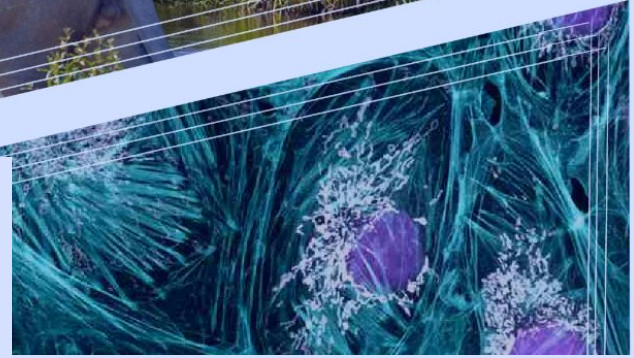


UC San Diego
Jacobs School of Engineering

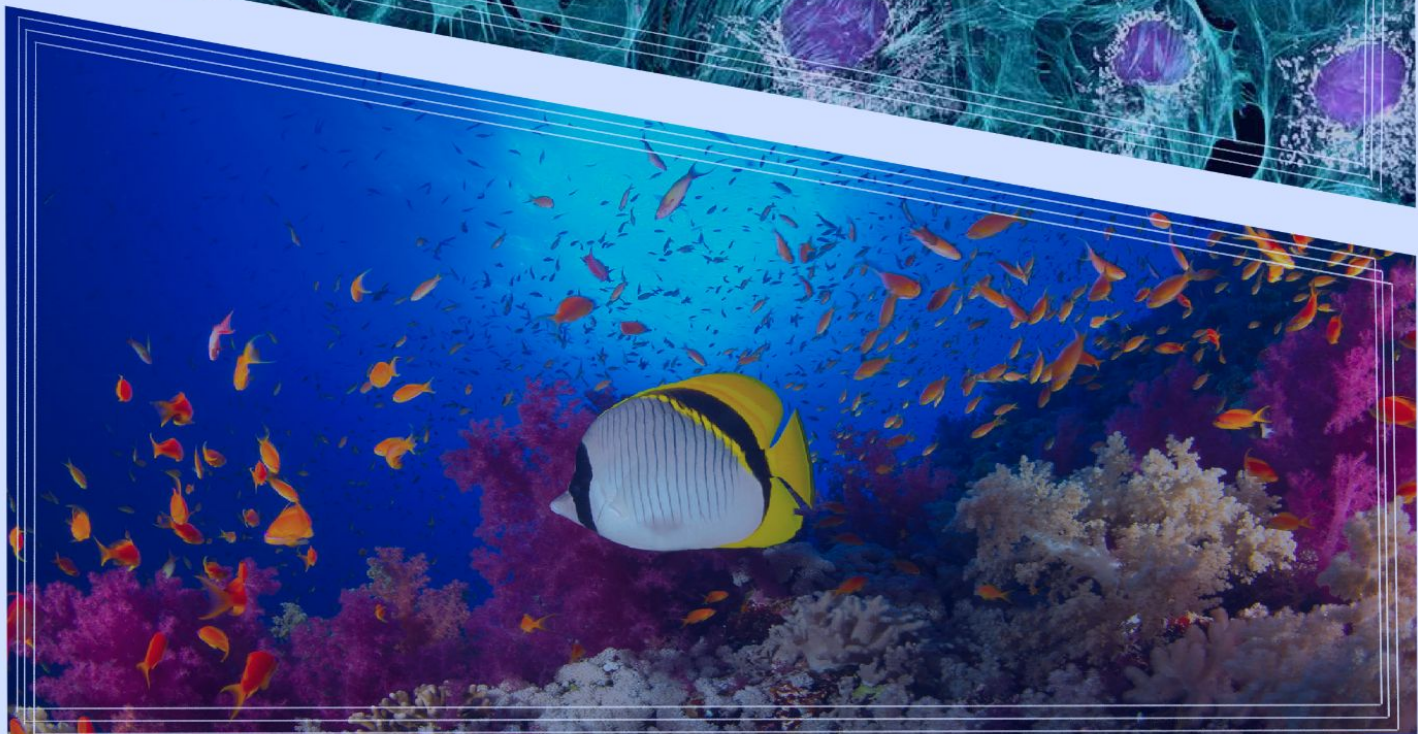
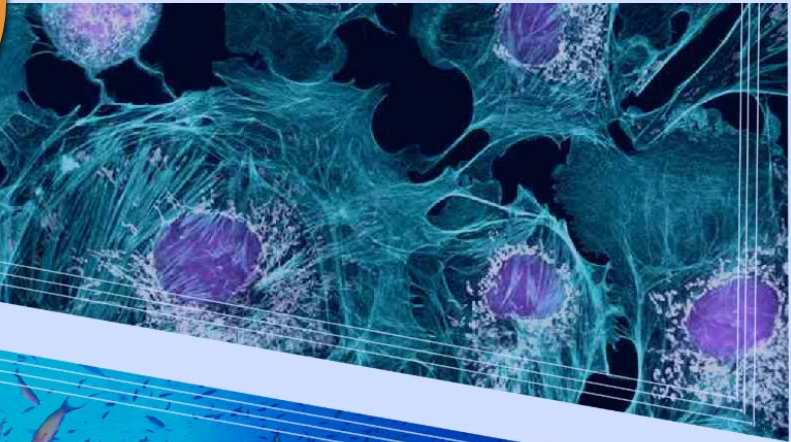


BioEngineering



Newsletter

I GOT MY
COVID-19
VACCINE!



Winter
2021

WIN21 Issue

A Bioengineer's Handbook on How to Make Things Happen Remotely, with Excellent Examples Inside.

The People of BEN

Editor-in-Chief.....	Yichen Xiang
Deputy Editor-in-Chief.....	Maria Sckaff
Features.....	Kevin Yu
Interviews.....	Nicholas Sada
Student Spotlight.....	Yichen Xiang
Copy Edit.....	Maria Sckaff
Production & Background Photo.....	Yichen Xiang
Cover Page.....	Janet Wong
Community Advisor.....	Dr. John Watson
	Professor, Bioengineering, UC San Diego



If you are interested in joining our staff, please contact us at ucsd.ben@gmail.com!

The BioEngineering Newsletter (BEN) is a student run publication that covers the people, research, and events that occur within the U.C. San Diego Bioengineering Department. This WIN21 issue is dedicated to celebrate the inclusive nature of BioEngineering concepts and applications with sincerity and authenticity.

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- ❖ Interviews with Industry
[Mr. Dooley from SeaSpine](#).....Group
- ❖ Interviews with Professor
[Dr.Valdez-Jasso](#).....Nicholas S.
- ❖ Student Spotlight
[Austin Doughty](#).....Yichen X.
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DIVERSITY



**"Mirror, mirror on the wall, who's the fairest of them all?"
--Snow White and the Seven Dwarfs (1937)**

We Care, We Act

The Collective Effort to Maintain And Enhance the Diversity of Our Bioengineering Department

By Maria Scaff & Yichen Xiang | Editors

In our **FALL20 Issue** we introduced the following organizations and foundations:

The Bioengineering Diversity Council
BE Community Committee
The Graduate Student Recruitment Diversity Efforts Program
IDEA Center
Society of Women Engineers
NSF CAREER Funded Outreach

We also promised to present and recognize more programs and individuals that make our Bioengineering Department a more inclusive place.

Once again, thank you for your dedication! We will continue to highlight the diversity efforts of the department on the next issue!

The Bioengineering Diversity Council

Chair

Dr. Stephanie Fraley

Representatives

Faculty: Dr. Francisco Contijoch

Staff: Irene Hom & Mariela Saldana

Graduate student: Maya Rowell

Undergraduate student:

Luis Gonzalez Barranca

**BE-SHIP -
Bioengineering Summer
High School Internship
Program**

This is an advanced six-week research internship program, with the option of experiencing campus life during the first three weeks.
<http://bioengineering.ucsd.edu/edl/highschool-inter-ship>

NSF Diversity Supplement

Funds to support diverse graduate students

Contact: Dr. Stephanie Fraley

*NSF stands for National Science Foundation.

**Training
in Multiscale
Analysis of
Biological Structure
and Function T32
Training Grant**

Contact: Dr. Andrew McCulloch

<http://interfaces.ucsd.edu/>

RISE Grant Training Collaboration

The goal of the grant is to increase the number of SUBR graduates who pursue PhDs in biomedical sciences and STEM related disciplines. For this grant we are taking a holistic approach. We are proposing year-round academic/research training utilizing a dual intramural/extramural model. The model is structured such that SUBR students are assigned both an academic mentor (intramural) and a research mentor (extramural). Students are paired (choose based on research interest) with an external research mentor from one of our collaborating laboratories (T32 granting institution) starting at the beginning of their sophomore year.
Contact: Dr. Wesley Gray - Southern University

**Diverse
Faculty Recruiting Efforts**

Contact: Dr. Schmid-Schonbein

FEATURES

Powell-Focht Bioengin
The w

Translational Medicine Day 2021

A Remote Reflection

By Kevin Yu | Head of Student Org Reps (BMES)



TRANSLATIONAL
MEDICINE
DAY 2021

From Research to Recovery

*Picture of the TMD promotion from the BMES.

In the (hopefully) final months of the COVID-19 pandemic, while vaccination efforts are improving throughout the globe, many annual traditions found themselves adapting to the mid-pandemic, “remote-format” life. Translational Medicine Day, hosted by UCSD Biomedical Engineering Society (BMES), found a unique kind of success in learning from last year’s efforts.

For those who are unfamiliar, Translational Medicine Day (TMD) is a conference-style event organized by BMES, dedicated to bringing together students, industry professionals, and researchers interested in transforming research advances into useful clinical outcomes. Last year, TMD was abruptly interrupted by the onset of the pandemic. The event date was just two days before the entire state of California entered official lockdown. With no time to adapt to a remote format, the responsible committee had to pivot in only about 48 hours to generate a hybrid in-person/online format in compliance with social distancing and capacity limits.

This hybrid format ended up creating some fairly-disruptive technical issues. For example, one of our streaming laptops ran out of power mid-stream. Our Industry Demonstration segment also saw serious limitations, being streamed from phone cameras. While we had successfully adapted to the onset of the pandemic, we performed serious

concessions for the event to happen. As one of the co-chairs for that year’s committee, I felt that we had failed our audience in some respects.

So how does this former co-chair feel about TMD 2021? Much better, in fact! The event transitioned into an entirely online format that allowed the organizing committee to better focus their efforts and avoid the technical issues of the previous year. Overall, the event shifted themes to emphasize a commonly-overlooked element: **community interactions and diversity in bioengineering.**

A strong opening keynote presentation by Dr. Jesse Nodora emphasized the need for engineers and clinicians to interact directly with community representatives in order to better address problems on a community level. It was a paradigm shift that has gone unspoken in the bioengineering community. Engineers design for the particular needs of their clients, and, as bioengineers, our clients are the communities that medicine/med-tech directly impacts. Very often, the needs and resources of impoverished communities make

advanced med-tech and medicine difficult deliverables; meanwhile, local culture and stigmas around medicine can challenge the potential of new med-tech to make an impact. Thus, the typical “bench to bedside” approach of translational medicine benefits when the model is shifted to **“bench to bedside to community.”**

The speaker sessions saw a focus on bioinformatics and modeling, ensuite with the new online format. Dr. Hannah Carter and Dr. Debashis Sahoo gave excellent in-depth presentations on genomics-based tumor treatment, and statistical modeling of cancer growth, respectively. Dr. Andrew McCulloch spoke on the racial, ethnic, and gender diversity of the UCSD bioengineering community, holding up the **committee’s new mission to support diversity in engineering**. I feel that the committee tried their best to find speakers who support their vision of TMD and of translational medicine as a whole.

This year I saw an even stronger demonstration of the TMD committee’s overall vision for the event during the Ethics Panel. Focusing on the ethics of precision medicine and genomics, the panel was downsized to only three panelists (compared to the four of previous years). However, the downsizing helped each panelist’s perspective stand out much more. For example, Dr. Sandra Lee spoke on the need to improve community trust and awareness in genomics – which came from her experience in an organizational role. Meanwhile, Dr. Shumei Kato emphasized clinicians as “knowledge fountains” for patients and the front-line for education on precision medicine – ideas he drew from his personal experience directly interacting with patients. Both perspectives were well-emphasized and played into the themes of community and diversity iterated throughout the event.

As a former co-chair of the TMD committee, I found it very enriching to experience TMD once again as an attendee (while armed with the perspective and memories of what it was like to organize such a large-scale event). The committee’s emphasis on vision shone through with more focused themes and presentation topics, all guided by the 2021 co-chairs Rachel Lian and Karthik Raj. With a break from 2020’s hectic organizational pace, TMD 2021 has been a good improvement. I believe there will be little limit for the heights TMD can aspire for in the future.

Learn more about
the BMES here:

<https://bmes.ucsd.edu/index.html>



INTERVIEWS With Industry

**The Geisel Library On A Cloudy Day -
A Spaceship In A Jungle**

Mr. Zac Dooley from SeaSpine

Manager, Research & Testing at SeaSpine

Group of BEN

Mr. Dooley and His Story with SeaSpine



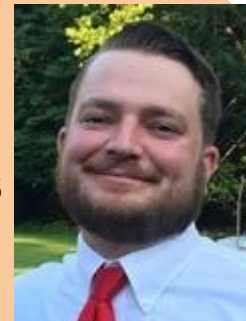
Logo of SeaSpine- Strong Together. Provided and copyright by SeaSpine.

Q: SeaSpine is known for developing technologies to resolve various aspects of spinal diseases, can you introduce the company to our readers as a research manager?

A: SeaSpine has a rather intriguing history. It was founded in its original form in the early 2000s. It went through some changes over the years. After a few years, it was purchased by a bigger company called Integra Life Science in New Jersey. After a few years, Integra made the business decision of making it independent, along with Theken Spine from Ohio and IsoTis from Irvine, CA. In the summer of 2015, this collective spinal business became one independent SeaSpine company, with our headquarters in Carlsbad, California, where I work. We had our biologics manufacturing in Irvine, CA and another engineering development office outside of Philadelphia, PA. We also have a small team of people in our international office in Lyon, France.

I joined SeaSpine 5 years ago in January 2016, and it's just been a good ride so far. Basically, the company's focus is on Spine Implants and Spine Biologics. Our business is structured pretty much 50/50, with half of our revenue coming from the hardware sales, where my specialty lies, and another half from the biologic products.

Mr. Dooley is a known regular at UCSD Bioengineering Department's industrial events. As the industrial representative from SeaSpine, a global company focused on spinal technologies, Mr. Dooley will present us with valuable insights of the company and his perspective as an experienced bioengineer.



In the last five years, we focused on renovating our designs and technologies and came up with plenty of amazing new products based on our decade-old designs. Sales wise, we have doubled our numbers over the last five years and expect to be profitable towards this end of the year (>180 million in sales). So, we are in a good position with lots of room to grow and a lot of areas where we can still go, such as some international territories and certain parts of the United States. Since our products are primarily spinal related, we work closely with surgeons to ensure that we provide the best quality products for our customers.

Q: Could you go over a brief overview of how you went from a college graduate to your position at SeaSpine?

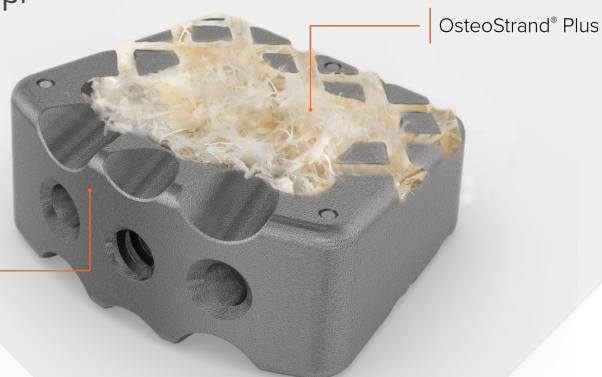
A: I went to Marquette University in Milwaukee, WI, graduating with a Biomedical Engineering Degree with a focus on Bioelectronics. I really thought I'd graduate and work on something related to bioelectronics – ECG's, etc.

But, at the time, my fiance took a job out in San Diego, so I needed to move out there as well.

When I arrived, I didn't really have any connections, and I just applied to a bunch of different places, probably sixty-plus. I heard back from one, which was Scripps Clinic. Dr. Darryl D'Lima runs a research group there that focuses on large joint implants, and I got hired there. For around three years, I did research on large joints (knees and hips), especially looking at cadaver studies for those joints primarily.

After a while, I felt that it was time to move on, so I applied for other jobs. I ended up at NuVasive, another spine implant company, working at their testing and research group. I got that job mostly from my qualifications at Dr. D'Lima lab, specifically that cadaver work, and my job focus was on testing and generating data. I did that for around 7 years, until an opportunity rose at SeaSpine for someone to run their own testing lab. The way I saw it, I could stay working at a lab, or I could join them and run my own lab, so the choice seemed clear.

I didn't think I would end up doing this after graduation, but one opportunity led to another, and I felt this was a path laid out that I was able to follow. So a piece of advice would be to be ready to adjust on the fly to different opportunities that come up.



Q: What excites you the most about your position at this company? In particular, are the challenges you and your team face, and the rewarding feeling of overcoming them, or something else?

A: It's a little bit of everything, but the main thing I enjoy from my position is the variety of work I get to do. Compared to the design engineers, who bring up a project from scratch over 18 months to 3 years, I get to see all of the projects the company makes, their variety and wide range of applications on the spine, as well as knowing the ins-and-out of the testing that we do. I also enjoy how the testing that we do has real, direct results that the design engineers can interpret and help make a difference in the patient's lives. Finally, I enjoy the way we are able to come to a definitive, scientific conclusion on how to better the company's designs, and satisfy FDA regulatory questions on how our products are better than those that already exist.

Q: For bioengineering students interested in pursuing a career in industry but unsure about graduate school, what factors would you suggest they consider in making their decision?

A: Personally, I took a job and worked for a few years, and when I was working at Nuvasive I went to USC and got my master's in biomedical engineering because they have a really nice program to make it easy to do that.

I will say of our engineering team, roughly a quarter of us have a master's, and on the biologics side we see some PhDs—we don't really see those on our hardware side of the field. For the most part, it's a really personal choice: do you have the desire to do it or not? You can get hired with one. You can get hired without one.

It just depends; your salary might adjust a little bit, but not a lot, so it's really personal. What I usually tell people is that whatever company you're working at, it depends on the company and their attitude a little bit. For a lot of companies, it is not going to matter for the job you have now.

When I was at NuVasive, I went back and got my masters, and NuVasive did not care. They paid me the same; I did not get a raise or a promotion because I got a master's, but when I went to apply for the next job at SeaSpine, it did make a difference. It definitely assisted me in getting this job. So it is really personal, whether you have the desire to do it or not. It may not pay off right away, or in the way you think it might, but it will probably pay off eventually.

At SeaSpine, we have some people who have done MBAs, and they are engineers. Those people are a little more management-focused as part of the business. They care about how the dollars and cents run through the company—which is useful to have because a lot of us non-business majors like to just focus on the technology and don't care how much it costs. So again, I would say if you have the desire to do it, then do it, more than anything, but don't feel obligated to do it. If you're wishy-washy, you're not going to have a fun time doing it.

The people who I have known who have waited a little bit after undergrad and worked for a little bit found it probably to be a little more of a rewarding experience, a little more practical application, a little more working on things you really love for your graduate degree, instead of just taking some more classes. Granted, I have worked for smaller companies, so if you work for the Johnson & Johnson's and Medtronic's of the world, they may have a very different attitude too.



* SeaSpine's Product, OsteoSurge® 300 Demineralized Bone Matrix, which contains Accell® Bone Matrix in an advanced medium carrier. Not every spinal-tech company can make their own demineralized bone matrix.

Q: When reviewing candidates for entry-level jobs/internship positions, what are the most important factors you would consider in the hiring process?

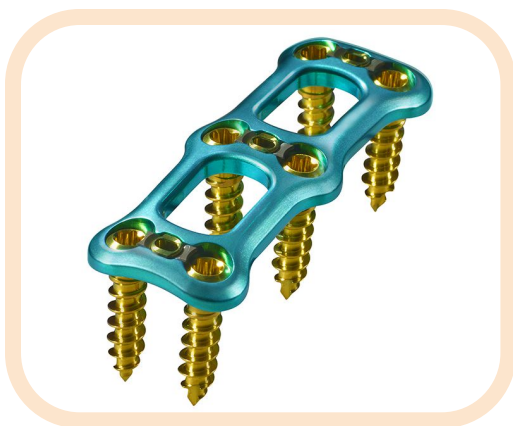
A: What really shines out to us is people with practical internship experience; it doesn't have to be in spine, but if they have orthopedics or good design experience—a lot of our design engineers work in CAD all day doing prints and things like that—so [we look for] things very practical for their internship or their future job. For manufacturing engineering, quality engineering, whether they have done statistical tests and things like that [are important]. After that, for me at least, it is really a matter of whether you can demonstrate some flexibility in your resume. Say you have been a leader over here, and you were taking classes, and you were working. It kind of shows that you have some time management skills, and some flexibility to switch from A to B. It's harder to point those things out obviously in a resume, but if someone knows what they are looking for, they can kind of pick up on those hints.

For my lab, it's important to have practical lab experience; I wouldn't say it is number one by any means, but it's important for me and the jobs that I hire for. That's not necessarily the case for other jobs that people get hired for. It is just what I emphasize because that is what future employees would be doing for me day-to-day.

It is the same thing for our biologics team, like they are looking for people with practical wet-lab experience. People with an engineering degree—mechanical, biomedical—that have practical internship experience tend to float to the tops of our piles when it comes to reading resumes. On the biologics side, if you have the master's or the wet-lab experience, you will have your resume be one of the ones that float to the top. The differentiators, once you add those factors in, are can you show some leadership experience, like the chair of some committee, and can you show some flexibility and work in multiple areas and have shown that you can learn quickly.



* One of SeaSpine's NanoMetalene® Product, used as an implant between two vertebrae.



* SeaSpine's Product Cabo™, used for anterior fixation.

Q: How has SeaSpine adjusted to the pandemic, and continue being a leader in advancing spinal technologies for patients?

A: The pandemic has been interesting. Initially, a lot of hospitals shut down their elective surgeries. As most spine surgeries are considered elective surgeries, there was a lot of uncertainty at SeaSpine around sales, demand forecasting, etc. Fortunately/Unfortunately, spine surgery is not really elective. A patient can only delay surgery so long. Eventually, they will have to have surgery to improve their life. As such, SeaSpine knew that the elective surgery would eventually come back, so our priorities did not change throughout the pandemic. We still had the same pace of development. Our goal was still to develop the best products possible for improving patient lives. Now, we didn't do that in our usual way. We were all sent home to work, which made collaboration a little harder initially. Eventually, everyone got used to the additional video meetings, etc. However, products continued to be developed and released on time. Our development goals and timelines for the year did not change.

For some of us like me, it is impossible to do 100% of my job from home. I have a lab to run, which cannot be moved. Hence, I split my time between the home and the office. The number of days in the office depends on how busy the laboratory is. Product still needs to be tested, and timelines have to be maintained. Primarily, when I am at the office, I do all the lab work. When I am at home, I write reports, do documentation, answer emails, etc.

Of course all of our company events were cancelled last year. Since SeaSpine is big on company culture, this was tough for our employees. SeaSpine likes to have a good time on occasion. There is no definitive talk about coming back to the office 100% of the time yet, but as the pandemic eases, this may be possible in 2021. Furthermore, the internships that we are offering for the summer of 2021 are expected to be hybrid, with some days in the office and some days at home.

Q: How can the UCSD bioengineering department improve in those industrial related events? Do you have any suggestions as to what we should try implementing during and after this global pandemic?

A: For SeaSpine, we are at most of the career fairs. Those are important to us, and those are a great way that we can advertise for open positions. Those are very useful to us from the company's standpoint. Beyond that, SeaSpine is sponsoring a senior design for this year and I am the SeaSpine representative. That is also a good way to get the SeaSpine name around campus. Occasionally, we will be invited to do a lecture for a class or a talk by student orgs, for example BMES. We definitely have been utilizing those opportunities as they are excellent ways to exhibit practical professional applications to those lecture topics.

So... What Do Spinal Implants Look Like On The Bone?



* SeaSpine's Mariner® Outrigger™ Posterior Fixation System, an example of how a variety of spinal implants are incorporated into a versatile and more complicated system.



INTERVIEWS With Professors

Dr. Daniela Valdez-Jasso

An Introduction to Pulmonary Arterial Hypertension (PAH)

By Nicholas Sada | Head Interview Writer



*Dr. Valdez-Jasso

Q: What is your current research focus and why did you choose UCSD?

My research focuses on studying pulmonary arterial hypertension (PAH) which is a disease of the arteries in the lungs that also affects the heart. I use a multiscale approach to understand how these organs interact to affect how the disease progresses, from the cellular level to the organ system scale. Actually, I didn't directly choose UCSD, I should say UCSD chose me. My research has always followed and continued Y. C. Fung's approach to biomechanics and science, so it turned out to be a great match between my research interest and my strong quantitative mathematics background with bioengineering and clinical research here in La Jolla.

Dr. Daniela Valdez-Jasso is a well-established Bioengineer and a passionate educator who enjoys interacting with students and providing them with both resources and opportunities. Her research is in the area of vascular biology with a focus on pulmonary arterial hypertension.

Q: How did you decide what you wanted to specialize in? What aspect of biomechanics did you find most fascinating?

I've always found PAH fascinating. My training in grad school was in vascular mechanics, specifically the more computational and theoretical aspects of it. This alongside my postdoctoral training in cardiac mechanics left me liking those two important organs. I also like the fact that there's this disease that interacts directly with these organs, is very understudied, disproportionately affects women and presents a very nice challenge for combining modeling and experiments in physiology.

Q: What do you find most challenging about modeling PAH and replicating this in humans?

The most important mechanical information is not accessible in humans because it's a silent disease. It's a disease of the arteries and lungs where only invasive measurements can detect the disease. You require echocardiography to confidently identify it, but by then it has already adversely affected the heart. In terms of animals, we actually need to

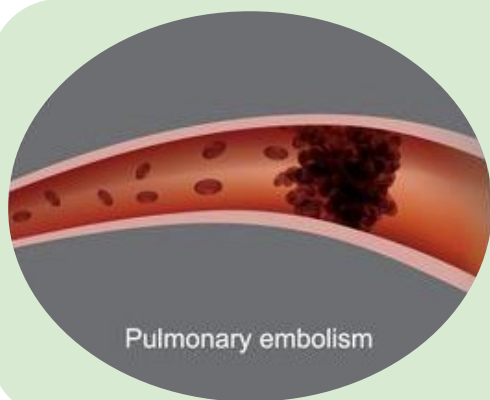
sacrifice them in order to get these types of measurements, so trying to replicate what we see in humans is very challenging. At the same time, what I like the most is maybe that it's so challenging and medically important.

Q: Hypertension is a risk factor for adverse outcome in COVID. Could this pandemic lead to an increase in patients with PAH in the future?

Yes, and in fact this has appeared in the field as with the original SARS-1 outbreak; we saw a big spike in PAH patients. Again, as a disease involving the lungs and the arteries, it's one of the things we're concerned about in the field to cause a spike.

Q: How has the pandemic affected teaching and research?

The part that has been the most challenging is that it's limited my interaction with undergraduate students. My lab is still running; we're at limited capacity but we're still working. Really, not having my class for Biomechanics (BENG 112A) coming into the lab and having to show them videos instead, even trying to motivate them becomes so much more challenging. I think that's the part that's affected me most.



*A common cause of PAH is this condition called Pulmonary Embolism, a blockage to lung blood vessel.

Q: Do you have any advice for the Bioengineering students under you, especially those wanting to pursue a career in Cardiovascular Engineering?

I think, from being in the field and talking to companies and those in higher administrative jobs, the two things that are key are to be strong in quantitative analysis and in-vivo physiology. Those are two aspects of Cardiovascular Engineering that are very highly sought-after skills in graduating students.

Q: What do you think about the Bioengineering field in general? How do you think it's growing? Where do you see it going in the future?

It's growing a lot, we're definitely seeing more Bioengineering undergraduate programs out there, but we also see a lot of other programs doing Bioengineering research, so it's not just growing in one department but in many of them. Anything with biological sciences really has been growing and will continue to grow.

Q: I saw that you received the NSF CAREER Award this year along with your first NIH grant. How have your plans shifted with these awards?

It's been very exciting to have been working so hard for these awards then to be getting them and receiving national recognition. We have a lot of exciting research going on, we're opening a program in my lab on mechanobiology, for example. My NSF CAREER grant and my NIH R01 are going to be opening



*Dr. Valdez-Jasso

up a lot more conversations with cardiologists by looking into how the ventricle remodels and again trying to get some sense of the clinical picture. With the NSF specifically, there's an outreach educational component to it. In addition to continuing my program on the physics of the heart - which is a workshop that I've developed with BEWiSE in San Diego where we have middle and high school girls coming into the lab and learning cardiovascular physiology and mechanics - we also have a program where we're going to be working with one of the local high schools to mentor and work with Hispanic girls and trying to keep them interested in the STEM field. So it's a lot of exciting things coming up on our end.

Q: I see you are the faculty advisor for SHPE, QL+ Plus and very active with the student BMES chapter. What motivates you to spend so much time with these activities?

First, I do like interacting with students and getting to know them. I also think that a little bit of my time goes a long way in making sure that they're well connected and that they have access to the resources they need. I am also really trying to see what I have to bring into the discussion with the faculty regarding what types of career development are needed. So when they ask me if I want to do something, I try and make sure I always make the time.



Student Spotlight

Austin C. Doughty

PhD Candidate, A Glance at Photothermal Therapy

By Yichen Xiang | Editor-in-Chief

My name is Austin, and I am a current 2nd year PhD student in Bioengineering at UC San Diego. After growing up in Oklahoma and attending the University of Central Oklahoma, I moved to San Diego two years ago to pursue my research interests in Synthetic Biology, designing and testing novel genetic circuits in bacteria. Since I've moved here, I've picked up surfing as a hobby (what else in beautiful La Jolla?) and have continued to pursue my passion for research.

Q: After earning your Bachelors Degree in University of Central Oklahoma, what made you become a PhD candidate at UCSD?

Through my research experience at the University of Central Oklahoma, I really just fell in love with the practice of science. I had a wonderful set of mentoring professors at the University of Central Oklahoma who helped guide me through my scientific journey, most notably my research mentor Dr. Wei Chen. Under their guidance and through my own ambition, I sought out a PhD in Bioengineering at UC San Diego to set off a career invested in research.

Q: Your research during undergrad years involved modeling temperature in tissues for cancer photothermal therapy. What is the advantage of photothermal therapy and why is temperature gradient important?

Photothermal therapy, as compared to normative cancer treatments such as chemotherapy and radiotherapy, has far better quality-of-life for patients. In situ irradiation damages the nearby cancer cells, but rather than targeting complete ablation or needing to kill every single cancer cell, our work focused



combining photothermal cancer therapy with immunotherapy so that damaging the tumor is enough to expose the cancer proteins and stimulate a specific anti-cancer immune response. In photoimmunotherapy, the temperature gradient is thought to be of particular importance especially clinically, as every cancer patient presents with a unique cancer with unique antigens and the temperature gradient allows full presentation of the cancer's antigen profile to the immune system. Though many groups are working on better tools to predict immune responses, there is no present way to determine the best antigens for stimulating an effective immune response a priori. As a result, exposing the full cancer protein profile with an ablation gradient and locally injecting immunostimulatory drugs helps to get the immune system to do its part and recognize the parts of the cancer that are not self.

Q: You also worked with nanoparticles and their applications on improving the photothermal therapy. What are some most interesting breakthroughs when incorporating nanotechnology to this cancer treatment?

There are many wonderful and creative nanoengineers who have left me marveled at the inventiveness of some of their structures. For me, there are two interesting breakthroughs in nanomaterial development for cancer treatment - one achieved and one anticipated. Already achieved is the inclusion of immunotherapies on nanoplatforms. These structures allow for precise targeting of the immunological action to the local site and help enhance distal effects of cancer treatments such as an antimetastatic response by combining the local effects of the nanomaterial therapy with a systemic immune response. Unfortunately, the main limitation in their clinical application is the high level of toxicity associated with an incompatible or inorganic nanomaterial backbone. So, for me, the next most-interesting breakthrough is the anticipated arrival of a highly biocompatible immunologically modified nanostructure that can be applied clinically.



Q: How did your early research experience shape your current interests?

My early research experience really helped drive my passion for science and interest in biology. Even though I started out working on macroscopic systems, I came to appreciate the complexities of the underlying biology. While I was thinking about whole tumors and temperature gradients from photothermal irradiation, the conclusions were always tied back to the tumor microenvironment and the complex interplay of immunological signaling. This really helped drive my passion for cellular and molecular biology, where I found the research puzzles to be the most engaging, and which helped lead me to my current field of synthetic biology.

Q: Biodynamics is a very inclusive subject. What else would you choose to study in a biodynamics lab, if you can choose anything?

Biology is a very complicated system. Although the rules of physics and chemistry govern biological interactions, the number and complexity of the interacting elements can lead to wild and unpredictable outcomes. Oftentimes, biology, including the intricate interactions that govern a single cell, is studied in broad populations of cells in tissues or other broad biological systems. Similarly, the dynamics of what occurs with the molecules inside the cells is often brushed over to study cellular function on longer timescales. What we try to understand in biodynamics is often how these intricate molecular interactions give rise to more complex phenotypes of behavior in cells. For example, how do cells understand and interact with the circadian clock and other long-timescale oscillations?

To do this, we construct new genetic circuits with engineered function as designed by us and test them in simple model systems like *E. coli*.

Q: Apart from your research experience and bachelors degree, what did you earn from your undergraduate years that helped you the most now?

I think the most important thing I gained from my undergraduate years is a hardy attitude towards life. Like many students, my undergraduate years were highly busy as I was involved in many classes and extracurricular activities, and this led to an experience not unlike a rollercoaster. Learning how to work through the busy times or buckle down with resolve to temper uncertain ones has been invaluable to me in graduate school since.



*Austin keeping himself and others safe during the pandemic. Way to go, Austin!





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