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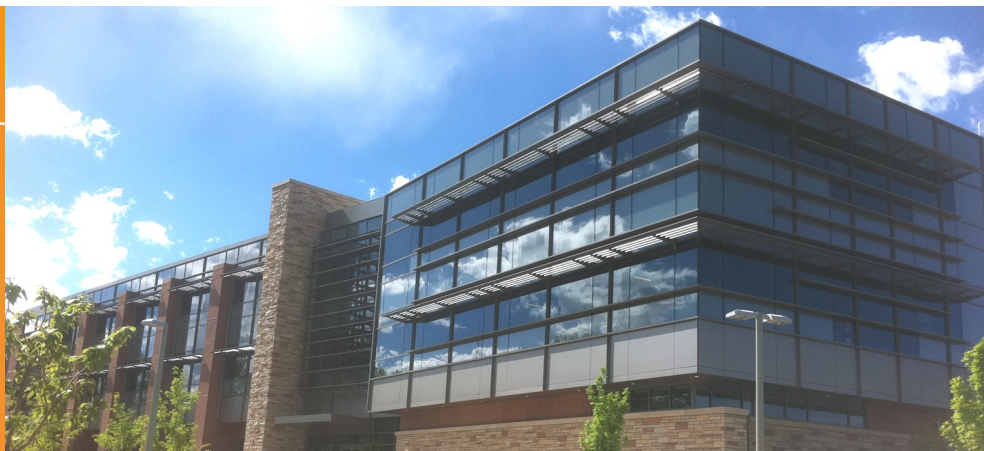
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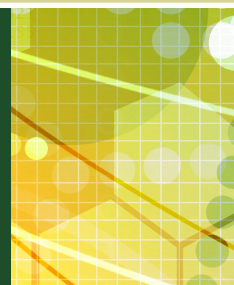


Volume 4, Issue 2

Fall 2016



Colorado State University
SCHOOL OF BIOMEDICAL ENGINEERING



visitors >>>

The Company We Keep

Each semester, the School of Biomedical Engineering invites distinguished professors from around the world to speak on biomedical engineering research and related disciplines for its weekly seminar series. The Spring 2016 speakers included:

Dr. Ray Goodrich

Terumo BCT

Dr. David Eddington

University of Illinois, Chicago

Dr. Kristen Billiar

Worcester Polytechnic Institute

Dr. Nakayama

Saga University, Japan

Dr. Martin Chalfie

Columbia University

Dr. Saad Khan

North Carolina State University

Message from Director

SBME Welcomes First Generation Students



Colorado State University—the first university in the country to identify first generation, low-income students and provide scholarships designed

to pay for tuition and student fees—created its First Generation Award program in 1984. First Generation status is defined as students whose parents did not complete a bachelor's degree or higher. Since 1984, CSU has continued to provide not only scholarships but also create a community of support for these students.

Dozens of first generation members make up the faculty and staff in the College of Engineering and are naturally prepared and particularly willing to share their experiences and relate to the obstacles first generation students face. I myself am a first generation college student, so I understand the additional challenges students face such as navigating undergraduate education and the familial challenges and stressors

that come with being the first in the family to venture into a distant university life.

As part of its commitment to student success, the SBME plans to grow assistance and programs for First Generation Students. The SBME began to address issues by providing underrepresented students an opportunity to mingle one-on-one with faculty at the inaugural SBME First Generation Dinner in February 2014. We look forward to continuing this outreach in spring 2017 when we host our 4th Annual SBME First Generation Dinner. In addition, we provide a number of resources that you can find on our new webpage devoted to SBME First Generation students: engr.colostate.edu/sbme/firstgeneration.

As we continue to search for new opportunities to support these pioneering scholars, I welcome your thoughts and ideas. Feel free to reach out to me via email at Stuart.Tobet@colostate.edu or by phone at (970) 491-7157.

New Advisory Board Member



Gary Johnson ('92 B.S.M.E.) is the Surgical Group President for Applied Medical, a global medical device developer, manufacturer, and distributor headquartered in Rancho Santa Margarita, California.

Johnson joined the company in June of 1992 as a process development engineer. Three years later, he transitioned into the clinical development role and then served as vice president of clinical development, division president and general manager. In September 1999, Johnson was promoted to Vice President and general manager.

Johnson holds over a dozen patents for a variety of medical devices and technologies. He is a graduate of Colorado State University and holds a Bachelor of Science in mechanical engineering.

Board Member Farewell

The SBME would like to thank three long-time board members for their leadership, enthusiasm, and dedication to helping excel the academic and research efforts of the biomedical engineering program at Colorado State.



Sean Hays ('95 M.S. Chemical Engineering), president and founder of Summit Toxicology, a toxicology, risk assessment, and pharmaceutical consulting firm, served as chair of SBME for a number of years and most recently served as co-chair as he guided Steve Simske, HP Fellow at Hewlett Packard, on taking over the reigns in 2015.



Rick Jory, former president and CEO of Sandhill Scientific, Inc., a medical device company focused on developing and marketing of gastrointestinal diagnostic solutions. Sandhill Scientific was acquired by Medovations in December 2013. Rick has since retired to pursue new goals. In 2012, he graduated from Denver Seminary with a master's degree in biblical studies.



Ivan Vesely, is a vascular product technical specialist for BSI. Prior to joining BSI, Ivan founded ValveXchange, and developed and marketed a two-piece bioprosthetic tissue valve system that resolves compromises between conventional mechanical and tissue-based prosthetic valves.

New SBME Faculty



Travis Bailey recently joined the School of Biomedical Engineering as a core faculty member. Bailey is an assistant professor in the Department of Chemical and Biological Engineering and has worked collaboratively with several core faculty of SBME over the last several years. His research interests focus on polymeric material development, including the development of chemically and mechanically tuned hydrogel systems for biomedical applications. In addition, he is interested in material systems that can be applied in soft tissue replacement and repair technologies, ocular lens applications, and device coatings.



Meet the new Office Coordinator

Michael Benedict is a new part-time office coordinator in the SBME. He has most recently worked as a program coordinator, event planner, writer, and writing instructor. Michael is from Seattle, Washington, and spent the last six years in Moscow, Idaho.

Michael did his undergraduate work at the University of Washington and Western Washington University, and received an MFA in creative writing from the University of Idaho. He has worked and taught composition, rhetoric, and creative writing at the University of Idaho, Lewis-Clark State College, and Washington State University. His short fiction has been featured in periodicals across the country, and he is finishing work on his first novel. He is excited to make CSU the sixth (and new favorite) institution of higher education with which he's been affiliated.

ABET Accreditation

School of Biomedical Engineering receives accreditation

Colorado State University's School of Biomedical Engineering (SBME) is proudly the first accredited undergraduate biomedical engineering program in the state of Colorado.

SBME is also the first accredited biomedical engineering degree in the country that has an obligatory tie to a partner degree in chemical and biological engineering, electrical engineering, or mechanical engineering. Biomedical engineering students receive degrees from both SBME and one of those disciplines. As an interdisciplinary program, biomedical engineering allows students and faculty alike to pursue research and education at the intersection of the life sciences, engineering, and medicine.

The school was established at CSU at the graduate level in 2007 by Susan James, professor of mechanical engineering, who also planted the seed for an undergraduate program that welcomed its first students in 2010.

Under the leadership of undergraduate program director Kevin Lear, professor in the Department of Electrical and Computer Engineering, SBME has grown to an enrollment of over 400 students as of fall 2016. Graduates of the undergraduate program have gone on to pursue degrees at various institutions including Stanford University School of Medicine and Massachusetts Institute of Technology, as well as careers at local and national companies, like Terumo BCT, Medtronic and Applied Medical.

Advantages to the two-degree program in industry

Lane Taylor, a graduate of the program and currently employed at Medtronic, explained that SBME helped him better understand the relationship between engineering and science. "The program gave me an incredible foundation in biology and in mechanical engineering fundamentals, and helped draw a link between the two. Several classes helped bridge the gap between engineering and science, and taught me to successfully apply engineering principles to health and bio problems," he said.

The SBME community is gender diverse, with a female enrollment rate of 45 percent—higher than any other engineering department at Colorado State. Because undergraduate students must pursue two majors in the program, the introduction of SBME has also helped raise female enrollment rates in every partner engineering department.

Nicole Puissant, a product development engineer at Terumo BCT, felt that the biomedical engineering program at CSU helped her start making an impact soon after completing her undergraduate degree. "I feel like the biomed degree gave me enough of a background in the other engineering majors that I am comfortable making educated decisions at my company," she said.

According to the Accreditation Board for Engineering and Technology (ABET), "students, employers, and the society we serve can be confident that [an accredited] program meets the quality standards that produce graduates prepared to enter a global workforce." The accreditation is retroactive for all prior graduates of the Bachelor of Science in biomedical engineering program.



Meet the New Undergraduate Advisor

As an advisor in SBME, Robyn Jeep Ernst will work with all first year students. She has been advising students for several years and loves talking with students about their stories and helping in the college experience navigation process.

Robyn is a Colorado native and has been fortunate to call several wonderful places in Colorado home, including Steamboat Springs, Durango, and Breckenridge. After growing up in Durango, Robyn attended CSU and majored in Psychology. She attended the University of Vermont and earned a Master of Education in Higher Education and Student Affairs Administration. Robyn spent several post-college years enjoying the ski areas around Breckenridge and worked abroad in New Zealand.

Outside of work, she enjoys spending time cooking, traveling, and having grand adventures with her young son and daughter, dog, and partner.

Cheers to Class of 2016!

Bachelor of Science in Biomedical Engineering and Chemical and Biological Engineering

Brett Baeverstad, BME-CBE
Nicole Boticke, BME-CBE
Wahida Khan, BME-CBE
Kate Knights, BME-CBE
Craig Meyer, BME-CBE
Lucas Suazo, BME-CBE
Tegan Walsh, BME-CBE
Danielle Weaver, BME-CBE
Tarah Welton, BME-CBE

Bachelor of Science in Biomedical Engineering and Electrical Engineering

Karsten Lockwood, BME-EE
Minh Nguyen, BME-EE

Bachelor of Science in Biomedical Engineering and Mechanical Engineering

Ryan Aldrich, BME-MECH
Brandon Bristol, BME-MECH
Peter Doro, BME-MECH
Kyle Hartson, BME-MECH
James Jaramillo, BME-MECH
Haley King, BME-MECH
Jeff Kostecki, BME-MECH
Katie Lawrence, BME-MECH
Emma Lichtenfels, BME-MECH
Lauren Newell, BME-MECH
Katherine O'Dell, BME-MECH
Quinn Olson, BME-MECH

David Qualls, BME-MECH
Marshall Rawley, BME-MECH
Megan Rives, BME-MECH
Mahli Ruff, BME-MECH
Tim Seek, BME-MECH
Evan Siebenmorgen, BME-MECH
Jaclyn Strom, BME-MECH
Noah Taherkhani, BME-MECH
Daniel Vance, BME-MECH
Dillon Wegrzyn, BME-MECH

Master of Engineering, Biomedical Engineering

Kristie Kordana

Master of Engineering, Biomedical Engineering (Online)

Mikala Hukka
Emily Stallings

Master of Science, Bioengineering

Richard Koch
Kate Remley

Doctor of Philosophy, Bioengineering

Kevin Labus
Michelle Mellenthin
Katherine Schaumberg



OUTSTANDING GRAD: BRETT BAEVERSTAD

Three years ago, a perfectly healthy Brett Baeverstad lay quietly in a Denver hospital bed, hooked up to

a machine siphoning precious, life-sustaining stem cells. Those cells from Baeverstad's body would give a gravely ill stranger a second chance to live. The apheresis machine that took Baeverstad's bone marrow stem cells that day is the same kind of machine on which the graduating senior began his engineering career.

After graduating from CSU with two bachelor's degrees (chemical engineering and biomedical engineering), Baeverstad began full-time employment as a quality engineer at Terumo BCT, a blood component and cellular technologies company. He interned at the company after he had the life-changing experience of donating bone marrow stem cells through the National Marrow Donor Program. In collaboration with the nonprofit Genny's Hope, Baeverstad and his fraternity brothers started on-campus bone marrow registry drives in 2013.

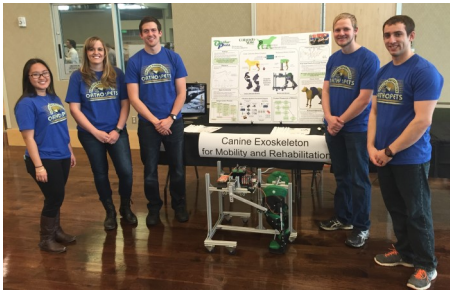
What started as a service opportunity with Phi Kappa Theta turned personal, when, during Baeverstad's junior year, his cells were a perfect match for a leukemia patient. Since Phi Kappa Theta began the drives, they've added close to 500 potential donors to the list, and one, besides Baeverstad, has gone on to donate.

Baeverstad donated peripheral blood stem cells to a patient with acute lymphoblastic leukemia. He experienced flu-like symptoms while his body built up drug-stimulated stem cells, and then spent about five hours on a Terumo BCT apheresis machine. Baeverstad couldn't be happier about how his school, service, and personal passion have come full circle to the opportunity to work at Terumo BCT. He believes the two degrees gave him "a lot of options."

Biomedical Engineering Awards at E-Days

On April 15, 2016, four members of the SBME Advisory Board—Dennis Bruner, Dr. Julie Dunn, Jeff Samson, and Dennis Schlaht—served as judges and provided three biomedical engineering teams with cash awards at E-Days, a longstanding annual showcase of capstone senior design projects. This year, three industry members also served as BME judges—Alan Dean of Beckman-Coulter, Arlen Ward of Medtronic, and Daniel Burke and Jared Walkenhorst of Zimmer Biomet—critically critiquing student projects on presentation, technical expertise, creativity, and overall impression.

First place honors went to group members Brett Baeverstad, Emma Lichtenfels, Minh Anh Nguyen, Megan Rives, Evan Siebenmorgen for their Terumo BCT-sponsored “Centrifuge Loading Human Factors” which developed a working prototype that will assist operators (primarily nurses and phlebotomists) in the loading of a complex disposable set onto a centrifuge intended for patient connected blood therapies in an effort to prevent misloads and alert an operator of loading errors.



Second Place Team. From left: Daniel Vance, Haley King, and three ECE students.

Second place was awarded to group members Haley King, Daniel Vance, and three ECE senior design students for their “Canine Orthotronic Mobility System.” This project was advised by Electrical and Computer Engineering Professor Anura Jayasumana. Students developed technology for an electronically-controlled, active orthoses that would help partially paralyzed canines by obtaining the nerve and muscle signals, process them to recognize what the canine is attempting to do, and integrate it to a simple orthoses.

Third place was awarded to David Qualls, Jaclyn Strom, Noah Taherkhani, Tegan Walsh for their Sharklet Technologies-sponsored “Intraocular Lens Injector” which focused on

designing and fabricating a one-time-use, disposable injector and cartridge system that facilitates both folding and delivery of an intraocular lens (IOL) with correct orientation, reducing complications in up to 50% of cataract patients worldwide.

E-Days provides undergraduate engineering students an opportunity to showcase the completion of their senior design projects to faculty, family, industry representatives, and peers. The capstone senior design project teaches students how to succeed in a well-integrated, interdisciplinary engineering design environment and allows students to develop practical, hands-on skills.



Third Place Team. From left: Jaclyn Strom, Noah Taherkhani, David Qualls, and Tegan Walsh

Students Receive Scholarships

Robinson Receives SBME Scholarship for Leadership and Innovation

Hannah Robinson received the \$1,000 SBME Scholarship for the 2016/17 school year for her leadership in designing a new lab for students taking machine dynamics. The SBME Scholarship was created to support biomedical engineering students who show a commitment to leadership and excel as creative problem-solvers. Robinson’s lab allows students to design a four-bar mechanism representing components of the human knee and testing their design on 3D printed bones.



Jennifer Brooks with husband, David.

Brooks Receives Joan C. King Endowed Memorial Scholarship

On July 20, 2016, Jennifer Brooks was awarded the Joan C. King Endowed Memorial Scholarship at the Women of Vision Gala hosted by the Colorado Women of Influence. Emily Li, a biomedical engineering student, placed second and received partial scholarship funding. In addition to strong academic qualifications, applicants for the Scholarship have to answer Joan’s favorite question, “How will you bring your greatness to the world?” Jennifer is an undergraduate student pursuing a degree in veterinary medicine and biomedical sciences. She intends to pursue a career in healthcare that will bring her talents to people in need.

The Joan C. King Memorial Scholarship supports students with an interest in biomedical sciences or engineering and with an eye toward sharing their talents with the world in the context of work/life balance.

SBME Faculty Research



Modeling the Correct Doses for Disease-Fighting Drugs

In treating diseases with drugs, dosing is critical; too little is ineffective, while too much can be lethal. Colorado State University's Brad Reisfeld takes a mathematical approach to achieving optimal dosing for various drugs.

Publishing earlier this week in the American Society for Microbiology's *Antimicrobial Agents and Chemotherapy*, Reisfeld, associate professor in the Department of Chemical and Biological Engineering and a faculty member in the School of Biomedical Engineering, has described a new computational model for optimizing dosing for the drug rifapentine. An antimycobacterial agent, rifapentine is commonly used to treat pulmonary tuberculosis, a disease that attacks the lungs and kills more than 1 million people every year, mostly in developing nations.

Their approach differs from typical dosing measurements in that they can quickly see how the drug affects different areas of the body, including the lung and the liver. "Our model essentially breaks the body up into discrete, physiologically recognizable compartments," Reisfeld said. Computationally, they can also account for changes in factors such as metabolism and kidney function, as a result of disease or individual differences. Underlying their models were both *in vivo* and *in vitro* data available in previous literature. Reisfeld's research motivation is to help reduce the need for animal testing of drugs.

Waste Not: Edible Wax Coating Slicks Liquids with Ease



When we reach the end of a ketchup bottle, there's always a little left, stuck to the sides. A Colorado State University lab offers a fix: a nontoxic, nonstick coating that lets loose every last drop. Materials scientists led by Arun Kota, assistant professor in the Department of Mechanical Engineering and the School of Biomedical Engineering, have created a "superhydrophobic" coating that easily slicks away viscous liquids like syrup, honey and ketchup. They detail the engineering feat in *Applied Materials and Interfaces*, published by the American Chemical Society.

Superhydrophobic coatings are not new, but they're typically fabricated with fluorocarbons. These materials, while generally safe in low doses, are labeled as "emerging contaminants" because of their potential decomposition into perfluorooctanoic acid, a known human toxin, according to the paper. The FDA recently banned three perfluorinated compounds (PFCs). "Companies are very specific about toxicity levels in these products, which is why they don't get into the market very easily," Kota said of hydrophobic coatings.

One of Kota's students came up with the idea of trying to make a simple, nontoxic, extremely liquid-repellant coating out of beeswax. Although their coating allows a wide range of aqueous liquids to bounce and roll away, there is room for improvement in the mechanical durability of their coatings, which currently can't withstand abrasive environments, according to the paper. Read full story here: <http://source.colostate.edu/waste-not-edible-wax-coating-slicks-liquids-with-ease/>.

Shine on: Miniature Horse Has Spring in His Step with Special Hoof



Shine, the miniature horse, will trot into an exclusive club of Colorado equines with artificial hooves. After suffering a vicious dog attack that mangled a hoof and led to infection, Shine needed surgical amputation of his lower-left hind leg in order to survive. His owners, Jacque Corsentino and Lee Vigil, asked veterinarians at Colorado State University to "do whatever it takes" to give the 3-year-old horse a chance at a normal life.

In mid-March, Dr. Laurie Goodrich, an associate professor of equine orthopaedics and the School of Biomedical Engineering, led a two-hour surgery to remove Shine's infected hoof and distal limb below the fetlock, the hinge joint of the lower leg. She placed two stainless steel pins through the cannon bone to help support Shine's leg while the wound healed. Goodrich then used measurements from her patient's radiographs and a 3-D printer to build an exact replica of his hoof, which helped Shine stay balanced while he healed.

But his small size made Shine a good candidate for amputation and prosthesis. It's an uncommon approach, even for Goodrich, a practicing veterinarian for 25 years. "It's the first one I've done, but I've always wanted to try," said Goodrich, who specializes in equine orthopaedic surgery. "We had no way of preserving that limb. So we had to take it off, and this was the only option to preserve his life." Radiographs revealed fractures in Shine's coffin bone and lower pastern bone. Read the full story online here: <http://source.colostate.edu/shine-on-miniature-horse-has-a-spring-in-his-step-with-special-hoof/>.

Faculty & Student Awards

With Keck Foundation Support, CSU Researchers to Study How Viruses Attack



Within the tiniest of spaces – single molecules in single cells – CSU scientists are aiming for something huge: illuminating in never-before-seen detail exactly how viruses hijack their host cells. Life science researchers Tim Stasevich and Brian Munsky have received a four-year, \$1.2 million grant from the W.M. Keck Foundation for a project that combines sensitive microscopes and sophisticated computation to quantify protein expression in single cells. Munsky is an assistant professor in the College of Engineering's Department of Chemical and Biological Engineering and in the School of Biomedical Engineering. Together, Stasevich and Munsky are seeking to quantify the translation and expression of up to 100 different RNA transcripts in real time, in living cells.

In the Keck project, Stasevich's imaging of real-time RNA translation at the single-molecule level will be amplified by computationally "fingerprinting" brightness fluctuations of tagged proteins as they're translated. By understanding the dynamics of these rapid-fire signals, Munsky can help differentiate and characterize many distinct signals, and this analysis could lead to a better understanding of all the dynamics of gene expression.

For the Keck proposal, Stasevich and Munsky will study a phenomenon called ribosomal frame shifting, a process that viruses use to encode more than one protein on the same region of DNA or RNA. To read the full story and learn more, visit: <http://source.colostate.edu/with-keck-foundation-support-csu-researchers-to-study-how-viruses-attack/>.

Grant Helps Assistant Professor Detect Melanoma Early, Without a Biopsy

Melanoma is a form of skin cancer that becomes dangerous when it spreads, but is treatable in its early stages. Doctors diagnose melanoma by cutting away a piece of a suspicious skin lesion—a procedure known as a biopsy—and testing it for malignant cells. It's an imperfect, invasive method that Colorado State University researcher Jesse Wilson wants to improve. His goal is to make early detection of melanoma faster, cheaper and less invasive than a biopsy.

An assistant professor in the Department of Electrical and Computer Engineering and in the School of Biomedical Engineering, Wilson's expertise is in pushing the boundaries of biomedical optics. He has received a one-year, \$30,000 grant from the Colorado Clinic and Translational Sciences Institute to develop a new microscope that can distinguish between benign and malignant pigmented skin lesions, without the need for biopsy. If his idea works, it could lead to low-cost, *in-vivo* imaging of melanin, the skin pigment that's made by cells called melanocytes, which can become cancerous and lead to melanoma.

Wilson's development of an experimental microscope that uses a technology called pump-probe can provide contrast between normal tissue and melanoma without stains or dyes. Pump-probe microscopes that can detect melanoma were developed in the lab of Warren Warren at Duke University, where Wilson completed his postdoctoral training. However, these microscopes require a short-pulse laser source that costs upwards of \$300,000—a major barrier to commercializing the technology for widespread use. Wilson's microscope will be built around a simpler laser source that's already widely used in telecommunications applications to encrypt voice communications and costs about \$5,000, making the pump-probe technology more realistic for melanoma applications. Full story at: <http://source.colostate.edu/detecting-melanoma-early-without-a-biopsy/>.

Celebrate Undergraduate Research and Creativity Showcase Awards

Thirteen students took home a total of three Celebrate Undergraduate Research and Creativity Awards, including Research: Highest Honors, Research: High Honors, and Research, College Honors. The Highest Honors Award went to a group of five College of Engineering students (Anura Jayasumana, faculty advisor) for their group project, Canine Exoskeleton for Mobility and Rehabilitation.

This project was aimed at developing an electronically controlled active exoskeleton that improves mobility and rehabilitation in partially paralyzed/weakened hind limbs of canines. This year's team developed a proof of concept system that uses microprocessor controlled stepper motors to emulate the hind limb movement of an exoskeleton for hind limbs. The control was based on the data gathered from using sensors. Future work will include developing an autonomous skeleton.

The group consisted of two biomedical/mechanical engineers Haley King and Daniel Vance, and three electrical and computer engineers, Katelyn Harada, Jacob Bryant, and Jeremy Valades. In addition to Dr. Jayasumana from the ECE department, they were also guided by Dr. Rebecca Packer, Dr. Nic Lambrechts, Dr. Dean Hendickson, and Sasha Foster of Veterinary Teaching Hospital, and Martin Kaufmann of OrthoPets, and animal orthotics company.



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SBME Events Calendar

OCTOBER 2016

BMES Annual Meeting

Oct. 5-8 | Minneapolis Convention Center, MN | bmes.org

CSU Homecoming Weekend

Oct. 6-8 | CSU Campus | homecoming.colostate.edu

SBME Seminar: Dr. Abe Lee, University of California, Irvine

Oct. 24 | 229 Scott Bioengineering Building | 12–12:50 p.m.

NOVEMBER 2016

SBME Seminar: Dr. Phyllis Wise, University of Illinois, Urbana-Champaign

Nov. 7 | 229 Scott Bioengineering Building | 12–12:50 p.m.

Graduate Student Showcase

Nov. 15 | 9 a.m.—6:00 p.m. | LSC Grand Ballroom

DECEMBER 2016

Front Range Neuroscience Group Annual Meeting

Dec. 7 | LSC Grand Ballroom | 10:30 a.m. –12:50 p.m.
FRNG.colostate.edu/events

giving opportunities >>>

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.

SBME Scholarship for Leadership and Innovation

<https://advancing.colostate.edu/SBME>

Joan King Memorial Scholarship

<https://advancing.colostate.edu/KingScholarship>



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