



**Weekly Newsletter**  
**TECHNOLOGY**  
**SURVEILLANCE**

N° 18-2023

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**OBJECTIVE:** *To provide weekly information about the latest global scientific and technological advancements, as well as the most innovative products and services entering the international market.*

## I. NEWS

### 1.1 Study suggests epigenetic changes in fathers' DNA linked to autistic traits in their children

Johns Hopkins University researchers say they have found a link between chemical “marks” on DNA in the sperm of fathers and autistic traits in their 3-year-old children. The research, reported April 27 in *Molecular Psychiatry*, adds to mounting evidence that the so-called epigenome influences the origins of autism spectrum disorder, a suite of developmental conditions that affects the brain and is marked by repetitive behaviors and problems with social communication. Epigenetic changes in DNA don’t alter the genetic code itself, but they disturb how the genetic code is “read” and used by the body.



*Credit: Getty Images, The Johns Hopkins University*

The researchers caution that the study is in a small group of people — 45 fathers and 31 children — and the findings may or may not hold up in the general population. But, they say, if further research confirms their work, the epigenetic signs they identified could be potential markers for autism risk, and may help families secure early intervention for children with autistic traits.

For more information, visit the following link:

<https://www.hopkinsmedicine.org/news/newsroom/news-releases/changes-in-fathers-sperm-linked-to-autistic-traits-in-their-children-small-preliminary-study-suggests>

#### Reference

Wasta, V. (April 27, 2023). Changes in father’s sperm linked to autistic traits in their children, small preliminary study suggests. Recovered April 27, 2023, The Johns Hopkins Medicine: <https://www.hopkinsmedicine.org/news/newsroom/news-releases/changes-in-fathers-sperm-linked-to-autistic-traits-in-their-children-small-preliminary-study-suggests>

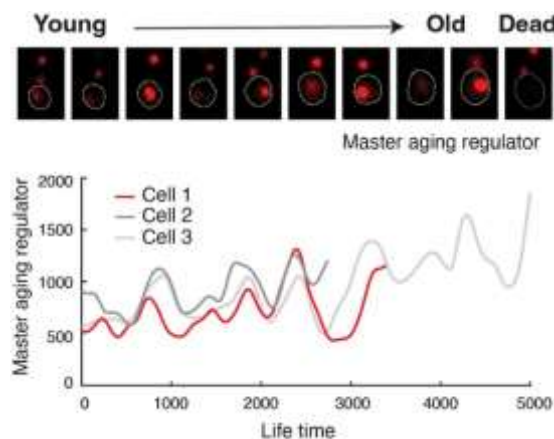


Information source: (The Johns Hopkins University, 2023)



## 1.2 Slow aging by engineering longevity in cells

Human lifespan is related to the aging of our individual cells. Three years ago a group of University of California San Diego (UC San Diego) researchers deciphered essential mechanisms behind the aging process. After identifying two distinct directions that cells follow during aging, the researchers genetically manipulated these processes to extend the lifespan of cells.



*Engineered cells show oscillating abundance of a master aging regulator.  
Credit: Hao Lab, UC San Diego*

However, the UC San Diego group uncovered that, under the control of a central gene regulatory circuit, cells don't necessarily age the same way. Imagine a car that ages either as the engine deteriorates or as the transmission wears out, but not both at the same time. The UC San Diego team envisioned a “*smart aging process*” that extends cellular longevity by cycling deterioration from one aging mechanism to another. In the new study, the researchers genetically rewired the circuit that controls cell aging. From its normal role functioning like a toggle switch, they engineered a negative feedback loop to stall the aging process. The rewired circuit operates as a clock-like device, called a gene oscillator, that drives the cell to periodically switch between two detrimental “aged” states, avoiding prolonged commitment to either, and thereby slowing the cell's degeneration.

For more information, visit the following link:

<https://today.ucsd.edu/story/scientists-slow-aging-by-engineering-longevity-in-cells>

### Reference

Aguilera, M. (April 27, 2023). Scientists slow aging by engineering longevity in cells. Recovered April 27, 2023, The University of California San Diego: <https://today.ucsd.edu/story/scientists-slow-aging-by-engineering-longevity-in-cells>

Information source: (The University of California San Diego, 2023)



### 1.3 Speedy robo-gripper reflexively organizes cluttered spaces

MIT engineers have now developed a gripper that grasps by reflex. Rather than start from scratch after a failed attempt, the team's robot adapts in the moment to reflexively roll, palm, or pinch an object to get a better hold. It's able to carry out these "last centimeter" adjustments (a riff on the "last mile" delivery problem) without engaging a higher-level planner, much like how a person might fumble in the dark for a bedside glass without much conscious thought.



*Researchers have designed a robot gripper that incorporates reflexes to quickly grasp and sort everyday objects.*

*Credit: Jodi Hilton, Massachusetts Institute of Technology*

New design is the first to incorporate reflexes into a robotic planning architecture. For now, the system is a proof of concept and provides a general organizational structure for embedding reflexes into a robotic system. Going forward, the researchers plan to program more complex reflexes to enable nimble, adaptable machines that can work with and among humans in ever-changing settings. The team's design includes a high-speed arm and two lightweight, multijointed fingers. In addition to a camera mounted to the base of the arm, this team incorporated custom high-bandwidth sensors at the fingertips that instantly record the force and location of any contact as well as the proximity of the finger to surrounding objects more than 200 times per second.

For more information, visit the following link:

<https://news.mit.edu/2023/speedy-robo-gripper-reflexively-organizes-spaces-0427>

Reference

Chu, J. (April 27, 2023). Speedy robo-gripper reflexively organizes cluttered spaces. Recovered April 27, 2023, Massachusetts Institute of Technology: <https://news.mit.edu/2023/speedy-robo-gripper-reflexively-organizes-spaces-0427>

Information source: (Massachusetts Institute of Technology, 2023)



#### 1.4 Technique up potential for producing new antivirals

King's College London researchers have developed a new technique that allows them to identify novel, naturally occurring antiviral molecules that could be used to help combat future viral pandemics.



*Credit: Kourish, E., King's College London*

Led by Dr Ebrahimi Kourosh, the researchers developed a new, simple, in vivo technique called the VITAS assay that allows them to identify enzymes involved in the production of antivirals. The study highlights how the assay was able to analyse the enzymes from human, fungi and bacterial cells and identify the ones with antiviral activity. As the rise of viral infections including HIV-1, Ebola and most pertinently SARS-CoV-2, researchers have long been interested in developing new broad-spectrum antiviral drugs blocking viral reproduction machinery. One area of focus has been natural products from organisms; these are molecules produced by nature's biocatalysts (enzymes) to support their growth, maintenance, reproduction, or defence.

For more information, visit the following link:

<https://www.kcl.ac.uk/news/technique-opens-up-potential-for-producing-new-antivirals>

#### Reference

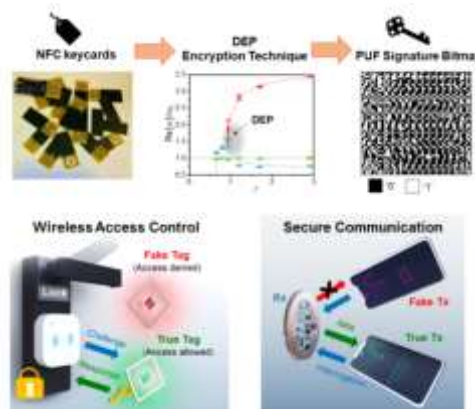
Ebrahimi, K. (April 27, 2023). Technique opens up potential for producing new antivirals. Recovered April 27, 2023, King's College London: <https://www.kcl.ac.uk/news/technique-opens-up-potential-for-producing-new-antivirals>

Information source: (King's College London, 2023)



## 1.5 Using quantum physics to secure wireless devices

Computer engineers at the University of Illinois Chicago have been investigating ways to create more secure devices. In a new paper, UIC scientists report a method inspired by quantum physics to improve wireless device identification and protect device-to-device communication. It uses a truly random and unique digital fingerprint to create a hardware encryption system that is virtually unbreakable.



*Physically unclonable function based cryptographic keys generated by the radio frequency electronic circuit with a divergent exceptional point for wireless identification, authentication, and secure communication applications.  
Credit: Pai-Yen Chen., University of Illinois*

The scientists, led by Pai-Yen Chen, used a theory from quantum physics in math-based experiments to identify a “Divergent Exceptional Point.” Chen and colleagues figured out a mathematical approach to identify these exceptional points in a radio frequency identification system — the technology used by key cards, fobs and other devices that unlock or communicate with nearby sensors. In traditional Radio Frequency Identification (RFID) systems, encrypted keys are stored inside memory chips, which are limited in size and vulnerable to attack. Chen’s group created new RFID lock-and-tag devices that utilize the exceptional point algorithm to create a secure signal. Since every piece of hardware is slightly different due to small variations during the fabrication process, each RFID device produces its own unique digital fingerprint in light of the maximized uncertainty at the exceptional point.

For more information, visit the following link:

<https://today.uic.edu/using-quantum-physics-to-secure-wireless-devices/>

### Reference

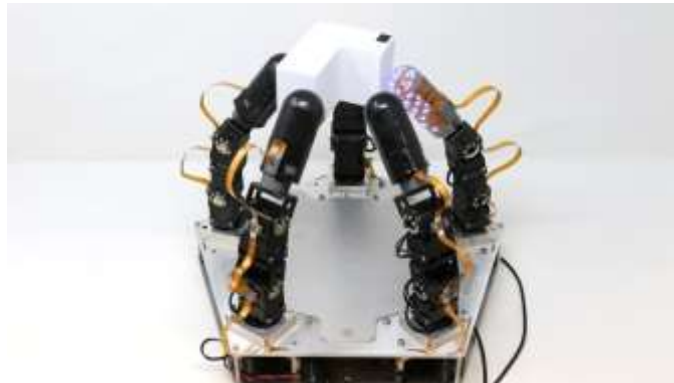
Carey, J (April 27, 2023). Using quantum physics to secure wireless devices. Recovered April 27, 2023, University of Illinois: <https://today.uic.edu/using-quantum-physics-to-secure-wireless-devices/>

Information source: (University of Illinois, 2023)



## 1.6 Highly dexterous robot hand can operate in the dark

Columbia Engineers design a robot hand that is the first device of its kind to join advanced sense of touch with motor-learning algorithms — it doesn't rely on vision to manipulate objects.



*Credit: Columbia University ROAM Lab*

Robotics researchers have long been trying to create “true” dexterity in robot hands, but the goal has been frustratingly elusive. Robot grippers and suction cups can pick and place items, but more dexterous tasks such as assembly, insertion, reorientation, packaging, etc. have remained in the realm of human manipulation. However, spurred by advances in both sensing technology and machine-learning techniques to process the sensed data, the field of robotic manipulation is changing very rapidly. For this new work, the researchers designed and built a robot hand with five fingers and 15 independently actuated joints--each finger was equipped with the team's touch-sensing technology. The next step was to test the ability of the tactile hand to perform complex manipulation tasks. To do this, they used new methods for motor learning, or the ability of a robot to learn new physical tasks via practice. They used a method called deep reinforcement learning, augmented with new algorithms that they developed for effective exploration of possible motor strategies.

For more information, visit the following link:

<https://www.engineering.columbia.edu/news/highly-dexterous-robot-hand-can-operate-in-the-dark>

### Reference

Evarts, H. (April 28, 2023). Highly dexterous robot hand can operate in the dark — Just like us. Recovered May 02, 2023, Columbia University in the City of New York: <https://www.engineering.columbia.edu/news/highly-dexterous-robot-hand-can-operate-in-the-dark>

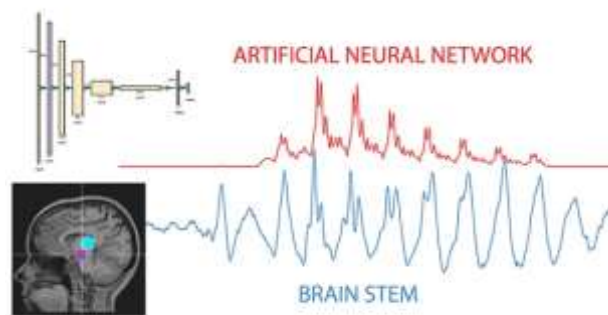
Information source: (Columbia University in the City of New York, 2023)





## 1.7 'Raw' data show AI signals mirror how the brain listens and learns

New research from the University of California, Berkeley, shows that Artificial Intelligence (AI) systems can process signals in a way that is remarkably similar to how the brain interprets speech, a finding scientists say might help explain the black box of how AI systems operate. Using a system of electrodes placed on participants' heads, scientists with the Berkeley Speech and Computation Lab measured brain waves as participants listened to a single syllable — “bah.” They then compared that brain activity to the signals produced by an AI system trained to learn English.



*Researchers found strikingly similar signals between the brain and artificial neural networks. The blue line is brain wave when humans listen to a vowel. Red is the artificial neural network's response to the exact same vowel. The two signals are raw, meaning no transformations were needed.*

*Credit: Gasper Begus, UC Berkeley*

Gasper Begus, assistant professor of linguistics at UC Berkeley, said he and his colleagues are collaborating with other researchers using brain imaging techniques to measure how these signals might compare. They're also studying how other languages, like Mandarin, are decoded in the brain differently and what that might indicate about knowledge. Many models are trained on visual cues, like colors or written text — both of which have thousands of variations at the granular level. Language, however, opens the door for a more solid understanding, Begus said.

For more information, visit the following link:

<https://news.berkeley.edu/2023/05/01/raw-data-show-ai-signals-mirror-how-the-brain-listens-and-learns/>

### Reference

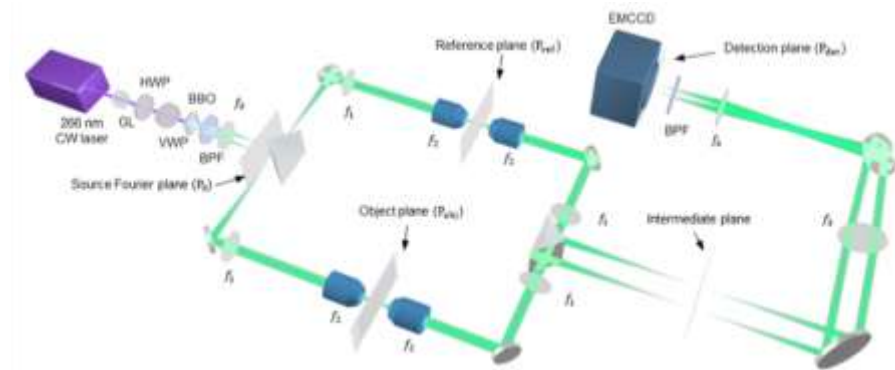
Pohl, J. (May 01, 2023). "Raw" data show AI signals mirror how the brain listens and learns. Recovered May 01, 2023, Berkeley University of California: <https://news.berkeley.edu/2023/05/01/raw-data-show-ai-signals-mirror-how-the-brain-listens-and-learns/>

Information source: (Berkeley University of California, 2023)



## 1.8 Quantum entanglement of photons doubles microscope resolution

Using a "spooky" phenomenon of quantum physics, Caltech researchers have discovered a way to double the resolution of light microscopes. a team led by Lihong Wang, Bren Professor of Medical Engineering and Electrical Engineering, shows the achievement of a leap forward in microscopy through what is known as quantum entanglement. Quantum entanglement is a phenomenon in which two particles are linked such that the state of one particle is tied to the state of the other particle regardless of whether the particles are anywhere near each other.



*A diagram of the quantum microscopy apparatus.  
Credit: Emily Velasco, California Institute of Technology*

According to quantum theory, any type of particle can be entangled. In the case of Wang's new microscopy technique, dubbed quantum microscopy by coincidence (QMC), the entangled particles are photons. Collectively, two entangled photons are known as a biphoton, and, importantly for Wang's microscopy, they behave in some ways as a single particle that has double the momentum of a single photon.

For more information, visit the following link:

<https://www.caltech.edu/about/news/quantum-entanglement-of-photons-doubles-microscope-resolution>

### Reference

Velasco, E. (May 01, 2023). Quantum entanglement of photons doubles microscope resolution. Recovered May 02, 2023, California Institute of Technology: <https://www.caltech.edu/about/news/quantum-entanglement-of-photons-doubles-microscope-resolution>

Information source: (California Institute of Technology, 2023)



## 1.9 Sensor enables high-fidelity input from objects

A new technique for recording and analyzing surface-acoustic waves can enable nearly any object to act as a touch input device and power privacy-sensitive sensing systems.



*A sensing system called SAWSense takes advantage of acoustic waves traveling along the surface of an object to enable touch inputs to devices almost everywhere. Here, a table is used to power a laptop's trackpad.*

*Credit: Interactive Sensing and Computing Lab, University of Michigan*

This system repurposes technology from new bone-conduction microphones, known as Voice Pickup Units (VPUs), which detect only those acoustic waves that travel along the surface of objects. It works in noisy environments, along odd geometries such as toys and arms, and on soft fabrics such as clothing and furniture. Called SAWSense, for the surface acoustic waves it relies on, the system recognizes different inputs, such as taps, scratches and swipes, with 97% accuracy. In one demonstration, the team used a normal table to replace a laptop's trackpad. The high fidelity of the VPUs allows SAWSense to identify a wide range of activities on a surface beyond user touch events. For instance, a VPU on a kitchen countertop can detect chopping, stirring, blending or whisking, as well as identifying electronic devices in use such as a blender or microwave.

For more information, visit the following link:

<https://news.umich.edu/sensor-enables-high-fidelity-input-from-everyday-objects-human-body/>

### Reference

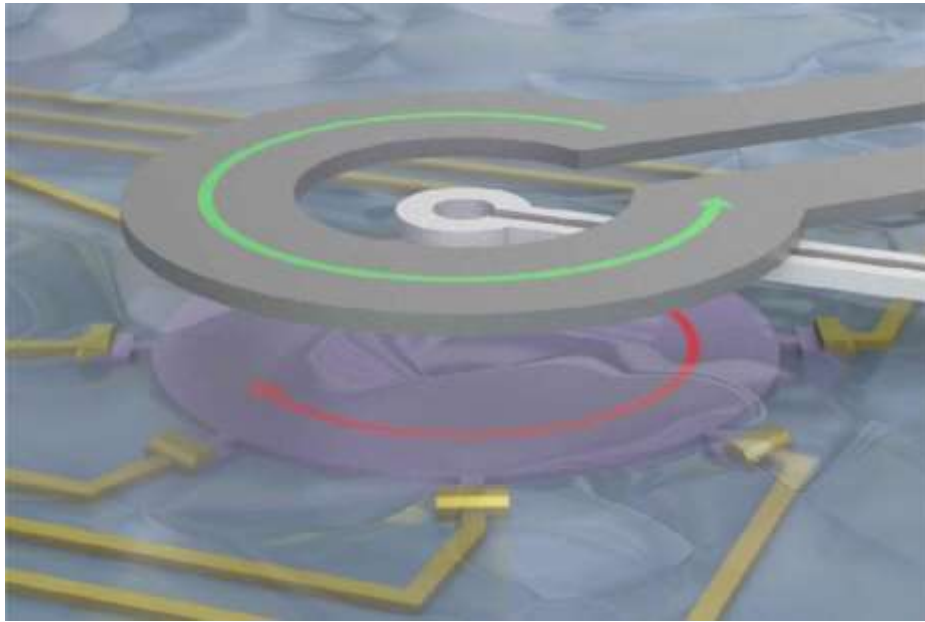
Champion, Z. (May 01, 2023). Sensor enables high-fidelity input from everyday objects, human body. Recovered May 02, 2023, University of Michigan: <https://news.umich.edu/sensor-enables-high-fidelity-input-from-everyday-objects-human-body/>

Information source: (University of Michigan, 2023)



## 1.10 Magnetic imaging unlocks crucial property of 2D superconductor

Using state-of-the-art magnetic imaging, a Cornell-led collaboration has for the first time characterized a key property of the superconducting state of a class of atomically thin materials that are too difficult to measure due to their minuscule size.



*Credit: David Nutt, Cornell University*

The project was led by Katja Nowack, assistant professor of physics in the College of Arts and Sciences and the paper's senior author, whose lab investigates emergent phenomena and order in quantum materials via a range of scanning probes. The group's superconducting quantum interference device (SQUID), is particularly adept at working at low temperatures and in small magnetic fields. The findings also show how 2D superconductors differ from their bulkier 3D relatives. In some devices, the researchers observed signatures of a Berezinskii-Kosterlitz-Thouless phase transition, which is specific to 2D materials, whereas in others they found an expanded superfluid response.

For more information, visit the following link:

[https://as.cornell.edu/news/magnetic-imaging-unlocks-crucial-property-2d-superconductor?utm\\_medium=source=CornellChronicle](https://as.cornell.edu/news/magnetic-imaging-unlocks-crucial-property-2d-superconductor?utm_medium=source=CornellChronicle)

### Reference

Nutt, D. (May 01, 2023). Magnetic imaging unlocks crucial property of 2D superconductor. Recovered May 02, 2023, Cornell University: [https://as.cornell.edu/news/magnetic-imaging-unlocks-crucial-property-2d-superconductor?utm\\_medium=source=CornellChronicle](https://as.cornell.edu/news/magnetic-imaging-unlocks-crucial-property-2d-superconductor?utm_medium=source=CornellChronicle)

Information source: (Cornell University, 2023)



### 1.11 *“Intelligence Artificial”* can efficiently detect cybersickness in augmented and virtual reality

University of Missouri researchers are exploring how explainable Artificial Intelligence can help detect how people develop cybersickness in augmented and virtual reality.



*This roller coaster simulation in virtual reality was used by Khaza Anuarul Hoque and a team of researchers to simulate and detect cybersickness. Credit: Khaza Anuarul Hoque, University of Missouri*

Exposure to an Augmented Reality (AR) or Virtual Reality (VR) environment can cause people to experience cybersickness — a special type of motion sickness with symptoms ranging from dizziness to nausea — and existing research to mitigate the severity of the symptoms often relies upon a one-size-fits-all approach. However, Khaza Anuarul Hoque, an assistant professor in the Department of Electrical Engineering and Computer Science at the University of Missouri, and a team of researchers are working to develop a personalized approach to identifying cybersickness by focusing on the root causes, which can be different for every person. Hoque said explainable AI can also help software developers identify the most important features needed to optimize the model for teaching the AI how to identify someone experiencing cybersickness. This is especially important for users wearing stand-alone VR headsets.

For more information, visit the following link:

<https://showme.missouri.edu/2023/explainable-ai-can-efficiently-detect-ar-vr-cybersickness/>

#### Reference

Stann, E. (May 02, 2023). "Explainable AI" can efficiently detect AR/VR cybersickness. Recovered May 02, 2023, University of Missouri: <https://showme.missouri.edu/2023/explainable-ai-can-efficiently-detect-ar-vr-cybersickness/>

Information source: (University of Missouri, 2023)



### 1.12 “Made-up” electrons to save time

Electronics apprentice at Eidgenössische Technische Hochschule Zürich (ETH Zurich) produced a test device that will save physicists a lot of time in developing a novel microscope. His work has been published in a scientific journal. Jingo Bozzini, electronics engineer and Yves Acremann from the Solid State Physics Research Group developed a test signal generator that simulates experimental data. This little silver box may look unremarkable, but it is of invaluable help in designing a novel microscope that will enable researchers to observe individual electrons.



*Jingo Bozzini, an electronics engineer, not only programmed the circuitry on the chip, he also designed and built the carrier board.*

*Credit: Fabio Merino, Eidgenössische Technische Hochschule Zürich*

“The test signal generator simulates the electrons hitting the detector,” explains Acremann, a physicist. “It is connected to the detector electronics to program the software for the microscope. This step can be done from the comfort of an office.” Bozzini’s simulator enables researchers to develop the software while the microscope is still being built. This will save them a lot of time and money because the software will already be fully operational when the researchers connect the microscope to the particle accelerator.

For more information, visit the following link:

<https://ethz.ch/en/news-and-events/eth-news/news/2023/05/how-an-apprentice-uses-made-up-electrons-to-save-researchers-time.html>

Reference

Hegelbach, S. (May 02, 2023). How an apprentice uses “made-up” electrons to save researchers time. Recovered May 02, 2023, Eidgenössische Technische Hochschule Zürich: <https://ethz.ch/en/news-and-events/eth-news/news/2023/05/how-an-apprentice-uses-made-up-electrons-to-save-researchers-time.html>

Information source: (Eidgenössische Technische Hochschule Zürich, 2023)



### 1.13 Self-folding origami machines powered by chemical reaction

A Cornell-led collaboration harnessed chemical reactions to make microscale origami machines self-fold – freeing them from the liquids in which they usually function, so they can operate in dry environments and at room temperature. The project was led by senior author Nicholas Abbott, a Tisch University Professor in the Robert F. Smith School of Chemical and Biomolecular Engineering in Cornell Engineering, along with Itai Cohen, professor of physics, and Paul McEuen, the John A. Newman Professor of Physical Science, both in the College of Arts and Sciences; and David Muller, the Samuel B. Eckert Professor of Engineering in Cornell Engineering.



*An SEM image shows an origami tetrahedra microstructure that self-folded after it was exposed to hydrogen.*

*Credit: David Nutt, Cornell University*

Abbott's group found a loophole of sorts while reviewing data from a catalysis experiment: a small section of the chemical reaction pathway contained both slow and fast steps. The researchers needed the right material platform to leverage that rapid kinetic moment, so they turned to McEuen and Cohen, who had worked with Muller to develop ultrathin platinum sheets capped with titanium, and were then able to exploit the crucial moment that the oxygen quickly strips the hydrogen, causing the atomically thin material to deform and bend, like a hinge.

For more information, visit the following link:

<https://news.cornell.edu/stories/2023/05/self-folding-origami-machines-powered-chemical-reaction>

#### Reference

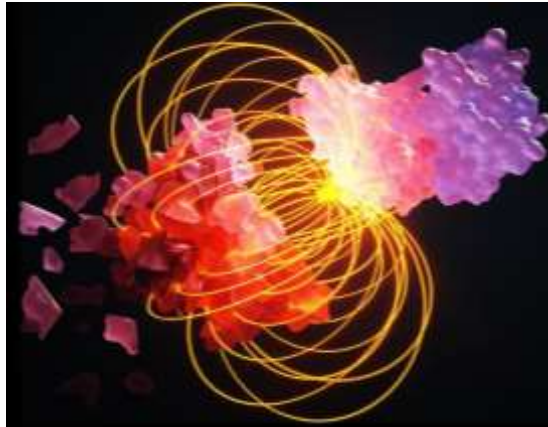
Nutt, D. (May 02, 2023). Self-folding origami machines powered by chemical reaction. Recovered May 02, 2023, Cornell University: <https://news.cornell.edu/stories/2023/05/self-folding-origami-machines-powered-chemical-reaction>

Information source: (Cornell University, 2023)



## 1.14 Engineering molecular interactions with Machine Learning

By using deep learning-generated “*fingerprints*” to characterize millions of protein fragments, École Polytechnique Fédérale de Lausanne (EPFL) researchers have computationally designed novel protein binders that attach seamlessly to key targets, including the SARS-CoV-2 spike protein.



*Credit: Celia Luterbacher, École Polytechnique Fédérale de Lausanne*

Scientists in the joint School of Engineering and School of Life Sciences Laboratory of Protein Design and Immunoengineering (LPDI) led by Bruno Correia developed MaSIF: A Machine Learning-driven method for scanning millions of protein surfaces within minutes to analyze their structure and functional properties. The researchers' ultimate goal was to computationally design protein interactions by finding optimal matches between molecules based on their surface chemical and geometric ‘fingerprints’. To design novel protein binders, the researchers used MaSIF to create protein surface ‘fingerprints’, and then identified complementary surfaces for key protein target sites from a database of fragments. They then digitally grafted the fragments onto larger protein scaffolds, and selected the resulting binders predicted to interact best with their targets.

For more information, visit the following link:

<https://news.epfl.ch/news/engineering-molecular-interactions-with-machine-le/>

### Reference

Luterbacher, C. (May 02, 2023). Engineering molecular interactions with Machine Learning. Recovered May 02, 2023, Ecole Polytechnique Fédérale de Lausanne: <https://news.epfl.ch/news/engineering-molecular-interactions-with-machine-le/>

Information source: (École Polytechnique Fédérale de Lausanne, 2023)





### 1.15 Motor neuron disease treatments a step closer

Research at The University of Queensland could eventually help develop viable treatments - and ultimately a cure - for motor neuron disease (MND). Dr Adam Walker and co-authors Dr Rebecca San Gil, Dr Wei Luan and PhD student Sean Keating from the Queensland Brain Institute have identified biochemical changes in a protein that is affected by MND. *"TDP-43 is a protein found in every cell of the body but is particularly important for the health of motor neurons, the brain cells that control voluntary muscle movement,"* Dr Walker said.



*Credit: Adobe, The University of Queensland*

*"To change the course of the disease we need pharmaceutical drugs that can prevent neuron death and this TDP-43 protein dysfunction."* The research used genetic engineering technology called Clustered Regularly Interspaced Short Palindromic Repeat (CRISPR), which is a gene editing tool. Co-author Sean Keating said the research also found neural pathways change as MND progresses, indicating the potential need for different treatments at different phases of the disease.

For more information, visit the following link:

<https://www.uq.edu.au/news/article/2023/04/motor-neuron-disease-treatments-step-closer-0>

Reference

Pye, M. (April 27, 2023). Motor neuron disease treatments a step closer. Recovered April 27, 2023, The University of Queensland: <https://www.uq.edu.au/news/article/2023/04/motor-neuron-disease-treatments-step-closer-0>

Information source: (The University of Queensland, 2023)



### 1.16 **'Green'** way to extract hair compounds for bandages, sunscreens

Hair styling can be a potent form of self-expression, whether it features dramatic updos, intricate braids or crazy colors. Beyond being a reflection of our personality, these strands contain compounds that could one day appear in bandages, sunscreens or other products. Researchers reporting in America Chemical Society (ACS) Omega have now designed a simple, green process to extract both keratin and melanin from human hair for these possible applications without harsh chemicals or excessive waste.



*A method to extract two common compounds in hair could one day allow for their use in a wide variety of biomedical products.*

*Credit: VGstockstudio/Shutterstock.com, ACS Chemistry for Life*

The researchers collected samples of hair from local salons, then washed and cut them into small slices. Then, they mixed the hair with an ionic liquid, which dissolved the mixture by interrupting the hydrogen bonds that held the keratin proteins together. When heated and poured into a hydrochloric acid solution, the melanin pigments precipitated out and were collected. Next, the researchers performed dialysis to collect the keratin proteins. The ionic liquid was recycled and reused in subsequent reactions, without a significant impact on the reaction's yield.

For more information, visit the following link:

<https://www.acs.org/pressroom/presspacs/2023/april/green-way-to-extract-hair-compounds-that-could-be-used-for-bandages-sunscreens.html>

#### Reference

American Chemical Society. (April 27, 2023). 'Green' way to extract hair compounds that could be used for bandages, sunscreens. Recovered April 27, 2023, de American Chemical Society Chemistry for Life: <https://www.acs.org/pressroom/presspacs/2023/april/green-way-to-extract-hair-compounds-that-could-be-used-for-bandages-sunscreens.html>

Information source: (American Chemical Society Chemistry for Life, 2023)



### 1.17 New biomaterial to speed up healing of cranial bone injuries

Venu Varanasi, associate professor in the Bone-Muscle Research Center in the College of Nursing and Health Innovation, is developing semiconductor biomaterials to help speed up bone healing in patients suffering from cranial bone defects.

There are typically two treatment strategies used for cranial bone treatments, each with its own drawbacks, Varanasi said. The first involves inserting a titanium plate over the injury area for new bone to grow over. A drawback is that this process is slow. The second involves the use of a gelatin-like material that degrades over time, allowing the new bone to take over the space. But the substance may degrade too quickly, not allowing enough time for the new bone to form. Varanasi and his team hope to develop a new material that can help speed up and standardize the amount of time it takes patients to heal. Varanasi said this new approach was inspired by previous research involving plants and the element silicon, which spurred the production of enzymes that helped the plants survive traumatic conditions such as drought. He said *“We’re using a particular material that can be found on a microchip and putting it as an implant coating onto fixative devices or as a nanoparticle in the degradable materials.”* *“This will help push antioxidant activity, which can help produce bone and vascular tissue that are required to heal the entire bone gap.”*

For more information, visit the following link:

<https://www.uta.edu/news/news-releases/2023/05/02/new-biomaterial-to-speed-up-healing-of-cranial-bone-injuries>

#### Reference

Rivera, N. (May 02, 2023). New biomaterial to speed up healing of cranial bone injuries. Recovered May 02, 2023, de The University of Texas at Arlington: <https://www.uta.edu/news/news-releases/2023/05/02/new-biomaterial-to-speed-up-healing-of-cranial-bone-injuries>

Information source: (The University of Texas at Arlington, 2023)



## 1.18 Silver nanoparticles spark key advance in thermoelectricity for power generation

Low Melting Point for Nanoparticles Plus High Melting Point of Bulk Silver Allows Thermoelectric Modules to Work Across Range of Operating Temperatures. Several high-performance thermoelectric materials have been discovered over the past two decades, but without efficient devices to convert the energy they produce into emission-free power. Now an international team of scientists led by a University of Houston physicist and several of his former students has reported a new approach to constructing the thermoelectric modules, using silver nanoparticles to connect the modules' electrode and metallization layers.



*Credit: Jeannie Kever, University of Houston*

The researchers tested the silver nanoparticles with three well-known thermoelectric materials, each of which operates at a different temperature. They also used the silver nanoparticles as the connective material in modules using low-temperature bismuth telluride and a half-Heusler high-temperature material, indicating the concept would work for a variety of thermoelectric materials and purposes.

For more information, visit the following link:

<https://uh.edu/news-events/stories/2023/may-2023/05012023-silver-nanoparticles-thermoelectricity.php>

### Reference

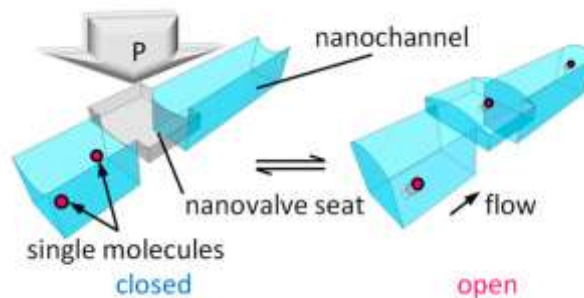
Kever, J. (May 02, 2023). Silver nanoparticles spark key advance in thermoelectricity for power generation. Recovered May 02, 2023, University of Houston: <https://uh.edu/news-events/stories/2023/may-2023/05012023-silver-nanoparticles-thermoelectricity.php>

Information source: (University of Houston, 2023)



### 1.19 Single-molecule valve: a breakthrough in nanoscale control

A joint research team led by Associate Professor Yan Xu of the Osaka Metropolitan University Graduate School of Engineering has succeeded in regulating the flow of single molecules in solution by opening and closing a nanovalve in a nanofluidic device by applying external pressure.



*Schematic drawing of the working principle of the single-molecule valve.  
Credit: Yan Xu, Osaka Metropolitan University*

The research team fabricated a nanofluidic device with a thin, flexible glass sheet on the top, and a hard glass plate with small structures that forms nanochannels and nanovalve seats on the bottom. By applying external pressure to the flexible glass sheet to open and close the valve, they succeeded in directly manipulating and controlling the flow of individual molecules in solution. They also found that when they trapped single fluorescent molecules in the nanospace inside the valve, the fluorescence of the single molecules became brighter. This happened because the small space made it harder for the single molecules to move around randomly. Professor Xu said that *“this effect of fluorescence signal amplification could help with detecting very small amounts of pathogens for early diagnosis of diseases such as cancers and Parkinson's disease, without requiring expensive equipment.”*

For more information, visit the following link:

<https://www.omu.ac.jp/en/info/research-news/entry-27753.html>

#### Reference

Xu, Y. (May 02, 2023). Single-molecule valve: A breakthrough in nanoscale control. Recovered May 02, 2023, Osaka Metropolitan University: <https://www.omu.ac.jp/en/info/research-news/entry-27753.html>

Information source: (Osaka Metropolitan University, 2023)



## 1.20 Cells are influenced by their environment as tissues grow

The cells of our body interact with their immediate environment. Researchers have now studied this interaction in detail. In time, they hope to use these findings for improved diagnosis and treatment of wound-healing disorders and cancer.



*Fibroblasts (centre) surround themselves with a fibrous matrix. Via special membrane proteins, they are able to sense mechanical stimuli from this extracellular matrix.  
Credit: Science Photo Library, Eidgenössische Technische Hochschule Zürich*

Their study focused on two cell types: fibroblasts and myofibroblasts. Each of them is important for human tissue functionality, and each one can change into the other. Fibroblasts are found in the connective tissue of our organs, where they ensure that the Extracellular Matrix (ECM) is continuously renewed and remains healthy. If an injury occurs or tissue growth is required, the fibroblasts transform into myofibroblasts, which play a key role in healing wounds and the growth of new tissue. Myofibroblasts not only produce large amounts of ECM but are also strong enough, for example, to pull together tissue in wounds.

For more information, visit the following link:

<https://ethz.ch/en/news-and-events/eth-news/news/2023/05/how-cells-are-influenced-by-their-environment-as-tissues-grow.html>

### Reference

Bergamin, F. (May 03, 2023). How cells are influenced by their environment as tissues grow. Recovered May 02, 2023, Eidgenössische Technische Hochschule Zürich: <https://ethz.ch/en/news-and-events/eth-news/news/2023/05/how-cells-are-influenced-by-their-environment-as-tissues-grow.html>

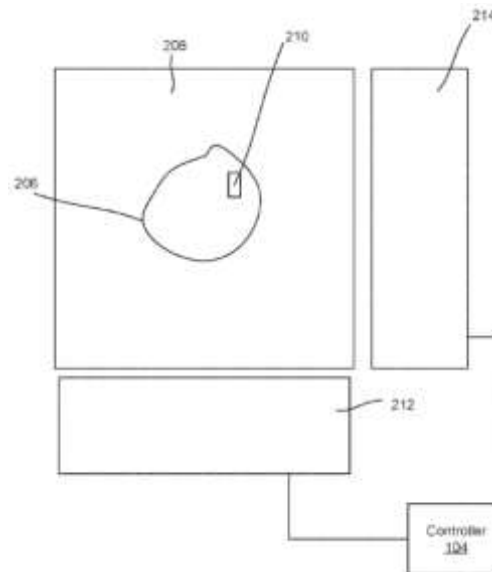
Information source: (Eidgenössische Technische Hochschule Zürich, 2023)



## 2 PATENTS

### 2.1 Three-Dimensional printed capacitors

In one example in accordance with the present disclosure, an additive manufacturing system is described.



*Is a simplified top view of an additive manufacturing system for forming 3D printed capacitors, according to an example of the principles described herein.*

*Credit: Wittkopf, J., Erickson, K., Luna-Ramirez, E., and Stasiak, J., WIPO IP Portal*

The additive manufacturing system includes an additive manufacturing device to form a three-dimensional (3D) printed object. The additive manufacturing system also includes a controller to form a 3D printed capacitor on a body of the 3D printed object. The controller does this by controlling deposition of a conductive agent to form electrodes of the 3D printed capacitor and by controlling deposition of a dielectric agent in a dielectric region between the electrodes of the 3D printed capacitor.

For more information, visit the following link:

[https://patentscope.wipo.int/search/es/detail.jsf?docId=US396247399&\\_cid=P22-LH6E9X-23740-1](https://patentscope.wipo.int/search/es/detail.jsf?docId=US396247399&_cid=P22-LH6E9X-23740-1)

Reference

Wittkopf, J., Erickson, K., Luna-Ramirez, E., & Stasiak, J. (April 27, 2023). Three-dimensional printed capacitors. Recovered May 02, 2023, WIPO IP Portal: [https://patentscope.wipo.int/search/es/detail.jsf?docId=US396247399&\\_cid=P22-LH6E9X-23740-1](https://patentscope.wipo.int/search/es/detail.jsf?docId=US396247399&_cid=P22-LH6E9X-23740-1)

Information source: (WIPO IP Portal, 2023)



## 2.2 Blockchain based E-Voting

In this research work, we assess a utilization of Blockchain as an assistance to execute disseminated digitized democratic frameworks. The work proposes a clever digitized democratic framework in light of Blockchain that tends to a portion of the constraints in existing frameworks and assesses a portion of the famous Blockchain structures to develop a Blockchain-based e-voting a ballot framework.

Blockchain technology came into the ground to overcome these issues and offers decentralized nodes (district nodes, boot nodes) for electronic voting and is used to produce electronic voting systems mainly because of their end-to-end verification advantages. For scalability transparency speed must be fast which can be achieved using smart contracts. Smart contracts are simply programs stored on a Blockchain that run when predetermined conditions are met. Specifically, we assess the capability of dispersed record innovations through the portrayal of a contextual analysis and the execution of a Blockchain based application, which works on the security and diminishes the expense of facilitating a cross country political decision.

For more information, visit the following link:

[https://patentscope.wipo.int/search/es/detail.jsf?docId=IN396259713&\\_cid=P22-LH6HWG-81510-1](https://patentscope.wipo.int/search/es/detail.jsf?docId=IN396259713&_cid=P22-LH6HWG-81510-1)

### Reference

MS. Gowsika, S., MR. Abzar, H., MS. Priyadharshini, M., MR. Nattudurai, C., MR. Saswin, V., DR. Sri, V., & MRS. Priya, L. (April 27, 2023). Blockchain based E-Voting System. Recovered May 02, 2023, WIPO IP Portal:

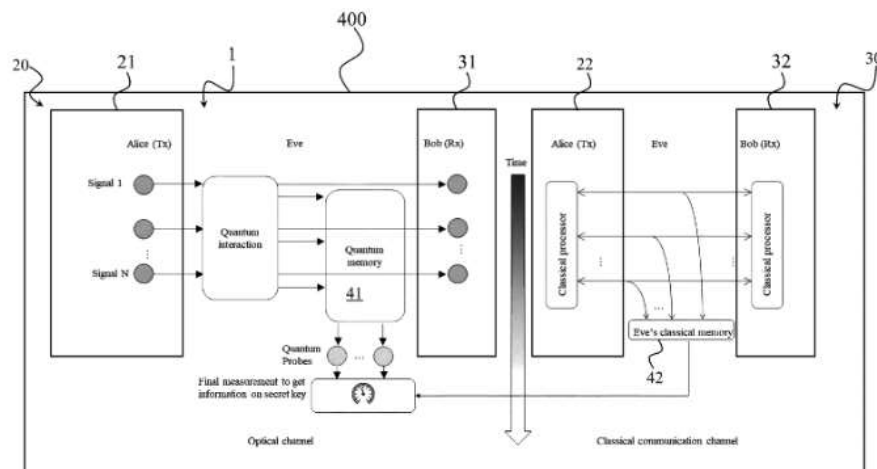
[https://patentscope.wipo.int/search/es/detail.jsf?docId=IN396259713&\\_cid=P22-LH6HWG-81510-1](https://patentscope.wipo.int/search/es/detail.jsf?docId=IN396259713&_cid=P22-LH6HWG-81510-1)

Information source: (WIPO IP Portal, 2023)



### 2.3 Quantum key distribution

A method for obtaining a quantum key. The method comprises transmitting a quantum signal from a transmitter device (Tx) to a receiver device (Rx) via an optical channel, and exchanging encrypted information over a classical communication channel. The method further comprises determining a transmitter-side sequence of symbols and a receiver-side sequence of symbols based on the quantum signal and the encrypted information, and obtaining the quantum key based on the transmitter-side sequence of symbols and the receiver-side sequence of symbols.



*Depicts a diagram illustrating a QKD system for obtaining a quantum key, according to an exemplary embodiment of the disclosure  
Credit: Fung, F., WIPO IP Portal*

In view of the above, the present disclosure aims to improve conventional Quantum Key Distribution (QKD) methods, operating methods of transmitter devices in QKD systems, operating methods of receiver devices in QKD system, and operating methods of QKD systems.

For more information, visit the following link:

[https://patentscope.wipo.int/search/es/detail.jsf?docId=WO2023066542&\\_cid=P22-LH6DZQ-17970-1](https://patentscope.wipo.int/search/es/detail.jsf?docId=WO2023066542&_cid=P22-LH6DZQ-17970-1)

#### Reference

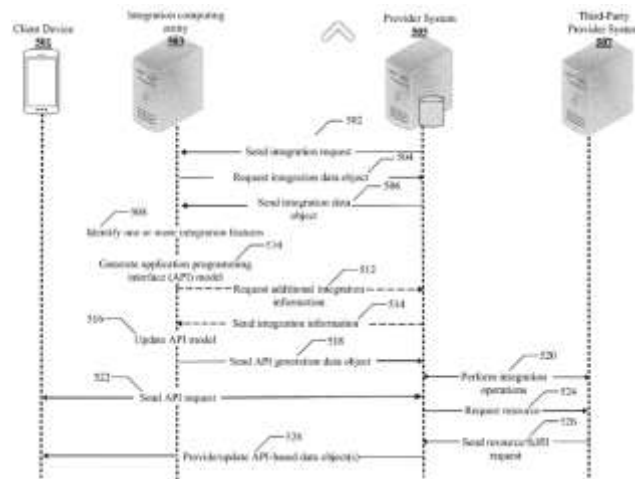
Fung, F. (April 27, 2023). Methods, transmitter device, receiver device, and system for quantum key distribution. Recovered May 02, 2023, WIPO IP Portal: [https://patentscope.wipo.int/search/es/detail.jsf?docId=WO2023066542&\\_cid=P22-LH6DZQ-17970-1](https://patentscope.wipo.int/search/es/detail.jsf?docId=WO2023066542&_cid=P22-LH6DZQ-17970-1)

Information source: (WIPO IP Portal, 2023)



## 2.4 Artificial Intelligence based integration frameworks

Described for Artificial Intelligence based techniques for programmatically generating and integrating Application Programming Interfaces (API).



*Is a signal diagram illustrating communication between a client device, an integration computing entity, a provider system and a third-party provider system, according to one or more aspects of the currently disclosed invention.*

*Credit: Dushyant, S., WIPO IP Portal*

An example method may include, in response to receiving by one or more processors, an integration data object, processing, by the one or more processors, based at least in part on an integration Machine Learning model, the integration data object in order to identify one or more integration features associated with the integration data object; programmatically generating, by the one or more processors, based at least in part on the one or more integration features, an application programming interface model corresponding with the integration data object; and generating, by the one or more processors, an API generation data object corresponding with the API model for execution.

For more information, visit the following link:

[https://patentscope.wipo.int/search/es/detail.jsf?docId=US396245967&\\_cid=P22-LH6F5D-39271-5](https://patentscope.wipo.int/search/es/detail.jsf?docId=US396245967&_cid=P22-LH6F5D-39271-5)

### Reference

Dushyant, S. (April 27, 2023). Artificial Intelligence based integration frameworks.

Recovered May 02, 2023, WIPO IP Portal:

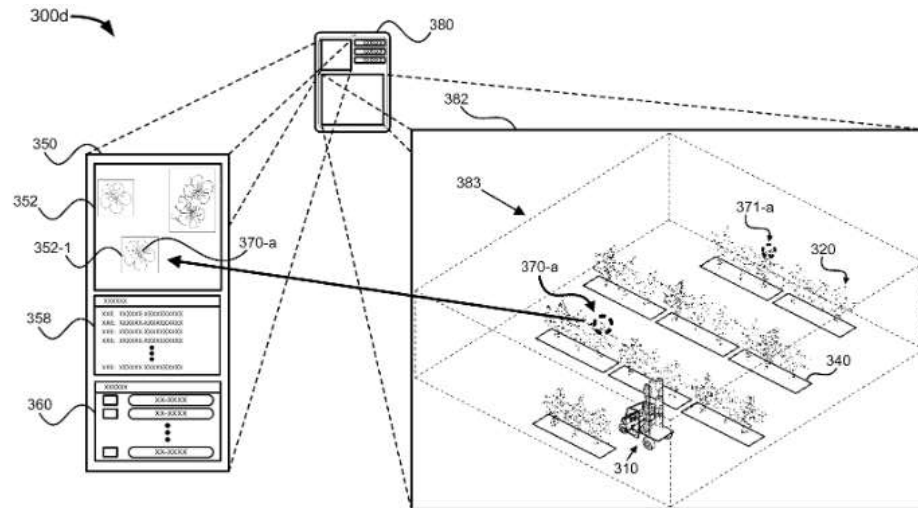
[https://patentscope.wipo.int/search/es/detail.jsf?docId=US396245967&\\_cid=P22-LH6F5D-39271-5](https://patentscope.wipo.int/search/es/detail.jsf?docId=US396245967&_cid=P22-LH6F5D-39271-5)

Information source: (WIPO IP Portal, 2023)



## 2.5 Precision detection and control of vegetation with real time estimation

Techniques for detection of and controlling growth of undesirable vegetation in a field are described.



*Credit: Sibley, G., Ibarria, L., Garner, C., & Leger, P., WIPO IP Portal*

The agricultural observation and treatment systems can be configured to obtain one or more sensor readings of a region of an agricultural environment. The systems can implement one or more Machine Learning (ML) algorithms, determine one or more parameters for use with the one or more ML algorithms, detect a real-world target from the one or more sensor readings using the one or more ML algorithms, and apply a treatment to the target by selectively activating a treatment mechanism configured to interact with the target.

For more information, visit the following link:

[https://patentscope.wipo.int/search/es/detail.jsf?docId=WO2023069842&\\_cid=P22-LH6EUE-33871-4](https://patentscope.wipo.int/search/es/detail.jsf?docId=WO2023069842&_cid=P22-LH6EUE-33871-4)

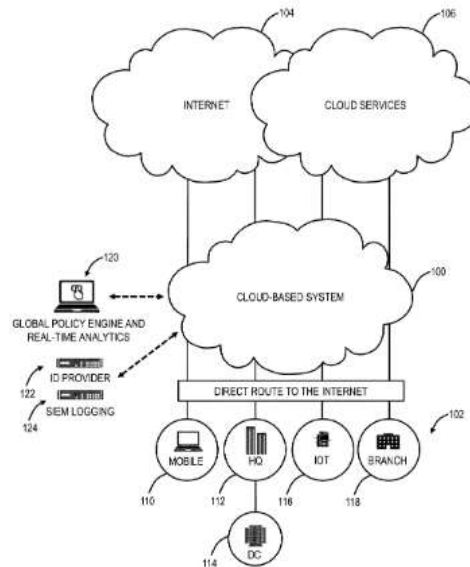
### Reference

Sibley, G., Ibarria, L., Garner, C., & Leger, P. (April 27, 2023). Precision detection and control of vegetation with real time pose estimation. Recovered May 02, 2023, WIPO IP Portal: [https://patentscope.wipo.int/search/es/detail.jsf?docId=WO2023069842&\\_cid=P22-LH6EUE-33871-4](https://patentscope.wipo.int/search/es/detail.jsf?docId=WO2023069842&_cid=P22-LH6EUE-33871-4)

Information source: (WIPO IP Portal, 2023)

## 2.6 Identity intelligence in cloud-based services

The present disclosure relates to systems and methods for tying activity of a user or group in a cloud service with an identity provider (IDP).



*Network diagram of a cloud-based system offering security as a service.  
Credit: Moore, S., Espacenet Patent Search*

This intelligence from the cloud service can be used to continuously authenticate a user or group as they are using the cloud service, thus confirming authentication beyond the initial identity (ID) determination or login process. By gathering a baseline for the access of users and groups, it is possible to detect when a user or user device shows anomalous behavior. Responsive to detecting anomalous behavior, the IDP can be notified, and remediation can be quickly initiated with the utilization of security measures such as access denial, account disabling, requiring a user to change a password, and/or other actions of the like. Such security actions may be preset in a playbook built for response to various security risks.

For more information, visit the following link:

<https://worldwide.espacenet.com/patent/search/family/086055452/publication/US2023129466A1?q=trust%20architectures%20AND%20digital%20identify>

### Reference

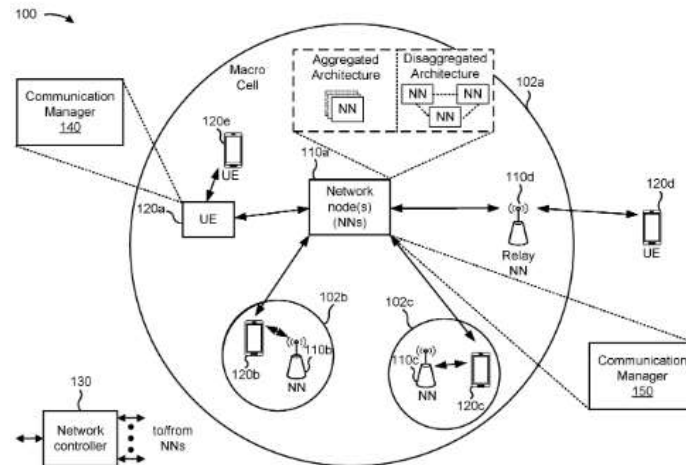
Moore, S. (April 27, 2023). Identity intelligence in cloud-based services. Recovered May 02, 2023, Espacenet Patent Search:

<https://worldwide.espacenet.com/patent/search/family/086055452/publication/US2023129466A1?q=trust%20architectures%20AND%20digital%20identify>

Information source: (Espacenet Patent Search, 2023)

## 2.7 Conditional handover with multiple radio access technology dual connectivity

Various aspects of the present disclosure generally relate to wireless communication.



*Is a diagram illustrating an example of a wireless network, in accordance with the present disclosure.*

*Credit: Purkayastha, P., Ozturk, O., & Zhu, X. Espacenet Patent Search*

In some aspects, a network node may receive, from a source master node, a secondary node release request corresponding to a conditional handover operation associated with a User Equipment (UE) operating in accordance with multiple radio access technology dual connectivity, wherein the secondary node release request indicates that the network node is to continue to be a secondary node associated with the UE or that a target secondary node is to be the secondary node associated with the UE. The network node may perform a data transfer operation based at least in part on receiving the secondary node release request.

For more information, visit the following link:

<https://worldwide.espacenet.com/patent/search/family/084406251/publication/US2023128210A1?q=advanced%20connectivity>

### Reference

Purkayastha, P., Ozturk, O., & Zhu, X. (April 27, 2023). Conditional handover with multiple radio access technology dual connectivity. Recovered May 02, 2023, Espacenet Patent Search:

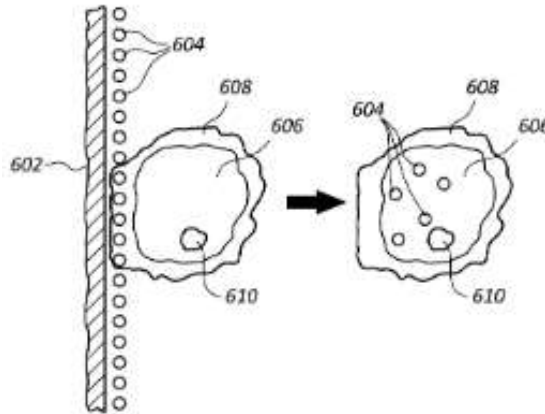
<https://worldwide.espacenet.com/patent/search/family/084406251/publication/US2023128210A1?q=advanced%20connectivity>

Information source: (Espacenet Patent Search, 2023)



## 2.8 Polymer compositions with antimicrobial nanoparticles

Disclosed are embodiments of polymer compositions and systems that contain antimicrobial and wavelength-shifting metal nanoparticles.



*Schematically illustrate a microbe after having absorbed spherical-shaped metal nanoparticle from a substrate and disulfide bonds being catalytically denatured by a spherical-shaped nanoparticle.*

*Credit: Niedermeyer, W., Espacenet Patent Search*

The polymer compositions containing metal nanoparticles protect exposed materials from Ultraviolet (UV) radiation. The polymer compositions containing metal nanoparticles down convert incoming UV light to light that may have a longer wavelength. Unexpectedly, by selecting at least two differently configured nanoparticle components (e.g., different in size, shape, or both), each with specific particle size distribution, it is possible to effectively protect an area from damage resulting from exposure to UV radiation. In addition, spherical silver nanoparticles do not cause bacteria to become resistant as do convention silver nanoparticles made by chemical synthesis.

For more information, visit the following link:

<https://worldwide.espacenet.com/patent/search/family/086055770/publication/US2023131273A1?q=quantum%20technologies>

Reference

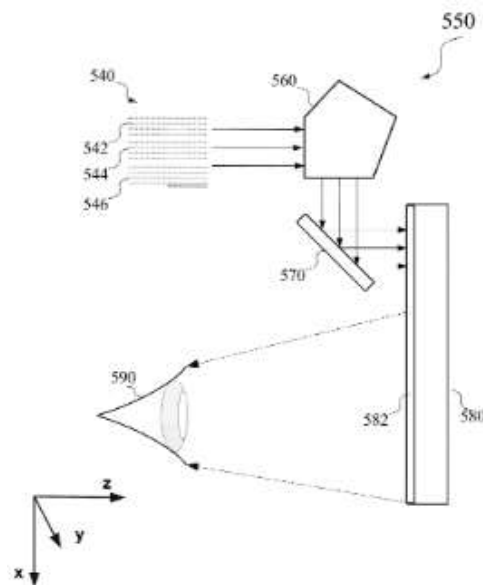
Niedermeyer, W. (April 27, 2023). Polymer compositions with antimicrobial and wavelength-shifting nanoparticles. Recovered May 02, 2023, Espacenet Patent Search: <https://worldwide.espacenet.com/patent/search/family/086055770/publication/US2023131273A1?q=quantum%20technologies>

Information source: (Espacenet Patent Search, 2023)



## 2.9 Micro-Led semipolar

A light emitting diode includes an N-type semiconductor layer including a pit structure formed therein, active layers grown only on sidewalls of the pit structure and configured to emit light, and a p-type semiconductor layer on the active layers and at least partially in the pit structure.



*Illustrates an example of a near-eye display device including a waveguide display according to certain embodiments.*

*Credit: Tan, W., Pinos, A., Yu, X., & Mezouari, S., Espacenet Patent Search*

In one embodiment, the pit structure is characterized by a shape of an inverted pyramid. The pit structure is formed in the N-type semiconductor layer by, for example, etching the n-type semiconductor layer using an etch mask layer having apertures with slanted sidewalls, or growing the n-type semiconductor layer on a substrate through a mask layer having an array of apertures.

For more information, visit the following link:

<https://worldwide.espacenet.com/patent/search/family/084357954/publication/US2023130445A1?q=quantum%20technologies>

### Reference

Tan, W., Pinos, A., Yu, X., & Mezouari, S. (April 27, 2023). Semipolar Micro-Led. Recovered May 02, 2023, Espacenet Patent Search:

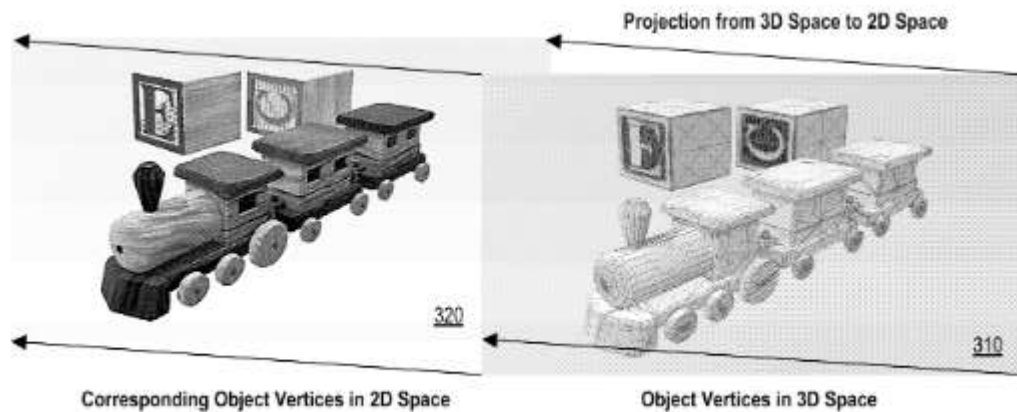
<https://worldwide.espacenet.com/patent/search/family/084357954/publication/US2023130445A1?q=quantum%20technologies>

Information source: (Espacenet Patent Search, 2023)



## 2.10 Two-Dimensional (2D) feature database generation

One embodiment provides a method comprising acquiring 3D content comprising a 3D object in 3D space.



*Illustrates an example projection of 3D objects from 3D space to 2D space, in one or more embodiments.*

*Credit: Hong, H., & Oh, S., Espacenet Patent Search*

The 3D object has object information indicative of a location of the 3D object in the 3D space. The method further comprises projecting the 3D object to a 2D object in 2D space based on the object information. The 2D object has one or more 2D vertices indicative of a location of the 2D object in the 2D space. The method further comprises determining one or more latent variables in the 2D space based on the object information and the one or more 2D vertices, and generating a 2D feature database including the one or more latent variables.

For more information, visit the following link:

<https://worldwide.espacenet.com/patent/search/family/086057124/publication/US2023131418A1?q=artificial%20intelligence>

### Reference

Hong, H., & Oh, S. (April 27, 2023). Two-Dimensional (2d) feature database generation. Recovered May 02, 2023, Espacenet Patent Search:

<https://worldwide.espacenet.com/patent/search/family/086057124/publication/US2023131418A1?q=artificial%20intelligence>

Information source: (Espacenet Patent Search, 2023)