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Engineering News, Fall 2020

School of Engineering

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SANTA CLARA UNIVERSITY

ENGINEERING NEWS

School of Engineering

REDEFINING VALUES IN A VALUES-BASED INSTITUTION

In a School of Engineering, embedded in a Jesuit institution, that is steeped in a tradition of values-based education, it is important that we periodically take a hard look at our own values, programs, and practices to assess how we can best move forward to realize our vision of “an engineering community that inspires and develops engineering leaders of competence, conscience, and compassion—entrepreneurial thinkers who will build a more just, humane, and sustainable world.”

For the past year, our engineering community has tackled that assessment. Weeks of listening sessions and roundtable discussions sparked in-depth discussions within and between our Faculty and Staff Councils.

The result of their collective efforts is our School of Engineering values of iCARE and a code of conduct that outlines our behavior in fulfilling these values. Though the goals may seem lofty, our community of faculty and staff have a deep sense of personal commitment to them, as they promote all that is best in a Santa Clara education. Our [Engineering Advisory Board](#) is also deeply invested in this work, having formed working groups to address diversity, equity, and inclusion, as well as Silicon Valley collaboration.

DEAN'S MESSAGE

For an academic community in a normal year, fall brings an almost giddy sense of joy and excitement. This year, following months of quarantine and social unrest, feelings are mixed, to say the least. But at Santa Clara Engineering, we embark on this new academic year with a sense of hope, purpose, and determination born of months of hard work on the part of our faculty, staff, and students.

First and foremost, our professors head into the virtual classroom armed with resources that carry our Jesuit tradition of academic excellence into the 21st century. Additionally, we have established and begun work on a set of School priorities drawn from extensive conversations with our entire SCU engineering community. Among others, these include fostering diversity, equity, and inclusion; expanding our graduate programs; supporting a higher emphasis on research; facilitating interdisciplinary collaborations; and leveraging our position within Silicon Valley to address the complex and changing needs of society and the world.

Yes, there is a lot of work to do, but we Broncos are chomping at the bit. Read about some of our efforts in this edition of *Engineering News*.



Elaine P. Scott, Ph.D. | Dean
School of Engineering

iCARE

INTEGRITY

in the pursuit of knowledge

COLLABORATION

between each other, across disciplines, and with Silicon Valley and beyond

ASPIRATION

for excellence in education, research, and service

RESPECT

and understanding of our differences among students, faculty, and staff

EXPLORATION

of the frontiers of engineering by research and innovation

WALKING THE WALK TOGETHER

Late last spring, as citizens banded together and took to the streets to protest racial injustice, the Engineering Diversity and Inclusion Council launched a monthly live panel discussion series with STEM and community leaders from around the country, called Walking the Walk Together.

Read more on [page 4](#)

ENGINEERING WITH A MISSION

WHO WE ARE

We are a community of scholars learning, teaching, and researching together in many different disciplines of engineering. While the COVID-19 pandemic has had us meeting remotely this fall, we hope to be back on campus in 2021, in compliance with health and safety guidelines for Santa Clara County.

UNDERGRADUATE ENROLLMENT

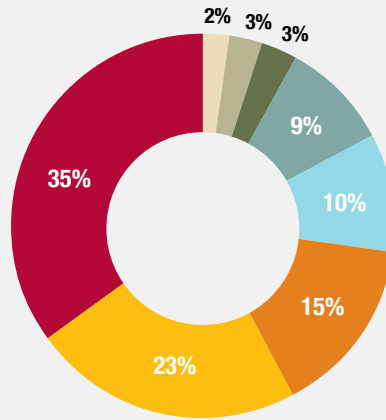
~915

undergraduate students

17% of total undergraduate population

29% women students

30% under-represented minorities



Undergraduate Enrollment by Major Academic Year 2019-20

- 35% Computer Science and Engineering
- 23% Mechanical Engineering
- 15% Bioengineering
- 10% Electrical and Computer Engineering
- 9% Civil, Environmental, and Sustainable Engineering
- 3% Web Design and Engineering
- 3% Undecided
- 2% General Engineering

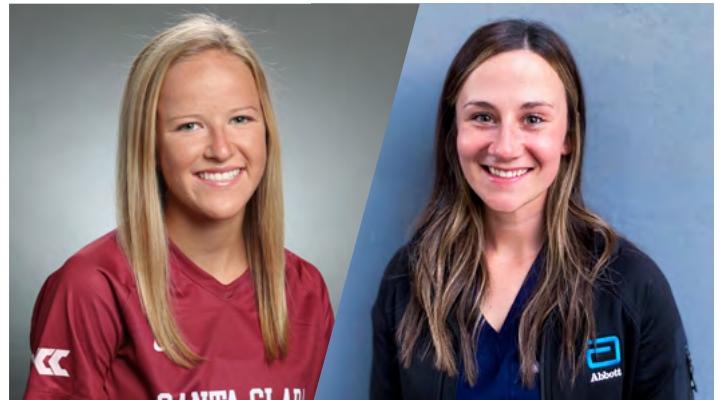
BRONCOS HELPING BRONCOS

ONE OF THE PERKS OF A SANTA CLARA EDUCATION IS GAINING ACCESS TO THE GREAT NETWORK OF BRONCO ALUMNI AND ALUMNAE.

Tapping into that network can be a challenge for current undergraduate students, so to help them out (and to give our newest engineering alums a chance to give back) the School of Engineering has established the Alumni/ae Mentoring Program through Mentor Collective, providing sophomores and new transfer students one-on-one help for navigating school and career challenges and opportunities.

Prior to the start of the fall quarter, engineering sophomores and transfer students were invited to participate in the program, and after taking a survey to assess personality and experience, enrollees were matched with an alum based on common interests, background, academics, and professional goals.

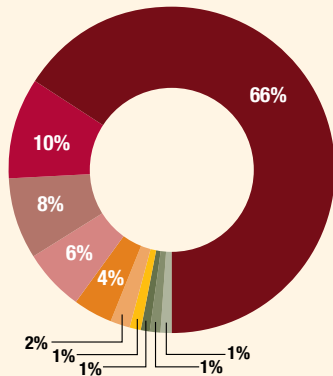
Ellie Glenn, a bioengineering major on the pre-med track has dreams of being a doctor, but also wants to find out more about other career opportunities within bioengineering and is hoping to find an internship with a biotech company. Her mentor, Katie Connelly '17, M.S. '18, who works at Abbott as a Coronary Senior Clinical Field Specialist, is excited to help. "I received a lot of help from and sought the advice of people I knew in the industry when I was going through Santa Clara and I wouldn't have achieved what I have today without them. In the most basic way, I'd like to pay that forward and help the next ones in line," Katie said.



In just the first two weeks of the program, 113 student mentees were matched, 177 alumni/ae mentors were enrolled, and 61 alums were trained and matched. And the numbers continue to grow!

Find more information on the program [here](#).

GRADUATE ENROLLMENT



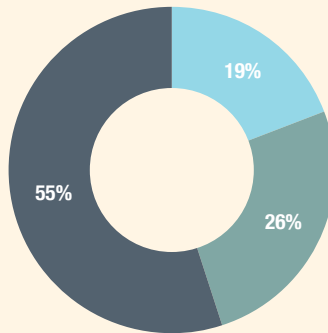
Graduate Enrollment by Program Academic Year 2019-20

- 66% Computer Science and Engineering
- 10% Mechanical Engineering
- 8% Engineering Management and Leadership
- 6% Electrical and Computer Engineering
- 4% Bioengineering
- 2% Certificate Program

- 1% Civil, Environmental, and Sustainable Engineering
- 1% Open Enrollment
- 1% Power Systems and Sustainability
- 1% Software Engineering
- 0% Aerospace Engineering
- 0% Applied Mathematics

Ph.D. Enrollment by Department Academic Year 2019-20

- 55% Computer Science and Engineering
- 26% Electrical and Computer Engineering
- 19% Mechanical Engineering



754
graduate students

58
Ph.D. students


New Master's in
Aerospace
Engineering


5 year BS/MS
program option
growing

BUILDING COMMUNITY OUT OF DISCORD

Building community among graduate engineering students has always been a challenge. The population is diverse, to say the least: some in their early 20s, others reimagining their lives after decades-long careers; some taking classes part-time around an already crammed work schedule, others—new to the United States—learning their field and adapting to a foreign culture full-time. Oddly, though, remote learning and being off campus has presented a unique opportunity for grad students to come together, thanks to Grace Ling.

When the pandemic hit and campus was closed in spring 2020, Ling, master's student in computer science and engineering and then co-president of SCU's Association of Graduate Engineering Students (AGES), decided to try "an experiment." She created a server on Discord, a group-chatting platform similar to Slack, and invited students to join. With channels dedicated to collaborations, course recommendations, job opportunities, events, and much more, members from all around the world, studying in seven different fields of engineering, in their first year or finishing up their degree, are meeting and supporting each other in a friendly, online environment. [Join in here.](#)

Around the same time that she started SCU's Graduate Engineering Discord group, Ling also launched [Design Buddies](#), a place where designers from all backgrounds can connect to share expertise and resources. Read more about that [here.](#)



[More about Grace Ling](#)

[More about Design Buddies](#)

 **Design Buddies**

WALKING THE WALK TOGETHER



Late last spring, as citizens banded together and took to the streets to protest racial injustice, the Engineering Diversity and Inclusion Council launched a monthly live panel discussion series with STEM and community leaders from around the country, called Walking the Walk Together.

Two SCU Engineering alumni, **Uchechukwu Agwu '18** and **Naeem Turner-Bandeale '18 (both currently working on a Ph.D. at Carnegie Mellon University)**, joined the panel in October. Hear what they had to say, and find information on other past and future panels [here](#).

Uchechukwu Agwu '18

Mechanical Engineering

» “The biggest thing is meeting people where they’re at. Sometimes that won’t be where you want them to be, but if you’re trying to create an environment or culture of understanding, at some point everyone has to listen to each other and try to understand each other as well.”



Naeem Turner-Bandeale '18

Electrical Engineering

» “When organizations reevaluate and reexamine their missions, and tie those into their goals and objectives, you can actually achieve better outcomes for diverse students.”



IDEAS FOR DIVERSITY AND INCLUSION AT SCU

A group of Santa Clara University students is working with faculty and administrators on campus to build community and advocate for diversity and inclusion initiatives in STEM at SCU. The IDEAS Coalition (Inclusion and Diversity in Engineering And STEM) is made up of members from six student-led organizations representing underrepresented or minority students.

With the aim of ensuring “every student has equitable access to the resources and opportunities needed to succeed in STEM at SCU,” SHPE Co-President Daniel Mendoza '21 reports the group works frequently with the Engineering Diversity and Inclusion (EDI) Council, providing a student perspective on all of the group's initiatives, such as the Walking the Walk Together panel series, adding more anti-racism content in engineering classes, and diversifying the makeup of the Engineering Advisory Council. They also work with the Diversity and Inclusion in Science and Engineering (DISE) Committee for initiatives outside of the School of Engineering.

During the fall quarter, their foremost project is creating a resource guide featuring a flowchart leading students to help in the event of a variety of situations, such as a classroom bias incident or mental health need.



IDEAS MEMBER ORGANIZATIONS

SHPE Society of Hispanic Professional Engineers

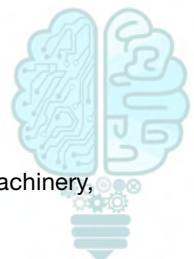
SWE Society of Women Engineers

NSBE National Society of Black Engineers

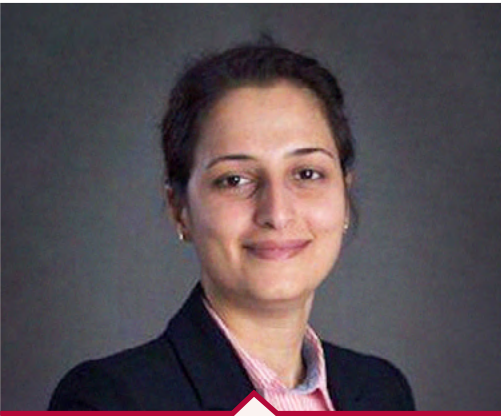
WinSTEM Women in STEM

ACM-W Association of Computing Machinery, Women's Chapter



STAR Student Academic Representatives



FACULTY PROFILE



Sara Tehranipoor


-  Assistant Professor; first new faculty member hired when Electrical Engineering became Electrical and Computer Engineering in 2019
-  Expertise: Hardware Security. While other researchers concentrate on expensive detection techniques in the hardware security domain, Tehranipoor's area of focus is on prevention methods, finding ways to secure hardware, especially those that are very limited in terms of resources—memory, power, etc.

Students ranging from undergraduates to master's and Ph.D. candidates help with her research, also collaborating with colleagues from other universities. Her undergraduate advisees published journal and conference papers last spring, and Tehranipoor is advising three senior design teams for the 2020-21 academic year

[More on Dr. Tehranipoor here.](#)

STUDENT PROFILE

Julia Lieberman '21

-  Society of Women Engineers corporate relations lead, mathematics and computer science major, avid athlete and former professional kiteboarder
-  Passion: Bringing people together. Julia is active in intern.club, managing the engineering channel and women's channel, and helped put on the first-ever InternCon, a virtual conference where students and new grads mixed with some of the youngest and brightest entrepreneurs, engineers, VCs and designers.



As she heads into her senior year, Julia looks forward to continuing her work with SWE and with intern.club. "A lot of doors have closed due to Coronavirus, but that leaves room for growth, and I'm trying to capitalize on that."

[More on Julia here.](#)

UNITED TO ADVANCE WOMEN IN STEM

Joining forces with Intel and UPWARD, a global network for executive women, the School of Engineering has launched a new mentoring program for undergraduate women in STEM at Santa Clara. Named UPWARD U.N.I.T.E.S. Women (the acronym stands for Universities Networking with Intel for Tomorrow's Engineering and Sciences), the program pairs 42 Broncos with 21 Intel mentors and includes a series of monthly hosted virtual events bringing students, faculty, engineers, and industry thought leaders together.

Katie Wilson, professor of electrical and computer engineering, and Ricardo Padilla, Jr., outreach and diversity programs manager for the School of Engineering, are leading the program for SCU. Professor Wilson notes, "While we know that diversity in the workplace is good for business, statistics show that women make up only about 20 percent of those earning a bachelor's degree in engineering, and only 30 percent of those women are still working in STEM fields 20 years later. The goal of UPWARD U.N.I.T.E.S. Women is to build a supportive community of women engineers and scientists that will empower everyone involved to lead

more fulfilling and productive careers in technical fields. Bringing Santa Clara STEM women together with mentors from Intel and executive women from the UPWARD network is our way of helping to move the needle forward on those statistics, by helping them see themselves succeeding, both now and into their future careers."

FACULTY RESEARCH



Bill Lu, M.D., Ph.D.

Associate Professor,
Bioengineering

RESEARCH

Developing a novel engineering strategy to produce safer and more powerful nano-medicine that can provide new solutions to the treatment of the most difficult to treat human diseases, such as cancers, viral infection, Alzheimer's and genetic disorders.

MS STUDENT RESEARCHERS

Mai Do, Daniel Levin

COLLABORATORS

UC San Francisco, UC Berkeley

AWARD

National Institute of Health,
Medical Sciences

\$410,768

ACADEMIC YEAR 2019-20 RESEARCH FUNDING AWARDS



FEDERAL

\$2,479,071



INDUSTRY

\$496,390



NONPROFIT

\$378,000

TOTAL AWARDS

\$3,353,461



On Shun Pak, Ph.D.

Assistant Professor,
Mechanical Engineering

RESEARCH

Developing artificial microscopic swimmers that can move like microorganisms such as bacteria and sperm cells for medical applications, including drug delivery and microsurgery.

PHD STUDENT RESEARCHER

Kexin Zheng

MS STUDENT RESEARCHERS

Ke Qin, Brandon van Gogh

UG STUDENT RESEARCHERS

Noah Lordi, Shreyes Nallan

COLLABORATORS

California Institute of Technology, Texas A&M University,
Indiana University of Pennsylvania

AWARD

National Science Foundation

\$251,000

THE SWEET SMELL OF CAREER SUCCESS

A TEAM OF STUDENTS FROM SCU'S [BIOINNOVATION AND DESIGN LAB](#) ARE RECEIVING OUTSTANDING MENTORSHIP WHILE GETTING A FLAVOR FOR WORKING WITH A REAL CUSTOMER IN THE BIOMEDICAL INDUSTRY.

Participating in weekly design sprints—a proven method for rapidly validating, testing, and prototyping ideas based on feedback from real customers—the Broncos are developing data analysis and visualization platforms to help Silicon Valley-based [Aromyx Corporation](#) on its groundbreaking quest to digitize human taste and smell for disease detection and improved product quality.

“A camera can capture an image to digitize sight; at Aromyx, we are creating an analog for smell. No one has done that before; no one has been able to use datasets to understand olfactory signatures associated with consumer products or diseases,” said Morgan Moncada, Director of Product and Operations.

An interdisciplinary team of students, directed by Navid Shaghghi, lecturer and researcher in Santa Clara University's Department of Computer Science and Engineering and Department of Mathematics and Computer Science, is collecting data to determine how people experience taste and smell and to identify the language they use to describe their olfactory sensations. “Students are scraping information from beer, wine, cheese, and other product reviews... looking at flavor profiles and how people describe them,” said Shaghghi.

Knowing which receptors drive the positive aspects of perception can help manufacturers determine which products to put through to production. Shaghghi explained that while beverage companies launch new flavors every year, only about 20 percent are successful. “This work could help stop countless dollars from ending up in a black hole—wasted on flavor profiles consumers won't find appealing,” he said.

As Aromyx's technical lead, relating the actual sense of taste and smell back to the human experience is Sen Hirano's job. “SCU's help mining this information will be helpful in the future. As we build profiles to better understand the breadth and variety of different likes, we will determine which subsets we want to model,” he said.



In weekly video conferences, students check in with their mentors on the work they have accomplished on their own. “Borrowing methods used in industry, we break the work into smaller, shorter milestones. Some students are building auxiliary databases and models that will give us a good amount of quantifiable information about taste and smell, others are working on front end web applications or designing graphics to visually represent smell and taste sensations. Meeting often keeps everyone on track and our feedback gives students a way to shape their project as they move forward,” said Hirano.

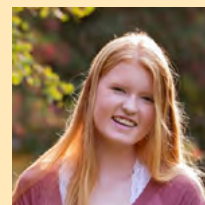
“We've been working with SCU for close to a year, and just signed on for another six months. It is rewarding to see how students have expanded their skillsets over time. I've noticed they get more and more excited and engaged as they solve problems through the lens of their own work, whether it is machine learning or graphics, and they give each other accountability and an incentive to bring something to the table each week,” said Moncada.

“Student training and career development is central to the efforts of the Lab. It is exciting and fulfilling to work with Silicon Valley companies, such as Aromyx, to establish joint training programs for SCU students that prepare them with qualifications and aptitudes to achieve career success in the biomedical industry,” commented Prashanth Asuri, Director of BioInnovation and Design Lab and Associate Professor of Bioengineering.

UNDERGRADUATE RESEARCH

These students were paid researchers during the summer and fall, helping advance a faculty mentor's research.

More here: scu.edu/engineering/kuehler



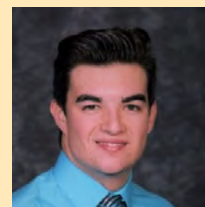
Emma Barrett-Catton

Exploring the relative roles of polymer-nanoparticle and polymer-polymer interactions on the mechanical properties of the interpenetrating polymer network hydrogel nanocomposites.



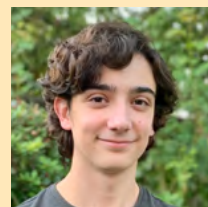
Jack Edmonds

Survey recent developments in attacks on lightweight hardware security primitives, including Physical Unclonable Functions and True Random Number Generators.



Dwight Johnson

Exploring the feasibility of thread-based electrochemical mechanisms for free radical detection using 3-D printed microneedles for wound healing applications.



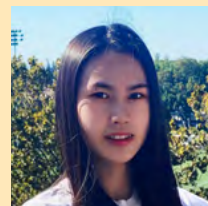
Steven Reimer

Developing an advanced marine sensing system that collects environmental data throughout a water column and then uses local information to adaptively determine when to execute high-cost physical sampling operations.



Austin Rothschild

Establishing rigorous physical bounds on aspects of light-matter interaction in nanophotonic systems to inform and direct work in inverse design.



Jiayi Zhang

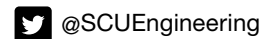
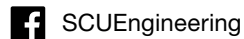
Developing stealth exosomes for the next generation of nano-medicine.



Santa Clara University
500 El Camino Real
Santa Clara, CA 95053

The Jesuit University in Silicon Valley

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RUTH DAVIS RECEIVES SWE DISTINGUISHED ENGINEERING EDUCATOR AWARD

Scholar. Visionary. Inspiration. These are just some of the words that describe Ruth Davis, professor of computer science and engineering, associate dean of undergraduate engineering at SCU, and 2020 recipient of the Society of Women Engineers' Distinguished Engineering Educator Award.

As the first female tenure-track faculty member hired by the School of Engineering in 1979, Dr. Davis has had a deep and lasting influence on engineering at Santa Clara. A founding member of the Computer Engineering Department, she developed 15 new courses in just 4 years. In her first two decades at SCU, she was a prolific scholar in her research area of software engineering, publishing three dozen conference and journal articles, and penning two books.

As the faculty advisor of SCU's Collegiate SWE section for more than 20 years, Dr. Davis facilitated partnerships and created programs with local high schools, among them, One Step Ahead, offering workshops to girls in the Santa Clara Unified School District.

Always a champion of women in computing and engineering, midway through her tenure here at SCU Dr. Davis' passion for recruiting and retaining diversity in engineering became the focus of her scholarship and service. She has since published more than two dozen papers on the subject, and has put SCU at the forefront of this effort through collaborations with the Academic Alliance of the National Center for Women in Information Technology (NCWIT), as a contributor to the founding of the Institute of Women and Technology (IWT, now AnitaB.org), and co-creator of the Virtual Development Center (VDC)—a collaborative effort of U.S. colleges and universities established in the 1990s to draw both technical and non-technical women into the field by connecting the dots between technology and social impact. She also helped create the School of Engineering's Summer Engineering Seminar, a fun, weeklong immersion program for women and other underrepresented students to learn about college life and the different fields of engineering.

Since 2003, Dr. Davis has served as Associate Dean, Undergraduate Programs. In this role, she continues to advance the recruitment and retention of underrepresented students in SCU engineering. Over the years, she has secured and managed more than \$3.5M in grants to support community-based learning, teacher support, course and curriculum development, pipeline programs drawing students to engineering, and more.



Photo by Nicole Morales

An excellent teacher and compassionate and driven administrator, Ruth Davis has had a profound influence on her students, her department, her School, and her field, greatly enhancing the lives of many Bronco engineering students over the past four decades.

"Through my career at SCU and my affiliation with SWE, NCWIT, and the Anita Borg Institute for Women and Technology, I have met so many outstanding women, and our amazing SCU students continually inspire me, as well, with their dedication, creativity, and energy. I can't begin to express how much I appreciate this award, and the efforts of these women in helping me earn it," said Davis, continuing, "As recently as ten years ago, women in engineering education were few and far between, but for many years Santa Clara held the distinction of being the school with the highest percentage of women engineering faculty in the nation. I am happy to report that we have fallen in that ranking—not because we have fewer women, but because many other schools have now hired more women engineering faculty—and that is good for engineering education and for the profession."