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GOSSIP

New solar desalination breakthrough makes fresh water without toxic brine

Science Daily · 28 Feb 2026

According to the United Nations, 2.2 billion people still do not have access to safely managed drinking water. To help meet growing demand, many regions, from California to parts of the Middle East, rely on desalination plants that convert seawater into fresh water.

Traditional desalination methods such as reverse osmosis and thermal distillation can be expensive and energy intensive. They often require chemical treatments before and after processing the water and generate large volumes of concentrated saltwater known as brine. When discharged back into the ocean, brine can damage marine ecosystems by increasing salinity and reducing oxygen levels.

Researchers at the University of Rochester have developed a new approach that could address several of these challenges. Their solar powered desalination system produces fresh water efficiently, operates without chemical pretreatment, and avoids creating brine waste. The research was led by Chunlei Guo, a professor of optics and physics and a senior scientist at the University's Laboratory for Laser Energetics. The team described the technology in the journal *Light: Science & Applications*.

Laser-Treated Solar Panels Drive the Process

The system relies on specially engineered solar panels made from black metal that has been textured with femtosecond lasers. This treatment gives the surface two important properties. It absorbs nearly all incoming sunlight and strongly attracts water, a characteristic known as superwicking.

A laser patterned active region draws a thin layer of seawater across the panel. As sunlight is absorbed, the water evaporates and is distilled into fresh water. At the same time, dissolved salts and minerals are guided away from the active area and deposited onto untreated sections of the panel called passive regions.

By moving the salts away from the evaporation zone, the design prevents buildup that could otherwise interfere with continuous operation.

Using the Coffee Ring Effect to Prevent Clogging

Guo notes that several solar thermal desalination technologies have shown promising results in laboratory studies using simplified seawater composed only of water and sodium chloride.

In those experiments, sodium chloride crystals form in a loose, porous structure as water evaporates. Water can continue flowing through these crystals, dissolving them and making the systems relatively easy to clean.

In addition to sodium chloride, oceans contain many other dissolved minerals. Materials containing magnesium and calcium often form hard, dense crusts when they crystallize. These deposits can block water flow and eventually shut down the desalination process.

The problem is similar to mineral...

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This new aluminum could replace rare metals and cut costs dramatically

Science Daily · 16 Mar 2026

A team of scientists at King's College London has identified a new form of aluminum, one of the most abundant metals on Earth, that could offer a far less expensive and more sustainable alternative to widely used rare earth metals.

Led by Dr. Clare Bakewell, a Senior Lecturer in the Department of Chemistry, the researchers created highly reactive aluminum molecules capable of breaking some of the strongest chemical bonds. Their findings, published in *Nature Communications*, also reveal entirely new molecular structures, opening the door to previously unknown types of chemical behavior.

The researchers reported the first known example of a cyclotrialumane, a compound made of three aluminum atoms arranged in a trimeric -- triangular -- structure. This unusual configuration shows remarkable reactivity. Importantly, the structure remains intact even when dissolved in different solutions, giving it the stability needed for a variety of chemical reactions.

These reactions include splitting dihydrogen and enabling the step-by-step insertion and chain growth of ethene, a simple 2-carbon hydrocarbon. Such capabilities highlight the compound's potential for building more complex molecules.

Metals play a central role in producing both everyday and specialized chemicals used across industry. Many of these processes rely on precious metals like platinum, which are costly and can have significant environmental impacts due to extraction.

Scientists have been searching for alternatives that are easier to obtain and more sustainable. Dr. Clare Bakewell explained: "Transition metals are the workhorses of chemical synthesis and catalysis -- but many of the most useful are becoming increasingly difficult to access and extract -- often being located in regions of political instability, increasing the demand and price.

"Chemists have been looking towards more common elements from the periodic table, and we chose aluminum, as it's super abundant, making it ~20,000 times less expensive than precious metals such as platinum and palladium."

Expanding the Possibilities of Aluminum Chemistry

In addition to designing aluminum compounds for use in chemical synthesis, the team is uncovering entirely new reactions.

Dr. Bakewell said, "What's special about this work, is that we're pushing the boundaries of chemical knowledge. Most excitingly, we can use this aluminum trimer to build completely new compounds with levels of reactivity that have never been observed before -- these include the 5- and 7-membered aluminum and carbon rings formed through reaction with ethene. These capabilities go beyond the transition metals we were originally trying to mimic, to the forefront of..."

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Scientists turn CO₂ into fuel using breakthrough single-atom catalyst

Science Daily · 17 Apr 2026

Every chemical reaction must overcome an energy hurdle before it can occur. Substances need an initial input of energy to start reacting. Sometimes this barrier is small, like lighting a match. In many industrial processes, however, the required energy is much higher, which increases costs.

To make reactions easier and more efficient, chemists rely on substances called catalysts. These "reaction helpers" reduce the energy needed. The most effective catalysts often contain metals, including rare and expensive ones.

Breakthrough Catalyst Turns CO₂ Into Methanol

Researchers at ETH Zurich have now made a major advance in catalyst design. Their new system significantly lowers the energy needed to produce methanol (an alcohol) from carbon dioxide and hydrogen.

The team also achieved an unusually efficient use of the metal indium. In this catalyst, each individual indium atom acts as its own active site. This is a major shift from traditional approaches, where metals are grouped in particles.

Another key advantage is improved precision. In the past, catalyst development often relied on trial and error. This new design allows scientists to better observe and understand the reactions happening on the surface, opening the door to more deliberate and optimized catalyst development.

"Methanol is a universal precursor for the production of a wide range of chemicals and materials, such as plastics -- the Swiss army knife of chemistry, so to speak," says Javier Pérez-Ramírez, Professor of Catalysis Engineering at ETH Zurich.

Methanol is essential for producing fuels and materials, and it plays a growing role in efforts to move away from fossil fuels. If the hydrogen and energy used in the process come from renewable sources, methanol production could become climate neutral.

This approach also offers a new way to use CO₂. Instead of releasing it into the atmosphere, it can be captured and turned into a valuable raw material.

Single Atom Catalysts Maximize Efficiency

"Our new catalyst has a single atom architecture, in which isolated active metal atoms are anchored on the surface of a specially developed support material," Pérez-Ramírez explains.

In conventional catalysts, metals are typically grouped into small particles that can contain hundreds or even thousands of atoms. Many of those atoms are not directly involved in the reaction, making the process less efficient.

Single atom catalysts represent a more efficient alternative. By using metals at the level of individual atoms, scientists can make better use of scarce and costly...

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Weaker bonds make for more impact-resistant polymers

New Atlas · 10 Jun 2026

In a new MIT study – in partnership with Purdue, Northwestern, and Duke universities – chemists have discovered that inserting weaker bonds into polystyrene actually makes the material more resistant to damage.

The weaker bonds are dispersed throughout the material as cross-links known as mechanophores, and upon a sudden strike, those mechanophores selectively snap at the impact site, absorbing the impact energy more effectively.

In their experiments, the researchers demonstrated how when the cross-linked polystyrene was struck with a high-speed particle, the temperature at the impact site increased high enough to form an adaptable zone that broke, leaving the surrounding area unaffected. As a result, the cross-linked polystyrene absorbed way more energy compared to regular polystyrene.

“These cross-linkers can substantially increase the amount of energy that the material absorbs under ballistic impact. You can imagine many applications of that, especially if this could be generalized to other polymers,” says MIT's Prof. Jeremiah Johnson. “It turned out that the mechanophore leads to substantial increases in energy dissipation compared to both uncross-linked and conventionally cross-linked polystyrene.”

This study builds upon a 2023 study from Johnson and colleagues at MIT and Duke University, which demonstrated that polymers could be toughened by distributing weak cross-links throughout polymer materials that break under slow tearing conditions in a way that perseveres the stronger bonds that bear the load to dissipate more energy.

“As a crack starts to propagate through the material, these mechanophores split in two, which helps to dissipate energy and redirect where the crack goes. That means you have to put in more energy to tear the material,” Johnson says.

In this case, the team devised a way to directly merge the mechanophores as cross-links into common polymers. They used an invention created by MIT's Prof. Keith Nelson, to study how the polymers responded to impacts via laser-induced micro-plastic impact testing (LIPIT).

Tiny silica beads about 10 microns in diameter are projected at the polymer at about 750 meters per second (over 1,600 miles per hour) with the amount of energy absorbed measured by calculating the change in particle velocity before and after the beads pass through.

“We first developed this method to study microparticle impact and penetration into bulk polymer samples, where we would monitor particle propagation through about 100 microns of material and analyze after impact how polymer morphology had changed,” Nelson says. “Our new measurements show how much additional information can...”

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Scientists Create “Intelligent” Bandage That Targets Harmful Bacteria

Sci Tech Daily · 10 Jun 2026

Researchers have created a smart wound dressing that can sense when harmful bacteria are present and respond by releasing antibiotics only when needed.

Biomedical engineers at Brown University have created a wound dressing that releases antibiotics only when harmful bacteria are detected. In a new study, the team found that the material may quickly eliminate wound infections and speed healing while cutting back on unnecessary antibiotic use. Overuse of antibiotics is a key factor behind antibiotic resistance and difficult-to-treat “superbug” infections, which kill tens of thousands of people worldwide each year.

The material is a smart hydrogel packed with antibiotics and designed to be applied directly to a wound beneath a bandage. It responds to an enzyme made by many harmful bacteria. When that enzyme is present, the hydrogel begins to break down and releases the antibiotics stored inside. If harmful bacteria are absent, the hydrogel remains intact and keeps the medication sealed away.

“Antimicrobial resistance is a major problem worldwide, so we need better approaches for how we use antibiotics,” said Anita Shukla, a professor in Brown’s School of Engineering who led the development of the smart hydrogel. “We’ve developed a material that releases antibiotics only when harmful bacteria are present, so it limits exposure to antibiotics when they’re not needed but still provides these important medications when they are needed.”

In the study, published in *Science Advances*, the researchers tested the hydrogel and found that it was highly selective for enzymes produced by common bacteria that cause wound infections. The findings also suggest that the material may clear infections and support wound healing more effectively than a hydrogel dressing currently used in clinical care.

Hydrogels are Jell-O-like materials made mostly of water and long polymer molecules. Smaller molecules called crosslinkers hold those polymers together and help the hydrogel keep its structure. For this material, the team used a crosslinker that breaks down when it encounters enzymes known as beta-lactamases, which are produced by many types of bacteria. Once that breakdown begins, the hydrogel falls apart and releases the antibiotics inside.

In petri dish tests, the material broke down only when harmful bacteria that produce beta-lactamases were present. When exposed only to harmless bacteria that do not make these enzymes, the hydrogel stayed intact and did not promote antibiotic resistance during long-term exposure to the dressing.

The researchers said this beta-lactamase sensitivity is important because it helps ensure...

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Extreme weather likely to increase methane emissions from landfills

Chemistry World · 9 Jun 2026

Landfill sites around the world could emit more methane as a result of extreme weather and higher temperatures, further fuelling climate change

Temperature and rainfall fluctuations are responsible for 13% of methane emissions at one of the largest landfill sites in the world, a new study has found. The researchers say that their models show that in a changing climate with more extreme weather, methane emissions from landfills will increase even more, amplifying global warming.

Methane accounts for approximately 16% of human-related greenhouse gas emissions, with studies estimating that the gas has contributed 30% to global warming since the industrial revolution. Landfills alone account for 19% of anthropogenic methane emissions, making these waste sites the

third-largest source of methane after agriculture and the fossil fuel sector. In certain cities the contribution of landfills to total methane emissions can climb even higher. A 2022 study revealed that a single landfill site in Buenos Aires produced half of the city's methane emissions .

Investigating the Sudokwon Landfill Site in South Korea – one of Asia's largest – researchers at Seoul National University adapted a widely used machine-learning model to reflect the local environment and calculate methane emissions at site-specific locations. By accounting for composition and degradable organic content of waste, as well as waste composition, waste particle size, temperature, moisture and pH, they showed that their climate-sensitive modelling improved methane emission estimations compared with previous models.

The scientists trained their machine-learning framework with field measurements from the Sudokwon site between 2005 to 2021 before assessing an idealised scenario with a fixed composition and volume of waste. Their model revealed that temperature variations were linked to approximately 6% of methane emissions, while fluctuating precipitation was linked to just over 7%.

The researchers say that adapting emissions calculations to be more climate-responsive and site-specific could help inform mitigation strategies and also help tailor them to landfill type and weather conditions.

D Kim et al , Atmos. Chem. Phys. , 2026, DOI: 10.5194/acp-26-7789-2026

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Modular next-gen US nuclear reactor goes critical

New Atlas · 9 Jun 2026

Nuclear energy in the West took another step forward as the first privately developed, non-light-water reactor to go critical in the United States in more than 40 years reached a major milestone when the Antares Nuclear Mark-0 test reactor came online at Idaho National Laboratory.

The milestone, achieved on June 4, 2026, was what is known as "initial criticality" or "zero-power fueled criticality," which means the reactor was only brought to the minimum power level required to start a nuclear chain reaction. The goal is to validate the reactor's computational physics models, core geometry, control rod performance, and initial neutronic behavior without generating significant thermal energy or requiring active coolant flow.

That may sound a bit like the equivalent of getting a car engine to turn over for the first time, and the analogy is not a bad one. But the important part is that it directly fulfills a mandate under the US Department of Energy's Reactor Pilot Program that challenged the US nuclear industry to bring at least three advanced reactor designs to criticality by July 4, 2026.

The initiative is intended to help jump-start the US nuclear sector, which largely stagnated after the 1970s due to shifting public opinion, political pressure, and increasingly stringent regulations that prioritized safety above all else. The result was an approval process so complex and costly that it was almost impossible to navigate without going bankrupt. Launched in 2025, the Reactor Pilot Program seeks to fast-track a new generation of reactors by using the DOE's independent safety authorization and oversight process at federal laboratory sites rather than the standard Nuclear Regulatory Commission (NRC) commercial licensing pathway for early-stage technology validation.

One of several program candidates, the planned Antares R1 reactor and its zero-power testing predecessor, the Mark-0, are high-temperature, solid-state microreactors designed to generate between 100 kW and 1 MW of electricity. Their modular design allows the reactors to be built in factories and then shipped to where they are needed for activation, while additional modules can be added to meet growing power demands.

The Antares reactors are fueled by High-Assay Low-Enriched Uranium (HALEU) formed into Tri-structural Isotropic (TRISO) fuel particles roughly the size of millet seeds. These contain uranium-235 formed into uranium oxycarbide that's been enriched to 19.75% and then encapsulated in layers of carbon and ceramic before being pressed into cylindrical compacts and loaded into the reactor's core blocks.

This configuration helps...

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CO₂ injection reveals hidden cement chemistry behind 13% stronger early strength

Phys Org · 11 Jun 2026

by Andrew Paul Laurent, Massachusetts Institute of Technology

One September day, it started to snow inside MIT's Pierce Laboratory. Researchers depressurized a tank of liquid carbon dioxide (CO₂), instantly freezing it and releasing solid flakes. These were blended into cement paste and pressed into disks roughly the size of a dime, each sealed with a thin layer of vegetable oil to keep water in and air out. The team trained lasers on each one, observing for the first time the transient chemical reaction that might explain why CO₂-injected cement paste gains strength faster.

Injecting CO₂ into cement products like concrete is one way to store it and keep it out of the atmosphere. The process has attracted commercial interest, with a growing number of companies offering CO₂-injected concrete mixes. But until now, the underlying cement chemistry hadn't been directly visualized.

A new paper in the *Journal of the American Ceramic Society*—led by associate professor Admir Masic and first-authored by graduate student Marcin Hajduczek, both of the MIT Concrete Sustainability Hub and MIT Department of Civil and Environmental Engineering—describes the chemical sequence that unfolds after CO₂ meets fresh cement paste. Co-authors include MIT colleagues Santiago El Awad and Franz-Josef Ulm, alongside researchers from IIT Jodhpur and CarbonCure Technologies.

Previous studies had pieced together a story about CO₂ injection's chemical impacts from theory and indirect evidence; the key reactions simply moved too fast and vanished too completely for conventional techniques to catch them in the act. Raman confocal microscopy could—and it works on a simple principle: illuminate a molecule with a laser, and the scattered light will reveal its identity. The light interacts with each material's unique chemical bonds, shifting in energy to produce a distinct spectral "fingerprint." Even the most fleeting and amorphous phases leave a readable trace.

"We've used Raman spectroscopy to better understand some of the most interesting materials in history, from the Dead Sea Scrolls to Ancient Roman concrete," says Masic. "Cement paste may

seem less glamorous in comparison, but pointing a laser at CO₂-injected cement paste as it hardens allows us to visualize things that haven't been seen before."

What they saw, unfolding during 24 hours of continuous scanning, was a three-act chemical drama.

The moment CO₂ is added to the fresh cement paste, it goes to work. It dissolves into the pore solution...

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Surprising oxidising power of carbon dioxide freed by photochemistry

Chemistry World · 10 Jun 2026

Carbon dioxide can be used to photo-oxidise alkenes into a variety of useful organic molecules under mild conditions, researchers in Germany and elsewhere have shown. The reaction, which requires only an iron-based catalyst, could potentially replace existing processes requiring extreme conditions or toxic reagents.

The iron-based photocatalyst releases oxygen from carbon dioxide that was used to oxidise alkenes into a range of products such as ketones and carboxylic acids

Oxidation reactions account for around 30% of the chemical industry's total output and the oxidative cleavage of the carbon-carbon double bond in alkenes is especially valuable. Ozonolysis is commonly used, but ozone's toxicity and explosive nature present serious safety concerns. Other mechanisms usually require hazardous reagents or conditions or generate toxic byproducts. Even molecular oxygen is a fire hazard in industrial applications.

Carbon dioxide is safe and readily available, but this is a double-edged sword as its stability arises from its weak oxidising power. In 2014, astrochemist William Jackson at the University of California, Davis in the US and colleagues showed that, in extreme ultraviolet light and high vacuum, it could photodissociate into carbon and oxygen – suggesting that this could explain abiotic oxygen production on carbon dioxide-rich exoplanets.

Before seeing the study, organic chemist Shoubhik Das at the University of Bayreuth in Germany and colleagues had already conceived of using the oxygen from carbon dioxide to oxidise organic molecules. However, he says: 'Obviously we needed to overcome these very harsh reaction conditions.' In conjunction with Matthias Beller's catalysis group at the University of Rostock, the team developed a process using an iron-based photocatalyst on a modified carbon nitride support. In a mixed solvent of acetonitrile and trichloromethane the reaction can proceed under near ultraviolet or even visible light under ambient conditions. 'Graphitic carbon nitride is well known to absorb visible light and this light is transferred to the transition metal centre,' explains Das.

Direct splitting is still thermodynamically uphill, but the researchers hypothesise that the adsorption of carbon dioxide on an iron site distorts the molecule into a bent configuration. This lowers the energy required to dissociate it to the point that, when coupled with oxidation of the trichloromethane, the overall bond cleavage becomes favoured on the surface of the catalyst. The researchers demonstrated the production of a wide variety of organic molecules such as carboxylic acids, ketones and the pharmaceuticals donepezil and fenofibrate. They validated their model using...

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How bacteria use acetyl coenzyme as a building block in the formation of cells

Phys Org · 11 Jun 2026

by Elisabeth Böker, University of Greifswald

Researchers at the University of Greifswald have discovered a new mechanism by which bacteria such as *Bacillus subtilis* can regulate the production of the central metabolic molecule acetyl coenzyme A (Acetyl-CoA). Acetyl-CoA, also known as activated acetic acid, is crucial in the production of nutrients, i.e., proteins, carbohydrates and lipids, and thus plays a key role in the metabolism of all cells.

Until now, it was unclear how bacteria coordinate the production and decomposition of activated acetic acid using this pathway. New findings published in the journal *Nature Communications* have now shown that *Bacillus subtilis* uses a special regulatory mechanism to coordinate both processes.

When cells are supplied with an abundance of nutrients, they are forced to decide whether to gain energy or create building blocks for growth. At the heart of this decision-making process is acetyl coenzyme A, which links the decomposition of nutrients with the synthesis of proteins, carbohydrates and lipids, thereby acting as a central hub for the entire metabolism during cell formation.

A Greifswald research team led by Prof. Dr. Michael Lammers from the Institute of Biochemistry has now succeeded in uncovering a previously unknown regulatory mechanism for the production of this important molecule in bacteria such as *Bacillus subtilis*.

In these bacteria, acetyl-CoA is produced from acetic acid, the universal cellular energy source adenosine triphosphate (ATP) and the molecule coenzyme A, which is important for increasing the biochemical reactivity of acetic acid. This reaction is catalyzed in cells by a biocatalyst, the enzyme acetyl-CoA synthetase (AcsA).

The activity of this enzyme can be switched on or off like a light switch by attaching and removing a small biochemical modification, the acetylation of the amino acid lysine. As a consequence, the presence of this modification is decisive for whether acetyl-CoA is formed: If the modification is present, the enzyme AcsA is inactive; if it is not present, it is active.

The research team, led by Lammers and doctoral candidate and first author of the study, Markus Janetzky (M.Sc. Biochemistry), was able to elucidate the structure and function of the AcuB protein at the molecular level. AcuB is a protein that acts as a sensor of the current energy state in cells and coordinates the production of activated acetic acid. It can bind directly to the enzyme AcuC and inhibit its catalytic activity.

Biochemically speaking, AcuC is a so-called deacetylase, which...

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CURIOSITIES

Honeybee trick helps drones fly home without GPS

New Atlas · 8 Jun 2026

Honeybees routinely travel up to 2 miles (3 km) from their hive in search of food before returning home, with remarkable accuracy. Relative to body size, this is comparable to a human traveling hundreds of miles and finding their way back without a map, compass, GPS, or smartphone. Despite possessing brains smaller than a sesame seed, bees accomplish this feat with astonishing efficiency. Now, researchers have adapted those same biological principles into a drone navigation system that can guide lightweight flying robots home using just 42 KB of memory.

Developed by a team led by Delft University of Technology in the Netherlands, the system, dubbed Bee-Nav, enables drones to autonomously navigate and return to their starting point without GPS or computationally intensive mapping systems. The researchers demonstrated the technology in both indoor and outdoor environments, including a flight covering more than 600 m (1,970 ft), while using neural networks thousands of times smaller than those typically associated with modern AI systems.

The work, published in the journal *Nature*, addresses one of the most fundamental challenges in robotics: navigation. Whether inspecting industrial infrastructure, delivering packages, monitoring crops, or exploring disaster zones, autonomous robots must be able to determine where they are and how to get where they need to go.

Modern autonomous drones typically rely on GPS and detailed environmental maps. Another common technique is simultaneous localization and mapping (SLAM), which continuously builds and updates three-dimensional representations of the environment while tracking the robot's position within them. While highly effective, these approaches require significant computing power, memory, and energy, resources that may be difficult to scale down to small flying robots, in which every gram of weight and every milliwatt of power matters.

Honeybees appear to have found a much more efficient solution. Their secret? Odometry, a process that estimates movement based on motion cues gathered during flight. In simple terms, the insect keeps track of roughly how far it has traveled and in what direction, based on its body movements. Much like a person mentally tracking their steps while walking through a dark room. The problem is that these estimates gradually accumulate errors over time, causing the navigational equivalent of a slowly drifting compass.

To compensate, bees also appear to rely on visual memories of their surroundings. Before embarking on longer journeys, they perform short "learning flights" around their hive, carefully observing nearby landmarks and scenery. A sort...

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Intermittent fasting triggers surprising changes in the brain

Science Daily · 18 Feb 2026

More than one billion people worldwide now live with obesity, a condition that raises the risk of cardiovascular disease, diabetes, and several types of cancer. Yet losing weight and keeping it off can be extremely difficult. The body does not simply respond to fewer calories in a straightforward way. Signals from the gut, hormones, metabolism, and the brain can all influence hunger, cravings, and weight regain.

One approach that has drawn growing interest is intermittent energy restriction (IER), a form of dieting in which periods of reduced calorie intake are followed by periods of more typical eating. Research published in 2023 suggests that this strategy may do more than reduce body weight. It may also shift the relationship between gut bacteria and brain activity in ways that are closely tied to appetite and food behavior.

"Here we show that an IER diet changes the human brain-gut-microbiome axis. The observed changes in the gut microbiome and in the activity in addition-related brain regions during and after weight loss are highly dynamic and coupled over time," said last author Dr. Qiang Zeng, a researcher at the Health Management Institute of the PLA General Hospital in Beijing.

To explore what happens inside the body during weight loss, the researchers studied 25 adults with obesity in China. The volunteers, who were about 27 years old on average, had a BMI between 28 and 45.

The team used several tools to track changes over time. Stool samples were analyzed with metagenomics to measure the composition of the gut microbiome. Blood tests were used to monitor metabolic and physiological changes. The researchers also used functional magnetic resonance imaging (fMRI) to examine activity in brain regions involved in appetite, emotion, attention, learning, inhibition, and reward.

"A healthy, balanced gut microbiome is critical for energy homeostasis and maintaining normal weight. In contrast, an abnormal gut microbiome can change our eating behavior by affecting certain brain area involved in addiction," explained coauthor Dr. Yongli Li from the Department of Health Management of Henan Provincial People's Hospital in Henan, China.

A carefully controlled weight loss program

The study began with a 32 day high controlled fasting phase. During this period, participants received meals designed by a dietitian. Their calorie intake was gradually reduced in steps until it reached about one quarter of their basic energy needs.

This was followed by a 30 day low controlled fasting phase. During this stage,...

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Sleep apnea's hidden heart disease trigger found in the gut

Science Daily · 29 Jul 2026

Millions of people worldwide live with obstructive sleep apnea, a common disorder that repeatedly interrupts breathing during sleep. New research in mice suggests that gut microbes and the

compounds they produce may play a surprising role in protecting against some of the condition's most serious consequences, including heart disease.

The findings, presented at ASM Microbe 2026, point to a potential new target for preventing and treating cardiovascular complications linked to sleep apnea.

Obstructive sleep apnea causes repeated pauses in breathing throughout the night. These interruptions reduce oxygen levels and increase carbon dioxide in the body, triggering a range of harmful effects.

Earlier studies have shown that low oxygen levels can alter bile acids, substances produced by the liver, stored in the gallbladder, and released into the intestines to help digest fats. Beyond digestion, bile acids also serve as chemical messengers that interact with receptors throughout the body.

Researchers had previously found that gut microbes can modify bile acids and influence the amount of atherosclerosis, or fatty plaque buildup in the arteries, that develops over time. Because bile acids enter the bloodstream, they can affect tissues and organs far beyond the digestive system.

"We were pretty sure from our previous studies that bile acids, especially microbially modified ones, were a key to regulating the disease so we wanted to know what happens when one of the key receptors for them are missing -- does the disease go away?" said study first author Celeste Allaband, DVM, Ph.D. from the University of California, San Diego.

To investigate, the team studied two groups of mice. One group consisted of mice genetically prone to heart disease, known as ApoE knock-outs. The second group included mice that were also prone to heart disease but lacked a bile acid receptor called the farnesoid X receptor (FXR). These animals are known as ApoE/FXR knock-outs.

Both types of mice were exposed either to normal sleeping conditions with room air or to conditions designed to mimic sleep apnea. Throughout the study, researchers analyzed fecal samples to track changes in gut microbes and metabolites. At the end of the experiment, they examined plaque buildup in the animals' arteries.

The results highlighted an important role for FXR in the development of cardiovascular disease during sleep apnea-like conditions.

"Our study shows that the FXR host receptor, which can be activated or deactivated by bile acids, plays a central role in driving the buildup..."

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This AI-Designed "Universal Vaccine" Could Stop Future Pandemics Before They Start

Sci Tech Daily · 11 Jun 2026

A groundbreaking AI-designed vaccine aims to protect against not only today's coronaviruses, but tomorrow's as well.

A new type of universal coronavirus vaccine has passed its first test in humans, marking an important step toward broader protection against future viral threats.

Researchers from the University of Cambridge and biotechnology company DIOSynVax (DVX) Ltd reported that the experimental vaccine was safe and caused no significant side effects in a clinical trial involving 39 healthy volunteers.

Unlike traditional vaccines that target a specific virus strain, this vaccine was designed to provide protection across the wider Sarbeco coronavirus family. This group includes SARS-CoV-2, the virus responsible for COVID-19, as well as SARS and related coronaviruses found in bats that could potentially spill over into humans in the future.

The vaccine represents a new approach to vaccine development. Instead of focusing on a single known virus, researchers used artificial intelligence and computer modeling to create a "super-antigen" capable of triggering immunity against many related viruses at once.

The antigen is the active ingredient in a vaccine that trains the immune system to recognize and respond to infection. By identifying genetic features shared across the Sarbeco coronavirus family, scientists designed a synthetic antigen intended to provide broad protection, including against viruses that have not yet emerged.

This is the first time a vaccine whose active component was designed entirely through computer simulations has been tested in people.

According to the research team, the technology could eventually be used to develop vaccines against other groups of viruses, including Ebola viruses and influenza viruses.

"We've converted vaccine development from being reactive to being future-proof. Our vaccines will continue to provide protection against viruses even as they mutate into new strains," said Professor Jonathan Heeney from the Lab of Viral Zoonotics, University of Cambridge's Department of Veterinary Medicine, the scientific lead of the research.

He added: "We've overcome the problem of traditional vaccines, which have limited protection. It means we can escape the constant cycle of chasing the virus variants circulating in humans and updating the vaccines to try to catch up, like a dog chasing its tail."

Volunteers between the ages of 18 and 50 received the vaccine at National Institute for Health and Care Research (NIHR) Clinical Research Facilities in Southampton and Cambridge. The study was sponsored by University Hospital Southampton NHS Foundation Trust (UHSFT).

Researchers found that the vaccine generated immune responses not...

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Warming seas impact cell structures that deliver oxygen to coral

Chemistry World · 8 Jun 2026

High temperatures have been shown to disrupt the function of cellular structures that deliver oxygen to corals. The finding reveals a new stress mechanism linking warming seas to coral death.

Corals play a vital role beyond the ocean ecosystem, but they are disappearing quickly as climate change progresses. Now, scientists seeking to understand the biological mechanisms behind coral stress have shown how rising temperatures affect tiny structures called cilia that coat the surface of cells found in the outer layer of coral tissue.

Cilia are threadlike structures, around 10–15 micrometres in length and 500 times thinner than a human hair. They beat in a synchronous wave-like rhythm, moving trapped particles in the coral's mucus to clean the surface and deliver food to the mouth opening. They also create local flows of oxygen-rich water around the coral's surface.

A team led by University of Copenhagen researchers Cesar Pacherres and Michael Kühl was particularly interested in this area of flow, called the concentration boundary layer. They released particles around 500 nanometres in size and coated in an oxygen sensitive dye into the water surrounding the coral and shined a laser on the coral to illuminate the particles. The dye used glows brighter depending on how much oxygen is present.

They captured images with a camera attached to a long-distance microscope and analysed them to determine the movement and concentration of oxygen at the coral surface. Combined with high-speed footage of the cilia beating, the team was able to explore the relationship between movement and oxygen uptake at various temperatures.

It's a method developed specifically for this study. 'We had to come up with new ideas and new ways of visualising things because we are talking [about] very, very small scales, and the techniques were non-existent,' says Pacherres. 'It was a combined effort of a couple of years at least,' he adds.

The team found that under moderate temperature increases the cilia beat more frequently, allowing the coral to keep up with increased metabolic oxygen demands. But at higher temperatures, the metabolic demand for oxygen exceeded the rate at which the cilia could generate sufficient oxygen flow, and the boundary layer progressively lost oxygen.

At 37°C the cilia rhythm collapsed, and the oxygen supply to the corals dropped. 'At that point the coral is in really bad shape ... we could see tissue disintegrating,' says Kühl.

Until now, one of the most reliable...

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The ocean's health may depend on a tiny microbe inside fish

Science Daily · 8 Feb 2026

Scientists have uncovered evidence that tiny microbes living inside fish may be helping drive important processes that affect the world's oceans.

The research, led by former University of Miami graduate student Anthony Bonacolta, suggests that gut bacteria and marine fish work together to produce calcium carbonate, a mineral that plays a significant role in ocean chemistry and the marine carbon cycle. The findings point to a previously overlooked partnership that could influence how oceans store carbon and maintain overall health.

Researchers have long believed that this mineral production was controlled mainly by the fish themselves. The new study indicates that microbes living in the fish intestine may also be essential participants in the process.

Bony fish, known as teleosts, constantly drink seawater to maintain proper hydration. As they process that seawater, excess calcium and carbonate ions are removed from the body and released as solid calcium carbonate pellets called ichthyocarbonates.

"This work suggests that the gut microbiome may play a broader role in both fish biology and global marine nutrient cycles," said one of the study's senior authors, Martin Grosell, Maytag Professor of Ichthyology and chair of the Department of Marine Biology and Ecology. "What was previously thought to be a process driven solely by the fish may actually reflect a close symbiosis between the fish and its gut microbial community."

Testing Fish in Different Salinity Conditions

To investigate the process, researchers conducted laboratory experiments using Gulf toadfish exposed to water with different salt concentrations. The fish were kept in brackish water (9 ppt), normal seawater (35 ppt), and hypersaline water (60 ppt).

Scientists wanted to determine how salinity affects ichthyocarbonate production, which is known to increase as fish adjust to saltier conditions through normal osmoregulation.

The results showed clear differences. Fish living in low-salinity water did not produce ichthyocarbonates. Fish kept in seawater did produce them, and production increased even further in the hypersaline environment.

The research team collected samples from multiple areas of the fish intestine, from the ichthyocarbonates themselves, and from the surrounding water.

DNA and RNA analyses allowed scientists to examine both the microbial communities living in the fish and patterns of gene activity in the fish and associated microbes. Genetic sequencing was used to identify the microorganisms present, while gene expression studies helped reveal potential biological functions connected to calcium carbonate formation.

The researchers found that vibrios, especially *Photobacterium damsela* subsp. *damsela*, were highly...

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The deadly tapeworm spreading across America has reached the Pacific Northwest

Science Daily · 20 Nov 2026

A dangerous tapeworm that has been spreading across North America has now been detected in the Pacific Northwest, according to new research. Scientists found the parasite, known as *Echinococcus multilocularis*, in local coyotes, marking the first time it has been identified in a wild host along the contiguous U.S. West Coast.

The parasite commonly infects coyotes, foxes, and other canids. While these animals often show no signs of illness, the tapeworm can cause severe disease in domestic dogs and humans if transmission occurs.

For decades, *E. multilocularis* has been recognized as a significant public health concern across parts of Europe and Asia. In North America, however, it was once considered exceptionally rare. That changed roughly 15 years ago when infections began appearing in dogs and people in Canada and the Midwest, signaling that the parasite was expanding its range.

Tapeworm Found in Pacific Northwest Coyotes

Researchers from the University of Washington surveyed 100 coyotes in the Puget Sound region and discovered that 37 carried the parasite. Their findings were published in PLOS Neglected Tropical Diseases .

"This parasite is concerning because it has been spreading across North America. There have been numerous cases of dogs getting sick, and a handful of people have also picked up the tapeworm," said lead author Yasmine Hentati, who recently graduated from the UW with a doctorate in environmental and forest science. "The fact that we found it here in one-third of our coyotes was surprising, because it wasn't found anywhere in the Pacific Northwest until earlier this year."

When *E. multilocularis* infects a person or animal, it can produce cancer-like cysts in the liver and, in some cases, other organs. Without treatment, the infection can be fatal.

Despite the danger it poses, many infected animals never become ill. The parasite relies on a complex life cycle involving several different hosts.

Coyotes and other canids serve as the primary hosts for adult tapeworms. These animals can carry thousands of worms in their intestines without becoming sick. The worms release eggs that pass into the environment through feces.

Rodents are another key part of the cycle. After consuming food contaminated with coyote feces, they can become infected. The parasite eggs migrate to the rodents' livers and develop into cysts, eventually weakening or killing the animals. Coyotes then become infected when they eat those rodents, continuing the cycle.

Humans and domestic dogs are considered accidental hosts....

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Scientists investigate origins of a 'ghost particle' 30x more powerful than any other

refractor.io · 11 Jun 2026

Three years ago, a single "ghost particle" soared into the Mediterranean with more energy than any ever observed before.

This ultra-energetic cosmic neutrino challenged previously held conceptions regarding the upper limits of neutrino energy. Its mysterious origins also drew global attention and speculation.

Now, a team of researchers in Italy has presented a new hypothesis, claiming the particle may have originated in a specific class of blazars. In a paper published in the *Journal of Cosmology and Astroparticle Physics*, they explain how they tested several hypotheses in simulations.

Ultimately, they found that the record-breaking neutrino may have come from not just one, but several blazars – colossal cosmic giants with black holes billions of times the size of the Sun at their center.

Blazars are some of the brightest, most energetic objects in the known Universe. They are a particularly luminous type of quasar, as the relativistic jets emanating from their black holes are shining in our direction.

Neutrinos, meanwhile, are arguably the most reliable carriers of information across the cosmos. For decades, scientists have aimed to uncover their secrets.

Unlike photons, neutrinos are largely undisturbed by matter and electromagnetic fields. This allows them to carry information that would otherwise be degraded, meaning they can provide a wealth of information about their source and the wider cosmos.

Their nickname, “ghost particles”, comes from the fact they have virtually no mass and pass effortlessly through solid matter without leaving a trace. In fact, roughly a hundred trillion are flying through you in any one second.

Despite their ubiquity, they are notoriously difficult to detect. They require precise instruments deep below the Earth’s surface to avoid cosmic interference and background noise.

On February 13, 2023, the most powerful neutrino ever observed was discovered by one of these instruments: a deep-sea neutrino detector called the Kilometer Cubic Neutrino Telescope (KM3NeT).

Though it is still under construction 11,300 feet (3,450 meters) beneath the waves, KM3NeT was able to capture an energy reading of approximately 220 PeV – making the 2023 neutrino 30 times more energetic than the previous record holder.

To better understand this ultra-powerful “ghost particle”, scientists at KM3NeT simulated several events and compared the results with real observations. In a press statement , they compared this process to a forensic investigation of a crime scene.

Typically, when a high-energy neutrino is discovered, scientists look for an electromagnetic “counterpart”. This...

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Hidden Phase of Matter Finally Captured After Decades of Predictions

Sci Tech Daily · 11 Jun 2026

Scientists have finally captured a hidden state of matter, revealing a long-predicted phase with intriguing quantum potential.

Researchers from Brown University and the University of Michigan College of Engineering have succeeded in stabilizing a previously elusive state of matter that had existed only in theoretical models.

Using carefully engineered nanoparticles as building blocks, the team created a new material structure that locks in a fleeting intermediate state between two of the most common crystal arrangements found in metals. The achievement not only provides new insight into how materials change their internal structure, but also reveals unusual optical properties that could one day prove useful for quantum computing and other quantum information technologies.

More broadly, the work demonstrates a powerful new strategy for designing materials from custom-made nanoparticles, opening possibilities for creating entirely new materials with tailored characteristics.

“Our work is a little bit like kids playing with LEGO blocks,” said Ou Chen, an associate professor of chemistry at Brown and a corresponding author of the research. “We synthesize unique nanoscale building blocks and stack them into interesting structures. In this case, we were able to stabilize these theorized transitional structures and demonstrate important quantum optical properties.”

Many metals naturally organize their atoms into one of two crystal structures: face-centered cubic (FCC) or body-centered cubic (BCC).

In an FCC arrangement, particles are packed as tightly as possible. Each cube contains particles at its corners and at the center of every face. In a BCC arrangement, particles occupy the cube's corners and a single position at the cube's center. These patterns are among the most common atomic arrangements found in metallic materials.

Some metals can switch between these structures when heated. Iron, for example, changes from BCC to FCC at 912 degrees Celsius. Scientists have proposed several possible mechanisms for how these transformations occur.

One of the best-known explanations is called the Nishiyama-Wassermann pathway. This model predicts a series of temporary intermediate structures that appear as a material shifts from FCC to BCC. Because these transition states are inherently unstable, they have been extremely difficult to observe directly.

The new study successfully recreated those elusive intermediate phases using specially designed silver nanoparticles.

"Materials scientists have cared about how to control the amount of FCC and BCC in their metals for a long time, but the transitions between these phases have been hard to study because they are so unstable," said Tim...

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Why cells started sticking together could help explain how animals first evolved

Phys Org · 11 Jun 2026

A recent study by Ruibao Li and Jennah Dharamshi published in *Nature* may help us understand the beginnings of animal evolution billions of years ago. These findings are the result of a collaboration among researchers at Indiana University Bloomington, the Institute of Evolutionary Biology in Spain and Uppsala University in Sweden, and were led by J. P. Gerdt and Iñaki Ruiz-Trillo.

The researchers found that after feeding a specific bacterium to a unicellular relative of animals, the single cells began to stick to one another, revealing a possible way our ancestors began to evolve into animals billions of years ago.

Animal bodies are made up of trillions of cells that stick together and cooperate. Billions of years ago—before animals evolved—every living thing on Earth was a single-celled organism. Eventually, some of these cells began sticking together, working together and then reproducing as multicellular organisms. Some of these early multicellular organisms evolved into present-day plants or fungi, while others evolved into animals.

How the cells began to stick together and why they did so has long been a mystery to scientists. To get to the bottom of this enigma, Li and his colleagues studied *Ministeria vibrans*, a unicellular organism that shares ancient ancestors with present-day animals.

M. vibrans survives by eating bacteria. Li rigorously tested different bacterial foods until he found one that encouraged single *M. vibrans* cells to stick together and become multicellular. The bacteria got trapped between the aggregating cells, meaning it was more efficient for *M. vibrans* to collect

food by sticking together rather than remaining single-celled organisms. Further, by sticking together, the cells might be able to protect their food from other organisms.

Sticking together also provides opportunities for cells to exchange genes via mating, which may produce new genetic combinations that enable adaptation to new environments.

Li and Dharamshi observed that when *M. vibrans* evolved from unicellular to multicellular, it produced the same proteins that many animal cells use to stick together. The multicellular form of *M. vibrans* also produced many proteins that animal cells use to communicate and coordinate behavior. The team concluded that the unicellular organisms that evolved into animals also likely used these proteins to form multicellular bodies and cooperate.

Li and his colleagues are excited to uncover further insights from the aggregation behavior of *M. vibrans*. Because the organism is much simpler than humans, it is easier to study, meaning it could...

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REACH UPDATE

HEAL comments on the SEAC draft opinion on the proposed restriction of per- and polyfluoroalkyl substances (PFAS)

HEAL · 21 May 2026

HEAL supports SEAC (ECHA Committee for Socio-economic Analysis) draft findings that the proposed restriction on PFAS is the most appropriate measure to address the known risks but cautions that any derogations from the restriction must be time-limited and their need thoroughly justified.

In the comments, HEAL particularly welcomes SEAC's acknowledgement that the severe transboundary pollution with highly persistent PFAS chemicals makes it necessary to address the PFAS risks on a Union-wide basis. Pollution with PFAS is prevalent throughout Europe with about 23 000 known and presumptive contaminated sites documented and approximately 12.5 million Europeans living in communities with drinking water polluted by PFAS.

Despite the very large scale of PFAS pollution in Europe and beyond, EU member states currently have varying policies to protect health from the pollution. While a few countries have national or regional PFAS plans (Austria, Belgium, Denmark, France), most EU member states rely on EU regulations, especially the proposed restriction of PFAS in application of the REACH regulation, underlining the importance of the ongoing work on this restriction.

A continuously growing body of scientific evidence links PFAS exposure to an increased risk of serious, adverse health impacts, such as kidney and testicular cancer, liver disease, higher cholesterol levels, cardiovascular complications, decreased immune response, thyroid disease, hormone disruption, decreased fertility, as well as maternal and neonatal risks and complications.

Furthermore, a 2026 report from the EU Commission estimates the total societal costs, including health and remediation, to be nearly €440 billion by 2050 if no measures to restrict PFAS use are taken. This number only considers the human health costs related to PFAS that are already regulated (PFOA, PFOS, PFHxS and PFNA), meaning that the real health costs of all PFAS pollution are likely even higher. The report also estimates that a full phase-out of PFAS would lead to a fall in health costs from approximately €39.5 billion a year in 2024 to roughly €0.5 billion a year by 2040.

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REGULATORY UPDATE

ASIA PACIFIC

World Ocean Day 2026 Commemoration: "One Action for a Sustainable Ocean"

UNEP · 23 May 2026

In celebration of World Ocean Day 2026, Indonesia's Ministry of Environment/Environmental Control Agency is organizing community-based clean-up activities on 23 May 2026 in Pramuka Island, Kepulauan Seribu, Jakarta, in cooperation with COBSEA, Regional Capacity Center for Clean Seas (RC3S), COBSEA's Regional Activity Centre on Marine Litter, and other government, NGO and local partners. The activities will engage approximately 1,000 participants, including local communities, through dive, snorkeling and island clean-ups to raise awareness and strengthen collective action to prevent marine litter and plastic pollution.

COBSEA is supporting the activity as a partner through its ongoing collaboration with the Secretariat of the Basel Convention, helping strengthen outreach and community engagement on marine litter and plastic pollution prevention and reduction.

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Narromine PFAS bore testing complete

EPA NSW · 4 Jun 2026

The NSW Environment Protection Authority (EPA) has completed initial PFAS residential bore testing in Narromine as part of the EPA's voluntary opt-in Bore Water Screening Program that supports local councils.

Town water supply is safe to drink.

Of 15 private residential bores tested by EPA officers in May, 13 had either no PFAS or PFAS below the Australian Drinking Water Guidelines (ADWG).

Two bores on neighbouring properties had PFAS detected in bore water above the relevant ADWG value and the EPA has provided precautionary advice directly to those residents.

All residents who opted-in for testing have been sent their individual results and information.

The EPA will now look into the extent and nature of PFAS in the area where it was detected and will be in contact with nearby residents in the coming days to offer additional voluntary targeted sampling.

NSW Health recommends that people do not use bore water for drinking, cooking and personal hygiene (including cleaning teeth and bathing) without testing and appropriate treatment.

PFAS is common in our environment and most people are exposed to small amounts through everyday household and industrial items such as packaging, cookware and personal care products.

The EPA's bore testing program is designed to support councils identify possible sources of PFAS, and support longer-term efforts to ensure the town water supply meets drinking water guidelines.

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AMERICA

Colorado approves fee increases to support air quality protections

EDF · 22 May 2026

Colorado updates permit and emissions fees so the cost of maintaining air pollution regulatory services falls on companies instead of taxpayers.

After years of chronic underfunding, today the Colorado Air Quality Control Commission unanimously approved increases to permit and emissions fees to fund the Air Pollution Control Division, also known as "the Division".

The Division is authorized to fund its programs through a combination of fee increases and General Fund contributions, but access to the General Fund is now extremely limited. With both the General Assembly and Joint Budget Committee indicating there will be no new appropriations to the Division, fee increases are currently the only viable way to support healthy air quality protections statewide without increasing the burden on taxpayers.

"The companies that profit from using the state's natural resources should bear the costs associated with controlling pollution, rather than taxpayers who already contend with the health and safety impacts of that pollution. Looking ahead, Colorado regulators should build on this progress by developing a more durable funding structure" said Nini Gu, Senior Regulatory & Legislative Manager at EDF.

State law requires the Division to improve air quality and meet state and federal climate, environmental justice, air toxics, and other regulatory obligations. Approval of this funding will allow the Division to fulfill its responsibilities while avoiding a negative budget balance at the end of fiscal year 2027.

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EUROPE

Government to draft national action plan against PFAS

Government Offices of Sweden · 17 Apr 2026

The Government aims to reduce the spread of PFAS 'forever chemicals' in order to protect the environment and human health. A national action plan to reduce the spread of PFAS into waterways and in nature will be drafted in the coming months.

PFAS substances are now prevalent everywhere in the environment, including inside human beings. It is essential to prevent and address exposure to PFAS and other harmful chemicals. PFAS in the environment pose a particular threat to our drinking water and food.

The State Secretary met with sectoral organisations

A national action plan to reduce the spread of PFAS will be drafted the coming months. State Secretary Daniel Westlén met with stakeholders representing several sectoral organisations to hear their thoughts and proposals on how to manage and prevent PFAS contamination.

Those organisations operate in sectors such as waste management, recycling, water purification, agriculture, aviation, forestry and technology. They discussed the challenges in reducing PFAS contamination, such as carrying out and financing decontamination, developing alternatives to PFAS and implementing actions at national level.

There was consensus among the participants that the problem is both large-scale and urgent, but at the same time they pointed out the recent gains in knowledge of how PFAS are circulated and how to destroy them. Several of the organisations highlighted the need for stronger coordination at national level and emphasised that measures taken at national level must work in tandem with regulations at EU level.

They also stressed the need for major investments in research and development in alternatives to PFAS.

Government agencies discussed PFAS pollution

The Ministry has also met with around 15 relevant government agencies responsible for issues including nature conservation, agriculture, food, and the defence sector in order to obtain their views on the work. The agencies agreed that long-term efforts are required to reduce pollution from PFAS. They emphasized that it is important both to reduce the inflow of new emissions and to limit the spread from already contaminated areas.

Among the issues raised in the discussion with the agencies were collaboration and learning from each other, an overview of groundwater contamination; financial and practical responsibility for the remediation of contaminated areas, guidance for supervision, and opportunities and challenges with the substitution of PFAS in certain areas of use.

Several countries have already drafted national plans, including Austria, Denmark and France. These action plans integrate environmental monitoring, human biomonitoring, market monitoring, decontamination efforts and measures to better inform the general public and communicate the risks associated with PFAS.

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Advanced materials: Research for safety over the lifecycle

BAM · 26 May 2026

Advanced materials hold the potential to address global and societal challenges in e.g. health care, energy transition and substituting substances of concern or critical raw materials. However, to fully exploit societal benefits of advanced materials, their safety for man and the environment as well as sustainability over the whole life cycle is of central relevance. This includes to avoid or mitigate potential adverse impacts related to the production, use and end of life of advanced materials in a

timely manner. In response to the European Commission's communication on 'Advanced Materials for Industrial Leadership', the German Environment Agency (UBA), the Federal Institute for Materials Research and Testing (BAM), the Federal Institute for Occupational Safety and Health (BAuA), the German Federal Institute for Risk Assessment (BfR), the National Metrology Institute (PTB) have published a strategic agenda for research in the field of safe advanced materials.

Considering that material innovations are funded with the objective to provide safer and more sustainable solutions compared to conventional chemicals and applications, it has to be ensured that the materials themselves are safe. However, safety research usually lags behind innovation. Therefore, the German federal authorities responsible for human and environmental safety, and metrology are accompanying the rapid pace of innovation of advanced materials with a long-term research strategy focusing on research needs from a regulatory perspective.

The strategy aims to guide and prioritise the German federal authorities' research, but also intends to inform policy makers, funding bodies and the scientific community on regulatory relevant research needs for safe advanced materials. The presented strategy provides an agenda to safety research supporting Regulatory Preparedness for regulators and "Safe and Sustainable by Design" (SSbD) for innovators.

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PFAS: Six months after France bans 'forever chemicals,' the law is still not enforced

Le Monde · 4 Jun 2026

Since January 1, France has banned per- and polyfluoroalkyl substances (PFAS, or "forever chemicals") in cosmetics, textiles used for clothing, shoes and ski wax. However, six months after the effective date of this key measure of the PFAS law (which was passed on February 27, 2025), it has still not been enforced and may not be for many more months. According to information obtained by Le Monde, the Directorate General for Competition Policy, Consumer Affairs and Fraud Control (DGCCRF) still lacks the appropriate inspection resources needed to fully enforce the law.

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INTERNATIONAL

WHO launches advocacy, communications and partnerships plan on the health response to climate change, air pollution and energy poverty

UNEP · 18 May 2026

The World Health Organization (WHO) today publishes its advocacy, communications and partnerships plan "WHO at the heart of the health response to climate change, air pollution and energy poverty (2025–2028)", translating the mandate set by Member States at the Seventy-eighth World Health Assembly into a coordinated programme of action to position health at the center of global climate, clean air and energy agendas.

In May 2025, Member States adopted the Global Action Plan (GAP) on Climate Change and Health (2025–2028), in response to resolution WHA77.14 and the updated roadmap on air pollution and health (EB156/24) in response to resolution on addressing the health impact of air pollution (WHA68/18).

The new advocacy, communications and partnerships plan operationalises that mandate, ensuring the political commitments made by Member States are matched by practical strategies to build momentum, unite stakeholders and deliver lasting health and climate benefits.

The case for action is well established. More than seven million people die each year from air pollution and health systems contribute close to five percent of global greenhouse gas emissions. Meanwhile, only around 0.5 percent of multilateral climate finance is allocated to projects that explicitly aim to protect or improve human health. While the need for action is undoubtedly clear, and member states have a climate and health mandate, closing the gap to ensure climate action that saves lives now requires strategic partnerships, evidence-based communication, and advocacy support. The plan aims to bridge this gap.

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As cities grow and climate risks rise, new UNEP report shows path to climate-resilient buildings

UNEP · 19 May 2026

Launched at the World Urban Forum, the Global Status Report for Buildings and Construction 2025–2026 warns that as cities expand rapidly and climate risks intensify, progress to decarbonize buildings is not happening fast enough to meet global climate goals.

While buildings are becoming more energy efficient, progress remains far too slow. Investment in building energy efficiency must more than double — reaching US\$5.9 trillion by 2030 — to keep climate goals within reach and deliver healthier, more resilient cities.

With roughly half of the buildings that will exist in 2050 yet to be built or renovated, the report highlights a major opportunity to shape healthier, more affordable and more climate-resilient buildings.

From homes and schools to hospitals and offices, buildings shape almost every part of daily life — influencing health, comfort, safety, energy bills and quality of life. The buildings and construction sector is also a cornerstone of the global economy, representing 11–13 per cent of global gross domestic product and employing around 9 per cent of the world's workforce across construction, renovation and engineering.

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Climate action key to affordable housing, but buildings decarbonisation stalls

UNEP · 19 May 2026

Buildings' operational emissions increased by 1 per cent to 9.9 GtCO₂ in 2024

Globally, buildings are becoming more energy efficient, but progress is too slow to meet climate goals

USD 5.9 trillion in investment in energy efficiency is needed by 2030

Decarbonisation of the buildings and construction sector has slowed, leaving it both a major emissions source and increasingly vulnerable to climate impacts and energy price shocks, according to a new report from the UN Environment Programme (UNEP) and the Global Alliance for Buildings and Construction (GlobalABC).

The tenth edition of the Global Status Report for Buildings and Construction (2025-2026) assesses progress across the sector using seven key indicators covering policies, finance, technologies, and investment aligned with global commitments towards a 2050 net-zero emissions pathway.

Published amid a global housing and energy affordability crisis, the report highlights how climate action in buildings can reduce energy bills, improve living conditions, and strengthen resilience to climate impacts, while cutting greenhouse gas emissions.

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WHO introduces PREVENT technical package to address lead poisoning

WHO · 18 May 2026

On the margins of the 79th World Health Assembly, the World Health Organization (WHO) offered a first look at its forthcoming PREVENT Technical Package on Lead Poisoning Prevention and invited Member States and other stakeholders to provide inputs as the full package is developed in the coming year. At an event co-organized with Bloomberg Philanthropies and Resolve to Save Lives, the overview module -- published as a discussion paper -- sparked dialogue between national and global health leaders about the urgency of lead poisoning prevention and the way forward.

Lead poisoning is responsible for an estimated 3.5 million cardiovascular-related deaths each year and affects up to 815 million children—one in three globally—resulting in lowered cognitive functioning, educational attainment, and lifetime income. Workers in the lead industry, pregnant women and children are the most at-risk, with the burden falling disproportionately on people living in low- and middle-income countries (LMICs) where 90% of deaths linked to lead poisoning occur.

Despite progress in removing lead from petrol and paint, it remains present in many common household items such as cosmetics, cookware, and spices. There is no safe level of exposure; even low levels of exposure over time can cause irreversible harm with devastating health, environmental, and economic costs.

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HAZARD ALERT

Acetone

12 Jun 2026

Acetone (also known as propanone, dimethyl ketone, 2-propanone, propan-2-one and β -ketopropane) is a common industrial solvent and the simplest representative of the ketone group of solvents with the molecular formula CH_3COCH_3 . A colourless, flammable liquid at room temperature, it occurs naturally and is also chemically synthesised. Acetone is miscible with water, ethanol, and ether and itself serves as an important solvent. [1]

It can polymerise rapidly due to heating and under the influence of air, light and on contact with a catalyst, strong oxidisers and metals such as copper and aluminium, with fire or explosion hazard. As a gas mixed with air, acetone is a fire and explosion hazard. On standing, acetone can form peroxides, which may then explode. Acetone will react with iron and steel in the presence of moisture. It is also capable of dissolving plastic glasses frames, jewellery, pens and pencils, rayon stockings and other rayon garments. [2]

Acetone is also produced and disposed of in the human body through normal metabolic processes. It is normally present in blood and urine. People with diabetes produce it in larger amounts. [3]

Uses [2]

Acetone is used as a solvent for fats, oils, waxes, resins, rubber, plastics, lacquers, varnishes and rubber cements. It is used to make many chemical compounds, rayon, photographic films, plastics, fibres, drugs and other chemicals, for storing acetylene gas, and is present in paint and varnish removers, purifying paraffin and for hardening and dehydrating tissues.

In the Environment [4]

A large percentage (97%) of the acetone released during its manufacture or use goes into the air. In air, about one-half of the total amount breaks down from sunlight or other chemicals every 22 days. It moves from the atmosphere into the water and soil by rain and snow. It also moves quickly from soil and water back to air. Acetone doesn't bind to soil or build up in animals. Microorganisms in soil and water break it down. Acetone can move into groundwater from spills or landfills. It is broken down in water and soil, but the time required for this to happen varies.

Sources & Routes of Exposure [2,4]

Sources of Exposure

- Industry sources: Acetone is produced as a result of manufacturing basic chemicals, plastic products, non-ferrous metals, iron and steel, fabricated metal products, motor vehicles and motor vehicle parts, photographic and scientific equipment, wood products, ceramic products,

cement, lime, plaster and concrete products, meat and meat products, rubber products, paper, paper products and industrial machinery. In addition, it is emitted from printing processes, mineral, metal and chemical wholesaling, water supply, sewerage and drainage services and coal mining.

- Diffuse sources: Solid fuels burning for heating in the home and for barbeques and incinerators are thought to be the highest sources of emissions of acetone. It is also present in solvents and aerosols used in the home. Acetone is present in tobacco smoke and landfill sites and is emitted as a result of using lawnmowers.
- Natural sources: Acetone occurs naturally in plants, trees, volcanic gases, forest fires and as a product of the breakdown of body fat.
- Transport sources: Acetone is present in the vehicle exhaust of cars, aeroplanes and from railway operations.
- Consumer products: Acetone is a common ingredient in domestic products. It is found in aerosol paints, architectural coatings, automotive and machinery paints and primers, furniture polish and cleaners, household hard surface cleaners, laundry pre-soaks, pet flea and tick removers, cockroach treatments, laundry starches, lubricating greases and oils, nail enamel and polish and polish remover, particleboard, paints (including interior clear finishes, undercoats and primers), varnish, paint and varnish removers and thinners, liniments for veterinary preparations, pharmaceutical preparations, pre-moistened towelettes, shoe polish, sun tan lotions and oils, and in wood office furniture.

Routes of Exposure

Exposure to acetone occurs via:

- Breathing low background levels in the environment.
- Breathing higher levels of contaminated air in the workplace or from using products that contain acetone (for example, household chemicals, nail polish, and paint).
- Drinking water or eating food-containing acetone.
- Touching products containing acetone.
- For children, eating soil at landfills or hazardous waste sites that contain acetone.
- Smoking or breathing second hand smoke.

Health Effects [4]

Acute Effects

Upon exposure to acetone, it enters your bloodstream where it is carried to all the organs of the body. If it is a small amount, the liver breaks it down to chemicals that are not harmful and uses these chemicals to make energy for normal body functions. Breathing moderate- to-high levels of acetone for short periods of time, however, can cause nose, throat, lung, and eye irritation; headaches; light-headedness; confusion; increased pulse rate; effects on blood; nausea; vomiting; unconsciousness and possibly coma; and shortening of the menstrual cycle in women. Swallowing very high levels of acetone can result in unconsciousness and damage to the skin in your mouth. Skin contact can result in irritation and damage to your skin. The smell and respiratory irritation or burning eyes that occur from moderate levels are excellent warning signs that can help you avoid breathing damaging levels of acetone.

Chronic Effects

Health effects from long-term exposures are known mostly from animal studies. Kidney, liver, and nerve damage, increased birth defects, and lowered ability to reproduce (males only) occurred in animals exposed long-term. It is not known if the same effects would occur in humans.

Carcinogenicity

The Department of Health and Human Services, the International Agency for Research on Cancer, and the Environmental Protection Agency (EPA) have not classified acetone for carcinogenicity. Acetone does not cause skin cancer in animals when applied to the skin. It is unknown if breathing or swallowing acetone for long periods will cause cancer. Studies of workers exposed to it found no significant risk of death from cancer.

Safety [5]

First Aid Measures

- Eye Contact: Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Get medical attention.
- Skin Contact: In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.
- Serious Skin Contact: Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.
- Inhalation: If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention if symptoms appear.
- Serious Inhalation: Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.
- Ingestion: Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.

Fire & Explosion Information

- Acetone is flammable
- Auto-ignition temperature is 465°C (869°F)
- Flash Points: closed cup -20°C and open cup -9°C
- Acetone is highly flammable in presence of open flames and sparks, of heat.
- Acetone is soluble or dispersed in water.
- Dry chemical powder should be used to extinguish small fires
- Alcohol foam, water spray or fog should be used to extinguish large fires
- Vapour may travel considerable distance to source of ignition and flash back.
- Acetone forms explosive mixtures with hydrogen peroxide, acetic acid, nitric acid, nitric acid + sulfuric acid, chromic anhydride, chromyl chloride, nitrosyl chloride, hexachloromelamine, nitrosyl perchlorate, nityl perchlorate, permonosulfuric acid, thiodiglycol + hydrogen peroxide,

potassium ter-butoxide, sulfur dichloride, 1-methyl-1,3-butadiene, bromoform, carbon, air, chloroform, thitriazolperchlorate

Handling & Storage

Keep away from incompatibles such as oxidising agents, reducing agents, acids, alkalis. Store in a segregated and approved area (flammables area). Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Keep away from direct sunlight and heat and avoid all possible sources of ignition (spark or flame).

Exposure Controls & Personal Protection

Exposure Controls

- Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapours below their respective threshold limit value.
- Ensure that eyewash stations and safety showers are proximal to the workstation location.

Personal Protective Equipment

The recommended personal protective equipment are as follows:

- Splash goggles
- Lab coat
- Vapour respirator (be sure to use an approved/certified respirator or equivalent)
- Gloves

Personal Protection in Case of a Large Spill:

- Splash goggles
- Full suit
- Vapour respirator
- Boots
- Gloves
- A self-contained breathing apparatus should be used to avoid inhalation of the product.

Note: Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Regulation [2,4,5,6]

United States

OSHA: The Occupational Safety and Health Administration (OSHA) has set a maximum concentration limit in workplace air of 1,000 ppm or 2400 mg/m³ for an 8-hour workday over a 40-hour week to protect workers.

NIOSH: The National Institute for Occupational Safety and Health (NIOSH) recommends an exposure limit of 250 ppm or 590 mg/m³ in workplace air for up to a 10-hour workday over a 40-hour workweek.

Australia

Safe Work Australia: Safe Work Australia have set the following exposure limits for acetone:

- Eight-hour Time Weighted Average (TWA) of 500ppm or 1185 mg/m³
- A 15-minute short-term exposure limit (STEL) of 2375 milligrams per cubic metre of air is recommended.

United Kingdom

- TWA: 750 STEL: 1500 (ppm)
- TWA: 1810 STEL: 3620 (mg/m³)

References

- <http://toxipedia.org/display/toxipedia/Acetone>
- <http://www.npi.gov.au/substances/acetone/index.html>
- <http://en.wikipedia.org/wiki/Acetone>
- <http://www.atsdr.cdc.gov/toxfaqs/tfacts21.pdf>
- <http://www.sciencelab.com/msds.php?msdsId=9927062>
- <http://www.cdc.gov/niosh/npg/npgd0004.html>

JANET'S CORNER

Who Am I?

12 Jun 2026

I am born from an ancient Roman recipe that has outlasted empires, yet my modern incarnation is barely two centuries old.

My strength comes from a carefully orchestrated crystalline dance between calcium silicates and water, a process that can take years to reach full maturity.

I am the world's most-consumed material by mass, covering highways, skyscrapers, and dams, yet my production accounts for roughly 8% of global CO₂ emissions.

My primary binder is Portland cement, I'm mixed with water, sand, and aggregates, and I harden into the gray foundation of modern civilization.