## Ultrasound device improves charge time, run time in lithium batteries

Jacobs School researchers developed an ultrasound-emitting device that speeds charging and extends lifetime for lithium metal batteries. The breakthrough came when acoustics researchers joined forces with battery researchers. The result: a device that emits ultrasound waves to create a circulating current in the electrolyte liquid between the anode and cathode. This prevents the formation of lithium metal growths, called dendrites, during charging that lead to decreased performance and short circuits in lithium metal batteries. The device is made from off-the-shelf smartphone components. The researchers say their work can be applied to a wide range of battery chemistries.
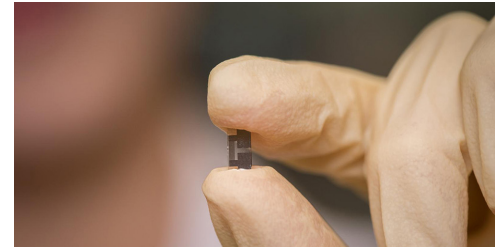
Learn more: bit.ly/FriendAdvancedMaterials2020

Wi-Fi radio uses 5,000 times less power

Electrical engineers developed an ultra-low power Wi-Fi radio. It enables IoT devices to communicate with existing Wi-Fi networks using 5,000 times less power than today's Wi-Fi radios. The radio consumes 28 microwatts of power and transmits data at 2 megabits per second over a range of up to 21 meters. "You can connect your phone, your smart devices, even small cameras or various sensors to this chip, and it can directly send data from these devices to a Wi-Fi access point near you. It could last for years on a single coin cell battery," said electrical and computer engineering professor Dinesh Bharadia.

Learn more: bit.ly/LowPowerWiFi

Detecting lead in water with biosensors

UC San Diego researchers demonstrated the ability to continuously monitor water for lead and other heavy metals using harmless E. coli. The work, published in PNAS, is the fruit of years of collaboration between synthetic biologists, microfluidics pioneers and data experts at both UC San Diego and Quantitative BioSciences, a company that spun out of UC San Diego over a decade ago. Used as a screening tool, the platform's unique combination of microfluidics and artificial intelligence will help uncover mechanisms that enable cells to interpret and react to changing environments. One likely outcome will be the development and testing of synthetic microbe strains that interact with the environment in new ways.
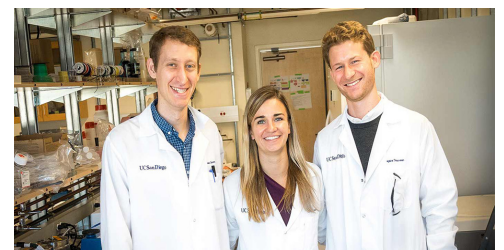
Learn more: bit.ly/MetalInWater

Improving Firefox security

A new framework to improve web browser security is the result of a partnership between computer scientists at UC San Diego and colleagues at UT Austin, Stanford and Mozilla. The framework, called RLBox, has already been integrated into Firefox to complement the browser's security-hardening efforts. RLBox increases browser security by separating third-party libraries that are vulnerable to attacks from the rest of the browser to contain potential damage—a practice called sandboxing. RLBox allows browsers to continue to use off-the-shelf, highly tuned libraries without worrying about the security impact of these libraries.

Learn more: bit.ly/FirefoxSecurity

Project Lim(b)itless: Using technology to empower amputees

Undergraduate engineering students created a cellphone app that gives amputees the power to scan their residual limb and send an autonomously-generated 3D model to a prosthetist. The outcome: a custom-built prosthetic delivered to them. The work is part of Project Lim(b)itless, an initiative founded by Jacobs School alumnus Albert Lin, a researcher at UC San Diego's Qualcomm Institute who lost a limb himself. The team of 10 students traveled to India in November to put their workflow to the test through a partnership with Jaipur Foot clinic. The project has the potential to help organizations like Jaipur Foot reach many more amputees, especially those without the means to travel.
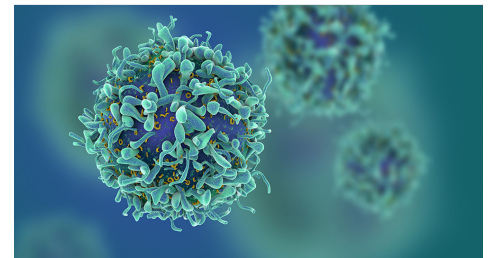
Learn more: bit.ly/Limbitless

Your AI stylist will see you now

Computer scientists at UC San Diego partnered with Pinterest to develop "Complete the Look," an AI-powered tool that recommends accessories and other fashion items to match an outfit based on just one photo. In terms of the tool's effectiveness, it did as well as four fashion experts who were each asked to complete the same compatibility task as Complete the Look. The project is led by computer science professor Julian McAuley, whose work focuses on better understanding how people behave and express opinions in online communities, including Amazon, Yelp, Reddit and Facebook. Another application of his work is improving recommendation algorithms that power the likes of Amazon and Netflix.

Learn more: bit.ly/ucsdAIstylist

Controlling CAR T cells with light could mean safer cancer treatment

Bioengineers at UC San Diego have developed a control system that could make CAR T-cell therapy safer and more powerful when treating cancer. By programming CAR T cells to switch on when exposed to blue light, the researchers controlled the cells to destroy skin tumors in mice without harming healthy tissue. In tests in mice, administering the engineered CAR T cells and stimulating the skin tumor sites with blue LED light reduced tumor size by eight to nine fold. Since light cannot penetrate deeply in the body, the researchers envision that this approach could be used to treat solid tumors near the surface of the skin. For future studies, they are looking to collaborate with clinicians to test the approach on patients with melanoma.

Learn more: bit.ly/LightControlCART