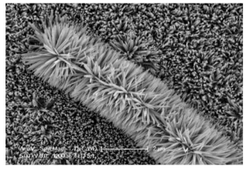
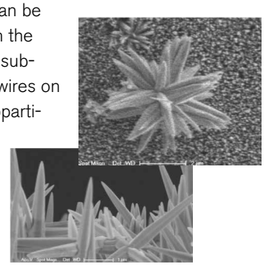
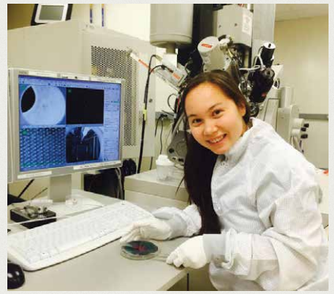


Medical Engineering Research to Aid Diabetes Patients

Current technology requires individuals with diabetes to undergo painful, inconvenient, and discontinuous measurement processes several times a day. Summer Undergraduate Research Fellowship (SURF) student Kelly Woo has been working with Hyuck Choo, an assistant professor of electrical and medical engineering, to create more convenient and accurate ways of measuring glucose levels by utilizing surface-enhanced Raman spectroscopy (SERS) techniques. SERS utilizes molecular vibrations to extract the properties of the sample and is highly sensitized through the application of metallic nanostructures. To accomplish commercially viable SERS technologies for glucose detection, an optimal substrate must be designed with higher electromagnetic enhancement so glucose can be detected in low concentrations from fluids in the body, not necessarily blood. To create these substrates, Woo hydrothermally grew zinc nanowires on silicon wafers and then deposited gold nanoparticles. She has successfully manipulated the synthesis process to produce controlled zinc nanowire growth on the silicon substrate by varying parameters of growth.



Cancer Detection Using Affordable Implantable Technology



Early detection of cancer can improve a patient's survival chances by up to 85%. Implantable cancer biosensors, which last up to several years in the body and provide continuous detection of cancer biomarkers, have the potential to provide a low-cost and accurate alternative to existing methods of cancer detection. Accurate detection of cancer biomarkers necessitates sensitivity of detection instruments in the nanomolar range. The sensitivity of currently available micro-scale implantable sensors can be improved by using electrical engineering principles of CMOS technology to enhance electrode design. Summer Undergraduate Research Fellowship (SURF) student Anna Winnicki has been working with Professor Axel Scherer to design and develop implantable electrochemical sensors of nitric oxide, a well-known cancer signaling molecule that dictates both tumor growth and inhibition. Over the summer, she designed electrodes with optimum sensitivity and fabricated the micro-scale electrodes at Caltech's Kavli Nanoscience Institute.

Sustainable Vehicle Club

Last year, with the support of the Resnick Sustainability Institute, a group of students founded the Caltech Sustainable Vehicle Club to promote sustainability through exploration of the design and construction of vehicles. The club's inaugural project has been to transform two defunct go-carts into electrical vehicles (EVs)—one battery powered and the other a fuel-cell vehicle. The parts for the vehicles were prototyped and built in the Jim Hall Design Laboratory. Mechanical Engineering undergraduate student and club president Rob Anderson explained, "Our projects wouldn't be possible without Caltech alumnus and racing legend Jim Hall's contributions! In June we had the chance to meet Jim and show him our first vehicle. He gave us very valuable advice on designing and testing our vehicle. He even gave us some tips on the handling of our vehicle after he took it for a spin around campus!" Professors Guillaume Blanquart, Azita Emami, and Richard Murray are faculty advisors to the club and will be teaching a systems design class in the fall to support this and other projects at Caltech.

To learn more, visit *www.its.caltech.edu/~cevc/*.

Caltech Sustainable Vehicle Club members meet with with Jim Hall (BS '57).

A Clear Path for Diversity

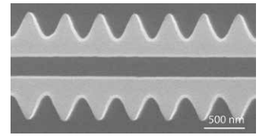
In April 2015, Caltech hosted the California Alliance for Graduate Education and the Professoriate's second annual retreat, entitled "The Next Generation of Researchers." The Alliance was formed in 2013 by Caltech, UC Berkeley, UCLA, and Stanford to support underrepresented minority graduate students in the fields of mathematics, the physical sciences, computer science, and engineering. More specifically, the Alliance aims to provide a clear path for underrepresented students and postdoctoral scholars to aspire to and populate the ranks of the faculty at competitive research and teaching institutions. The Caltech retreat brought together graduate students, postdoctoral fellows, research scientists, and faculty from the four institutions and national labs in California for mentoring and network-building opportunities. Caltech is addressing the challenges highlighted by the Alliance through the development of new programs and the strengthening of existing ones that create access to resources, build community, and leverage relationships.

To learn more about the Alliance and Caltech's involvement, visit *www.california-alliance.org*.

From Exotic Quantum Materials to Photonic Probes of the Brain

For over a decade, the Kavli Nanoscience Institute (KNI) at Caltech has been an intellectual hub and facilitator of cross-disciplinary research in the area of nanoscience and nanotechnology. It houses an advanced nanofabrication facility that supports the research endeavors of many Caltech faculty and has been critical to realizing exciting breakthroughs in nanoscale photonics, materials science, and biotechnology. The Fletcher Jones Foundation co-directors of the KNI, Professors Nai-Chang Yeh and Oskar Painter, with help from the Kavli Foundation, are planning to provide funding to several nascent research projects that exemplify the new directions that "nano" science is taking at Caltech. Selected projects range from the creation of new quantum materials of photons and atoms made by embedding laser-cooled gas-phase atoms in porous nanostructured dielectric materials, to the development of neurophotonic probes for massively multiplexed mapping of brain activity. The KNI will also be starting a new KNI Scholar Program that will recognize exceptional nanoscience-related research by tenure-track faculty at Caltech.

To learn more, visit *kni.caltech.edu*.



This "alligator" nanoscale optical waveguide is used by H. Jeff Kimble, William L. Valentine Professor and Professor of Physics, and colleagues to optically trap gas-phase atoms.

Engaging Students in Science and Engineering Policy

The Science & Engineering Policy at Caltech (SEPAC) club was formed by a group of students in February 2013 to educate its members on the policies governing research and innovation. According to Environmental Science and Engineering student and current president of the club Zachary Erickson, "Policy can determine the viability of entire fields of academia, such as stem cell research. In other instances, science policy translates research results into action, as in the adoption of catalytic converters in cars, a result of Environmental Protection Agency emission regulations spurred by atmospheric chemistry research. Yet students do not often encounter science policy during their studies, meaning they can be underequipped to engage with it in their future careers." To address this concern, SEPAC facilitates student-led discussions on science policy issues and sponsors luncheons. In February 2015, the club collaborated with the Graduate Aerospace Laboratories of the California Institute of Technology (GALCIT) to organize an all-day event focused on student research and culminating in a keynote address by Dr. Wanda M. Austin, president and CEO of the Aerospace Corporation. SEPAC has also supported members in attending a national Congressional Visit Day in Washington D.C.

To learn more, visit *sepac.caltech.edu*.

Caltech graduate students and SEPAC officers Katherine (Kat) Saad and Thomas Catanach attend Congressional Visit Day on March 12, 2014.