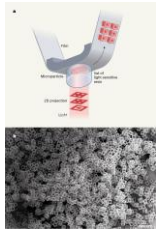


# Weekly Discovery

We SHARE to inspire and ignite ideas!

18 Mar – 22 Mar 2024

## 3D PRINTING 3D Printing Enables Mass Production of Microcomponents



"Micrometre-sized particles are key elements of several technologies ranging from drug-delivery vehicles to microelectronics, which makes optimizing the fabrication of these particles big business. One production strategy involves a bottom-up approach<sup>1–3</sup>, in which particles come together from smaller components, through self-assembly, for example. Although bottom-up techniques enable high-throughput production, they offer limited control over particle geometry. By contrast, top-down strategies<sup>4–7</sup> produce particles by breaking down bulk materials, using moulds, for example. Top-down approaches can overcome the shortcomings of bottom-up techniques, providing pathways towards improved shape control, but such methods produce only 2D or simple 3D particles. Writing in *Nature*, Kronenfeld et al.<sup>8</sup> present an innovative high-throughput fabrication method that enables microparticles to be 3D printed rapidly, and with complex geometries."

Source: [Nature](#) (13 Mar 2024)

## AI Why Are Large AI Models Being Red Teamed? Intelligent Systems Demand More Than Just Repurposed Cybersecurity Tools



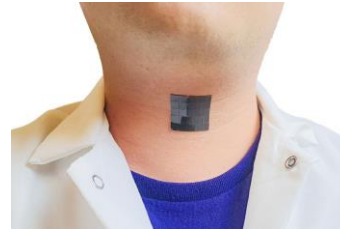
"In February, OpenAI announced the arrival of Sora, a stunning "text-to-video" tool. Simply enter a prompt, and Sora generates a realistic video within seconds. But it wasn't immediately available to the public. Some of the delay is because OpenAI reportedly has a set of experts called a red team who, the company has said, will probe the model to understand its capacity for deepfake videos, misinformation, bias, and hateful content.

Red teaming, while having proved useful for cybersecurity applications, is a military tool that was never intended for widespread adoption by the private sector.

"Done well, red teaming can identify and help address vulnerabilities in AI," says Brian Chen, director of policy from the New York-based think tank Data & Society. "What it does not do is address the structural gap in regulating the technology in the public interest."

Source: [IEEE Spectrum](#) (15 Mar 2024)

## AI Speaking Without Vocal Cords, Thanks To A New AI-Assisted Wearable Device



"People with voice disorders, including those with pathological vocal cord conditions or who are recovering from laryngeal cancer surgeries, can often find it difficult or impossible to speak. That may soon change.

A team of UCLA engineers has invented a soft, thin, stretchy device measuring just over 1 square inch that can be attached to the skin outside the throat to help people with dysfunctional vocal cords regain their voice function. Their advance is detailed this week in the journal *Nature Communications*.

The new bioelectric system, developed by Jun Chen, an assistant professor of bioengineering at the UCLA Samueli School of Engineering, and his colleagues, is able to detect movement in a person's larynx muscles and translate those signals into audible speech with the assistance of machine-learning technology — with nearly 95% accuracy.

The breakthrough is the latest in Chen's efforts to help those with disabilities. His team previously developed a wearable glove capable of translating American Sign Language into English speech in real time to help users of ASL communicate with those who don't know how to sign."

Source: [UCLA](#) (14 Mar 2024)

## AI Alzheimer's Drug Fermented with Help from AI and Bacteria Moves Closer to Reality



"Galantamine is a common medication used by people with Alzheimer's disease and other forms of dementia around the world to treat their symptoms. Unfortunately, synthesizing the active compounds in a lab at the scale needed isn't commercially viable. The active ingredient is extracted from daffodils through a time-consuming process, and unpredictable factors, such as weather and crop yields, can affect supply and price of the drug.

Now, researchers at The University of Texas at Austin have developed tools — including an artificial intelligence system and glowing biosensors — to harness microbes one day to do all the work instead.

In a paper in *Nature Communications*, researchers outline a process using genetically modified bacteria to create a chemical precursor of galantamine as a byproduct of the microbe's normal cellular metabolism. Essentially, the bacteria are programmed to convert food into medicinal compounds."

Source: [CNS](#) (14 Mar 2024)

## AI Straightening Teeth? AI Can Help



"Many of us remember the feeling of having our braces regularly adjusted and retightened at the orthodontist's office. And every year, about 30 percent of Danish youth up to the age of 15 wear braces to align crooked teeth. Orthodontists use the knowledge gained from their educations and experience to perform their jobs, but without the possibilities that a computer can provide for predicting final results.

A new tool, developed in a collaboration between the University of Copenhagen's Department of Computer Science and the company 3Shape, makes it possible to simulate how braces should fit to give the best result without too many unnecessary inconveniences.

The tool has been developed with the help of scanned imagery of teeth and bone structures from human jaws, which artificial intelligence then uses to predict how sets of braces should be designed to best straighten a patient's teeth.

"Our simulation is able to let an orthodontist know where braces should and shouldn't exert pressure to straighten teeth. Currently, these interventions are based entirely upon the discretion of orthodontists and involve a great deal of trial and error. This can lead to many adjustments and visits to the orthodontist's office, which our simulation can help reduce in the long run," says Professor Kenny Erleben, who heads IMAGE (Image Analysis, Computational Modelling and Geometry), a research section at UCPH's Department of Computer Science."

Source: [SCIENCE](#) (13 Mar 2024)

## ARCHITECTURE Designing for Plants: The Architecture of Greenhouses and Their Relationship with the Environment

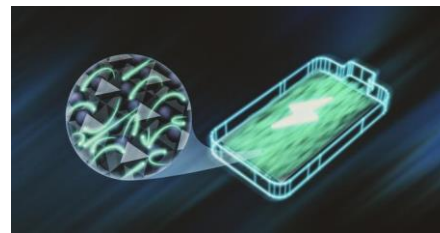


"When delving into the envelope of construction and examining how the interior relates to the exterior, the concept of greenhouses emerges as an opportunity to cultivate life indoors, whether dependent on external factors or not. Defined as spaces enclosed by glass or other transparent plastic materials, greenhouses facilitate the growth of vegetables and ornamental plants even during periods of adverse external weather conditions. However, what does designing for plants involve? Climate, species, structural design, and the type of covering are just a few of the considerations to take into account.

While the concept of a greenhouse is often associated with transparent walls and roofs in rural areas, there are proposals such as the Fazenda Cubo Hydroponic Cultivation by Estúdio Lava that aim to bring its language into buildings, giving rise to indoor urban farming. In this way, through a hydroponic water recirculation system, the use of photovoltaic lights, and a climate-controlled chamber, a sustainable, self-sufficient system is structured, with low water consumption, clean, and pesticide-free."

Source: [Archdaily](#) (17 Mar 2024)

## BATTERIES A Battery's Hopping Ions Remember Where They've Been



"Solid-state batteries store and release charge by nudging ions back and forth between two electrodes. From our usual point of view, the ions flow through the battery's solid electrolyte like a gentle stream.

But when seen on an atomic scale, that smooth flow is an illusion: Individual ions hop erratically from one open space to another within the electrolyte's roomy atomic lattice, nudged in the direction of an electrode by a steady voltage. Those hops are hard to predict and a challenge to trigger and detect.

Now, in the first study of its kind, researchers gave the hopping ions a jolt of voltage by hitting them with a pulse of laser light. To their surprise, most of the ions briefly reversed direction and returned to their previous positions before resuming their usual, more random travels. It was the first indication that the ions remembered, in a sense, where they had just been.

The research team from the Department of Energy's SLAC National Accelerator Laboratory, Stanford University, Oxford University and Newcastle University described what they found in the Jan. 24 issue of *Nature*."

Source: [EurekaAlert!](#) (15 Feb 2024)

## DESIGN WXY And Situ Lead Design Of New York Outdoor Dining Prototypes



"Local studios WXY Architecture and Situ have collaborated with government agencies to create standardised formats for outdoor dining pavilions in New York City to improve health and safety along with new guidelines.

Following a decision to keep outdoor dining pavilions as a permanent fixture on New York streets, the city launched a public competition for studios to standardise the materials and formats of the structures — many of which were hastily built during the Covid-19 pandemic."

Source: [Dezeen](#) (15 Mar 2024)

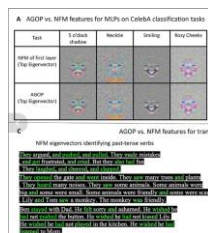
## MEDICAL DEVICES Rice Breakthrough Could Make Automated Dosing Systems Universal



"Rice University synthetic biologists have found a way to piggyback on the glucose monitoring technology used in automated insulin dosing systems and make it universally applicable for the monitoring and dosing of virtually any drug.

In a recently published study in *Nature Communications*, researchers in the lab of Caroline Ajo-Franklin demonstrated the technique by modifying a blood-glucose sensor to detect the anticancer drug afimoxifene, an

## NEURAL NETWORKS How Do Neural Networks Learn? A Mathematical Formula Explains How They Detect Relevant Patterns



"Neural networks have been powering breakthroughs in artificial intelligence, including the large language models that are now being used in a wide range of applications, from finance to human resources to healthcare. But these networks remain a black box whose inner workings engineers and scientists struggle to understand. Now, a team led by data and computer scientists at the University of California San Diego has given neural networks the

## ROBOTICS ANYmal Can Do Parkour and Walk Across Rubble



"In brief

Using machine learning, quadrupedal robot ANYmal learns like a child by means of trial and error. In this way it taught itself to do parkour.

With the aid of a camera and an artificial neural network, it detects and overcomes obstacles.

Through the combination with classic model-based control, the robot can negotiate difficult terrain.

## VR VR Headsets Are Approaching the Eye's Resolution Limits: Some Manufacturers Want to Go Beyond That



"The Chinese consumer electronics company TCL Technology recently unveiled a monstrous, 163-inch 4K Micro-LED television that one home theater expert described as "tall as Darth Vader." Each of the TV's 8.3 million pixels is an independent, miniscule LED, a feat for which TCL charges over \$100,000.

But here's the real surprise: TCL's new TV isn't the most pixel-dense or exotic display ever produced. That honor goes to the emerging

estrogen inhibitor that patient's bodies also make after they take the chemotherapy tamoxifen.

By building on mature biosensing technology that's commercially available at most drug stores for under \$20, Ajo-Franklin's team hopes to speed the development of automated dosing systems for chemotherapies and other drugs as well as other technologies for real-time monitoring of biomarkers in the blood.

"The dream is to have technology similar to what's available today for monitoring and treating variations in blood glucose, and have that be true for basically any drug," said Ajo-Franklin, a bioscientist, cancer researcher and director of the Rice Synthetic Biology Institute. "Millions of people use blood-glucose monitors every day. If we can use that same basic technology to monitor other drugs and biomarkers, we could move away from the one-size-fits-all dosing regimes that we're stuck with today."

Source: [RICE](#) (15 Mar 2024)

equivalent of an X-ray to uncover how they actually learn.

The researchers found that a formula used in statistical analysis provides a streamlined mathematical description of how neural networks, such as GPT-2, a precursor to ChatGPT, learn relevant patterns in data, known as features. This formula also explains how neural networks use these relevant patterns to make predictions.

"We are trying to understand neural networks from first principles," said Daniel Beaglehole, a Ph.D. student in the UC San Diego Department of Computer Science and Engineering and co-first author of the study. "With our formula, one can simply interpret which features the network is using to make predictions."

Source: [UCSD](#) (13 Mar 2024)

ANYmal has for some time had no problem coping with the stony terrain of Swiss hiking trails. Now researchers at ETH Zurich have taught this quadrupedal robot some new skills: it is proving rather adept at parkour, a sport based on using athletic manoeuvres to smoothly negotiate obstacles in an urban environment, which has become very popular. ANYmal is also proficient at dealing with the tricky terrain commonly found on building sites or in disaster areas.

To teach ANYmal these new skills, two teams, both from the group led by ETH Professor Marco Hutter of the Department of Mechanical and Process Engineering, followed different approaches."

Source: [ETHZ](#) (13 Mar 2024)

frontier of Micro-OLED and Micro-LED displays built for AR/VR headsets. Mojo Vision, a leader in micro-LED displays, recently demonstrated a full-color Micro-LED display frontplane with a density of 5,510 pixels per centimeter (14,000 pixels per inch) at CES 2024. That display, if blown up to the size of TCL's television, would pack over 220 billion pixels."

Source: [IEEE Spectrum](#) (15 Mar 2024)

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