devise methods and utilize machinery to accomplish assignments as I saw fit. The BREG pain management products, known as the Pain Care® line, are portable infusion pumps which allow post-operative patients to self-administer pain relief medication directly to the wound site by way of a multi-port catheter. One of my larger scale projects involved designing the test lead fixtures and specifications for use of a new test apparatus to ensure that each Pain Care unit is build correctly. The testers verify that each drug delivery unit is built with no leaks and the correct flow rate by pressurizing the unit with a consistent volume of air and electronically monitoring the air pressure decay. This project required detailed analysis of the flow mechanics and possible failure modes of the units as well as biological knowledge of how the quantity of delivered drug would affect the body. As a class two medical device, it was very important that the testers identified all faulty units, for a unit that did not properly restrict medication flow could be potentially lethal. I enjoyed the hands-on work of taking the units apart and analyzing the individual valve components as well as building glass flow restrictors in the lab to model different unit flow scenarios. Part of this project involved designing the fixtures that would attach a Pain Care unit to the testers and allow it to be pressurized. I became acquainted with such heavy machinery as a vertical mill, bandsaw, and lathe when creating prototype test leads. After sawing and drilling my fair share of lopsided would-be fixtures, I have a newfound respect for the art of machining. One of the most rewarding moments of my internship was when the new Pain Care testers were finally put out on the production line after copious testing and I was able to see the culmination of my efforts.

Jason Malkin, another UCSD Bioengineering undergraduate, also spent the summer interning for BREG Engineering, working primarily on the cold therapy product line. These products aim to help patients to quickly recover from injury or surgery by decreasing fluid flow to the affected area and slowing the release of chemicals that cause pain and inflammation. Malkin's assignments included determining diameters for the product tubing system that would provide safe and effective cooling fluid flow rates, as well as designing prototype parts for the casing of the product motor. Jason recounted that "Learning material specifications and how to design parts on SolidWorks [3D modeling software] were some of the most valuable things I learned at BREG". He employed many concepts of thermodynamics and fluid flow and his projects often left puddles on his desk.

One of the most noteworthy, and perhaps often overlooked, facets of working in product engineering is the importance of effective communication. I was surprised by the amount of collaboration occurring on a daily basis between engineers of varied backgrounds. I found that the ability to express myself clearly and be open to varied approaches proved essential to making progress on my assignments. The BREG engineers facilitated this collaboration by holding frequent team meetings to share problems and ideas and by extending a general air of approachability. "The working environment was conducive to product creation and [other engineers] were quick to help out with questions," adds Malkin. Frequent collaboration between engineers and members of the production and marketing teams made it necessary to be able to explain technical concepts in clear, accessible terms. Effective written communication also proved crucial as every aspect of product design had to be documented in detail

I highly recommend internship experience to Bioengineering undergraduates. Many of the projects I worked on served to reinforce and provide practical application to concepts from my UCSD coursework, such as fluid mechanics and the nature of human circulation. I feel that the design experience and familiarity with engineering tools that I have gained at BREG will prove useful in future coursework and in my work in research laboratories on campus. Malkin also endorses industrial internship experience: "It can boost your chances of being employed in industry and give you a better idea of what to research in the future." I would like to thank BREG and the UCSD internship coordinator, Imani Tyus, for providing me with this worthwhile experience and I encourage other BMES undergraduates to take advantage of internship opportunities as well.

Landing a Summer Research Internship

Some Useful Information

Michael T. Kim

Dear underclassman Bioengineers,

Harking back to two years ago, I remember well the pains I went through to land an internship for the following summer. I remember the mistakes, the frustration, the stress, and the few things that I did right. The things I have learned, I wish to convey to you.

It was my first year at UCSD. I was young and it was mid-February. As I begin my search for possible summer opportunities, my heart sinks upon discovering that many program deadlines have already expired. The still viable ones have deadlines on 1 March 2005. I know I need to get a move on, but I can't shake off a certain foreboding image. I can already see the scowls and scorns of my professors, who are anxious to know why I had waited until two weeks before the deadline to ask them for letters. This stress and headache could have been missed had I been thoroughly introduced to two key concepts.

"This stress and headache could have been missed had I been thoroughly introduced to two key concepts."

Concept A - Deadlines. A few programs are due as early as January. Most fall on either 1 February or 1 March. But these are the absolute deadlines. In reality, there are several precursor items that must be taken care of much earlier. Do not find yourself in my shoes, where you are forced to ask professors for recommendation letters one or two weeks before their due dates. By one month prior to any absolute deadline, you should already have a resume and a statement of career goals. At one month prior, you should begin soliciting for reference letters from your professors. They will want to see your resume and your personal statement, and you will have them ready.

Concept B – Starting point. It is helpful to start with a comprehensive list of summer opportunities; more focused lists that are tailored to your specific research interests can always be derived from there. Luckily, there are resources that already do this for you. One great online resource is the RIT Co-op and internship listings (www.rit.edu/~gtfsbi/Symp/summer.htm).

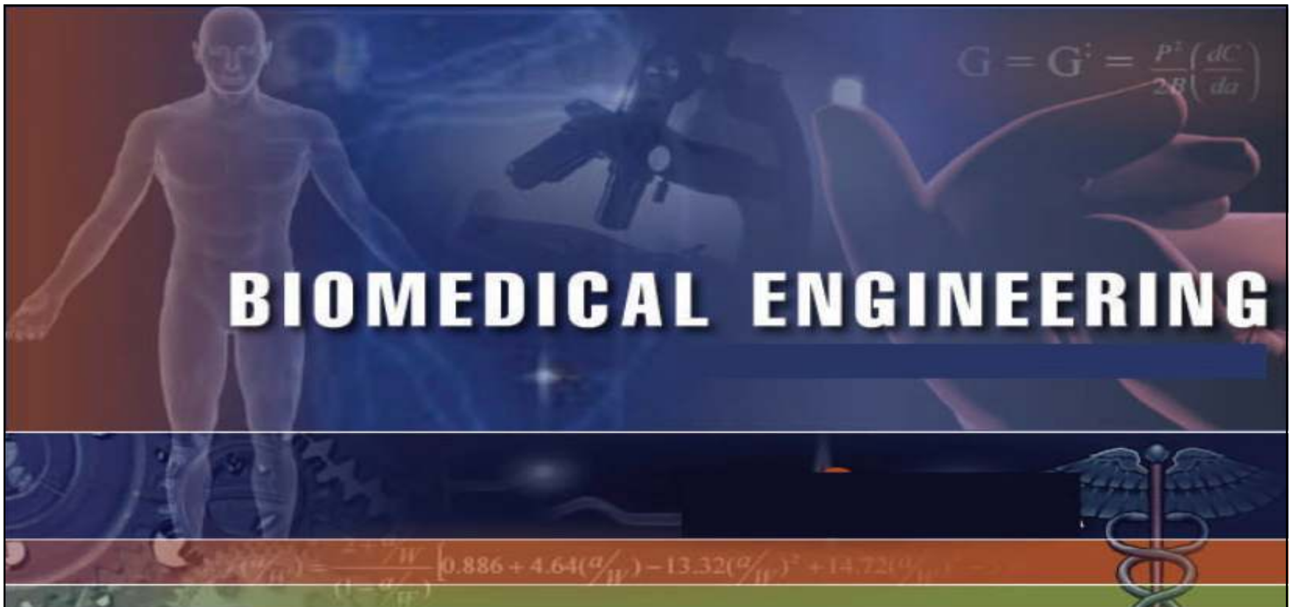
The RIT webpage provides several summer program website listings, each targeting a different audience or purpose. The bioengineer, for instance, may find the co-op and internship listings "in bioinformatics, genomics & proteomics", "related to biomedical engineering", "pre-medical studies", "immunology", or "private companies" the most enticing. Each listing enumerates a hundred or so different summer opportunities. For your convenience, the word "coop" appearing next to each program name links to the corresponding program website, and a short, one or two sentence description, is included for each program. Last year, putting these concepts into practice, I applied for programs at UCSF, UCLA, Scripps, NYU, and CalIT2. I was accepted to two of them and I accepted the offer by UCLA's Neuroengineering Summer Program. I had a blast. I met new friends and future collaborators, felt the different vibes of a different campus, tasted a bit more of what it is like in grad school, and naturally dirtied my hands in new and compelling research topics. As a nice bonus, they awarded me ~$3000 in stipend plus room and board. The particulars of the my independent research I will refrain from delving here, but it would suffice to say that the engineering problems related to a dual-sensing micro-biosensor piqued my interest and kept me preoccupied the entire summer. My purpose here is not to claim that I have found a secret solution that will enable you to escape the initial hardships of landing an internship. I have not even touched upon issues concerning ways to build your experiences during the school year and make your application more competitive. Indeed, many articles could be written addressing this topic alone. Instead, I hope that through my anecdote and advice, you can find ways of organizing and facilitating the application process.

Good luck!

New Developments

Bioengineering Department, UCSD

Ryan Chuang



This picture is taken from the university of Texas at San Antonia (http://engineering.utsa.edu/BME_program/index.html)

As the new school year progresses, plenty of developments are happening in the bioengineering department.

On November 18-20, evaluators representing the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET) visited the department to re-evaluate and make sure that the bioengineering and bioengineering: biotechnology program met standards. This evaluation occurs every six years and ABET accreditation has been obtained and maintained continuously for the bioengineering major since 1987 and the biotechnology major since 2002. Dr. Andrew McCulloch and Dr. Robert Sah, chair and vice-chair of the department, appreciate the students who took part in the evaluation process by talking with evaluators at the lunch and around the department. The results of the evaluation will be released in July 2008.

The application process for the UCSD Amgen Scholars program opened this November. This eight-week summer research program will provide students interested in pursuing a Ph.D or M.D/Ph.D an opportunity to learn valuable research skills and gain networking opportunities and collaborative experience necessary for a career in science or engineering. Students will work in pairs on projects designed and supervised by faculty mentors and will present his/her paper at the UCSD Summer Research Conference. Students must have finished at least four quarters at the time of application. See http://aep.ucsd.edu/amgen for further requirements and details.

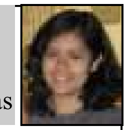
Congratulations to Espoir Kyubwa, a junior, who won the Quantitative Science oral presentation at the Annual Biomedical Research Conference of Minority Students (ABRCMS) for his presentation on cartilage engineering. ABRCMS is the largest professional conference for biomedical students and attracts approximately 2,600 individuals, including 1,650 undergraduate students, 280 graduate students, 30 postdoctoral scientists and 750 faculty and administrators. This year, 1,118 abstracts were accepted and of those only the top eight abstracts in each of the ten disciplines won oral presentations.

The sixth Annual California Tissue Engineering Meeting took place on November 30th at UCLA. The event strives to "provide a forum for education and dissemination of research and development knowledge, for students and researchers in academics and industry, in the field of tissue engineering and regenerative medicine." Faculty and students from UCSD attended including Dr. Karen Christman of bioengineering and Dr. Martin Marsala of anesthesiology who spoke at the event.

The department is planning to propose changes in the course requirements and application requirements for the bioinformatics major in the next few months.

BMES Offerings

Get Involved With These Activities!

Melanie Das 

BMES strives to provide programs that benefit you academically, professionally, and socially. Take a quick look at some of the many programs organized by BMES and see how they can help you!

Mentor/Mentee Program
Connect one-on-one with a knowledgeable undergraduate, graduate or medical student mentor. These mentors have volunteered to share their sapient musings and an extensive amount of experience with you. Chat with them at BMES sponsored mentor/mentee events and get tips and advice on admissions, professors, internships and so much more! Now if only they could help you out with that chemistry lab…

Research Mixers
Learn more about the research your fellow undergraduate bioengineers are currently working on at this panel discussion. They are also ready to answer any of your questions and offer some helpful advice on launching your own undergraduate research debut.

Industry Tours
Tours at local biotech companies give you the chance to experience the environment of an industry setting and get a feel for the differences and similarities between the various companies. This is also a great chance to meet a diverse range of students interested in similar career goals. Plus, who *doesn't* love a good old FIELD TRIP!!!

Industry Nights
Local biotech industry representatives come by the campus to speak about their company and research. Representatives are eager to meet you and answer your questions about their company. Who knows? There may even be an internship or a full-time job offer waiting for you!

Lunch with the Professors
At this event bioengineering students and professors come together to have lunch and converse in an informal setting. This a great chance to get to know the amazing minds of the nationally renowned UCSD faculty. It has become a general consensus among students that have previously attended this event that not only are the professors brilliant but they can be pretty awesome and inspiring individuals as well!

Outreach
An ever-growing program encompassing various volunteering programs in cooperation with local schools and companies, this is an opportunity to give back to the San Diego community. Volunteering is a gratifying way to become involved with BMES, your local community, and the future generation of Dr. Sah, Dr. Ideker and Dr. Sung.

BE-Day Bioengineering Quiz Bowl
Currently in its second year, the Bioengineering Quiz Bowl (BQB) brings together students, professors, alumni and industry members for a night of competition, networking, and fun! Bioengineering students team up to answer quiz questions from a wide range of subjects applicable to their major. This is an opportunity to make key contacts as well as vie for the glory of being the next Ken Jennings of bioengineering.

Contact Us

BMES

If you would like to get involved with the various facets of the BMES, let us know!

bmes.ucsd@gmail.com
(http://bmes.ucsd.edu)

The BEQ

Would you like to contribute to the Newsletter Committee's The BEQ? This involves not only writing, but so much more with design and layout. Contact Priya Sundaramurthy at

thebeq@gmail.com

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We at The BEQ believe that a newsletter would serve to inform students about past and upcoming events. Since then, the publication has grown greatly. Please enjoy this year's first edition of the Bio-E Quarterly!

The Bio-E Quarterly is a newsletter published by the BMES Chapter at UC San Diego.
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GET INVOLVED!

Senior Committee

The Senior Committee organizes events and programs particularly aimed at seniors and graduating bioengineering students. A tradition of the committee has been the annual Senior Graduation Video, which is filmed, edited and produced by members of the committee and shown at the bioengineering graduation ceremony. We hope to plan many fun events for seniors so they enjoy their last year at UCSD. No need to be a senior to join! Contact GianCarlo @ gparico@ucsd.edu.

Historian Committee

We, of the Historian Committee, design, produce, and distribute the BMES yearbook and brochures. Our members are actively involved in BMES and will be required to attend, photograph, and/or write about BMES events. Those who participate in the Historian Committee will become intimately involved with BMES and gain inside perspective on the organization. It is also a great stepping stone for leadership within BMES. Experience in design, photography, and/or newspaper writing are a plus. Contact Michelle @ bmesyearbook@gmail.com.

Entrepreneurship Committee

Interested in entrepreneurship? Have any ideas to share with us or the Bioengineering Department? Then, join this committee. For more information, Contact Nilam @ n3patel@ucsd.edu.

Publicity Committee

We know how much you love BMES, so why not help spread the love? The publicity committee is involved in anything and everything related to publicizing BMES and BMES sponsored events. Activities include creating posters, putting up fliers around campus, and chalking classrooms. No prior experience is necessary but artistic and creative abilities are a plus!
Contact Muthu @ mannaama@ucsd.com.

Alumni Committee

This committee leads you to network with UCSD Bioengineering alumni, find out what they have set out to since graduation, and help others find out anything about post-graduation life through alumni events. In this committee, members help put together events that bring alumni to come and talk about how they find life after graduation - real world stories may, after all, be worth sharing with others.
Contact Harn @ hbchiu@ucsd.edu

Outreach Committee

As we all know, the Outreach Committee does work that appeals to everyone's senses! Help the San Diego community, starting from a very small level - help young school students gain interest in the sciences and engineering by doing fun experiments, and in general, being an unforgettable mentor to those fresh minds! Contact the BMES at bmes@ucsd.edu.

Bioengineering Day Committee (Internal/External)

Members of this committee will be involved in the planning of Bioengineering Day, an all day bioengineering event which includes alumni panels, company presentations, an undergraduate research poster exposition, and the 3rd Annual Bioengineering Quiz Bowl. Committee members will have the opportunity to network with industry professionals, faculty members, graduate students, and other UCSD undergraduates. Contact Stephany and Edward @ stchang@ucsd.edu and eblin@ucsd.edu.

BMES Newsletter Committee

Via the BMES newsletter, you can write about fascinating topics in the Bioengineering field, share any contributions you have made to Bioengineering, and help us substantiate the newsletter. Join us as we pursue our goal of expanding the newsletter - anyone interested in writing or working on the design and layout of the newsletter are welcome. Contact Priya @ thebeq@gmail.com.

Contact UCSD BMES

If you would like to get involved with the various facets of the BMES, let us know!

bmes.ucsd@gmail.com

http://bmes.ucsd.edu

Information on a New Organization:

Happy New Year from Engineering World Health!

It is my pleasure to introduce the newest, youngest engineering organization at UCSD: Engineering World Health! As we all make resolutions for the coming year, EWH at UCSD stands committed to one promise: to improve the condition of health care in disadvantaged areas of the world by developing solutions for hospital instrumentation and infrastructure. Known best for its annual summer institute, in which student engineers travel abroad to assist physicians at beneficiary hospitals, the national Engineering World Health Organization also collects device donations from hospitals and companies in the United States and provides refurbished medical equipment to hospitals in developing countries. Student teams can also participate in designing inexpensive alternatives to more advanced equipment that needy hospitals cannot afford. EWH at UCSD will be holding its very first GBM in the new year, so stay on the lookout for dates and activities. All majors are invited!

Sincerely,
Nikhil Karmarkar
President, EWH at UCSD
nkarmark@ucsd.edu