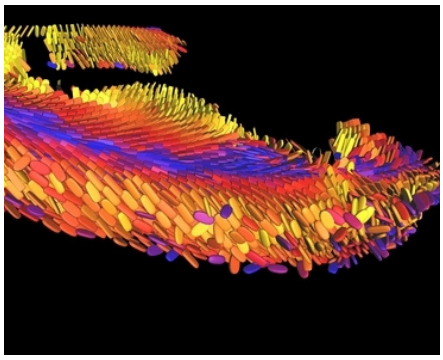
UC San Diego
JACOBS SCHOOL OF ENGINEERING
Bioengineering

Vol. 2

BIOENGINEERING

ANNUAL IMPACT REPORT

2019-2020



INNOVATE **TRANSFORM** **THRIVE**

54 YEARS 1966-2020

UC San Diego
JACOBS SCHOOL OF ENGINEERING
Bioengineering

BIOENGINEERING
Opportunities for Life

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$3.43 M Increase in Grant Funding

LEARNING COMMUNITY

556 Undergraduates

105 Graduate

152 Ph.D.

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33 → 40 Total Faculty

29 → 31 Society Fellows

30 → 58 Average H-Index

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10k+ → 26K

5 National Academy Members

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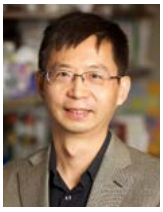

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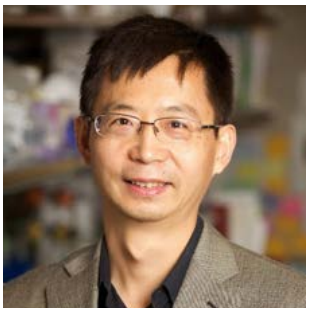


In Adverse Times

INNOVATE TRANSFORM THRIVE

This year presented us with a multitude of new challenges universally and on various fronts. From COVID-19, to the current climate of anti-blackness and calls for anti-racism and social justice. Students, teachers, staff, and families have had to adapt to new ways of life under what seems like a pressure cooker ready to burst. It is during these trying times that there is a need for solidarity and innovation to move forward and succeed.

Fortunately, at the UC San Diego Bioengineering Department - we have come together to face these challenges and support one another. As the Chair of the department, it brings me great pleasure to see the department thrive during these adverse times. The stories highlighted in this year's annual report depict this year's current message "Innovate, Transform, Thrive".

Faculty-led efforts to combat COVID-19 include Prof. Rob Knight's call for citizens to contribute to COVID-19 studies as well as new teaching and learning innovations and continuous diversity efforts. Students have also been working relentlessly to find solutions to the current pandemic. During Spring Break, a group of Bioengineering students harnessed their knowledge to participate in the life ventilator challenge and, along the way, realized that with their engineering skills they can make a direct impact.

Code Life Ventilator Challenge

When it came to teaching, instructors such as Prof. Fraley utilized tools students were already familiar with to create a new way of teaching and learning online and along the way improved teaching and learning skills. In addition, students such as Hope Leng and the Big BENG, have been working on empowering Bioengineering students via educational resources to help them succeed during these tumultuous times. Students like Gladys Ornelas are crossing borders to bridge gaps in the STEM field for underrepresented people. Students have truly taken it upon themselves to teach and support one another.

There also continues to be an emergence of faculty leaders, such as Prof. Andrew McCulloch, who is the new director for the Institute of Engineering and Medicine. New faculty members are also making strides, like Prof. Ben Smarr who is creating an alert system for COVID-19 and Dr. Brian Aguado who is working to build a sense of community through his work and fierce advocacy for equity, diversity and inclusion. Prof. Daniela Valdez-Jasso and Prof. Adam Engler are also fierce advocates for diversity and inclusion from running programs for underrepresented students to winning inclusivity awards.

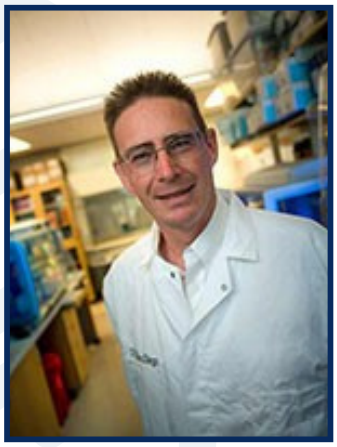
Students and organizations are continuing to earn awards and alumni are paving pathways for future students. These alumni credit support from faculty and the interdisciplinary aspect of the department for their successes. Across the board, the fervor and energy of the entire department cannot be more apparent.

Despite the challenges we faced in our current state and the fears and uncertainties we encountered, everyone in the Bioengineering Department at UC San Diego has contributed to our continued strength as a learning community and we persevere. I am honored to present to you this year's Annual Report, spotlighting some of our efforts and achievements.

Kun Zhang, Ph.D.

Professor and Chair of Bioengineering Department

Rob Knight, Ph.D.
Professor of Bioengineering | Computer Science | Pediatrics
Director of The Center for Microbiome Innovation



Call for Citizen Scientists to Contribute to COVID-19 Studies

The Microsetta Initiative, a crowdsourced research effort led by Bioengineering Professor Rob Knight at UC San Diego, has expanded its capabilities to now allow citizen-scientists around the world to help collect crucial information about SARS-CoV-2, the novel coronavirus causing a COVID-19 pandemic.

"We are now positioned to collect data that will help drive epidemiological studies of where the virus is and isn't, and help researchers determine who is at greatest risk, who is already immune, how the virus is transmitted and how it spreads through a population," said Dr. Knight, who also is director of the Center for Microbiome Innovation at UC San Diego.

The Microsetta Initiative's original goal is to improve our understanding of human microbiomes —which types of bacteria live where in our bodies, how many of each and how they are influenced by diet, lifestyle and disease. To do this, citizen-scientists around the world contribute $99 to receive a kit to collect fecal, nasal, oral or skin swabs and instructions to mail them back. Once the UC San Diego team processes the sample, participants receive a report that details what is living in their guts or other body sites they sampled. The anonymized data contributed by participants drive hundreds of research studies around the world on the many ways bacteria and other microbes are influenced by our environments, health, diet and habits, and how those microbes in turn influence our health.

In order to now collect valuable research data on SARS-CoV-2, the team has tweaked the Microsetta kits in two key ways:

1) Preserving viral RNA: Instead of including dry swabs appropriate for collecting microbial DNA, the kits mailed out to participants will now include 95 percent ethanol, which preserves viral RNA, the genetic material used by SARS-CoV-2. This information will help researchers better understand how the virus spreads and the environmental and lifestyle factors that might increase a person's risk for contracting and transmitting the virus.

2) Collecting blood samples: the kits also include lancets—small devices that allow for easy blood sample collection by finger-stick, similar to at-home glucose tests used routinely by persons with diabetes. These samples may be used to determine who has already been exposed to SARS-CoV-2 and has developed immunity in the form of antibodies.

Microsetta's ability to pivot to RNA collection was driven by collaboration with several other UC San Diego faculty members in the School of Medicine, who communicate via a new Slack channel called San Diego COVID Research Enterprise Network (SCREEN), which now includes more than 800 San Diego researchers. Additionally, BD (Becton, Dickinson and Company), a global medical technology company with a large presence in San Diego, offered 20,000 lancets.

Ranjeet Banerjee, worldwide president of Medication Management Solutions at BD, said the lancet offer was inspired by BD's commitment to public/private partnership that address critical community needs, both scientific and global.

Adapted from article published April 9, 2020 by Heather Buschman, courtesy of UC San Diego News Center https://ucsdnews.ucsd.edu/

Kevin King, M.D., Ph.D.
Assistant Professor of Bioengineering | Cardiology

Technologies for Chronic Disease Management during COVID-19

The COVID-19 pandemic has preferentially impacted the elderly and patients with chronic diseases such as heart failure and Chronic Obstructive Pulmonary Disease. As some of the most vulnerable individuals in our community, these patients are self-quarantining at home and are reluctant to self-report symptoms out of fear they will require hospitalization. As a consequence, hospitals and clinics have markedly increased usage of telemedicine and virtual visits. Remote monitoring technologies offer an opportunity to supplement virtual visits with objective home health data, but most solutions require regular adherence to wearable sensors, regular device charging, or engagement with a smartphone app.

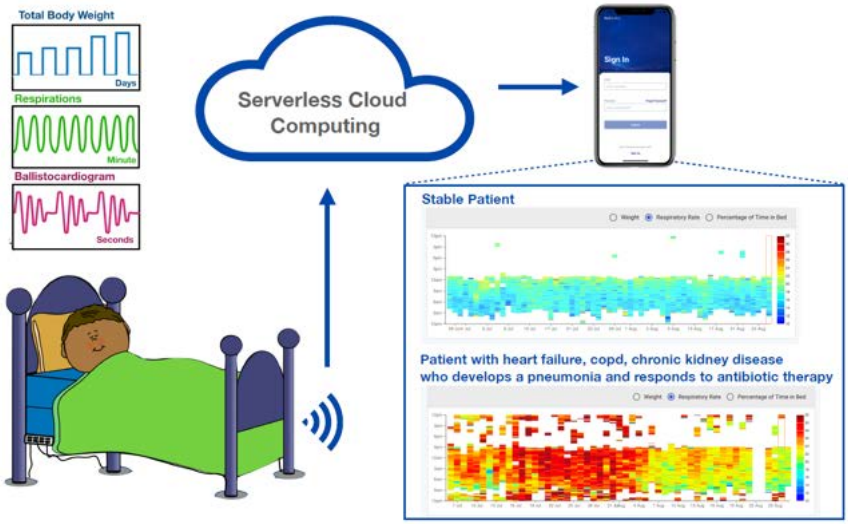
Professor Kevin King's lab at UC San Diego Bioengineering has developed a fully non-contact vitals sensor that requires no adherence to a wearable device or any other form of patient participation, making it easy to monitor elderly patients and those with diseases like heart failure and COPD who are not technophiles. The solution, termed "BedScales", consists of low-profile sensors placed underneath the legs of a typical bed, which automatically collects physiologic data during sleep and securely transmits it for analysis in the cloud via the home WiFi.

Using signal processing, the team is able to deeply characterize the dynamics of respirations, heart rate and regularity, movements, and sleep.

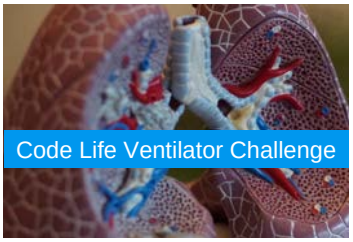
It is also able to measure total body weight, which can highlight fluid accumulation in patients with heart failure or advanced kidney disease.

Since many people share the bed with a partner or a pet, the team developed algorithms that separate signals from multiple individuals sleeping in bed at the same time. The team has deployed devices to patients throughout the broader San Diego area and has monitored for as long as 6 months, all without requiring any patient participation. In several cases, signatures of impending hospitalization can be seen in the data.

As we work to continue caring for the vulnerable in our communities, technologies such as BedScales offer a new opportunity to create detailed pictures of home health in patients and learn to recognize the signatures of acute illness, exacerbation of chronic disease, and response to therapy.



The work has been funded by grants from the National Heart, Lung and Blood Institute at the National Institutes of Health, the Clinical and Translational Research Institute at UCSD, and the American Heart Association.



COVID-19: Students Harness Their Knowledge for Ventilator Challenge

Inspire: it can mean *to breathe in air*, or to *fill someone with the urge to take action.*

Both definitions were on display as a group of Bioengineering Ph.D. students at UC San Diego traded their conventional spring breaks for a chance to address the ventilator shortage created by the COVID-19 pandemic. As part of the international Code Life Ventilator Challenge, the team set out to design and prototype a low-cost, easy-to-build ventilator that meets the needs of COVID-19-infected patients with severe respiratory distress – all in the just eight days.

Bioengineering Ph.D. students Anjulie Agrusa, Sydnee Hyman, and Nicholas Harrington, partnered with a retired electrical engineer, a Sacramento physician, and a video game developer in Canada to form the multidisciplinary team. Despite having no formal experience building ventilator technologies, the students applied creativity, problem-solving skills, fundamental first principles, and their individual areas of expertise.

Anjulie Agrusa

Sydnee Hyman

Nicholas Harrington

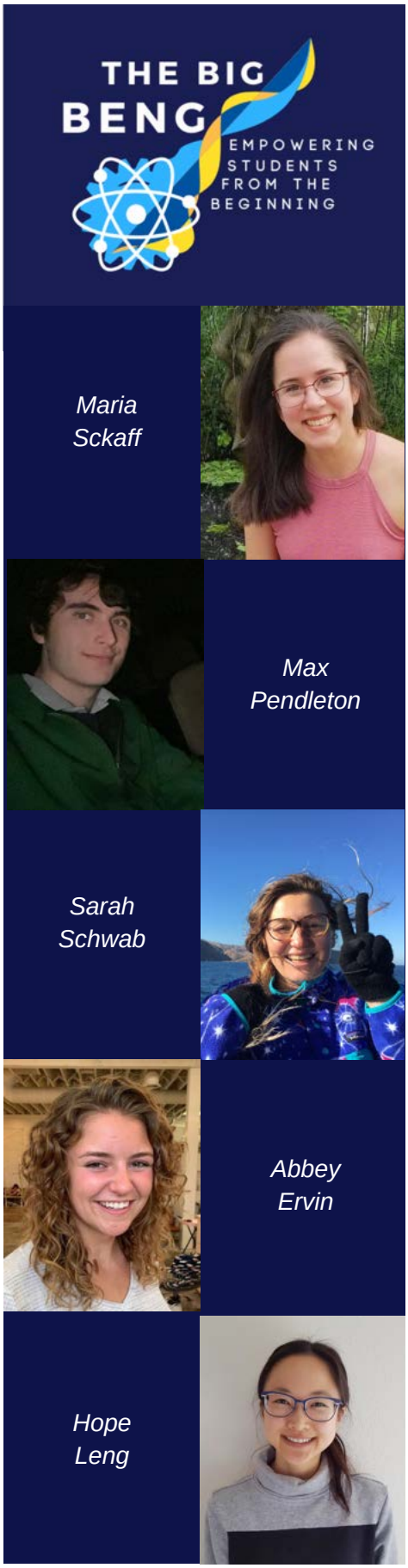
Agrusa, who develops computational methods to understand the electrical waves of the gastrointestinal tract described that the competition felt like as a *"call to action"* and reflected that *"UC San Diego prepared us really well for something like this."* She commented, *"we couldn't just sit there and have a spring break without trying to help solve this problem."*

Hyman, whose graduate research focuses on development of therapies for rotator cuff disease, leveraged agile project management and commented that "virtually managing the multidisciplinary team to meet the changing design specifications in a very short timeframe was the biggest learning opportunity."

Harrington, who develops home health devices to reduce avoidable heart failure hospitalizations, acknowledged that "this was all new to us," but found it "interesting to balance the need for a high-pressure supply while precisely controlling low pressures to minimize lung injury."

Indeed, patients infected by COVID-19 often develop acute respiratory distress syndrome (ARDS), which places them at risk of pressure-related lung injury during mechanical ventilation. Therefore, the team was specifically focused on designs that performed pressure-control rather than flow-control ventilation. As the students analyzed the tradeoffs of various pressure control technologies, they learned that state-of-the-art ventilators require expensive difficult-to-manufacture components to simultaneously control low pressures and low flows with high precision. In the end, the team decided to base their ventilator design on scuba diving regulators and now await feedback on their design and announcement of finalists.

Regardless of the outcome, the students can be assured that this will remain the most inspired spring break of their lives.



The Big BENG: Empowering Students from the Beginning

The Big BENG strives to empower bioengineering undergraduate students with educational resources to succeed in their courses through educational videos on bioengineering topics. Our mission is to provide bioengineering students with the opportunity to unlock their potential in this growing field.

Every quarter, hundreds of bioengineering students have found it desirable to supplement their learning with additional online resources. Symptoms include frustration, fatigue, and loss of productivity as students frantically search for visual examples and accessible explanations to accompany the material provided in lectures and discussion sections. An online video resource specifically tailored to foundational bioengineering courses will decrease stress and increase motivation to tackle big questions in the growing field of bioengineering. The Big BENG will provide open-source material that all STEM students, from high school to college and beyond, can view and review, leading to a larger, more diverse, and more proficient group of future bioengineers and scientists.

Specific Aims:

1. **To create an online visual resource that bioengineering students will find useful for understanding complex problems and concepts**
2. **To build foundational skills in problem-solving videos that students can apply to any of their STEM courses**
3. **To return the focus to learning with a variety of videos that cover breadth and depth of bioengineering, so students do not need to search for online supplemental resources (that may not exist!)**

The Big BENG is establishing a community where information can be shared freely, so that students know where to look when they need help. We hope the resources we create will support fundamental courses and serve as a launching pad for students to take the initiative to delve deeper into research and learn all they can about bioengineering topics.

We are closely collaborating with faculty who teach the BENG courses to check the accuracy of the scripts we write for the videos. Using several different video editing platforms, we will creatively present complex material with visual animations, walking through problems step by step, and/or practical examples. We are currently preparing videos for Fall 2020, so please stay tuned!

The Art of Assisting Discovery

Stephanie Fraley, Ph.D.
Associate Professor of Bioengineering

In the era of COVID-19, teachers and students in the United States often find themselves asking, "how will teaching and learning look like from now on?" Being a teacher, as many of us know, is not an easy feat. However, instructors such as Prof. Stephanie Fraley have taken present challenges and used them to develop innovative teaching methods, ultimately leading to new ways of learning.

As an Associate Professor in the Department of Bioengineering, Prof. Fraley teaches the course BENG 103B Mass Transfer. This course is typically taught in person but due to COVID-19, the course had to be moved online for Spring 2020. For Prof. Fraley this was a perfect opportunity to create a course in which students would delve into real life scenarios and acquire a stronger grasp of the material rather than just being bogged down with math. Her whole approach was built around the goal of avoiding an increase in the burden of learning on her students while simultaneously ensuring that learning opportunities are not reduced.

Create and Share the Tools

To accomplish this, Prof. Fraley organized training sessions for faculty and teaching assistants to help them setup and run their courses using remote learning tools that she was familiar with, such as Zoom, Canvas, and Gradescope. In addition, she negotiated a free license for 'Explain Everything' that was extended to anyone with a UC San Diego email to further the teaching and learning potential of the spring quarter.

Restructure and Challenge

In her own course, Prof. Fraley restructured her midterm exam into a lower-stakes, more frequent assessment format. This consisted of weekly Oral Quizzes where students filmed themselves explaining key concepts, like the rationale for a simplifying assumption or how they would approach solving a certain problem based on the week's material. As for the final exam, Prof. Fraley and her teaching assistants devised an interactive web interface to simulate reallife industry work scenarios for a class size of 130. Each student was "hired" to work on a design and analysis project and had to request key measurements or experiments to solve their problems.

> "The Art of Teaching is the Art of Assisting Discovery" is a quote by Mark Van Doren that succinctly sums up what Dr. Fraley has achieved. Dr. Fraley has truly mastered the art of teaching.

Outcomes and Feedback

Using a points bank system integrated into the web interface, they would "pay" for the data they requested. As such, the more accurate approaches would result in better scores. This again challenged the students to think about the 'how' and the 'why' of the subject. This interactive format also allowed for a variety of unique sets of data to be distributed leading to unique solutions, which supported the maintainence of academic integrity in the course.

As such, the more accurate approaches would result in better scores. This again challenged the students to think about the 'how' and the 'why' of the subject. This interactive format also allowed for a variety of unique sets of data to be distributed leading to unique solutions, which supported the maintainence of academic integrity in the course. To only say that Prof. Fraley thought of everything in preparation for teaching this course does not do justice to all the planning and work that was done to make the course truly successful. As a measure of her success, Prof. Fraley has received positive feedback from students and faculty.

Students have stated that initially they thought it would take a long time to adjust to the class but Prof. Fraley made the class easy to adjust to. Students have also said that as a result they want to base their research projects and senior design coursework on topics taught in the course, also mentioning that the course taught them new ways of thinking, learning, and approaching problems.

Bernhard Palsson, Ph.D.
Distinguished Professor of Bioengineering

$110M for Biotechnology Research

The Center for Biosustainability at The Technical University Denmark (DTU) just received an extension grant of $110M, 10-15% of which will be subcontracted to UC San Diego. The center is led by Bernhard Palsson, the Distinguished Galletti Professor of Bioengineering at UC San Diego.

These funds were provided by The Novo Nordisk Foundation, Denmark's largest foundation, which has been supporting the Center since 2011 to pave the way for the development of new sustainable consumer products and strengthening biotechnology research. Over 40% of manufacturing in Denmark is done through biomanufacturing and this area of research is of critical importance to the country.

"We are very grateful to receive a grant of this size. It ensures that we have excellent conditions for continuing our research activities and exploration of how biotechnology, synthetic biology, and data analysis can contribute a wide range of consumer goods being produced in a greener and cheaper way than today," says Dr. Palsson, who serves as CEO of the Novo Nordisk Foundation Center for Biosustainability that houses the project.

The additional funding will ensure that the Center can continue its research activities for the coming 5 years. The Center has become a world leader when it comes to gaining knowledge and developing technologies for the sustainable production of biochemicals and green consumer products by mastering the design of cell factories.

During the new funding period, the Center for Biosustainability will focus on three main areas: sustainable chemicals, bioactive compounds, and microbial foods and feed ingredients. Research within these areas will be an incentive to promote more sustainable lifestyles and to develop bio-based products such as medicine, foodstuff ingredients and specialty chemicals – products which today are produced mainly through oil-based processes or by extracting valuable materials from rare plants, harming both the climate and the world's biodiversity. This vision goes hand in hand with DTU's decision to work strategically with the UN's 17 Sustainable Development Goals.

The new funding provides an important framework for continuing existing research activities while venturing into new scientific areas. For instance, the latest technological developments within genome-scale analysis and advanced robot technologies have been a game-changer when it comes to generating and analyzing large datasets that are crucial in understanding and managing complex biological systems. One new goal for the center is to establish an infrastructure – a so-called Biofoundry – to use big data in the design of the next generation of cell factories. This proves that big data has not only become the talk of the town in large technological companies, but that it has also caught the attention of scientists as a tool to develop smarter and greener products.

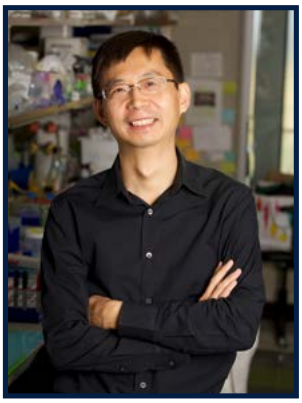
*"We have already established 27 spinout companies, and we will continue to create new companies along with new and greener workplaces,"*says Bernhard Palsson.

The center does not expect to drive the development on its own: future success will depend on an expansion of international collaboration with other research centers, including efforts at UCSD. Furthermore, there is a clear wish to establish new collaboration agreements with industrial partners to ensure that scientific work can be translated into new products for the benefit of society.

The new funding period runs from January 2021 to December 2025.

FACULTY SPOTLIGHT

Kun Zhang, Ph.D.
Professor of Bioengineering



Non-invasive Blood Test Can Detect Cancer Four Years Before Conventional Diagnosis Methods

An international team of researchers led by Kun Zhang, Ph.D. Professor and Chair of the Department of Bioengineering at the UC San Diego, has developed a non-invasive blood test that can detect whether an individual has one of five common types of cancers, four years before the condition can be diagnosed with current methods.

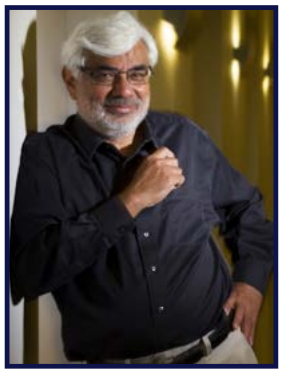
Featured in a July 2020 publication of Nature Communications, the test detects stomach, esophageal, colorectal, lung and liver cancer. Blood samples in the study were collected as part of 2007-2017 longitudinal study that has collected plasma samples from over 120,000 individuals at regular check-ins with physicians. Once a person was diagnosed with cancer, the researchers had access to blood samples taken one to four years before these patients even started to show symptoms.

Called PanSeer, the test detected cancer in 91% of samples from individuals who had been asymptomatic when the samples were collected and were only diagnosed with cancer one to four years later. In addition, the test accurately detected cancer in 88% of samples from 113 patients who were already diagnosed when the samples were collected. The test also recognized cancer-free samples 95% of the time.

The study is unique in that researchers had access to blood samples from patients who were asymptomatic and had not yet been diagnosed. “The ultimate goal would be performing blood tests like this routinely during annual health checkups. But the immediate focus is to test people at higher risk, based on family history, age or other known risk factors” said Prof. Zhang, who also is a co-founder and scientific advisor at Singlera Genomics, a spinout that is working to commercialize the tests based on advances originally made in his lab.

Prof. Zhang, Singlera Genomics and additional collaborators have been working to make a formal demonstration that cancer can be detected in the blood prior to conventional diagnosis. The July 2020 Nature Communications publication is an outcome of a decade-long effort by Prof. Zhang and his lab to develop methods for cancer detection based on a biological process called DNA methylation analysis. The method screens for a particular DNA signature called CpG methylation, which is the addition of methyl groups to multiple adjacent CG sequences in a DNA molecule. Each tissue in the body can be identified by its unique signature of methylation haplotypes.

Early detection is important because the survival of cancer patients increases significantly when the disease is identified at early stages, as the tumor can be surgically removed or treated with appropriate drugs. However, only a limited number of early screening tests exist for a few cancer types. Prof. Zhang and his co-authors believe that the Pan Sear test is most likely equipped to identify patients who already have cancerous growths, but remain asymptomatic for current detection methods.



Shankar Subramaniam, Ph.D.
Distinguished Professor of Bioengineering

Prof. Subramaniam wins $1.5M in NIH Common Fund support, his 8th active NIH grant

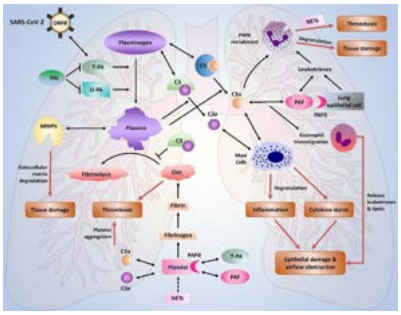
Despite all the challenges that the year of 2020 has brought, Shankar Subramaniam, PhD, Distinguished Professor of Bioengineering, Computer Science & Engineering and Cellular & Molecular Medicine, and President of the IEEE Engineering in Medicine and Biology Society, has managed to keep his momentum of asking the hard questions and establishing new paradigms in biomedical research.

Shankar Subramaniam who holds the inaugural Joan and Irwin Jacobs Endowed Chair in Bioengineering and Systems Biology has just received an additional $1.5M 3-year grant over 3 years on Other Transactions Award (OTA) for Mechanisms of Integration of NIH Common Funds Data. According to the NIH, the Common Fund programs address emerging scientific opportunities and pressing challenges in biomedical research that no single NIH Institute or Center (IC) can address on its own, but are of high priority for the NIH. Prof. Subramaniam's funding will be utilized to establish new insights out of existing datasets that were created from other NIH Common Fund projects to make them more actionable.

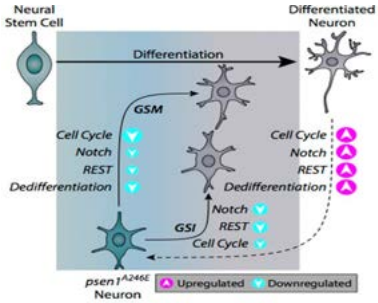
To Prof. Subramaniam, measurements, modeling and design are the foundations of engineering. He states that *"the big data challenge is not simply how the big data is dealt with but rather how does one build new engineering models with the data to yield new and meaningful insights."* These words of wisdom from Prof. Subramaniam speak to his long-standing ties with the National Institute of Health (NIH).

With the new grant, he has a total of 8 NIH Research Grants. In addition, he is the Principal Investigator of the NIH Training grant in Systems Biology which has been ongoing for 20 years under his directorship and just underwent submission for a renewal for years 21-25. Since its establishment, the Program has graduated 68 Ph.D. students many of whom have secured positions in academia and industry, including faculty positions at Stanford University, Washington University in St. Louis, University of California San Diego, and University of Virginia, and serving as research scientists in biotech companies Illumina, Johnson and Johnson Co., Pacific Biosciences, and Synthetic Biology.

Prof. Subramaniam is excited about some of his research group's new findings about Covid-19 mechanisms and new insights into Alzheimer's disease. Specifically, his recent publication titled "Plasmin Cascade Mediates Thrombotic Events in SARS-CoV-2 Infection via Complement and Platelet-Activating Systems" in *IEEE Open Journal of Engineering in Medicine and Biology* shows why does COVID-19 lead to thrombotic complications in critically ill patients and recommends potential therapeutic interventions. He is currently focused on understanding the failure of cell-mediated immunity in patients with acute infection.



Prof. Subramaniam's new finding about Alzheimer's, to be featured in *Science Advances* in November provides a paradigm shift into fundamental mechanisms that lead to disease. He and his colleagues have shown that the hallmark of familial Alzheimer's disease is dedifferentiation of neurons. Using induced pluripotent stem cells derived neurons from familial AD patients, his laboratory has carried out myriad omics measurements to decipher what goes wrong in AD neurons. His work shows that onset of dementia is associated with neurons reversing to a non-neuronal state leading to synaptic loss. This systems view sheds new light on Alzheimer's disease



Ben Smarr, Ph.D.
Assistant Professor of Bioengieering

Creating an Early Alert System for COVID-19

To better understand early signs of coronavirus and the virus' spread, physicians around the country and data scientists at UC San Diego are working together to use a wearable device to monitor more than 12,000 people, including thousands of healthcare workers. The effort is already underway at hospitals in the San Francisco Bay Area and at the University of West Virginia.

Our first push is to get as many people involved as possible," said Benjamin Smarr, an Assistant Professor in Bioengineering at UC San Diego who leads the data analysis effort. "If enough people are involved we can cover the whole country," he said.

The ultimate goal is to develop the equivalent of a weather map for COVID-19 spread and severity, based on developing algorithms for sickness prediction and early alert, with the help of researchers at the San Diego Supercomputer Center, which have previously developed tools to gather data about wildfires and predict where the blazes are headed. The team hopes to do the same with the virus. Algorithms will be released publicly and anyone providing data would have the option to contribute to these efforts.

"**This will be the deepest data dive into an illness that has been attempted and carried out**," said Prof. Smarr.

The wearable device is a ring provided by Oura, a Finnish startup. More than 10,000 Oura ring users have signed up to provide data and fill out questionnaires for this study. While not an FDA registered healthcare device, the ring monitors a range of signals, including continuous temperature, heart rate, respiration rate and activity.

Initial analysis suggests that a destabilization of temperature happens a couple of days before coronavirus symptoms manifest. The Oura ring detects this pattern. The app also reports daily temperature changes, which can be a signal for healthcare workers to check their temperature with a thermometer and stay home if it's elevated. Oura has provided the device free of charge to 2,000 healthcare workers at the UCSF Medical Center and Zuckerberg San Francisco General Hospital. After UC San Francisco shut down all non-essential work, Prof. Smarr and researchers at UCSF worked together with Oura to design a study to target healthcare workers with the aim to alert them to stay home from work and get treatment in a more rapid fashion than exists today.

Ultimately, said Prof. Smarr, *the researchers hope to use the data to predict the virus' spread and set up an early alert system.*

Adapted from article published on April 2, 2020 by Ioana Patringenaru,
https://www.universityofcalifornia.edu/news/creating-early-alert-system-covid-19

FALL 2021

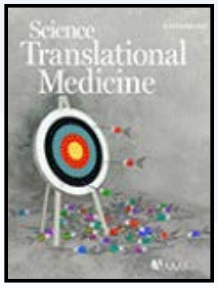
Dr. Aguado will join the Department of Bioengineering at UC San Diego in Fall 2021. He is currently completing a postdoctoral fellowship with Prof. Kristi Anseth at U Colorado, Boulder and does research on investigating biological mechanisms governing sex differences in cardiovascular disorders using precision biomaterials and data science techniques.

He aims to use precision biomaterial systems as in vitro culture tools or implantable devices in vivo to understand how sex-specific variables may impact cardiovascular disease onset, progression, and treatment at multiple length scales.

He was the first author on a 2019 *Science Translational Medicine* paper titled "Transcatheter aortic valve replacements alter circulating serum factors to mediate myofibroblast deactivation" and a 2018 publication in the same journal titled "Engineering precision biomaterials for personalized medicine".

Dr. Aguado's research has been supported by a Burroughs-Wellcome Fund postdoctoral enrichment program, an NIH NHLBI postdoctoral fellowship, and an NIH K99/R00 pathway to independence award.

Brian Aguado, Ph.D.



FALL 2021

Bogdan Bintu will join the Department of Bioengineering as well as Cellular & Molecular Medicine at UC San Diego in Fall 2021.

He is completing his Ph.D. at Harvard with Breakthrough Prize winner Prof. Xiaowei Zhuang at Harvard and does research in high throughput imaging of gene regulation.

He was the first author of a 2018 *Science* paper, titled "Super-resolution chromatin tracing reveals domains and cooperativeinteractions in single cells", which already has over 200 citations.

His most recent findings on "Genome-Scale Imaging of the 3D Organization and Transcriptional Activity of Chromatin" were published in *Cell* in September 2020.

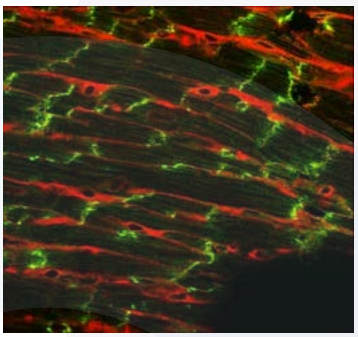
Bogdan Bintu, Ph.D. (2021)

Andrew McCulloch, Ph.D.
Distinguished Professor of Bioengieering

New Leadership, New Initiatives

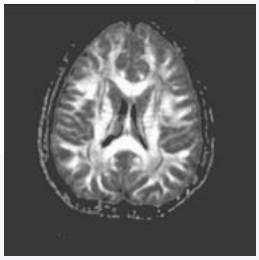
Following the retirement of Professor Shu Chien, Professor Andrew McCulloch has taken over as the new director of the Institute of Engineering in Medicine (IEM).

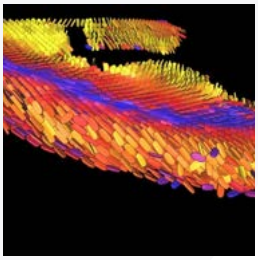
The Institute of Engineering in Medicine (IEM) is an organized research unit on campus that brings together faculty, research scientists, and students from different disciplines with a common scientific interest. In the case of IEM, our theme centers on the application of engineering approaches to solve biomedical problems, advance medical science, and improve the delivery of healthcare to patients.

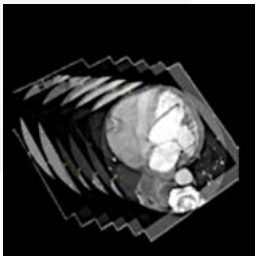


There are currently 15 centers within IEM, running the gamut of technologies from nanomedicine and tissue engineering to multi-scale imaging and focusing on medical fields ranging from perinatal health to cancer. Under the umbrella of IEM, numerous engineers, basic health scientists, and clinicians collaborate to advance research at the interface between engineering and medicine. While some of our centers focus on specific health problems, others develop sophisticated technological solutions to various scientific and clinical problems.

The Whitaker Center for Biomedical Engineering is IEM's outreach center. This center bridges the gap between industry and academia via the Industrial Advisory Board (IAB), consisting of members from not only local but also national and international companies. These corporate representatives inform us on new biomedical technology, give us employers' expectations when hiring bioengineers, and propose potential partnerships with the university to promote new educational and research opportunities. The Whitaker Center also partners with student organizations such as the Biomedical Engineering Society (BMES) and Engineering World Health (EWH) to inspire the future generations of bioengineers to innovate in medical technology and serve the community.

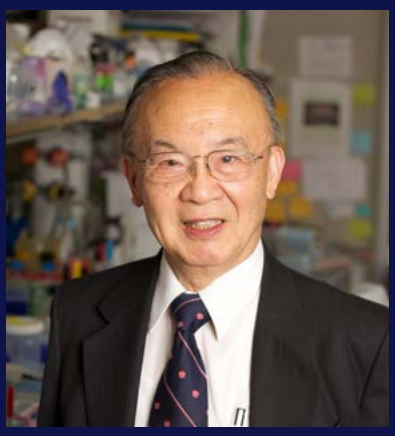






Adapted from Chak Hang (Julian) Ho, UC San Diego

Dr. McCulloch is currently a Distinguished Professor in the departments of Bioengineering and Medicine. He has a distinguished academic and research history having served as vice chair of the Bioengineering Department from 2002 to 2005 and chair from 2005 to 2008. He was an NSF Presidential Young Investigator and is a Fellow of the American Institute for Medical and Biological Engineering. He has been both the Konrad Witzig Memorial Lecturer and the Donald Wassenberg Memorial Lecturer. Recently, he was elected a Fellow of the Cardiovascular Section of the American Physiological Society. He is also chair of the Physiome and Systems Biology Committee of the International Union of Physiological Sciences. He received his Ph.D. in 1986 from the University of Auckland, New Zealand in Engineering Science and Physiology.



Shu Chien, M.D., Ph.D.
Distinguished Professor of Bioengineering

Pioneering Bioengineer Shu Chien retires after 31 years at UC San Diego

UC San Diego bioengineering professor Shu Chien made many foundational scientific discoveries over the course of his 62-year academic career, ranging from uncovering a key reason why sedentary lifestyles can be unhealthy even with short daily bursts of exercise, to how to more efficiently screen for adverse effects of small molecule drugs in patients. But from the stories that emerged during a two-day celebration in honor of his retirement, it's clear that it's the lessons he unknowingly taught on how to be a better person that resonated most deeply with the hundreds of students, colleagues and collaborators the world over who view him as a deeply beloved mentor.

The Mentor

One of the many qualities that has set Prof. Chien apart is his mentorship, whether in a formal capacity or not. "He's a brilliant scientist, he's a visionary administrator and leader, and he's a gifted mentor, but to me what really stands out as I think about my interactions with him over the past decade-plus is his great personal generosity," said Sanjay Kumar, Chancellor's Professor and chair of the Department of Bioengineering at UC Berkeley.

The Triton

Professor Chien joined the University of California San Diego in 1988 after a 31 year career at Columbia University. He joined a nascent group of faculty working on biomedical research, and was a galvanizing force in the creation of the university's Department of Bioengineering, which has consistently been top-ranked globally. In 1994, Prof. Chien became the founding chair of the department, and was the principal investigator on the Whitaker Foundation grant that led to the establishment of Powell-Focht Bioengineering Hall, the first privately funded academic building on UC San Diego's campus.

The Research Pioneer

Professor Chien was born and raised in China, and earned his M.D. from National Taiwan University before moving to Columbia to earn his Ph.D. in Physiology. His early work focused on blood rheology, figuring out the forces that effect blood flow, in the heart and blood vessels. Prof. Chien's foundational work on microcirculation, endothelial cell transport and arterial disease are fundamental to our understanding of cardiovascular disease, and his research into the effect of mechanical forces on gene expression and signal transduction have far-reaching effects on stem cell research and our understanding of cancer cells.

In honor of his retirement, the journal APL Bioengineering collected 5 Perspective articles in 2020 written by former trainees about the research and impact of his career.

AIP Publishing

The Leader

The Federation of American Societies of Experimental Biology and The Biomedical Engineering Society aren't the only organizations that Prof. Chien helmed during his 62 year-career. In what is believed to be a record, he served as president of eight different professional organizations, shaping the trajectories of the fields of physiology, biomedical engineering, and experimental biology as a whole, and perfecting a leadership style that was at once gentle yet effective.

"I've observed a phenomenon I call the Shu phenomenon—that is when Shu asks us to do something, we never question him. Instead, we just follow his plan," said Professor Shaochen Chen, chair of the UC San Diego Department of NanoEngineering and founding co-director of the Biomaterials and Tissue Engineering Center in the Institute for Engineering in Medicine.

Shu Chien and his lovely wife Kuang-Chung (KC) have been happily married for 63 years. They have two wonderful daughters and son-in-laws, with six lovely granddaughters who have all graduated from college.

This article was published on Octobber 17th, 2019, courtesy of UC San Diego Jacobs School of Engineering.
Pioneering bioengineer Shu Chien retires after 31 years at UC San Diego. https://jacobsschool.ucsd.edu/news/release?id=2878

Marcos Intaglietta, Ph.D.
Distinguished Professor of Bioengineering

An Engineering Legend

Dr. Marcos Intaglietta, Distinguished Professor and the longest-serving member of the UC San Diego Bioengineering faculty, is retiring. He conceived and co-founded the first Biomedical Engineering academic program in the nation at UC San Diego in 1965, and in 1966 became a founding bioengineering faculty member. He is the internationally recognized authority in bioengineering applied to cardiovascular and microvascular analysis to develop transfusions for blood loss, a global problem due to the present annual world deficit of 200 million units of blood. His over 500 scientific publications and books address fundamental problems in emergency medicine, cancer, ischemia, and the physics of blood flow in microscopic vessels in health and disease

A Giant In Equipping Bioengineering with Engineering Foundations

Professor Intaglietta earned his Ph.D. in Applied Mechanics from CalTech in 1963 and used its rigorous principles in bringing forth engineering concepts, including Transport Phenomena and Digital Signal Processing, to the Bioengineering field. *"There is no one in our Bioengineering department and likely across the country who can speak more authoritatively on the foundations and importance of engineering in bioengineering. It is not an exaggeration to say that he founded the field of quantitative microcirculation research in bioengineering. Fluid flow in human physiology is a fascinating field, and Marcos pioneered every measuring technique to study this flow,"* says Professor Shankar Subramaniam, a Distinguished Professor and the Jacobs Endowed Chair in Bioengineering.

Fundamental Discoveries and Instrumentation Inventions

He discovered the extraordinary role of blood viscosity in maintaining microcirculatory function, showing that a critical benefit from blood transfusion is the restoration of blood viscosity and not necessarily oxygen-carrying capacity. This led to his invention of "supra-plasma expanders" that reverse engineer the purpose of transfusion, rendering the microcirculation more effective in transporting oxygen, rather than restoring oxygen-carrying capacity using blood transfusions. This approach significantly reduces the need for transfusing 1-2 units of blood, which uses 1/3 of the available world blood supply. Dr. Intaglietta demonstrated unequivocal excellence in using engineering concepts to design instrumentation for measuring many aspects of fluid flow in physiologic systems. It is widely recognized that most instruments in his laboratory are his brainchildren developed with elegant and opportune engineering approaches. Many of these instrumentation platforms have been adopted for basic and applied clinical research, with intra-vital imaging, a technique routinely used worldwide to image microcirculation in living tissue, as an example.

Gracious Commitment to Bioengineering Education

Dr. Intaglietta has demonstrated selfless devotion to future bioengineers at UC San Diego with his service, particularly in education. He served as Vice Chairman for the Department under multiple chairs, and was Chair of the Graduate Affairs Committee and Chair of Bioengineering Graduate Students Recruitment Committee. For years as Chair of Graduate Affairs, he directed each admission interview of graduate applicants to our program and presided on every Departmental Ph.D. Qualifying Exam Committee for 20 years. This selfless effort raised the quality of Ph.D. student education and established clear guidelines for a quality bioengineering education. Many of our Ph.D. graduates remember their qualifying exam experience, Professor Intaglietta's questions, and his supportive interaction during the qualifying examination, having helped shape them to become better bioengineers.

The university is planning a formal celebration of his retirement, where his colleagues and friends will have a chance to celebrate his legacy.

Siebel Scholars

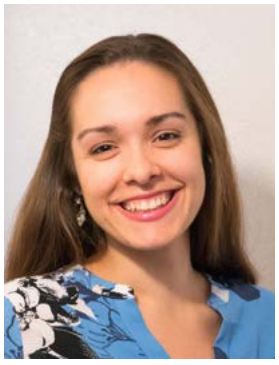
2020

The Siebel Scholars program was established by the Siebel Foundation in 2000 to recognize the most talented business and computer science students at ten of the world's leading graduate schools. In 2009, bioengineering was introduced as a new program at five universities; including UC San Diego and John Hopkins University. Each participating university receives more than $2 million in grants for the selection of five graduate student recipients of the $35,000 scholarship awards, as determined by their outstanding academic performance and qualities of leadership.

Dhruva S. Katrekar

Dhruva Katrekar is a Ph.D. candidate in the department of Bioengineering at UC San Diego, and works towards addressing some of the key challenges of in vivo gene therapy. During his graduate studies, advised by professor Prashant Mali, Katrekar has pioneered the development of an RNA editing tool for the treatment of rare genetic disorders. He has won awards for presentations at premier gene therapy conferences and garnered acclaim for his work in the broad research community. In addition to a strong publication record, he has been granted multiple provisional patents for his inventions. In the near future, Katrekar aims to enable clinical translation of his research as a novel therapeutic agent to positively impact the lives of patients suffering from rare genetic disorders.

Gabrielle M. Colvert



Gabrielle Colvert is a bioengineering graduate student in the Cardiovascular Imaging Lab under the mentorship of professor Elliot McVeigh. Her PhD research is dedicated to developing noninvasive methods for evaluating cardiovascular function using four-dimensional computed tomography. Colvert has established successful collaborations with physicians, researchers, and industry partners both in the US and internationally which have led to multiple co-authored manuscripts and conference presentations. She was nominated by her department to be an ARCS Scholar and awarded an NIH F31 Predoctoral fellowship. At UC San Diego she has trained and served as a mentor to several undergraduate students. Outside of UC San Diego, she is involved with organizations that empower girls to become leaders, creators, and problem-solvers.

Gregory D. Poore

Gregory Poore is in his fifth year of the UC San Diego Medical Scientist Training Program (MSTP), having completed two years each of medical school and of the Bioengineering Ph.D. program. He has a unique background in oncology and microbiology, with his PhD research focused on building the most comprehensive survey of microbes in cancer to date, and studying the three-way interactions between intratumoral microbes, cancer cells, and immune cells. Poore is also an entrepreneur and has co-founded two companies: a medical device company for managing respiratory diseases (Vigor Medical Systems) and a cancer diagnostic company (Micronoma).

This article was published on September 23rd, 2020, courtesy of UC San Diego Jacobs School of Engineering.
https://jacobsschool.ucsd.edu/news/release?id=2878

Award for Excellence in Bioengineering

Almudena Prieto Prieto's favorite part about bioengineering is its impact on improving the lives of others through drug treatments and medical devices. Throughout her four years at UC San Diego, Prieto Prieto has been a part of the Biomedical Engineering Society and served as the Translational Medicine Day (TMD) co-chair her junior year.

"As TMD co-chair I was able to organize a conference-style event displaying the field of translational medicine and its bench-to-bedside approach that ensures that medical innovation reaches patients and benefits them sooner rather than later."

Almudena Prieto Prieto, Undergraduate

Dr. **Jun Wang Jun** completed his Ph.D. thesis under the guidance of Professor Gert Cauwenberghs, and his thesis title is: *"Silicon Integrated Neuromorphic Neural Interfaces"*

Dr, Pranjali Beri Pranjali completed her Ph.D. thesis under the guidance of Professor Adam Engler, and her thesis title is: *"Cellular Adhesion Strength as a Potential Biophysical Marker of Metastatic Behavior"*

2019-2020 Shunichi Usami Ph.D. Thesis Design Award

"Shunichi Usami Memorial Award for Biomedical Engineering" is a permanently endowed annual Student Award in the Department of Bioengineering in memory of the late Professor Shunichi Usami who over decades has made pioneering contributions to bioengineering design. The award is specifically for the most meritorious Ph.D. thesis of the academic year with a special emphasis on the design aspects of bioengineering.

2019-2020 Engelson Ph.D. Thesis Award

"The Engelson Ph.D. Thesis Award " is a permanently endowed annual Student Award in the Department of Bioengineering. The award will recognize the "best" Ph.D. Thesis of the academic year in the Department of Bioengineering according to the following criteria:

- **Originality**
- **Depth of the analysis**
- **Significance of the work and its potential impact**

Dr. Yiqian (Shirley) Wu Yiqian completed her Ph.D. thesis under the guidance of Professor Peter Yingxiao Wang and her thesis title is: *"From Visualization of Molecular Events to Remote Control of T Cells"*

Dr. Yan Wu Yan completed his Ph.D. thesis under the guidance of Professor Kun Zhang and his thesis title is: *"Studying human development via the single-cell profiling of primary human tissues and genetic perturbation of novel developmental models"*

Training the Next Generation of UC San Diego Scholars

This is an exciting time for Bioengineering as we push the utmost boundaries of science and knowledge. The Department of Bioengineering at the University of California, San Diego stands at the forefront of education and cutting-edge research that will impact humanity for years to come. By inspiring education and through dedicated mentorship, we train leaders in biomedical engineering who have experience in research as well as industrial and clinical applications. The integration of engineering principles with scientific discoveries and technology innovation will realize our ultimate goal to improve health and quality of life.

DEPARTMENT PROGRAMS

Doctor of Philosophy (Ph.D.)

The intensive Doctor of Philosophy program trains students for research and teaching in academic or research institutions and leadership in bioengineering industry.

Doctor of Medicine | Doctor of Philosopy (M.S.T.P.)

The medical scientist training program (M.S.T.P.) is a partnership between the School of Medicine and Graduate Division for training physician scientists/engineers through clinical practice and research.

Joint Doctoral Program (J.D.P.) with San Diego State University (S.D.S.U.)

A Bioengineering Ph.D. degree awarded jointly between UC San Diego and SDSU.

Masters of Engineering (M.Eng.)

Preparation for design and project engineers for engineering design, development, manufacturing, management within industrial or professional settings in the medical and biological engineering industries.

Masters of Engineering with a Specialization in Medical Device Engineering (MEng MDE)

Training for project engineers for engineering design, development, manufacturing, management within professional settings in the medical device industry.

Masters of Science (M.S) Plan I - Thesis

Advanced training in applied physical and biological sciences for specialized bioengineering fields through a combination of coursework and faculty supervised original research.

Masters of Science (M.S.) Plan II - Comprehensive Exam

Advanced training in applied physical and biological sciences in specialized bioengineering fields through coursework and a comprehensive exam.

Masters of Science with a Medical Specialization (M.S. Med)

Advanced coursework and diverse clinical experiences that enables the development of an understanding of careers in medicine and medically-oriented organizations. Degree curriculum is designed to include the physical, chemical, and biological foundations for the MCAT.

PROGRAM SPOTLIGHT

UCSD Interfaces Graduate Program

The interdisciplinary Interfaces Graduate Training Program was developed through the HHMI/NIBIB Interfaces Initiatives to bring together faculty and graduate students from a broad range of disciplines in the Biological, Engineering, Physical and Health sciences. Program students and faculty have a common interest in interdisciplinary approaches to problems in biomedical science that span physical scales of biological organization and require specialized technologies for measuring, manipulating and analyzing biological structures at scales from the single molecule to the whole organism. Integrating quantitatively across physical scales in biology is a fundamental challenge of modern biomedical science, since most medical therapies act at the molecular scale, whereas physicians diagnose and treat the whole patient.

NIH Awarded Training Grants

Training in Multi-Scale Analysis of Biological Structure and Function

(2T32EB009380-11)

Principal Investigator Andrew McCulloch

Many scientific challenges in biomedicine require understanding of how biological processes at the molecular scale give rise to functions at the levels of whole body. This interdisciplinary training program trains a pre-doctoral students apply modern technologies to these multiscale challenges.

Integrative Bioengineering of Heart; Vessels; and Blood

(5T32HL105373-10)

Principal Investigator Andrew McCulloch

The research projects performed by the trainees have potential applications to cardiovascular diseases, including hypertension, atherosclerosis, diabetes, coronary heart disease, heart failure, cerebrovascular disease, shock, peripheral vascular disorders, and blood diseases.

Graduate Training Program in Bioinformatics

(5T32GM008806-20)

Principal Investigator Shankar Subramaniam

The purpose of this doctoral training program is to train students in the interdisciplinary area of Bioinformatics area of Bioinformatics and Systems Biology. The NIH has recognized that there is a critical need for such interdisciplinary training that integrates the biomedical, computational and engineering sciences, in order to harness the opportunities of the post-genomic era, to furthering the health sciences research and improving health care outcomes.

NATIONAL FELLOWSHIP AWARDEES

The Bioengineering Department at UC San Diego attracts and trains some of the most talented and ambitious graduate students in the country. Each year, with the dedicated support and mentorship of our faculty and their dynamic research environments, our graduate students successfully compete for highly coveted national fellowships from the NIH, NSF, and foundations such as the American Heart Association. This past year (2019-2020) was no exception, as **33** UC San Diego Bioengineering graduate students were awarded national fellowships.

National Science Foundation Graduate Research Fellowship Program

Alyssa Chiang
Kyle Ford
Erica Gacaan
Giselle Gonzalez
Sydnee Hyman
Kevin Joslin
Julia Kudryashev
Erin La Montange
Andrew Lezia
Joyce Li
Michael Liao
Anne Lyons
Alexander Postlmayr
Vish Ramash
Kiersten Scott
Serena Shi
Shivani Shukla
Abigail Teitgen
Laura Vasquez-Bolanos
Margot Wagner
Alexander Whitehead
Tiffany Zhou

The NSF GRFP recognizes and supports outstanding graduate students in NSF-supported STEM disciplines who are pursuing research-based master's and doctoral degrees at accredited US institutions.

National Insitutes of Health Research Training and Career Development

Gabrilelle Colvert
Miranda Diaz
Pamela Duran
Kyle Marra
Gregory Poore
Lauren Severance
Holly Sullivan

The purpose of this Kirschstein-NRSA program is to enable promising predoctoral students with potential to develop into a productive, independent research scientists, to obtain mentored research training while conducting dissertation research.

American Heart Association Predoctoral Fellowship

Evan Matsutani
Aileena Nelson
Abby Teitgen
Martin Spang

The American Heart Association (AHA) offers a Predoctoral Fellowship to enhance the research and clinical training of aspiring professionals in a predoctoral or clinical health degree.

Ruth L. Kirschstein National Research Service Award
Individual Predoctoral Fellowship to Promote Diversity in Health-Related Research

NIH AWARD SPOTLIGHT

Miranda Diaz

"Notification of Access to Injectable Decellularized Myocardial Matrix Hydrogel Mitigates Negative Left Ventricular Remodeling in a Chronic Myocardial Infarction Model"

Miranda Diaz, one of this year's NIH F31 NRSA predoctoral fellowship awardees, is a Hispanic woman who graduated magna cum laude from NYU with an interest in biomaterials and medicine.

Inspired by family experiences battling chronic progressive heart failure ultimately requiring transplantation, she decided to dedicate her research efforts to developing new bioengineered therapies for the heart.

Her doctoral research in the laboratory of Professor Karen Christman aims to develop new treatments for chronic heart failure using injectable hydrogels derived from porcine decellularized extracellular matrix. Miranda is working to understand how the biomaterial induces cellular and molecular changes that may reduce adverse remodeling and improve contractile function.

Miranda is also an Alfred P. Sloan Foundation Scholar, which provides PhD students from under-represented backgrounds in the physical sciences and engineering with additional resources and mentoring. She is engaged in the community, participating in the Bioengineering Graduate Society (BEGS), and volunteers her time with weekly STEM-focused lessons at Lafayette Elementary, a local underserved school that also caters to children that are deaf or hard of hearing.

We are thrilled that Miranda chose to bring her ambitions, creativity, and generosity to UC San Diego, that leveraged initial funding from our NIH NHLBI Training grant to successfully compete for the individual F31 predoctoral fellowship. Miranda is a rising star who we are confident will go on to become a lifelong leader in the bioengineering community. It is students like Miranda that make the UC San Diego Bioengineering Department a compelling and vibrant place to launch a young career.

Daniela Valdez-Jasso, Ph.D.
Assistant Professor of Bioengineering

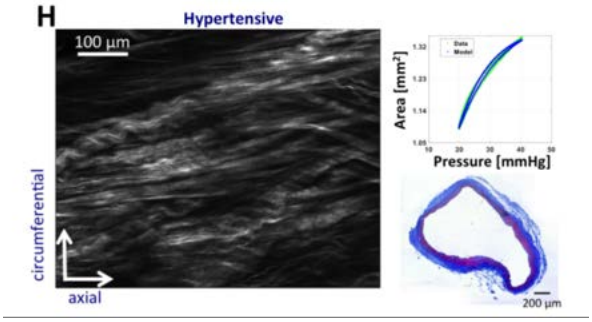
2020 Faculty Inclusive Excellence Award

Prof. Daniela Valdez-Jasso, who uses math and physics to computationally model the effect of heart and lung diseases on various tissues, was honored for her commitment to creating and sustaining a more diverse student body. Prof. Valdez-Jasso serves as the faculty advisor for the UC San Diego chapter of the Society of Hispanic Professional Engineers, and worked with the Center for Research on Educational Equity, Assessment & Teaching Excellence (CREATE) to support the restarted chapter of the Society for Advancement of Chicanos and Native Americans in Science (SACNAS). She will also serve as faculty advisor to this group of students.

In addition, Prof. Valdez-Jasso is an avid supporter of students in the Society of Women Engineers, and is involved in the Fleet Science Center's BeWise program for high school girls, bringing a group of students to campus each year to tour her lab and learn more about bioengineering.

"*I feel responsible, in some sense,*" she said. *"Bioengineering is still a new field and I think it's really hard to know what it entails, unless you're already in the field and know what it is all about. I feel like it's part of my duty to really teach and show people what we do as bioengineers."*

"For me this is one of the fun things—it's rewarding," she said. **"I love interacting with students and seeing them get all excited, partly because I really like what I do, and I really want others to get involved in the field and have fun with us."**



She focuses her efforts, in particular, on girls and Hispanic students, because she didn't see enough people like her during her journey to becoming a professor, and wants to not only encourage these students to choose paths in STEM, but to not lose any parts of their identity in the process.

"I was really discouraged, a lot, for being in science and being bubbly and very social," Prof. Valdez-Jasso said. *"I want to make sure we don't keep having scientists with the same type of personalities, because I think we need people who also have other interests and are different. I like to be a little bit of an ambassador in that sense. The other thing is it saddens me to see that UC San Diego is a university in San Diego yet the population of students is not really representative of the city's population. I really like to reach out to a lot of the Hispanic communities and make sure they know that we're here, this is their school and they should apply to UC San Diego."*

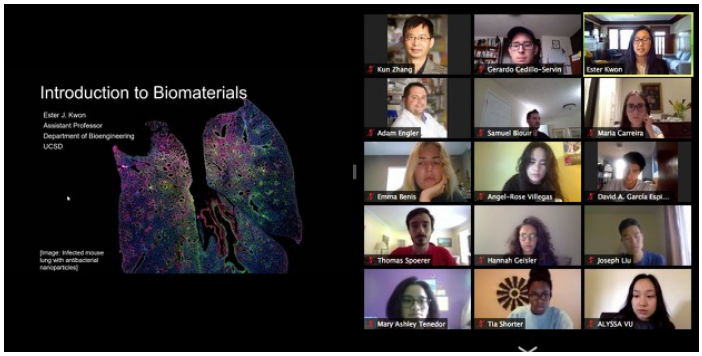
This article published on February 4th, 2020, courtesy of UC San Diego Jacobs School of Engineering. *Jacobs School faculty, student, staff honored with Inclusive Excellence Awards*. https://jacobsschool.ucsd.edu/news/release?id=2969

EQUITY, DIVERSITY, AND INCLUSION

Adam J. Engler, Ph.D.
Professor and Vice-Chair of Bioengineering

Research Experience for Undergraduates (REU) Summer Program

The Jacobs school of Engineering (JSOE) at UC San Diego hosts a summer Research Experience for Undergraduates (REU) summer program in Biomaterials. The objectives of the program are to train undergraduates in basic research through challenging biomaterial-related engineering projects performed with research mentors from engineering departments across JSOE. Research areas include tissue engineering and 3D printing, bio-inspired biomaterials, biomaterial-stem cell interaction, nanoparticles and drug delivery.



"I think this program was such a blessing during the current world scenario. Given that I lost completely the opportunity to continue research in the UCSD lab where I volunteered and lost the opportunity to do the REU to which I had been accepted over the summer, this program allowed me to engage in research in a different way. I really appreciate this."

Despite the pandemic, social justice concerns, and the stress of many university and college campuses continuing with online education, the REU Program had a fulfilling summer with over 700 participants via Zoom.

2020 ZOOM REU
Program Highlights

- The program included **25 hours of programming over 8 weeks** including: (1) Research talks from our 11-program faculty, (2) 8 research skills workshops, featuring external speakers on research ethics, library resources, and experimental design, (3) 3 networking sessions with representatives from Graduate School program, MD-PhD programs, and Industry opportunities, and (4) 3 community building sessions.
- The department has run an **NSF-sponsored REU program since 2008.**
- As a result of the ZOOM REU, **72% are more likely to attend graduate school.**
- Since 2016, **72% of our REU participants have attended graduate school** and **80% of all URM students**. That is **10x** the national average for URM students.

First "Masters Excellence" Fellow

Mahsa Nafisi

The Department of Bioengineering has placed a priority on diversity since its inception- diversity of research, diversity of gender, diversity of background. Over the past few years, it has concentrated that effort on the graduate student population with the creation of "Masters Excellence" Fellowships, to bolster underrepresented students as they transition from their undergraduate studies to doctoral-level bioengineering work via the completion of a Master of Science (MS) degree.

"The Masters Excellence Fellowships enables students to embark on this progression that provides motivation to tackle difficult subjects, seasoned by experience," shared Prof. Kun Zhang, Professor of Bioengineering and Department Chair. "*A hallmark distinction of UC San Diego's Jacobs School of Engineering is our support of students from a wide range of backgrounds in their development as high-performing engineers. Our approach is embedded in an experience-centric curriculum allowing students to feel the exhilaration of hands-on engineering while gaining an appreciation for learning the engineering foundations that allow them to solve challenging problems.*"

The inaugural Masters Excellence Fellow is Mahsa Nafisi, beginning her Masters in Fall 2020. "Mahsa is a passionate and dedicated student with research lab experience in cutting edge single-cell and exosome genomics technologies," shared Prof. Zhang. "*She is looking to gain the necessary training and education to create novel technologies for understanding, diagnosis, and treatment of neurological diseases.*"

FOCUS (Future Faculty of Cardiovascular Sciences) Program

Daniela Valdez-Jasso, Ph.D.
Assistant Professor of Bioengineering

The research goal of Prof.Valdez-Jasso's group focuses on soft-tissue biomechanics and multi-scale mathematical modeling of organ and tissue function, particularly as they pertain to understanding the ventriculo-vascular adaptations to pulmonary hypertension (PH).

Francisco Contijoch, Ph.D.
Assistant Professor of Bioengineering

Prof. Contijoch's primary research interests are focused on developing translational imaging techniques to better diagnose, monitor, and understand cardiac dysfunction and vascular disease.

Working with Health Sciences (NHLBI funded 5-year program)

FOCUS
Future Faculty of Cardiovascular Sciences

The FOCUS program goals are to provide strong mentorship, enhance critical academic and grant writing skills and the development of cardiovascular research to improve the long-term success of early career faculty and transitioning postdoctoral scholars from groups underrepresented in the biomedical workforce.





Bridging Collaborative Networks Across Countries

A Discussion with Ph.D. Student Gladys Ornelas

Clubes de Ciencia is a program dedicated to providing high quality STEM education and bridging collaborative networks across countries. Clubes de Ciencia (CdeC) connects graduate students, many from the United States, to graduate students or professors in Latin America. Together as co-instructors, they design a one-week intensive summer STEM workshop for high school and college students. Quoted directly from their website, CdeC aims "to spark and support the students' interest in STEM as a long-term career and as a tool for social impact."

I was fortunate to participate as a co-instructor in 2018 and 2019. In 2018, I went to Ensenda, Baja California Mexico, and worked with the professor Carlos Dias Tufinio on a workshop titled "Enzymes under Surveillance: Biosensors for Characterization". In that workshop, students worked in teams of 5 to build their own electrochemical biosensors using circuits. They then used their sensors to study enzymatic reactions and analyze their results using Python Jupyter Notebooks. In 2019, I went to La Paz, Baja California, Mexico and worked with the professor Juan Francisco Villa Medina on a workshop titled "Sensors, Robots, and the Human-Computer Interface."

This year, I participated as a staff member for CdeC which we had to quickly revamp into an online format due to COVID-19 in the span of two months. Though intense, CdeC quickly adapted by adding online webinars, science cafes, podcasts, and CdeC Challenges. CdeC Challenges was a one-week online workshop that attempted to replicate the traditional CdeC format. Students were assigned to instructors based on their interest and worked in teams of four to complete various tasks ranging from diagnostic analysis to data analysis dealing with COVID-19 or omics related data.

I have found CdeC to be an incredibly inspiring opportunity. The students are all highly motivated and passionate about STEM. It's amazing to see what students can do in the span of a week. Additionally, CdeC also exposes students to a variety of science workshops ranging from data science, geology and engineering just to name a few. Through CdeC, I have also learned about other scientific fields and Mexico's scientific culture, an experience that has opened many opportunities for me. I have made friends with graduate students, staff, and professors from various countries and in different fields, all united by their dedication to CdeC's cause. In all, more importantly, CdeC bridges connections to scientists abroad performing novel research while providing an environment for students to pursue their own scientific passion.

Gladys Ornelas *started at UC San Diego as an undergraduate student in bioengineering and has remained here for her Ph.D. In Prof. Todd Coleman's lab, she assists with research involving the non-invasive assessment of neuromuscular disorders of the neck using high-density surface electromyography. As a graduate student, she has devoted her time outside of school and research to mentor undergraduate students through the JUMP mentorship program and is a member in the Bioengineering Graduate Society (BEGS) mentorship and social committees. Through BEGS she has hosted educational events such as managing research, school, and related difficulties, and has hosted social events such as the BEGS Murder Mystery Dinner. She also volunteers during BEGS outreach events and has participated as a panelist in other BEGS events such as the mock qualifying exams, M.S. to Ph.D. transition panel, and grant writing. She was also a graduate student representative for the Graduate Student Association during the 2017-2018 school year.*

Bioengineering Day 2020

Bioengineering Day (BE Day) is a celebration of the top-tier bioengineering department here at UC San Diego, as well as the research-centered education essential to our program. Bioengineering Day helps students at all stages in their research journey as they develop scientific literacy, leadership abilities, and professional communication skills. Younger students have the opportunity to explore research options for their future projects, and hone their networking skills with industry and faculty. Junior and senior students take part in senior design projects - leading their own research project under faculty mentorship.

The theme this year for Bioengineering Day 2020 was "BE Diverse" - we intended to showcase the importance of understanding the healthcare needs of populations that are served by bioengineering research, both through representation by diverse researchers and through acknowledgments of the diversity amongst patients. Although our plans for BE Day 2020 were forced to change due to COVID-19, we successfully adapted several aspects of our event into an online format.

Initially, we planned an in-person event attended by guests from across the country with an expected 400+ attendees. However, as a result of social distancing guidelines put into place due to coronavirus, we made the necessary changes and successfully altered our event to adapt to a completely virtual format. The main focus of our online event was our senior design poster sessions. When it comes down to its core, BE Day is about serving the students and their educational experience, so now more than ever it was important for us to recognize and highlight the achievements of our 41 senior design groups. All 41 of these teams presented at Virtual BE Day 2020, and 4 of them were recognized for their exemplary work with awards. Fortunately, the incredible work of our committee paid off, and we successfully hosted the first-ever online Bioengineering Day at UCSD, with a 14% increase in attendance from last year's in-person event.

ANUSHKA MICHAILOVA MEMORIAL AWARD

Dr. Anushka Michailova was a brilliant mathematical biophysicist who joined the Cardiac Mechanics group in 2000. After passing away in 2014, friends and colleagues in the Department of Bioengineering at UC San Diego have honored Dr. Anushka Michailova by establishing the Anushka Michailova Memorial Award as a tribute to her tireless commitment to undergraduate and graduate student research by recognizing outstanding student accomplishment in cardiovascular bioengineering research.

Best Undergraduate Poster

Reza Aghavali, Natalie Chen, Jaquelin Dezha Peralta, Adam Kadwory, and Andy Nguyen

Most Innovative Project

Justin Hover, Gabriel Shatkin, Bryan Thai, and Alexander Yan

Best Attention to Detail

Lauren Fang, Bushra Rajput, and Michelle Tong

Best Poster Composition

Dallin Wayne George, Kevin Joslin, Mahsa Nafisi, and Andrew Nguyen

Distinguished teams and poster presentations will receive an award based on their presentation here at Bioengineering Day 2020.

BMES Outstanding Chapter Award

UC San Diego's chapter of the Biomedical Engineering Society (BMES) was recognized with the Chapter Outstanding Achievement Award for their 2019-2020 efforts. This is the second time the undergraduate BMES chapter received this prestigious award, after earning the honor in 2017.

The 150+ person UC San Diego chapter offers a variety of events that serve as a resource to bioengineering students, the UC San Diego campus, and the San Diego community. They were recognized for their "ability to be well-rounded, hardworking, and efficient in their chapter activities."

"**I think what makes us unique is that we're focused on building something great together,**" said Michael Bennington, the incoming 2020-2021co-president. "**Members are not competing with each other; they can come together and contribute to BMES and build friendships.**"

"We're not about outshining each other or other events or workshops," said Elisabette Tapia, 2020-2021 co-president. "We very much have a 'how can we grow together?' format of thinking, which is why we're able to to do more. Our members want each other to put their best foot forward."

BMES's mission is to be a resource for undergraduate bioengineering students and anyone who is interested in learning more about the field. They offer technical workshops focused on a variety of topics, while also connecting people with lab and research opportunities, hosting outreach events, networking opportunities, and social events for bioengineering students.

Bioengineering Day was also held virtually, and celebrated UC San Diego's consistently top ranked bioengineering department, current research by students, and advances in the field itself. The online event was an opportunity for undergraduates, graduate students, faculty, and members from industry to form valuable connections with one another.

BMES's outreach efforts extend far beyond UC San Diego. Students host bioengineering demonstrations for K-12 classrooms, mentor and advise high school students, and connect with local teachers to share resources. In just under five weeks, BMES students were able to reach over 100 high school students through a college advising program they hosted, where undergraduate BMES members connected with high school classrooms via Zoom and answered questions about college.

"**I'm glad that all the hard work that the executive board, officer board, and our members put in is being recognized as something positive,**" said Reo Yoo, 2019-2020 chapter president. "**We spend a lot of time planning things, leading events, and being present in all aspects of the organization -- almost like a second job. It feels nice that apart from doing good for the community, our efforts are something that other people also see as impactful.**"

This article published on July 31st, 2020, by Gabby Gracida courtesy of UC San Diego Jacobs School of Engineering. Biomedical Engineering Society earns Outstanding Chapter Award. https://jacobsschool.ucsd.edu/news/release?id=3093

Jervaughn Hunter
Ph.D. Student, Bioengineering
Christman Lab, University of California, San Diego

A Spirit Lifted by:
Curiosity, Discovery, Perseverance and Engagement

One's journey is not always easy. In fact, Jervaughn Hunter reflects on his journey and the setbacks that led him to this present moment. Jervaughn received his undergraduate degree in Biomedical Engineering from the University of Alabama Birmingham (UAB) and is currently a third year PhD student in Bioengineering at UC San Diego. He is under the mentorship of Professor Karen Christman whose lab focuses on developing novel biomaterials for tissue repair and regeneration. Jervaughn Hunter is exactly the embodiment of UC San Diego Bioengineering's spirit. It is a spirit lifted by human curiosity, regardless of race, ethnicity, gender, religion, etc. It is a spirit that pushes the boundaries of science into discovery. A spirit that is unwavered by failure but rather, lifted further to continue the journey that truly impacts the human experience.

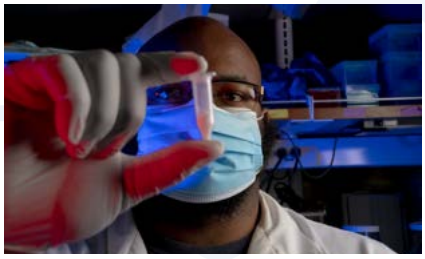
"Sometimes people who perform the best are those that have to scrap to get to where they are, because they know an opportunity when they see one and they know that if they experience failure, it is a temporary failure. So, it's how you respond to challenges and set-backs that matter."

"*So, tell me what led you to today?*" asks Professor Coleman, who was charged with interviewing Jervaughn for this edition of the Bioengineering Annual Report. What a crossroad this is as Jervaughn begins to narrate his story of perseverance turned into success.

"Coming close to the end of my senior year in undergrad, I was looking at finding a job at Stryker, Johnson & Johnson, and a few places but had not heard from anyone. During senior design, the project that I ended up doing was biomaterials based…I collaborated with Professor Vinoy Thomas in the Material Science Department. This got me interested in lab and experimental work. Near graduation, I saw an REU poster and I saw UC San Diego Professor Adam Engler's contact information, so I decided to contact him explaining that although this program was for undergraduates, I was still trying to get research experience."

Little did Jervaughn know that Professor Engler's response would trigger serendipity and ultimately set in motion his access to graduate education.

"With UC San Diego what I have enjoyed most has been the opportunity to engage in many of these different organizations. Since I have gotten here, I have organized and executed student events. I love giving back and doing outreach" Jervaughn replies.



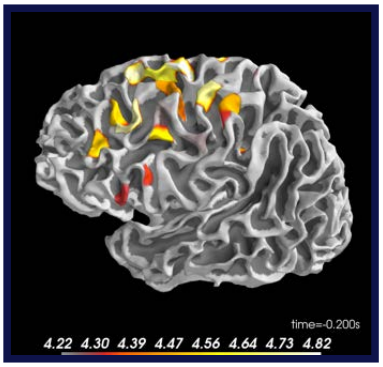
Nelvin C. Cepeda / The San Diego Union-Tribune

"*One thing that I would highlight - is the community that I grew up in sits below the poverty line and the healthcare system there is lacking. I am from the very small town of Port Gibson, Mississippi with a makeup of 92% African-Americans, and a population less than 5,000 (UC San Diego is bigger). I grew up on a farm and the concept of engineering aside from electrical and mechanical were abstract to me. Careers such as those in biotech were not prevalent in my community, so for many, if you don't see it you don't pursue it. Luckily, both of my parents ended up with successful careers and provided me with exposure to many different experiences outside of my community. While they did not have advanced degrees (father a 10th grade dropout and mother a B.S. in education), they were still able to instill in my sister and I a strong work ethic and encouragement to think for ourselves. During my senior year of high, I received a brochure from UAB and noticed the major Biomedical Engineering. Having no idea what it was, I quickly googled it and found out that it included using engineering techniques to heal and repair the human body. This stood out to me, and being that is was something no one where I grew up had done, I knew I should pursue it so that I could my a stronger impact on my community.*"

Amanda Beck
B.S. Degree in Bioengineering, 2016

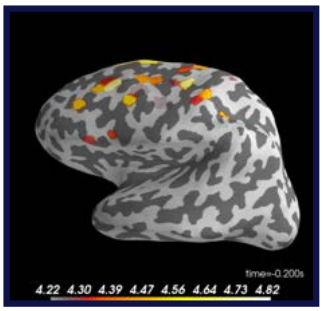
Progress is Not Linear

You know the saying "Progress is not linear"? Well, this universal truth unquestionably applies to recent UC San Diego Bioengineering Alum Amanda Beck. When Amanda first began her undergraduate studies in Bioengineering at UC San Diego, she did not think that it would lead her to a Ph.D. in Electrical Engineering at the Massachusetts Institute of Technology (MIT). Having worked in Professor Todd Coleman's lab as an undergraduate, she recounts being exposed to research and interdisciplinary tracks, which have helped her as she now enters her fifth year of her Ph.D.



Currently, at MIT, she is focusing on Alzheimer's disease and is continuing to pursue research at the intersection of medicine and engineering. She believes that, "we can make our current treatments more efficient and effective with better understanding and biological processes."

In the long run, she would like to work in research and development in industry or academia and goes on to say that, "with industry collaborations (I want) to be closer to the eventual consumer and to be able to produce devices that improve personalized medicine for a large number of people. I'm hoping to experience research in both a start-up and more established environment in order to determine the best way to generate a concrete impact on patients' health."



Amanda Beck is a bright star and her current and future endeavors show just how bright she is. Not only do her endeavors depict her brightness but her ability to persevere in challenging circumstances takes that even further. When she first began at MIT she did not have a mentor and is still in between tracks because she started too early for a Biotech Track. This did not deter her, instead she took her experience with interdisciplinary tracks at UC San Diego to help her excel at MIT. Amanda states that working in different research areas and with different faculty mentors at UC San Diego prepared her for her current successes.

Working with Professor Coleman, she developed a "Systems Mentality" which also prepared her to think broadly and nonlinearly which has served her very well in going to a new field.

Amanda also thanks the encouragement she felt from the faculty to pursue a Ph.D. and in the end discover her passion. With her Masters' Thesis Title: "State Space Models for Isolating Neural Oscillations" and her current progress, along with a National Science Foundation Fellowship (NSF) with a proposal title of "Signal Processing: Dynamic Models to Localize Oscillatory Networks in the Brain", Amanda's unique ability to commit and adapt will without a doubt lead her to the future she envisions for herself.

Interview with Recent Alumni

Raj Krishnan, Ph.D.
CEO at Biological Dynamics
Ph.D. Degree in Bioengineering 2010

Perseverance and Desire

Why did you choose UC San Diego?

During my time at UC San Diego Bioengineering, the school was ranked second in the nation for Bioengineering, with an amazing reputation, which I believe is still the case. It's extremely valuable having such luminaries as Prof. Fung, Prof. Chien, and the other people out there and other absolutely fantastic professors who are doing great work and helping teach the fundamentals of Bioengineering. The school has always excelled at combining quality teaching with an entrepreneurial nature, and San Diego leads the top four locations in the country, including South San Francisco, Research Triangle Park and Boston, for biotech startup companies. Along with academic and business opportunities, it's a fantastic place to learn and meet people.

When I came to UC San Diego I had a chance to work with Prof. Mike Heller, who was working on Nanoengineering at the time and we ended up with a great group of people. As you know, Prof. Heller has started several companies as well, so he was a positive role model to guide my education and career aspirations, the San Diego ecosystem was an ideal place to make it happen. Currently, about half of our staff at Biological Dynamics are UC graduates and more than a third are from UC San Diego alone.

UC San Diego and the new UC Moores Center are leading resources for our company's new hires. One other point I'd like to stress is the amazing amount of help and support the school provides. For example, the Tech Transfer Office has really excelled, so I'm excited that students now have greater flexibility.
The school is much more entrepreneurially focused and can really push companies and push people so they can build the successful parts.

Tell us how your company spun out of your Ph.D.

As for the company, it spun directly off of my Ph.D. work at UC San Diego and the science I did during my work with Prof. Heller. We were working on electric fields and using micro electric rays to isolate particles directly out of solutions. The Moores Cancer Center and UC San Diego offered the perfect mix of electrical, chemistry, biochemistry, biology and cancer research, so it was an amazing place to learn and grow. The data we worked on to this day is unparalleled and unrepeated. We not only had the opportunity to spin off a company, we had the chance to be on the cutting edge and we are still breaking new ground. This shows how ahead of our time we were beauce it has been ten years and nobody still has gotten close to it.

Biological Dynamics

We built this isolation platform, we spun off this company, we obviously have this fantastic group of board of directors led by Irwin Jacobs. The key that we learned was to focus on applications. The first application we are working on is early cancer detection and that is where we spend most of our time and efforts. The second one is on a grant that we got for a Tuberculosis Program funded by the Bill and Melinda Gates foundation since 2018. Finally we have some new investors from the Alzheimer's Drug Discovery Foundation that have funded a direct investment into using our platform for Alzehimer's research. So we actually are using all the same platform with minor tweaks for all three which shows you the robustness and capability of the platform.

What was something nontechnical with your experience at UC San Diego that helped you get to where you are today?

This is a very good question. I can tell you probably hours worth of stories of the no's I got when we first started the company but at the end of the day it's the one yes that you need. At the end of the day, perseverance is the key here.

I will give you an example of something that worked well for me. UC San Diego used to have this fantastic program that was the Entrepreneur Challenge. That's what actually made the company successful—or even exist—in the first place. When I was a second year Ph.D. student, I applied for the program. The fall was a written plan, the winter was a business plan and the spring was a presentation. My second year when I tried this it was horrendously bad. No one wanted to give me an opportunity.Then I took additional courses, talked to more people, and when I tried again in my third year, I won third place in the winter. Spring did not go as well. Then finally, my fourth year was the $80,000 entrepreneur challenge. For this attempt, I studied past winners and runners up from the MIT $100K Entrepreneurship Competition and watched what the difference was, and it really helped me. We made it all the way to spring and fortunately won the competition.

In summary, it is the level of perseverance and desire to learn at UC San Diego that has really helped me get to where I am today.

Women Who Mean Business

UC San Diego ranks in top 25 for female-founded startups

Rachel Dreilinger
Co-Founder & CEO at NeuraMedica
B. S. Degree in Bioengineering, 1999

Dreilinger is proud of her resiliency and determination despite the obstacles she has faced as a Native female entrepreneur: "I didn't quit, and now I can use my influence to create more inclusive companies and environments that value and respect diversity."

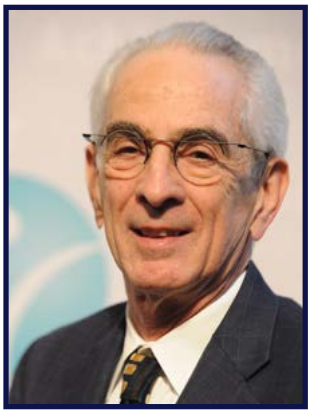
The University of California San Diego is proud to have been named a top 25 undergraduate university for female-founded startups by Pitchbook, a financial data and software company.

Pitchbook tracked companies that raised their first round of funding between January 1, 2006 and August31, 2019. UC San Diego landed in the No. 22 spot with 45 female founders whose companies raised over $580 million in first-round funding.

Rachel Dreilinger, B.S., Bioengineering 1999, is Co-Founder & CEO at NeruaMediaca and one of UC San Diego's outstanding 45 alumuni female founders. NeuraMedica is developing a bioabsorbable surgical clip that can help neurosurgeons and orthopedic spine surgeons more quickly and easily repair the dura mater during spinal surgery. The dura is the membrane that covers and protects the brain, spinal cord and cerebrospinal fluid. It is a small device that can have a big impact, with product launch slated for early 2021.

NEURAMEDICA

Paul Citron inducted as a Fellow 2019 class of the National Academy of Inventors



Paul Citron

Vice President of Technology Policy Academic Relations (Retired) Medtronic

This is a well-deserved honor for Paul capping his illustrious career at Medtronic. When selecting a host academic institution, Paul selected UC San Diego - we are grateful for his commitment to the education of our students and his work as a member of the Department Board of Trustees.

The NAI Fellows Program highlights academic inventors who have demonstrated a spirit of innovation in creating or facilitating outstanding inventions that have made a tangible impact on quality of life, economic development and the welfare of society. Election to NAI Fellow is the highest professional distinction accorded solely to academic inventors. Paul Citron is a Faculty Affiliate of the Department of Bioengineering at the UC San Diego

Jacobs School of Engineering. Citron was vice president of Technology Policy and Academic Relations at Medtronic, Inc. when he retired in 2003 after 32 years at the company. His previous position was Vice President of Science and Technology. He was given Medtronic's "Invention of Distinction" award for his role as co-inventor of the tined pacing lead.

Walt Baxter inducted as a Fellow 2020 class of Biomedical Engineering Society

Walt Baxter, Ph.D.

Senior Principal Scientist at Medtronic Neuromodulation

Ph.D. Degree in Bioengineering and Biomedical Engineering, 1999

Alumni of the UC San Diego Bioengineering Department are some of the most highly influential leaders in our community.

This past year, one of our particularly accomplished and engaged alumni, Dr. Walt Baxter, was elected as a Fellow of the Biomedical Engineeirng Society. Walt did his doctoral training in bioengineering at UCSD with Prof. Andrew McCulloch, developing novel algorithms for elucidating the mechanics of implanted medical devices.

Since graduating from UC San Diego, he has become a powerful force at the interfaces of industry and academia. He serves as a Senior Principal Scientist and Technical Fellow in Medtronic's Implantables RestorativeTherapies business group helping to develop novel stimulation leads for positioning electrodes within the nervous system. He patented key ideas and published seminal works detailing the mechanical conditions that implanted medical devices are exposed to during their lifetimes and he is a Bakken Fellow 2017, Medtronic's highest technical honor.

In addition to his work at Medtronic, Walt proudly chairs the Board of Trustees of the UC San Diego Bioengineering Department and also serves on the external advisory board for UC San Diego's Whitaker Institute of Biomedical Engineering. He guest lectures in Bioengineering courses at UC San Diego, speaks to student groups about careers in the medical device industry, and fosters meaningful academic-industrial collaborations through his interactions with faculty. We congratulate Walt on being elected BMES Fellow and look forward to the continued impact he will undoubtedly have on the lives of students, professional colleagues and patients.

A Lifetime of Achievement

Y.C. Bert Fung, Ph.D.
Distinguished Professor of Bioengineering
1919-2019

Professor Yuan-Cheng "Bert" Fung, known as "the father of biomechanics" and one of the founders of the discipline of bioengineering at the University of California San Diego, passed away Dec. 15, 2019 of natural causes. He was 100.

Professor Fung was the first to realize that physics and mechanics apply to living tissues just as they do to manmade structures, giving rise to the field of biomechanics. Later, Fung was the first to coin the term "tissue engineering."

Professor Fung received a National Medal of Science in 2000, the first bioengineer to earn the distinction. He also was the fourth individual in history elected into all three branches of the National Academies—Science, Engineering and Institute of Medicine. But Fung's favorite accolade was a Founders Award from the National Academy of Engineering he received in 1998, because it was bestowed by his peers, said his son, Conrad Fung.

Research and Career

Professor Fung moved to California from China in 1946, immediately after the end of WWII, to pursue a graduate degree in aeronautics at Caltech. He very quickly became an expert in the field of aeroelasticity—the study of the interaction of aerodynamic forces with structures that aren't rigid. He wrote the leading textbook on the subject and led a renowned research group at Caltech.

Teacher and Mentor

Professor Fung's key principle was "*Take it easy. And work hard*," said his son, Conrad. It might sound like a paradox, but to Fung it meant that it was important to set clear goals and keep those in mind while working hard without second-guessing and fretting. He passed this on to his students.

Evan Evans, PhD '70, created a new endowed award for bioengineering graduate students in honor of his thesis advisor and mentor, Y.C. "Bert" Fung. The newly created Y.C. "Bert" Fung Interdisciplinary Award will recognize the most multidisciplinary thesis each year with an annual award funded by Dr. Evans' philanthropy.

"Y.C. had such an impact on all of us as students," shared Evans. *"He fostered such a collaborative community with those studying bioengineering, applied physics, and aeronautical and mechanical engineering. Dr Fung brought people together from different disciplines and would not allow us to work in silos. It opened up all of our research."*

Professor Fung's Legacy at UC San Diego

At UC San Diego, Fung's legacy is upheld by many researchers, said bioengineering professor Schmid-Schoenbein. Shu Chien, who was recruited by Fung to come to UC San Diego from Columbia University, focused on the study of how blood flow and pressure affect vessels until his retirement this year. He earned a National Medal of Science in 2011. Chien wrote a 20-page academic paper on Fung's legacy for his 100th birthday. "*Through his vision of the power of 'model making' to explain and predict biological phenomena, Dr. Fung opened up a new vista for bioengineering,*" Chien wrote. "*Dr. Fung is not only a superb scientist and engineer, but also a wonderful artist. He has excellent command in Chinese calligraphy and poetry. He is a Renaissance man.*"

Contents adapted from an article published on December 20th, 2019, by Ioana Patringenaru courtesy of UC San Diego News Center. *News Obituary: Y.C. Bert Fung*. https://ucsdnews.ucsd.edu/pressrelease/obituary-y.c-bert-fung

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*Contributed writing content for 2020 Annual Report
**Contributed design/layout for 2020 Annual Report

Bioengineering
2015

2019