



**SCHOOL OF BIOMEDICAL
ENGINEERING**
COLORADO STATE UNIVERSITY

ST. VRAIN

Intro to BME course offered to high school students thru St. Vrain Valley Schools.

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Salazar of Medtronic is the latest board member to join the SBME Industry Advisory Board.

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Exciting research taking place in the award-winning SBME research labs across campus.

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MESSAGE FROM DIRECTOR

Celebrating our strength: Regenerative & Rehabilitative Medicine

A number of years ago, the School of Biomedical Engineering underwent an introspective process to determine a way to characterize its research strengths: (1) regenerative and rehabilitative medicine, (2) imaging and diagnostics, and (3) medical devices and therapeutics. Starting with this spring newsletter, we will celebrate each of these areas of strengths. It is particularly appropriate to celebrate the strengths of regenerative and rehabilitative medicine because this spring brings the opening of the new C. Wayne McIlwraith Translational Medicine Institute (TMI). The goal of this Institute is to foster the discovery and delivery of solutions that utilize the body's healing capacity to improve the lives of animals and humans. The 130,000-square-foot facility is housed on Colorado State University's Veterinary Medical Campus. Many of the faculty in this facility are derived from the Department of Clinical Sciences in the College of Veterinary Medicine and Biomedical Sciences and the Department of Mechanical Engineering in the Walter Scott Jr. College of Engineering. Proudly, we can point to the fact that quite a number of these faculty are also core faculty in the School of Biomedical Engineering.

It is the essence of the School of Biomedical Engineering to explore translational solutions at the forefront of unmet medical needs. A major focus of the TMI is on biologic therapies that leverage the body's own abilities to heal. These therapies may be stem cells or products related to or derived from stem cells. The fact that we chose to label one of our strengths "regenerative and rehabilitative medicine" more than half a dozen years ago is interesting in light of a recent editorial note in the *Nature Partner Journal* *npg* Regenerative Medicine concerning the rise of "regenerative rehabilitation". This is an area where CSU will lead into the future.

In 1966, Robert F. Kennedy delivered a speech that included the statement "we live in interesting times." For the world of stem cells, that time is most certainly now. There has been a recent call by a leader in the field, Arnold Caplan, to change the name of "Mesenchymal Stem Cells" (MSC) to "Medicinal Signaling Cells" (Caplan AI, *Stem Cells Translational Med* 2017; 6:1445). This was followed by a call for "a coordinated global effort to improve understanding of the biology of the cells currently termed MSCs, and a commitment from researchers, journal editors and others to use more-precise labels" (Sipp et al., *Nature* 2018; 561:455). This is further echoed by our own leader in the field, C. Wayne McIlwraith, for whom the TMI is named. The problem to the public is the exploding number of "clinics" that make outrageous claims for the magical properties of stem cells without understanding whether and how any effects might be mediated. The majority of scientific studies indicate that stem cells do not provide solutions by acting as a source of tissue cells. The investigators in the TMI are dedicated to determining how stem cells might lead to improving healthcare and do it in a way that will provide the understanding necessary to render therapeutic treatment options reliable.

I invite you to contact me at Stuart.Tobet@colostate.edu with your thoughts on this controversial topic.

Sincerely,

Stuart Tobet, Ph.D.
Director, School of Biomedical Engineering

Built on strong transdisciplinary faculty & research programs



Walter Scott Jr.
College of Engineering



College of Health and
Human Sciences



College of
Natural Sciences



College of Veterinary
Medicine & Biomedical
Sciences

CSU HIRES FIRST FEMALE PRESIDENT

Joyce E. McConnell will assume the top position at CSU on July 1, 2019. Currently serving as provost and vice president for academic affairs at West Virginia University, McConnell has served in these roles since July 2014. In those positions, her charge has had broad scope: overseeing university budgets; building partnerships with political, governmental, business and nonprofit leaders at the state, national, and international levels; and playing a lead role in fundraising. McConnell's track record also includes tenure as dean of the College of Law at WVU, during which she spearheaded major fundraising and academic initiatives.



INTRO TO BME FOR HIGH SCHOOL STUDENTS

By Michael Benedict

Biomedical engineering is an emerging discipline, and here in SBME, we pride ourselves on innovation, and willingness to think outside the box. This fall, SBME undertook an exciting new experiment: the development of an introductory biomedical engineering course for local high school students. The goal was to introduce students to the world of biomedical engineering before they even get to campus, and to let them earn college credit in the process. The resulting course – BIOM 180 – is a 1-credit online course that covers the same content as BIOM 100, which most BME majors take as first-year students. BIOM 180 was taken by a pioneering group of students in the St. Vrain Valley School District this fall.

The course was an experiment in hybrid teaching, with many educators involved in the process. Dr. Ketul Popat, an associate professor in the Department of Mechanical Engineering and core faculty in SBME, oversaw the creation of the curriculum and developed the course materials. Mark Allen, a teacher at Frederick High School, facilitated the experience – handling some of the day-to-day teaching, helping students with their work, and making sure they stayed on top of assignments. The efforts of CSU BME Ph.D. Students Jasmine Nejad and Jessi Vlcek were also instrumental in making the course possible.

When asked about the experience of guiding students through the course, Mark Allen said, “This was all new for my students, [who] found the material to be challenging but worthwhile.” For their final projects for BIOM 180, students took a trip to Fort Collins, visited CSU, and presented for Mark and Dr. Popat. “The presenting part made them nervous at first,” Mark said. But in the end, “They did a really great job and impressed Ketul and me.”

This exciting new program had a successful first year, and can only grow from here. Several of the students who took the course now plan to matriculate at CSU in the fall of 2019. “I plan on making my seniors take this course every fall semester,” Mark said. “I think our partnership is a win-win and I look forward to continuing the Frederick HS-CSU bond.”



6th ANNUAL SBME FIRST-GENERATION DINNER

If you are the first in your family to receive a bachelor's (or higher) degree, you are a First-Generation college student. Most of the time, "First Gen" students don't even know this definition, or that what they are doing is special, or that they may face challenges that other students don't. They simply do what they've done their whole lives—buckle down, work hard, figure things out, and do spectacular things.

Colorado State University is the first university in the country to identify first-generation students and provide scholarships and services for these important members of our community. For the past six years, the SBME has hosted a dinner for its First Gen students, and this year's event was another success. Approximately 40 students, faculty, and staff got together for conversation and connections on January 31. Biomedical engineering First Gen alumni were also invited, and one alumna shared that her motivation to come to the program this year was "to share my story, help the students in whatever way I can and connect with faculty."

Students consistently report that meeting other First Gen students is important for them, as are the informal conversations and connections with faculty that result from the evening. Faculty like to attend as well because it's another venue in which to find students who can contribute in their research labs.

Next year we hope to have more First Gen alumni join us. If you are a First Gen BME alum, or work for an organization that is interested in recruiting first-generation students, please contact us. We are always looking for alumni and industry partners to share their stories and help mentor our students! Contact Brett.Beaal@Colostate.edu, if interested.

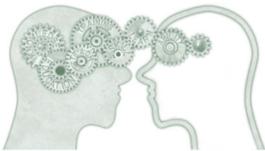


GRADUATE PROGRAM UPDATE

Program Recognition

Colorado State University's online programs rank among the best according to *U.S. News and World Report*. It's engineering program ranks top in the state, at No. 33 among public universities. Methodologies include factors such as student engagement, faculty credentials, and student services and technology.

Bioscience is one of nine industries that are driving Colorado's roaring economy. It's no wonder our Master of Engineering, Biomedical Engineering Specialization degree was highlighted in the March issue of *5280*, Denver's mile high magazine, as one of 22 savvy ways to jumpstart your career.



Skill Swap Event

The BME graduate program hosted a first-of-its-kind Skill Swap event in the fall of 2018. Graduate students with particular expertise in one area were asked to share their skills, and students looking for "go-to" experts for gaining new tips and tricks were invited to come and take part in this unique event. Shared knowledge included CAD, cell culture, and 3D printing (to name a few of the 10). The swap was well-received and an expanded version is likely to be held again in October 2019.

Graduate Interview Days

The SBME hosted its annual poster session and awards ceremony, part of the activities on Graduate Interview Days on February 25 and 26. Thirteen Ph.D. candidates seeking admission to the biomedical engineering program had an opportunity to interview with faculty, tour labs and campus, and interact with current graduate students at several events. At the poster session, current students showcased their research, giving prospective students an opportunity to learn more about the research on campus. We look forward to welcoming a new class of graduate students in August 2019.

Graduate School Mini-Grant

The BME graduate program received a mini-grant from the Graduate School this academic year to host a career event for its current students in the spring semester. This year, we took the event on the road and headed to Medtronic Boulder on April 24 to host an alumni career panel with four alumni. Students toured Medtronic's R&D research labs and had the chance to view tissue demonstrations.



NEW SBME BOARD MEMBER

Stephanie Salazar (**'11 B.S. Mechanical Engineering**) is a senior sterile device engineer at Medtronic and currently works in Research and Development for the Restorative Therapies Group, Brain Division. She joined Medtronic in 2011 as a Technical Specialist in the Services Organization.

Stephanie's technical expertise includes mechanical design, biocompatibility, device reprocessing, sterilization and packaging of single use, reusable and capital equipment medical devices.

She is the founder of the Medtronic Women's Network Chapter at the Louisville, Colorado site and is currently the co-chair of the Develop Committee, orchestrating business, diversity, and mentoring initiatives across the company. Additionally, she champions and partners with STEM outreach opportunities in her community.

OFFICIAL OPENING OF HIGH-TECH INNOVATION HUB

The Translational Medicine Institute celebrated its grand opening on May 6. Prior to this event, the School of Biomedical Engineering hosted its 4th Annual Engineering Days Industry Reception on the beautiful 3rd-floor terrace on April 19 and provided guests with tours of this 130,000 square foot high-tech innovation hub.

This facility is equipped with four surgical suites, MRI, CT, and advanced imaging equipment. It also includes multiple high-tech auditoriums and meeting rooms and a 3D bio-printer.



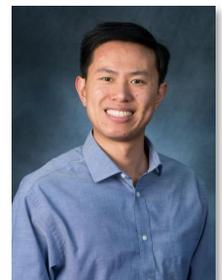
**TRANSLATIONAL
MEDICINE INSTITUTE**
COLORADO STATE UNIVERSITY

The faculty research teams who are utilizing the space, many of whom are core faculty in the School of Biomedical Engineering, are focused on creating diagnostics, treatments, and advanced techniques for understanding the biology of injury and disease in the musculoskeletal system. Additionally, they are creating and testing cell-based therapies for fighting infection, inflammation, and injury. Their mission is to help answer tomorrow's questions in medicine, for both animals and humans.

NGUYEN-TRUONG BECOMES 2019-20 RESEARCH FELLOW FOR WINNING 3-MINUTE CHALLENGE

Thirty-nine graduate students vied for fellowships as they explained their research in three minutes for a panel of judges on February 11, 2019. As students quickly summarized their research, judges scored the content and comprehension of the presentation, as well as students' effective engagement and communication skills. Fifteen participants in the Vice President for Research 3-Minute Challenge were selected to become the next VPR Graduate Student Fellows, and Michael Nguyen-Truong, biomedical engineering graduate student, was one of them. He presented "Preparing Stem Cells in their Fight Against Heart Failure: What is their Ideal Niche?"

Nguyen-Truong will receive \$4,000 in scholarship and travel support and participate in professional development workshops, mentorship, leadership and engagement opportunities over the 2019-20 academic year.



GRADUATE SEMINAR SUMMARY: DR. PREETHI CHANDRA, HOWARD UNIVERSITY

By Jasmine Nejad

Dr. Preethi Chandran, Assistant Professor of Chemical Engineering at Howard University, presented “The skin and backbone of systems: Biophysics in the glycan shield and the semiflexible ligaments,” for the SBME seminar on Monday, November 5, 2018. Dr. Chandran’s research aims to understand the physics of semi-flexible nano-scale biological assemblies through experimental analysis and computational modeling. She presented her research on the mechanics of DNA-polymer assemblies, mannobiose coatings, and novel approaches for computational modeling of assemblies of fibers and filaments.

Dr. Chandran’s lab studies the mechanics of DNA-polyethylene imine (PEI) assemblies and the effects of adding an outer layer of mannobiose, a sugar commonly found on the outer layer of viral and fungal walls. Using atomic force microscopy (AFM) indentation for compression testing, they were able to determine that the mannobiose-modified assemblies exhibited behaviors similar to a thin-walled shell. It was determined that the mannobiose caused hydrogen bonding which leads to water structuring around the assembly, acting as a viscous layer that resists faster-moving objects. These unique properties can be utilized for applications such as smart materials and nanomedicine.

To better understand the mechanics of larger assemblies, Dr. Chandran’s group also developed a computational method to better understand the physics of groups of fibers. Current models are limited in their ability to accurately model interactions between multiple fibers due to the high computational cost. By modifying a method that models fibers as a string of beams, Dr. Chandran’s group was able to improve accuracy with lower computational power. This model is important in understanding the interactions between fibers for more directed engineering of smart biological materials.

The Company We Keep

Each semester, the School of Biomedical Engineering invites distinguished guests from around the world to speak on biomedical engineering research and related disciplines for its weekly seminar series. The Fall 2018 speakers included:

Dr. Alyssa Panitch

University of California, Davis

Biomacromolecular approaches to treating disease

Dr. Ray Browning

Former Senior Director, Footwear Research, Nike Sport Research Laboratory, Nike, Inc.

Product Innovation for Sport: The business of making athletes better

Dr. Preethi Chandran

Howard University

The skin and backbone of biological systems: Biophysics of the glycan shield and semiflexible filaments

UPCOMING INDUSTRY CONFERENCES

Mark your calendar & save the date!

TERMIS World Congress
Rhodes, Greece • May 27-31



ASMS Annual Conference
Atlanta, GA • June 2-6



World Congress of Biomechanics
Seven Springs, PA • June 25-28



Protein Society Annual Symposium
Seattle, WA • June 30-July 3



American Society of Biomechanics
Calgary, Canada • July 31-August 4



BMES Annual Meeting
Philadelphia, PA • October 16-19



Neuroscience Meeting
Chicago, IL • October 27-30



IEEE Sensors Conference
Montreal, Canada • October 27-30



CBMS MicroTAS Conference
Basel, Switzerland • October 27-31



AIChE Annual Meeting
Orlando, FL • November 10-15



2nd World Congress on Biosensors and
Bioelectronics
Singapore City • November 27-28



International Conference on Fatigue
Damage of Structural Materials
London, UK • December 9-10

SBME FACULTY RESEARCH & AWARDS



Best of the best: Outstanding BME teacher honored

By Tony Phifer

Christopher Snow, assistant professor of chemical and biological engineering and the School of Biomedical Engineering received one of six Best Teacher Awards at this year's banquet on March 27. *"It is difficult to summarize all that Dr. Snow does for his students – his giving seems incalculable. Perhaps, however, what distinguishes Dr. Snow most is not what he does, but how much he cares."* –Peter Meyer ('20)

Full story: <https://source.colostate.edu/best-of-the-best-six-outstanding-teachers-to-be-honored/>



Open insulin, 'DIY BIO' and the future of pharma

By Jessica Cox

The U.S. Pharmaceutical market may soon be turned on its head. Jean Peccoud, the Abell Chair in Synthetic Biology in the Department of Chemical and Biological Engineering and core faculty member in the School of Biomedical Engineering, is one of the authors of a perspective piece in *Trends in Biotechnology*, a scholarly journal. The paper's authors use the California-based Open Insulin Project as a case study of how the do-it-yourself bio movement might shape the future of medicine.

Full story: <https://enr.source.colostate.edu/open-insulin-diy-bio-and-the-future-of-pharma/>

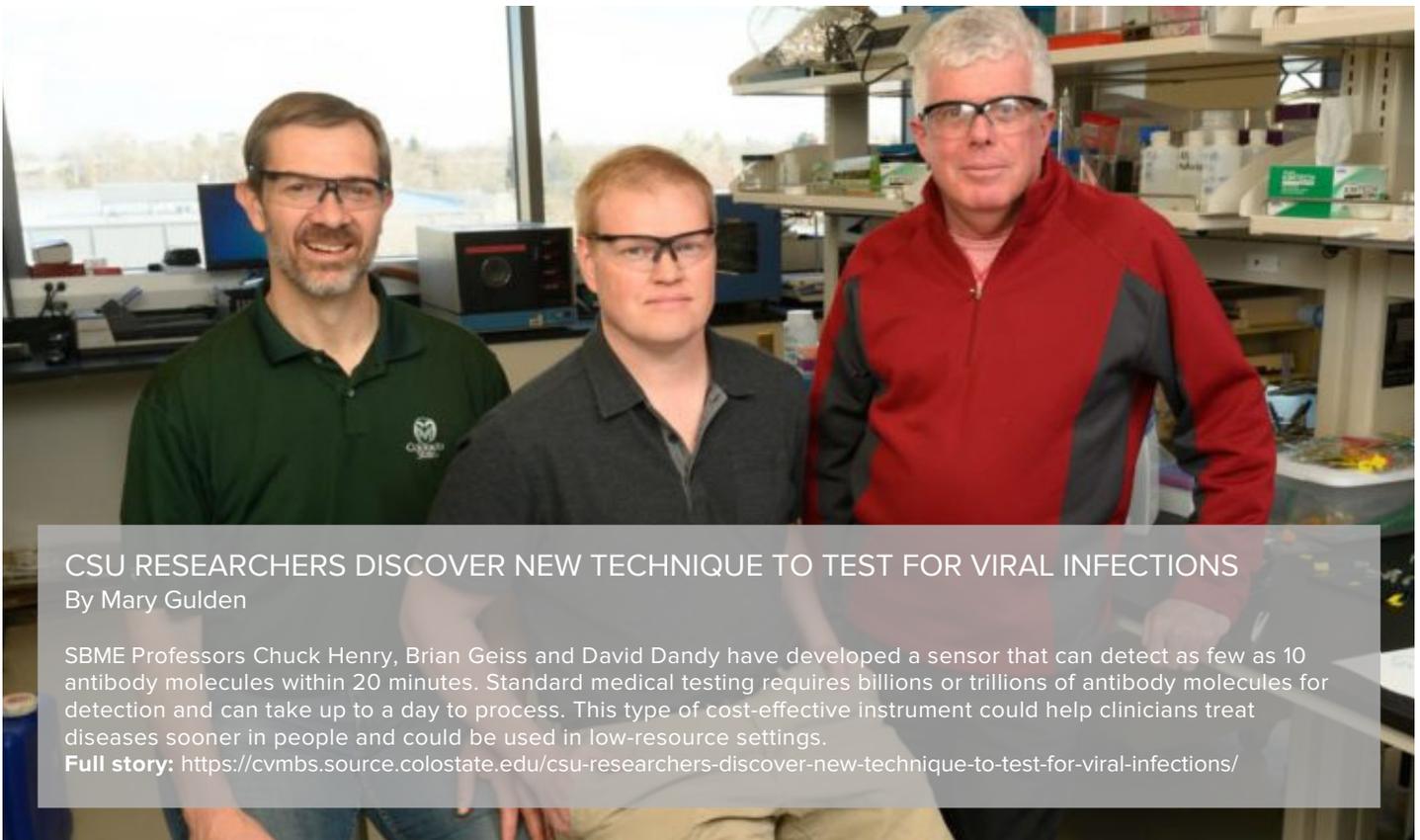


Jumpin' droplets! Researchers seek to improve efficiency of condensers

By Anne Manning

A team led by Arun Kota, assistant professor in mechanical engineering and the School of Biomedical Engineering, has figured out how to keep condensed droplets from coalescing into a film, and to make the droplets jump high enough to move away from the condenser surface. "Our strategy is simple, power-free and scalable," Kota said.

Full story: <https://enr.source.colostate.edu/jumpin-droplets-researchers-seek-to-improve-efficiency-of-condensers/>



CSU RESEARCHERS DISCOVER NEW TECHNIQUE TO TEST FOR VIRAL INFECTIONS

By Mary Gulden

SBME Professors Chuck Henry, Brian Geiss and David Dandy have developed a sensor that can detect as few as 10 antibody molecules within 20 minutes. Standard medical testing requires billions or trillions of antibody molecules for detection and can take up to a day to process. This type of cost-effective instrument could help clinicians treat diseases sooner in people and could be used in low-resource settings.

Full story: <https://cvmb.ssource.colostate.edu/csu-researchers-discover-new-technique-to-test-for-viral-infections/>

SBME STUDENT ACTIVITIES & AWARDS

STUDENTS TAKE ON SUPERBUGS AT SYNTHETIC BIOLOGY COMPETITION

By Jessica Cox



It's projected that by 2050, 10 million people will die per year from diseases caused by antibiotic-resistant bacteria. That's more than the current death rate due to cancer and diabetes combined, and will cost \$100 trillion to treat.

The Colorado State University International Genetically Engineered Machine (iGEM) team is leveraging expertise in synthetic biology to propose a solution to this prevalent health issue. The team is advised by Christie Peebles, associate professor in the Department of Chemical and Biological Engineering, and Claudia Gentry-Weeks, associate professor in the Department of Microbiology, Immunology, and Pathology.

The multidisciplinary team, made up of students from three colleges and seven disciplines, presented their project at iGEM 2018 in October. They earned a bronze medal for their work. **Full story:** <https://enr.source.colostate.edu/students-take-on-superbugs-at-synthetic-biology-competition/>

BME+MECH STUDENT AWARD WINNER AT MURALS 2019 SYMPOSIUM

Brandon Tighe, biomedical engineering and mechanical engineering major, received second place for Science Technology Engineering and Mathematics at the 2019 Multicultural Undergraduate Research, Art and Leadership (MURALS) Symposium, which took place on March 29.

MURALS encourages students of color in various disciplines to showcase their scholarly work. The event highlights student work in social sciences, humanities, STEM, creative arts, and service learning and leadership.

SCOTT SCHOLARS MAKING THEIR MARK

By Brett Beal

Colorado State University engineering alumnus Walter Scott, Jr. made a gift of \$53 million to CSU—the largest gift in the history of the university—which provided (among other things) the creation of the Walter Scott, Jr. Undergraduate Scholarships for a select group of incoming first-year students who demonstrate exceptional academic accomplishments and intellectual promise, and are committed to leadership, citizenship and excellence. Among this year's talented cohort is Katie Graham and Ethan Barron.



A Colorado native, **Katie Graham** has grown up with a love for the mountains, her family, and volunteering. Her parents were within the first generation of their families to go to college, and growing up she always knew she wanted to follow in their footsteps. She was drawn to the people at Colorado State, and has found a welcoming, friendly community with challenging and interesting classes, as well as a strong support system to help everyone graduate. She's an active member of the Society of Women Engineers and was fundraising chair for the recent "Introduce a Girl to Engineering" Day.

Katie shares that "Volunteering at Children's Hospital has made me realize that my goal for the future is to find a career where I can make people's lives a little bit more enjoyable, especially people who are having a rough time. Currently, I am pursuing degrees in biomedical engineering as well as electrical and computer engineering, and I hope to one day work on machines that are used for imaging in hospitals. Whether I work on improving the speed, quality, or comfort of imaging devices, I hope that I can better these instruments to have a positive impact on people's experiences with them."

Ethan Barron was born in Wichita, Kansas, and grew up in Austin, Texas, where he was involved in outdoor activities such as rock-climbing and caving, and even developed a hoverboard (that worked!) in middle school. He also has a passion for medicine, and plans to become a physician who designs biomedical devices after he graduates with his degrees in biomedical engineering and mechanical engineering. Taking care of others has been an important part of his life and he has always been fascinated in the problem-solving aspect of engineering.

He is taking full advantage of the opportunities at CSU by becoming involved in the Pre-Medica club, a cardiovascular research lab, and working with the Engineering Success Center as an ambassador. He also devotes time to Medical Center of the Rockies and has worked at the Dell Children's Medical Center in Austin.





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FIND US ON:



SAVE THE DATE

MAY 2019
BME Spring Commencement
May 17 | Moby Arena | 11:30 a.m.

OCTOBER 2019
BMES Annual Meeting
October 16-19 | Philadelphia, PA

APRIL 2020

ENGINEERING DAYS (E-DAYS) SHOWCASE
April 24 | Lory Student Center | 9:00 a.m.



SCHOLARSHIPS

Scholarship support at all levels provides critical aid to our students. We strive to help as many students as possible with the financial obligations of their engineering education.

Donate to an SBME scholarship today and know that your gift will make an impact for years to come.

Biomedical Engineering Alumni Scholarship
<https://advancing.colostate.edu/SBME>

Joan King Memorial Scholarship
<https://advancing.colostate.edu/KingScholarship>

SBME Scholarship for Leadership and Innovation
<https://advancing.colostate.edu/SBME>

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