

CHEMWATCH

# BULLETIN

Week of 6 March 2026

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## Paper mill waste could unlock cheaper clean energy

Science Daily, May 29, 20 · 29 May 2020

Researchers have developed a catalyst sourced from renewable plant waste that shows strong potential for speeding up clean hydrogen production. The material is produced by embedding nickel oxide and iron oxide nanoparticles into carbon fibers made from lignin, creating a structure that improves both efficiency and durability during the oxygen evolution reaction, a crucial part of water electrolysis.

The study, published in *Biochar X*, reports that the catalyst reaches a low overpotential of 250 mV at 10 mA cm<sup>2</sup> and remains highly stable for more than 50 hours when operating at elevated current density. These performance levels point to a viable, low cost alternative to the precious metal catalysts typically used in large-scale water splitting.

"Oxygen evolution is one of the biggest barriers to efficient hydrogen production," said corresponding author Yanlin Qin of the Guangdong University of Technology. "Our work shows that a catalyst made from lignin, a low-value byproduct of the paper and biorefinery industries, can deliver high activity and exceptional durability. This provides a greener and more economical route to large-scale hydrogen generation."

### Transforming Lignin Into a Functional Carbon Framework

Lignin is one of the most abundant natural polymers, yet it is often burned for minimal energy return. In this work, the team converted lignin into carbon fibers using electrospinning and thermal treatment. These fibers serve as a conductive and supportive framework for the metal oxide particles. The resulting catalyst, known as NiO/Fe<sub>3</sub>O<sub>4</sub>@LCFs, contains nitrogen-doped carbon fibers that offer fast charge transport, high surface area, and strong structural stability.

Microscopy revealed that the nickel and iron oxides form a nanoscale heterojunction within the carbon fiber structure. This interface plays a central role in the oxygen evolution reaction by helping intermediate molecules bind and detach at optimal rates. Pairing these metal oxides with a conductive carbon network improves electron movement and prevents the particles from clumping together, which is a frequent issue in conventional base metal catalysts.

### Verified Activity Through Advanced Testing

Electrochemical measurements showed that the material performs better than catalysts containing only one metal, especially under the high current conditions needed for real world electrolysis systems. The catalyst also exhibits a Tafel slope of 138 mV per decade, indicating more rapid reaction kinetics. Additional evidence from in situ Raman spectroscopy and density functional theory calculations supports the proposed mechanism, confirming that the engineered interface efficiently drives oxygen evolution.

### Scalable Design Using Widely Available Biomass

"Our goal...

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## New catalyst makes plastic upcycling 10x more efficient than platinum

Science Daily, Nov. 14, 2026 · Nov. 14, 2026

Many common products, including plastics and detergents, rely on chemical reactions that depend on catalysts made from precious metals such as platinum. These metals are effective but costly and limited in supply. For years, scientists have been searching for alternatives that are cheaper and more sustainable. One promising option is tungsten carbide, an Earth-abundant material already widely used in industrial machinery, cutting tools, and chisels.

Despite its potential, tungsten carbide has not been easy to use as a catalyst. Its chemical behavior can be unpredictable, which has restricted its broader adoption. Researchers led by Marc Porosoff, an associate professor in the University of Rochester's Department of Chemical and Sustainability Engineering, have now made important progress that could allow tungsten carbide to compete with platinum in key chemical reactions.

According to Sinhara Perera, a chemical engineering PhD student in Porosoff's lab, one of the main challenges lies in how tungsten carbide atoms arrange themselves.

Tungsten carbide's atoms can form many different configurations, known as phases, says Perera. These phases can strongly influence how well the material performs as a catalyst.

"There's been no clear understanding of the surface structure of tungsten carbide because it's really difficult to measure the catalytic surface inside the chambers where these chemical reactions take place," she says.

To address this problem, the research team designed a method to precisely control the structure of tungsten carbide during active reactions. In a study published in *ACS Catalysis*, Porosoff, Perera, and chemical engineering undergraduate student Eva Ciuffetelli '27 manipulated tungsten carbide particles at the nanoscale inside chemical reactors that operate at temperatures above 700 degrees Celsius.

Using a technique called temperature-programmed carburization, the researchers created tungsten carbide catalysts in specific phases directly inside the reactor. They then ran chemical reactions and analyzed which versions delivered the strongest performance.

"Some of the phases are more thermodynamically stable, so that's where the catalyst inherently wants to end up," says Porosoff. "But other phases that are less thermodynamically stable are more effective as catalysts."

The team identified one phase in particular,  $\beta$ -W<sub>2</sub>C, that showed exceptional performance in reactions that convert carbon dioxide into key building blocks for fuels and useful chemicals. With additional optimization by industry, the researchers believe this form of tungsten carbide could match platinum's effectiveness without its high price or supply limitations.

Beyond carbon dioxide conversion, Porosoff and his collaborators have also explored tungsten carbide as a catalyst...

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## How a California desalination plant could help solve water shortages on the Colorado River

Phys Org, 4 March 2026 · 4 Mar 2026

With desert cities like Phoenix and Tucson bracing for their allotments of Colorado River water to be slashed dramatically, San Diego County's water agency could for the first time sell some of its water to other states by drawing on its ample supplies from the nation's largest desalination plant.

The San Diego County Water Authority's board unanimously approved an initial agreement last week to consider selling some of its water to Arizona and Nevada, where cities that depend on the over-tapped

Colorado River are expected to face substantial cuts in water supplies.

General Manager Dan Denham said the agreement, if approved by other agencies, could clear the way for the first-ever interstate transfers of Colorado River water starting next year.

"It's just a different way of managing water in the West," Denham said. "I think it has to happen now, and it has to happen because of the situation on the river."

The Colorado River provides water for farms, cities and tribal communities across seven states and northern Mexico. Its reservoirs have declined dramatically over the last 25 years as drought compounded by climate change has shrunk the river flow.

Negotiators for the seven states, despite extensive talks, remain at odds on the water cutbacks each should accept to prevent reservoirs from declining further.

Officials at San Diego County Water Authority plan to consider selling water across state lines by letting agencies in Arizona and Nevada purchase some of its Colorado River supplies. The revenue generated, the San Diego County agency says, would be used to reduce costs for its ratepayers.

The agreement—technically a memorandum of understanding—first would need to be approved by the Metropolitan Water District of Southern California, the federal government and agencies in Arizona and Nevada. Then, various water agencies would need to negotiate the details.

The San Diego County Water Authority serves as a wholesaler, delivering water to 22 cities and other agencies that serve 3.3 million people.

The authority is in a position to sell a portion of the region's water because it has invested heavily in securing additional water supplies from the Claude "Bud" Lewis Carlsbad Desalination Plant, which since 2015 has been drawing in seawater and churning out a portion of the area's drinking water. The authority secured additional water through a 2003 agriculture-to-urban transfer deal.

These and other investments have brought San Diego County plentiful water—though as a result, the region...

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## **PFAS found in most americans linked to rapid biological aging**

Science Daily, Feb. 23, 2023 · Feb. 23, 2023

Per- and polyfluoroalkyl substances (PFAS), often called 'forever chemicals', include thousands of manmade compounds used in non-stick cookware, water-resistant clothing, fire-fighting foams, food packaging, cleaning supplies, and plastics. Their chemical structure is built on extremely strong molecular bonds, allowing them to resist breaking down in the environment.

As a result, PFAS have spread widely. They are now routinely detected in water, soil, wildlife, and human tissue. Some of these compounds have been linked to serious health problems, including certain cancers, obesity, infertility, and hormone disruption.

Several older, so-called 'legacy' PFAS, including perfluorooctanesulfonic acid (PFOS), perfluorooctanoic acid (PFOA), and perfluorohexane sulfonate (PFHS), have been targeted for global phaseout under the 2001 Stockholm Convention on Persistent Organic Pollutants. However, newer PFAS have since entered the market, including uses tied to emerging technologies such as AI data centers.

### **Study Links Specific PFAS to Faster Biological Aging**

"Here we show that specific forever chemicals, namely perfluorononanoic acid (PFNA) and perfluorooctanesulfonamide (PFOSA), appear to accelerate biological aging, with middle-aged men being the most vulnerable group," said Dr. Xiangwei Li, a professor at Shanghai Jiao Tong University School of Medicine in China and the corresponding author of a new study in *Frontiers in Aging*.

"These findings suggest that some newer PFAS alternatives are not necessarily low-risk replacements and warrant serious attention regarding their environmental impact."

To investigate, Li and colleagues analyzed publicly available data from 326 older adults who participated in the US National Health and Nutrition Examination Survey between 1999 and 2000. The group was nationally representative and randomly selected. Blood samples from each participant were tested for 11 different PFAS. Researchers also examined the DNA 'methylome' -- an epigenetic marker regulating gene expression -- in blood cells. Participants completed questionnaires detailing their demographics, socioeconomic status, and lifestyle habits.

Using these methylation patterns, the team applied 12 established and newer 'epigenetic clocks' to estimate each person's biological age. Biological age reflects how old the body appears at a cellular level, which may differ from chronological age. Earlier NHANES research has suggested that higher PFAS levels in the blood are associated with faster biological aging, possibly due to inflammation.

PFNA and PFOSA were detected in 95% of participants. Higher levels of these two chemicals were strongly linked to accelerated epigenetic aging in men between 50 and 64 years old. This association was not observed in women.

PFNA and PFOSA were first developed in the 1950s and...

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## AI Finds a Hidden Signal That Could Unlock Faster Solid-State Batteries

Sci Tech Daily, 4 March 2026 · 4 Mar 2026

A new AI-driven technique spots the telltale Raman signal of liquid-like ion motion—helping scientists rapidly identify materials for next-generation solid-state batteries.

All-solid-state batteries (ASSB) are widely viewed as a safer and potentially more energy-dense alternative to conventional lithium-ion batteries. Their performance relies heavily on how quickly ions can move through solid electrolytes. Finding materials that enable this rapid ion transport has traditionally required extensive synthesis and experimental testing. Researchers also rely on computer simulations, but many existing computational approaches struggle to accurately represent the disordered and high-temperature conditions where ions move most freely.

Predicting when ions will move through a solid in a liquid-like way has been especially difficult. Standard computational methods that simulate these complex systems demand enormous computing resources, making them impractical for screening large numbers of candidate materials.

To overcome these challenges, researchers developed a machine learning (ML) accelerated workflow that combines ML force fields with tensorial ML models to simulate Raman spectra. Their results show that strong low-frequency Raman intensity can serve as a clear spectroscopic marker of liquid-like ion conduction.

When ions travel through a crystal lattice in a fluid-like manner, their motion temporarily disturbs the symmetry of the structure. This disturbance relaxes the normal Raman selection rules and produces distinctive low-frequency Raman scattering. These spectral signals are closely associated with high ionic mobility. The new method achieves near-ab initio accuracy when simulating vibrational spectra of complex, disordered materials at realistic temperatures, while also lowering computational costs.

The team applied this workflow to sodium-ion conducting materials such as  $\text{Na}_3\text{SbS}_4$ . In these materials, strong low-frequency Raman features appeared when ions moved rapidly through the lattice. These signals arise from symmetry breaking caused by fast ion transport and provide a reliable indicator of efficient ionic conduction. The method also helps explain experimental observations reported in earlier studies and creates new opportunities for high-throughput screening of superionic materials.

The researchers confirmed the approach using several sodium-ion conductors. The model consistently identified Raman features linked to liquid-like ion motion. Materials that showed strong low-frequency Raman signals also exhibited high ionic diffusivity and dynamic relaxation of the host lattice.

In contrast, materials where ions move primarily by hopping between fixed positions did not produce the same spectral signatures. This difference highlights the connection between diffusive ion motion and the Raman features identified by the model.

By extending the concept of Raman selection rule breakdown beyond traditional...

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## New Hydrogel Micromachines May Transform How We Study Living Tissues

Sci Tech Daily, 4 March 2026 · 4 Mar 2026

Scientists have engineered a lab-on-a-chip system capable of applying precisely controlled mechanical forces to biological materials that mimic the extracellular matrix.

Inside the body, cells are surrounded by intricate three-dimensional scaffolds called the extracellular matrix. The physical interactions between cells and this surrounding structure are essential for many biological functions.

Researchers at the Max Planck Institute for the Science of Light have created a new lab-on-a-chip platform built around responsive hydrogel structures. This system can apply carefully controlled pressure to tiny cellular environments. The approach may eventually support medical diagnostics aimed at detecting mechanical abnormalities in living tissues.

The extracellular matrix is constantly reshaped by mechanical forces. This remodeling is vital for normal development, the maintenance of physiological balance (homeostasis), and wound repair.

Reproducing these mechanical changes under laboratory conditions helps scientists better understand how diseases arise. Earlier technologies, however, were difficult to incorporate into compact lab-on-a-chip devices and did not provide the level of precision required for detailed studies.

Dr. Katja Zieske, who leads the independent research group “Molecular Biophysics & Living Matter” at the institute, and her colleagues have now introduced a technique that enables precise control of mechanical disturbances within biological polymer networks on a chip. These disturbances can be applied at defined locations and times. Researchers can then observe how the affected biological structures respond under a microscope.

The system relies on intelligent hydrogel microstructures. Hydrogels are polymer-based materials that change their shape when exposed to specific triggers such as light or temperature. Depending on the stimulus, they either shrink or swell.

The team harnessed this behavior to generate well-defined mechanical forces within biological materials, including collagen networks. They also tested whether the setup is compatible with living cells, which is crucial for future biomedical applications.

To begin, the researchers fabricated and refined thermoresponsive hydrogel microstructures inside flow chambers. By applying controlled temperature changes over specific time intervals, they induced the hydrogels to expand and compress surrounding molecular networks. These included Matrigel, a gel-like mixture of proteins, and collagen.

After compression, the scientists measured how each material responded. Matrigel showed plastic deformation, meaning it retained its altered shape. Collagen behaved differently and returned toward its original form, demonstrating elastic relaxation. By reproducing pressure forces similar to those generated by cells, the researchers established a flexible platform for studying how mechanical stress

reshapes biological environments. Future work could explore how the extracellular matrix adapts under force and...

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## From water splitting to H<sub>2</sub>O<sub>2</sub>: A new method narrows carbon nitride photocatalyst design

Phys Org, 4 March 2026 · 4 Mar 2026

by Simon Schmitt, Helmholtz Association of German Research Centres

Photocatalysis promises an efficient conversion of abundant solar energy into usable chemical energy. Polyheptazine imides have some key structural and functional twists that make them especially interesting for photocatalysis. So far, there is only limited knowledge about how structural changes affect the electronic and optical properties of the many material candidates in this class. A team led by researchers from the Center for Advanced Systems Understanding (CASUS) at HZDR has now presented a reliable and reproducible theoretical method to solve this challenge that was confirmed by measurements done on genuine candidate materials.

Polyheptazine imides belong to the family of carbon nitrides, which are layered, graphene-like compounds composed of nitrogen-rich, ring-shaped units. Unlike graphene, which exhibits excellent electrical conductivity but lacks photocatalytic activity, polyheptazine imides possess band gaps suitable for visible-light absorption.

Carbon nitride-based materials impress due to their low production cost, nontoxicity and thermal stability. However, the first generation of such materials were not ideal photocatalysts as the materials possessed properties that hindered charge separation. If a material has a low charge separation, the electron excited by an incoming photon quickly recombines with the hole it was propelled from—and releases energy only as heat or light. No energy is available to drive chemical reactions.

"Polyheptazine imides containing positively charged metal ions exhibit markedly improved charge separation. This feature renders them highly suitable for practical applications," says Dr. Zahra Hajiahmadi, first author of the article published in the *Journal of the American Chemical Society*.

Better materials are, for instance, needed to realize the expected economic potential of photocatalytic reactions like water splitting (to produce hydrogen as a fuel), carbon dioxide reduction (to produce basic carbohydrates as fuels or industrial chemicals) or hydrogen peroxide production (as a basic industrial chemical). To successfully design a polyheptazine imide material that catalyzes a desired reaction smoothly, researchers have to fine-tune every aspect of the material. Obviously, this cannot be done by synthesizing every possible candidate material. This is where computer science comes to the rescue.

"The design space is enormous," says Prof. Thomas D. Kühne, Director of CASUS, leader of the CASUS research team Theory of Complex Systems and senior author of the new publication. "One can, for example, add functional groups on the surface or substitute specific nitrogen or carbon atoms with oxygen or phosphorus atoms." Kühne's group at CASUS is developing novel numerical...

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## Ocean carbon storage boosted by alkalinity enhancement, finds open-water trial

Chemistry World, 2 March 2026 · 2 Mar 2026

As the world struggles to cut emissions, attention has turned to carbon capture as part of the climate solution – plucking carbon from the air and locking it away long term. One novel approach is to increase ocean alkalinity, which forces it to draw down additional carbon dioxide from the atmosphere. This week, a US team revealed promising provisional results from an experiment of ocean alkalinity

enhancement (OAE) in an open marine environment. They say they quantified the carbon uptake while observing minimal impact on the ecosystem.

The ocean is the largest carbon sink on Earth, holding about 38,000GT of carbon. That's 40 times more than in the atmosphere and 15–20 times more than the carbon stored in all the world's land plants and soils.

Seawater is already naturally alkaline because it contains dissolved minerals and ions – released from rocks, shells and sediments – that can neutralise acids. This alkalinity causes the ocean to draw down carbon dioxide from the atmosphere, where it forms carbonic acid, which then dissociates into bicarbonate and hydrogen ions.

Over time, however, as additional carbon dioxide dissolves into the seas their pH falls. As the oceans' pH drops, their capacity to absorb and store additional carbon dioxide declines, weakening one of Earth's most important natural carbon sinks.

The Loc-Ness project used an integrated monitoring system including gliders, drifters, long-range autonomous underwater vehicles, shipboard sensors, and satellite imagery

The concept of OAE is simple: add naturally occurring and synthetic alkaline materials to the ocean to make it more alkaline, forcing it to draw down more carbon. 'Alkalinity enhancement' is already a restoration tool for lakes and rivers affected by acid rain. But reducing the acidity of the ocean has wider-ranging ecological implications, and it's much harder to track whether it's actually working.

That is where the Loc-Ness project comes in, run by the Woods Hole Oceanographic Institution. This interdisciplinary team aims to answer key questions about the effectiveness and impacts of OAE. In August 2025, they ran a six-day field trial in the Gulf of Maine, off the Massachusetts coast.

First, they dispersed 65,000 litres of sodium hydroxide over 1km<sup>2</sup>. This was accompanied by 760 litres of fluorescent rhodamine dye that was used to monitor how the sodium hydroxide was dispersing throughout a 3600km<sup>2</sup> zone.

The project is seeking to answer questions around the safety and effectiveness of increasing sea surface alkalinity...

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## Benzylated backbone behind bulkiest N-heterocyclic carbene yet

Chemistry World, 27 February 2026 · 27 Feb 2026

Researchers in Canada have created an N-heterocyclic carbene ligand with the highest buried volume reported to date. <sup>1</sup> The exceptionally sterically encumbered ligand features N-bound trityl groups and a benzylated backbone, and its steric and electronic nature allows it to access low-coordinate gallium and lithium complexes.

Bulky ligands can enforce rare low coordination in inorganic elements, often giving rise to unusual properties that are exploited in catalysis. Among the most versatile of these ligands are N-heterocyclic carbenes (NHCs), which feature a neutral carbon atom bearing two unshared electrons, stabilised by two ring nitrogen atoms. Their stability, capacity to form strong metal–carbon bonds and tuneable steric and electronic characteristics have made NHCs a versatile and widely used class of ligands.

In 2017, a team lead by Eric Rivard from Alberta University reported the extremely bulky NHC ITr (ITr = [(HCNPh)<sub>3</sub>]<sub>2</sub>C:), which featured two nitrogen-bound sterically shielding trityl (CPh<sub>3</sub>) substituents. <sup>2</sup> At the time, it represented the highest percent buried volume (% V<sub>bur</sub>) reported to date for an NHC and allowed access to a thermally stable quasi-monocoordinate thallium(I) cation complex.

Enhancing the steric profile of NHC ligands has become a research topic in many chemistry labs as bulkier frameworks can reshape metal centre reactivity, improve selectivity in catalysis, and support unusual or reactive coordination environments

Now, Rivard and Ludwig Zapf have made a benzylated analogue, NHC ligand Bn ITr ( Bn ITr = [(C<sub>6</sub>H<sub>4</sub>)<sub>2</sub>NCPPh<sub>3</sub>]<sub>2</sub>C:]). Using a two-step synthesis from commercially available 2-trityl-benzimidazole, they produced a ligand with a % yield exceeding 60%. This surpasses the previous record of 58.8% set by an NHC ligand with biphenyl wingtips reported by Michal Szostak's group at Rutgers University, US, in 2025. <sup>3</sup>

Single-crystal x-ray diffraction showed that the benzylated backbone in Rivard and Zapf's ligand forces the trityl groups to rotate towards the carbene moiety. Such rotation increases the steric bulk beyond that of the non-benzylated ITr, resulting in a highly shielded carbene centre.

The duo used this new bulkier carbene to stabilise a quasi-monocoordinated gallium( i ) cation complex and isolate a previously elusive quasi-monocoordinated lithium cation complex. The lithium-based complex represents the first example of a monomeric molecular complex without any extra ligands or solvents at the lithium centre. Zapf and Rivard also attempted to exploit this ligand for the synthesis...

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## New iron nanomaterial wipes out cancer cells without harming healthy tissue

Science Daily, June 20, 2025 · June 20, 2025

Researchers at Oregon State University have created a new nanomaterial designed to destroy cancer cells from the inside. The material activates two separate chemical reactions once inside a tumor cell, overwhelming it with oxidative stress while leaving surrounding healthy tissue unharmed.

The work, led by Oleh Taratula, Olena Taratula, and Chao Wang from the OSU College of Pharmacy, was published in *Advanced Functional Materials*.

The discovery strengthens the growing field of chemodynamic therapy or CDT. This emerging cancer treatment strategy takes advantage of the unique chemical conditions found inside tumors. Compared with normal tissue, cancer cells tend to be more acidic and contain higher levels of hydrogen peroxide.

Traditional CDT uses these tumor conditions to spark the formation of hydroxyl radicals, highly reactive molecules made of oxygen and hydrogen that contain an unpaired electron. These reactive oxygen species damage cells through oxidation, stripping electrons from essential components such as lipids, proteins, and DNA.

More recent CDT approaches have also succeeded in generating singlet oxygen inside tumors. Singlet oxygen is another reactive oxygen species, named for its single electron spin state rather than the three spin states seen in the more stable oxygen molecules present in the air.

"However, existing CDT agents are limited," Oleh Taratula said. "They efficiently generate either radical hydroxyls or singlet oxygen but not both, and they often lack sufficient catalytic activity to sustain robust reactive oxygen species production. Consequently, preclinical studies often only show partial tumor regression and not a durable therapeutic benefit."

To address these shortcomings, the team developed a new CDT nanoagent built from an iron-based metal-organic framework or MOF. This structure is capable of producing both hydroxyl radicals and singlet oxygen, increasing its cancer-fighting potential. The MOF demonstrated strong toxicity across multiple cancer cell lines while causing minimal harm to noncancerous cells.

"When we systemically administered our nanoagent in mice bearing human breast cancer cells, it efficiently accumulated in tumors, robustly generated reactive oxygen species and completely eradicated the cancer without adverse effects," Olena Taratula said. "We saw total tumor regression and long-term prevention of recurrence, all without seeing any systemic toxicity."

In these preclinical experiments, tumors disappeared entirely and did not return, and the animals showed no signs of harmful side effects.

## Next Steps Toward Broader Cancer Treatment

Before moving into human trials, the researchers plan to test the treatment in additional cancer types, including aggressive pancreatic cancer, to determine whether...

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# CURIOSITIES

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## Physicists Finally Observe a 50-Year-Old Theory Come to Life in a 2D Crystal

Sci Tech Daily, 4 March 2026 · 4 Mar 2026

By cooling an atom-thin magnetic material, physicists have experimentally confirmed a classic 1970s model of two-dimensional magnetism.

Bizarre things happen when materials are thinned from bulk crystals down to layers just one atom thick. In a study published in *Nature Materials*, physicists at The University of Texas at Austin reported that they have observed a series of unusual magnetic states in an ultrathin material.

Their experiments provide the first complete demonstration of a theoretical model of two-dimensional magnetism that was introduced in the 1970s. According to the team, the findings could help guide the development of future ultracompact technologies.

The newly observed behavior involves two major magnetic transitions that occur as certain materials are cooled toward absolute zero. Although scientists have previously detected each transition separately, this is the first time both have been seen together as part of the full predicted sequence.

To carry out the experiment, the researchers cooled a single layer of nickel phosphorus trisulfide (NiPS<sub>3</sub>) to temperatures between  $-150$  and  $-130$  °C. Within this range, the material entered an unusual magnetic state known as a Berezinskii–Kosterlitz–Thouless (BKT) phase. In this phase, the tiny magnetic directions associated with individual atoms, known as magnetic moments, organize into swirling configurations called vortices. These vortices form in pairs that rotate in opposite directions, one clockwise and the other counterclockwise, and the paired structures remain closely linked rather than separating.

The BKT phase is named for physicist Vadim Berezinskii and for J. Michael Kosterlitz and David Thouless, who received the 2016 Nobel Prize in Physics for developing the theory that describes this type of transition.

“The BKT phase is particularly intriguing because these vortices are predicted to be exceptionally robust and confined to just a few nanometers laterally while occupying only a single atomic layer in thickness,” said Edoardo Baldini, assistant professor of physics at UT and leader of the research. “Because of their stability and extremely small size, these vortices offer a new route to controlling magnetism at the nanoscale and provide insight into universal topological physics in two-dimensional systems.”

When the material was cooled even further, it shifted into a different magnetic arrangement known as a six-state clock ordered phase. In this configuration, the magnetic moments settle into one of six symmetry-related directions. Observing both the BKT phase and this lower temperature ordered phase confirms the full set of transitions predicted by the two-dimensional six-state clock model,...

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## ‘We just don’t know if this process is ecologically important or what’s causing it’: the team probing ‘dark oxygen’ in the ocean’s depths

Chemistry World, 26 February 2026 · 26 Feb 2026

An international team made headlines in 2024 after they discovered that the metallic nodules now sought by deep-sea mining firms were producing 'dark oxygen' in the depths of the Clarion Clipperton Zone (CCZ) in the Pacific . Such nodules contain high levels of metals like nickel, cobalt and lithium, which find uses in green technologies such as rechargeable batteries.

The origin of 'dark oxygen' in the ocean's depths is largely unknown. The nodules themselves may be producing oxygen, with the team previously suggesting that the nodule's charged surface may create the right conditions for water electrolysis.

The Nippon Foundation – a Japanese organisation with an interest in the world's oceans – has just given a \$5.2 million (£3.7 million) grant for a three-year long project to better understand this phenomenon. This includes deploying three purpose-built landers in the CCZ up to 6km below sea level later this year.

Mason Wakley spoke to Andrew Sweetman , a biogeochemist at the Scottish Association for Marine Science, who is leading the project.

The first goal is to see if we can document the presence of dark oxygen again using a whole new set of deep-sea instrumentation.

Andrew Sweetman at the Scottish Association for Marine Science is leading an expedition later this year to better understand the origin of 'dark oxygen' – oxygen that may be being generated chemically, rather than biologically

The second goal is to figure out what is causing this phenomenon. Is it a microbial process? Or is it somehow linked to the chemistry of the sea floor, the nodules or manganese oxide particles in the sediments?

And then the third goal is to try and do some more simulation experiments whereby we see what the effect is of, for example, sediment burial on the process. Sediments may be resuspended during deep-sea mining activities, potentially uncovering electrochemically active sites on the deposits. We think these sites may be involved in the oxygen producing process.

Hopefully where the oxygen is coming from and the dominant process responsible for what we're seeing down at the sea floor. We can then start to understand the process better and put it into an environmental context. For example, if we see that oxygen and hydrogen production are linked, then the process is probably important to the ecosystem because there'll be microbes that are able to take that hydrogen and synthesise it into living cells.

During the...

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## How to Age Well, According to Ancient Greek And Roman Doctors

sciencealert.com, 5 March 2026 · 5 Mar 2026

Just like in the modern world, people in ancient times wanted to know how to live a long and healthy life.

Greeks and Romans heard fantastic tales of faraway peoples living well beyond 100.

Greek essayist Lucian (about 120–180 CE) writes :

"Indeed, there are even whole nations that are very long-lived, like the Seres [Chinese], who are said to live 300 years: Some attribute their old age to the climate, others to the soil, and still others to their diet, for they say that this entire nation drinks nothing but water.

"The people of Athos are also said to live 130 years, and it is reported that the Chaldeans live more than 100, using barley bread to preserve the sharpness of their eyesight."

Whatever the truth of these tales, many ancient Greeks and Romans wanted a long and healthy life.

This is how they thought this could happen.

Ancient doctors were interested in what people who lived long lives were doing every day and how this might have helped.

The Greek physician Galen (129–216 CE), for example, discusses two people he knew personally in Rome who lived to old age.

First, there is a grammarian (someone who studies and teaches grammar) called Telephus, who lived to almost 100.

According to Galen , Telephus ate just three times a day. His diet was simple: "Gruel boiled in water mixed with raw honey of the best quality, and this alone was enough for him at the first meal."

"He also dined at the seventh hour or a little sooner, taking vegetables first and next tasting fish or birds. In the evening, he used to eat only bread, moistened in wine that had been mixed."

Galen also tells us Telephus had some bathing habits that might seem unusual to us today. Telephus preferred to be massaged with olive oil every day and only have a bath a few times a month:

"He was in the habit of bathing twice a month in winter and four times a month in summer. In the seasons between these, he bathed three times a month. On the days he didn't bathe, he was anointed around the third hour with a brief massage."

Second, there was an old doctor named Antiochus, who lived into his 80s.

According to Galen , Antiochus also had a simple diet.

In the morning, Antiochus usually ate toasted bread with honey. Then,...

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## Citric acid cycle a 'garbage compactor' as well as an energy powerhouse

Chemistry World, 3 March 2026 · 3 Mar 2026

The citric acid cycle generates energy as its products go round the cycle. But does this central cycle have other roles that haven't been appreciated?

Generations of biochemistry students have learned that the role of the Krebs' cycle or tricarboxylic acid (TCA) cycle is two-fold: to generate energy for cells and to create the building blocks for growth. But researchers are finding that metabolic pathways – even canonical ones like the TCA cycle – can actually be configured in a variety of ways, and they have many more jobs than previously imagined. Now, researchers have discovered that the TCA cycle has yet another underappreciated role: getting rid of waste.

Depending on cell type and development stage, cells change how they metabolise nutrients. A few years ago, for example, researchers discovered that during infection, immune cells rewire their TCA cycle to make itaconate , an anti-microbial metabolite. Lydia Finley , a cancer biologist at Memorial Sloan Kettering, and her team wanted to know what metabolism is doing in various cells . 'We know that what you need is different depending on who you are as a cell,' Finley says. 'What are the different ways that cells are solving metabolism, and what is metabolism doing for them?'

To examine this question, Finley's team knocked out one of the enzymes in the TCA cycle, creating a bottleneck that caused the accumulation of citrate, the initiating metabolite in the cycle. Its accumulation signals that there are too many nutrients coming in relative to demand and triggers a stress response, the researchers found. When they knocked out a second enzyme in the TCA cycle – the one that makes citrate – this restored the cells and they grew normally, despite the disruption of energy production through the TCA cycle. The result showed that the ability to prevent citrate accumulation, either by clearing it quickly or by avoiding producing it in the first place, was key to keeping cells healthy.

In mice carrying this TCA cycle mutation, the kidney was the first organ to fail. That's because the kidney is the only organ that uses citrate as a fuel: it is therefore the one that experiences the biggest problems when citrate can't be cleared. Surprisingly, the heart and brain, tissues that require a lot of energy, were fine for three weeks, the duration of the experiment, in spite of a broken TCA cycle. This suggested that...

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## Scientists discover a bacterial kill switch and it could change the fight against superbugs

Science Daily, Sep. 19, 2019 · Sep. 19, 2019

Scientists have revealed how viruses that infect bacteria shut down MurJ, a protein essential for building the bacterial cell wall. Remarkably, different viruses evolved separate proteins that all block MurJ in the same way, highlighting it as a promising new antibiotic target.

The findings appear in the February 26 issue of *Nature*. The research was led by Yancheng Evelyn Li, a graduate student in the lab of Bil Clemons at Caltech. Clemons, the Arthur and Marian Hanisch Memorial Professor of Biochemistry, is the corresponding author.

Bacteria evolve quickly, and that adaptability is fueling a growing public health crisis. As Clemons explains, "Evolution is powerful, and in bacteria, resistance to antibiotics develops quickly. This means that we now deal with bacteria that are resistant to all the medicines that we have." He adds, "In the USA alone, tens of thousands of people die every year from antibiotic-resistant bacterial infections, and that number is rising rapidly. We need new antibiotics to combat this."

With existing drugs losing effectiveness, researchers are searching for entirely new bacterial weak points.

One long standing focus has been the pathway bacteria use to construct peptidoglycan, the rigid material that forms their cell wall. This process, called the peptidoglycan biosynthesis pathway, is especially attractive because peptidoglycan is found in bacteria but not in human cells. As Clemons notes, "Peptidoglycan is a unique feature of bacteria, and that makes it an attractive antibiotic target."

Several antibiotics already disrupt this pathway. Penicillin, discovered by Alexander Fleming in the mid 20th century, blocks a late stage of peptidoglycan production. Related drugs such as amoxicillin work in a similar way.

Three essential proteins drive the movement of peptidoglycan building blocks across the bacterial inner membrane: MraY, MurG, and MurJ. These proteins help transport the components needed to assemble the cell wall outside the inner membrane barrier. If any one of them fails, peptidoglycan cannot be produced and the bacterium dies, making them promising drug targets.

Although researchers understand much about how these proteins function, Clemons points out that important mechanistic details remain unclear.

At present, no approved drugs directly inhibit these three proteins. Still, Clemons says there is potential. "We do know that we can find small molecules, either derived from nature or synthesized in chemical libraries, that will inhibit these proteins. Excitingly, recent discoveries have shown that bacteriophages have figured out how to target this pathway."

How Bacteriophages Break Through...

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## Young cancer survivors face faster aging and possible early dementia

Science Daily, Jan. 10, 2019 · Jan. 10, 2019

Teens and young adults who survive cancer appear to age more quickly than people their same age who have never had the disease, according to new research. Scientists found signs of faster aging not only inside cells but also in brain performance, including memory, attention, and the ability to process information.

The findings were published in *Nature Communications*. The research was led by AnnaLynn Williams, PhD, of the University of Rochester Wilmot Cancer Institute, along with co-corresponding author Kevin Krull, PhD, of St. Jude Children's Research Hospital.

### Lifestyle Changes May Help Reverse Biological Aging

There may be encouraging news ahead. Ongoing work at Wilmot suggests that some of the accelerated aging seen in young survivors could potentially be slowed or even reversed through healthy habits such as quitting smoking, exercising regularly, and improving diet, Williams said.

"Young cancer survivors have many more decades of life to live," she said. "So, if these accelerated aging changes are occurring early on and setting them on a different trajectory, the goal is to intervene to not only increase their lifespan but improve their quality of life."

Many survivors treated in childhood or young adulthood are working toward finishing school, launching careers, gaining independence, or starting families. Cognitive challenges can make those milestones harder to reach.

"It's kind of like a perfect storm," Williams said. "This is why we see many survivors having worse educational and employment outcomes than their siblings."

Williams, who is also a cancer survivor, serves as an assistant professor in the Department of Surgery and is part of Wilmot's Cancer Prevention and Control research program, which focuses on reducing long-term symptoms in survivors.

The study included about 1,400 participants treated at St. Jude. All were at least five years beyond their cancer therapy, and some had survived for decades. Most had been treated for acute lymphoblastic leukemia (ALL) or Hodgkin lymphoma.

Researchers found evidence of faster biological aging regardless of the type of treatment received during childhood. However, chemotherapy was linked to the greatest acceleration. Because chemotherapy can alter DNA structure and cause widespread cellular damage, it appears to have the strongest effect on the aging process.

The investigators also identified a close connection between cellular aging and cognitive performance. Survivors whose biological age was higher than their actual chronological age had more difficulty with memory and attention.

For individuals who received radiation directly to the brain, Williams said...

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## **A bold new plan could finally cure type 1 diabetes**

Science Daily, Aug. 2, 20 · 2 Aug 2020

At the Medical University of South Carolina (MUSC), researcher Leonardo Ferreira, Ph.D., is leading an ambitious effort to change how type 1 diabetes (T1D) is treated. Backed by \$1 million from Breakthrough T1D, a leading global research and advocacy organization, Ferreira and collaborators at partner institutions are testing a new strategy aimed at treating and potentially curing the disease.

Their approach brings together stem cell science, immunology, and transplantation research. The central goal is straightforward but bold: restore insulin-producing beta cells in people with T1D without requiring immunosuppressive drugs.

"These awards support the most promising work that can significantly advance the path to cures for type 1 diabetes," said Ferreira. "This is what Breakthrough T1D believes is the next wave in type 1 diabetes therapy."

### Engineering the Immune System to Protect Insulin Cells

Ferreira specializes in modifying the immune system using chimeric antigen receptors, or CARs. These engineered receptors help guide regulatory T cells, known as Tregs, to specific targets in the body. Tregs play an essential role in keeping immune responses under control and preventing excessive damage, including the autoimmune attack seen in T1D. In simple terms, they act like bodyguards, preventing the immune system from going too far and harming healthy tissue.

He is working alongside two prominent collaborators. Holger Russ, Ph.D., associate professor of Pharmacology and Therapeutics at the University of Florida, is a leader in stem cell research for T1D. Many scientists view this field as the future of transplantation because stem cells can provide a virtually unlimited supply of islet cells for research and clinical use. Michael Brehm, Ph.D., of the University of Massachusetts Medical School, completes the team. He is known for developing humanized mouse models that help researchers study human immune and metabolic responses in T1D.

Type 1 diabetes (T1D) is an autoimmune condition in which the immune system mistakenly attacks the pancreas's insulin-producing beta cells. Without these cells, the body cannot properly regulate blood sugar levels. People with T1D must closely monitor their glucose and rely on insulin injections to survive. According to the Centers for Disease Control and Prevention, about 1.5 million Americans live with the disease. Over time, it can lead to serious complications, including nerve damage, blindness, coma, and even death.

The new Breakthrough T1D award builds on a 2021 Discovery Pilot grant from the South Carolina Clinical & Translational Research Institute (SCTR), which first brought Ferreira and Russ...

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## What snow monkeys' steamy baths are really doing to their bodies

Science Daily, June 12, 2022 · June 12, 2022

Japanese macaques, better known as snow monkeys, are famous for sitting in steaming hot springs when temperatures drop. While the warm water clearly helps them cope with winter cold, researchers at Kyoto University found that these baths do more than provide heat.

"Hot spring bathing is one of the most unusual behaviors seen in nonhuman primates," says first author Abdullah Langgeng. His team wondered whether regularly soaking in hot springs might also influence the parasites and microscopic organisms that live on and inside the monkeys.

### Studying Parasites and the Gut Microbiome

To find out, the researchers traveled to Jigokudani Snow Monkey Park in Nagano prefecture. Over the course of two winters, they tracked a group of female macaques, comparing those that frequently bathed in hot springs with those that rarely or never did. The scientists combined direct behavioral observations with parasite checks and gut microbiome sequencing. Their goal was to determine whether bathing affects the macaque holobiont, the combined biological system made up of the animal and the microbes and parasites associated with it.

The findings showed that time spent in hot springs subtly changes how the monkeys interact with parasites and gut microbes. Monkeys that soaked in the warm water had different patterns of lice on their bodies and differences in certain gut bacteria. This suggests that immersion in hot water may interfere with lice activity or where they lay their eggs.

Subtle Microbial Shifts Without Higher Infection Risk

The researchers also detected modest differences in the gut microbiome. Overall diversity of gut bacteria was similar between monkeys that bathed and those that did not. However, several bacterial genera were more common in individuals that skipped the hot springs. Importantly, sharing the pools did not appear to raise the risk of intestinal parasites. Bathing macaques showed no increase in parasite infection rates or severity.

Taken together, the results show that behavior can influence the animal holobiont and play a meaningful role in health. The study highlights how complex the relationship between behavior and health can be in wild animals. Bathing changed some interactions between the monkeys and the organisms that live with them, while leaving others unaffected.

"Behavior is often treated as a response to the environment," says Langgeng, "but our results show that this behavior doesn't just affect thermoregulation or stress: it also alters how macaques interact with parasites and microbes that live on and inside them."

What...

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## Evolution of new physical traits in mollusks has declined and grown more predictable over time

Phys Org, 4 March 2026 · 4 Mar 2026

Paleobiologist Geerat Vermeij is enthralled with mollusks. Their shells line the surfaces and fill the cabinets and drawers in his office on the second floor of the Earth and Planetary Sciences Building at UC Davis. But Vermeij's deep study of these organisms isn't just about the animals themselves, it's an avenue for deeper insights about the principles governing evolution and history.

"There really are principles emanating from biology that give history a direction, and a predictable direction," said Vermeij, a Distinguished Professor in the Department of Earth and Planetary Sciences. "It really emanates from profound principles, which are natural selection, on the one hand, but also—and I think most misunderstood and important—agency. The fact that organisms do things, and in doing so, they also modify their environment. There's fundamental feedback going on between organisms and the environment."

In a new paper appearing in the Proceedings of the National Academy of Sciences, Vermeij and his research colleague Tracy Thomson cataloged the features of various mollusks in the fossil record and found that early mollusks evolved a unique physical trait once every 2 million years. That frequency began declining roughly 444 million years ago to about one new feature every 9 million years.

"All these unique traits and first occurrences of repeated traits occurred within the first 96 million years of molluscan history," Vermeij said. "Then the frequency goes down by a factor of at least four or five."

The research shows that the evolution of mollusks has become increasingly predictable over its 540-million-year history despite the increasing diversity of mollusk species.

In their study, Vermeij and Thomson identified 96 unique physical traits found in mollusks over the course of their evolution. Such traits include the spiral coiling of mollusk shells; the radula, which are tiny teeth-like structures mollusks use to eat; and the ventral foot, the muscular sole that mollusks use for movement.

Of those 96 traits, 46 (48%) originated during the first 96 million years of their evolution. The remaining 50 traits (52%) have evolved in the succeeding 444 million years.

"They're evolving structures, which we always have to remember were successful when they evolved, because we wouldn't see them otherwise," Vermeij said. "And then many of these traits, of course, evolved again and again, modified, perhaps, from the original, but nevertheless the same thing."

The researchers noted that secondary peaks in the frequency of the development of unique...

## Ancient Hot Springs Reveal How Life Survived on a Toxic Early Earth

Sci Tech Daily, 3 March 2026 · 3 Mar 2026

Our planet did not always resemble the blue and green world we know today. In its distant past, atmospheric oxygen levels were roughly a million times lower than they are now. There were no forests, no animals, and none of the familiar life forms that depend on oxygen to survive. In fact, for early organisms, oxygen was poisonous.

So what did life look like in that hostile environment? A recent study led by Fatima Li-Hau (graduate student at ELSI at the time of the research) and supervised by Associate Professor Shawn McGlynn (at the time of research) at the Earth-Life Science Institute (ELSI), Institute of Science Tokyo, Japan, set out to investigate this question. The team turned to iron-rich hot springs that resemble the chemistry of ancient oceans during one of Earth's most dramatic transitions: the rise of atmospheric oxygen.

Their results suggest that early microbial communities gained energy by combining iron with small amounts of oxygen produced by photosynthetic microbes. This points to a transitional ecosystem in which life repurposed what had once been a harmful byproduct into a new energy source, before photosynthesis became widespread and dominant.

Around 2.3 billion years ago, the Great Oxygenation Event (GOE) marked a major turning point in Earth's history. The increase in atmospheric oxygen was likely driven by green Cyanobacteria that used sunlight to split water molecules and convert carbon dioxide into oxygen through photosynthesis.

Today, Earth's atmosphere consists of roughly 78 percent nitrogen and 21 percent oxygen, with only small amounts of gases such as methane and carbon dioxide, which likely played a larger role before oxygen became abundant. The GOE permanently altered the trajectory of life. Oxygen made complex life possible, including animals that rely on it to breathe. However, it also posed a serious challenge to earlier life forms that had evolved in an oxygen-poor world and had little exposure to the O<sub>2</sub> molecule. How these ancient microbes managed to survive the spread of oxygen remains a central scientific question.

To explore how microbes adapted, the researchers examined five Japanese hot springs with distinct chemical properties. These sites included one in Tokyo and two each in Akita and Aomori prefectures. All are naturally rich in ferrous iron (Fe<sup>2+</sup>), a dissolved form of iron that was once common in early oceans.

Such springs are rare today because in oxygen-rich conditions, ferrous iron reacts quickly with oxygen and...

# REACH UPDATE

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## ECHA's Biocides Committee supports approval of ethanol in disinfectants

ECHA, 24-02-26 · 24 Feb 2026

ECHA/NR/26/09

The European Chemicals Agency's (ECHA) Biocidal Products Committee (BPC) has concluded that ethanol may be approved for use in hand and general disinfectants. The Committee did not take a position on whether ethanol should be considered a carcinogenic or reprotoxic substance.

Helsinki, 24 February 2026 – In its February meeting, the BPC adopted its opinions supporting the approval of ethanol as active substance in the following product-types:

Product-type 1: Human hygiene products, such as hand disinfectants;

Product-type 2: Disinfectants and algaecides not intended for direct contact with humans or animals; and

Product-type 4: Products used in food and feed areas.

In its opinions, the Committee considered that safe use has been demonstrated for all uses in these product-types. BPC did not reach a conclusion on the carcinogenic or reproductive properties of ethanol. As a result, no new hazard classification has been proposed.

According to the BPC, the following factors prevented a clear hazard conclusion:

The applicant's dossier, although considered complete, lacks data on dermal exposure, a key route of exposure for biocidal products. The available inhalation data has not been performed in accordance with the standard guidelines.

Most of the evidence relating to the carcinogenic and reproductive properties of ethanol is from voluntary oral consumption of alcoholic beverages, which the Committee did not consider an appropriate basis for decisions in the context of these biocidal uses.

New studies on more relevant exposure routes are underway, and the BPC believes these must be considered before determining carcinogenic or reprotoxic properties. However, waiting for these studies to become available could significantly delay the approval process.

Next steps

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# REGULATORY UPDATE

## ASIA PACIFIC

### Asbestos Framework Review

Safe Work Australia, 25-02-26 · 25 Feb 2026

Safe Work Australia is reviewing how asbestos risks are managed and how asbestos-containing materials are safely removed. The review will look at possible changes to the model Work Health and Safety (WHS) regulations for asbestos and related Codes of Practice and guidance materials. You can read the full Terms of Reference for the Asbestos Framework Review [here](#).

Why are we doing this review

The third phase of the Asbestos National Strategic Plan 2024–2030 has been endorsed by the Commonwealth and all state and territory governments. The plan continues national efforts to eliminate asbestos-related diseases in Australia and focuses on practical steps to safely remove old asbestos-containing materials from buildings. There are a number of actions for Safe Work Australia to lead or support in the Asbestos National Strategic Plan.

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### Agricultural chemical products and approved labels

APVMA, 24-02-24 · 24 Feb 2024

Pursuant to the Agricultural and Veterinary Chemicals Code scheduled to the Agricultural and Veterinary Chemicals Code Act 1994, the APVMA hereby gives notice that it has registered or varied the relevant particulars or conditions of the registration in respect of the following products and has approved the label or varied the relevant particulars or conditions of the approval in respect of the containers for the chemical product, with effect from the dates shown.

Table 1: Agricultural products based on existing active constituents

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### Veterinary chemical products and approved labels

APVMA, 24-02-24 · 24 Feb 2024

Pursuant to the Agricultural and Veterinary Chemicals Code scheduled to the Agricultural and Veterinary Chemicals Code Act 1994, the APVMA hereby gives notice that it has registered or varied the relevant particulars or conditions of the registration in respect of the following products and has approved the label or varied the relevant particulars or conditions of the approval in respect of the containers for the chemical product, with effect from the dates shown.

Table 4: Veterinary products based on existing active constituents

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## Approved active constituents

APVMA, 24-02-24 · 24 Feb 2024

Pursuant to the Agricultural and Veterinary Chemicals Code scheduled to the Agricultural and Veterinary Chemicals Code Act 1994, the APVMA hereby gives notice that it has approved or varied the relevant particulars or conditions of the approval of the following active constituents, with effect from the dates shown.

Table 7: Approved active constituents

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## AMERICA

### RCRA/CERCLA/CWA/CAA/PHMSA/SDWA

Bergeson & Campbell, P.C., 17-02-26 · 17 Feb 2026

#### Appellate Court Denies EPA's Request To Vacate SDWA Limits For Four PFAS

The U.S. Court of Appeals for the District of Columbia Circuit issued a January 21, 2026, order denying EPA's motion for partial vacatur of its April 2024 National Primary Drinking Water Regulation (NPDWR) for six per- and polyfluoroalkyl substances (PFAS). American Water Works Association (AWWA) v. EPA (No. 24-1188). EPA announced on May 14, 2025, that it would keep the current NPDWR for perfluorooctanoic acid (PFOA) and perfluorooctane sulfonic acid (PFOS) and that it intended to rescind the regulations and reconsider the regulatory determinations for perfluorohexane sulfonic acid (PFHxS), perfluorononanoic acid (PFNA), and hexafluoropropylene oxide dimer acid (HFPO-DA or GenX), and the Hazard Index mixture of these three plus perfluorobutane sulfonic acid (PFBS) "to ensure that the determinations and any resulting drinking water regulation follow the legal process laid out in the Safe Drinking Water Act [SDWA]." EPA filed a brief on December 3, 2025, asking that a motions panel vacate the NPDWR for the four PFAS. The petitioners sought a merits panel ruling on the motion, however. The January 21, 2026, order states that "[t]he merits of the parties' positions are not so clear as to warrant summary action." More information on the April 2024 final rule is available in our May 9, 2024, memorandum.

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### PFAS Regulation Comparison: Minnesota and Great Lakes Region

University of Minnesota, 23-02-26 · 23 Feb 2026

The National Sea Grant Law Center is partnering with Minnesota Sea Grant and Illinois-Indiana Sea Grant to disseminate research findings and lay the foundation for future regional policy conversations about per- and polyfluoroalkyl substances, or PFAS.

PFAS, are a family of over 15,000 man-made chemicals used in everyday products since the 1950s. Because these chemicals are incredibly effective at resisting heat, water, and oil, they are woven into everything from non-stick cookware and waterproof jackets to industrial foams. However, the traits that make them so durable also make them persistent; they don't break down easily, earning them the nickname "forever chemicals." Today, these substances are found worldwide, and research has shown that even low levels of exposure can pose significant risks to human health.

As the science surrounding PFAS evolves rapidly, it can be difficult to find information that is both current and easy to understand. Many existing resources are either outdated or written for technical experts rather than the general public. Minnesota Sea Grant is working to bridge this gap by providing

clear, up-to-date guidance that helps our communities navigate these risks and stay informed about the latest PFAS research.

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## **EPA Releases Fluoride Preliminary Assessment Plan And Literature Survey For Public Comment**

Bergeson & Campbell, P.C., 17-02-26 · 17 Feb 2026

On January 28, 2026, as the first step in developing the Fluoride Human Health Toxicity Assessment (toxicity assessment), EPA released the Fluoride Preliminary Assessment Plan and Literature Survey (Assessment Plan) for public comment to provide transparency and gather early feedback. 91 Fed. Reg. 3722. According to EPA, the objectives of the Assessment Plan are to describe the approach EPA intends to follow to develop the fluoride toxicity assessment and present the results of the preliminary literature survey. EPA notes that the Assessment Plan is not a toxicity assessment; it does not contain conclusions regarding harmful human health effects of fluoride or determine the level of fluoride exposure at or above which is associated with harmful health effects. Such conclusions about fluoride human health effects will be released as part of the forthcoming draft human health toxicity assessment. EPA's toxicity assessment will be used to inform future decisions about potential revisions to the existing fluoride drinking water standard under the SDWA. Comments are due February 27, 2026.

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## **PHMSA Seeks Feedback On ANPRM To Modernize HMR To Facilitate Transportation Of Hazardous Materials Integral To Spacecraft Components And Payloads**

Bergeson & Campbell, P.C., 17-02-26 · 17 Feb 2026

The Pipeline and Hazardous Materials Safety Administration (PHMSA) published an advance notice of proposed rulemaking (ANPRM) on January 29, 2026, to solicit stakeholder input on opportunities to amend requirements in the Hazardous Materials Regulations (HMR) for spacecraft (e.g., launch vehicles, reentry vehicles) and space operations that require the transportation of hazardous materials integral to spacecraft payloads or components (i.e., transporting satellites, capsules, and related equipment to and from launch and recovery sites by all transportation modes, but most often by highway or vessel). 91 Fed. Reg. 3860. PHMSA notes that to account for the complexities of space operations, it has issued special permits to government and private entities, providing variances from the requirements of the HMR to facilitate the domestic transportation of hazardous materials in commerce in support of space operations. PHMSA requests public input to determine what existing standards and best practices are used in the space sector to ensure the safety of these hazmat shipments, and what regulations may be unnecessary when operating under these standards and best practices. According to PHMSA, "[t]his will improve government efficiency and provide regulatory certainty for the regulated community by reducing the need to issue special permits and addressing cases in which the regulations do not prescribe specific provisions." Comments are due April 29, 2026. PHMSA will consider late-filed comments to the extent possible, however.

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## **Revocation of Methods of Analysis Regulation**

US FDA, 19-02-26 · 19 Feb 2026

The Food and Drug Administration (FDA, the Agency, or we) is issuing a final rule to revoke the methods of analysis regulation, which describes an FDA policy to use certain methods of analysis for

FDA enforcement programs when the method of analysis is not prescribed in a regulation. FDA is issuing this action because the existing regulation is no longer necessary.

**DATES:**

This rule is effective on March 23, 2026.

**ADDRESSES:**

For access to the docket to read background documents or comments received, go to <https://www.regulations.gov> and insert the docket number found in brackets in the heading of this final rule into the "Search" box and follow the prompts, and/or go to the Dockets Managements Staff, 5630 Fishers Lane, Rm. 1061, Rockville, MD 20852, 240-402-7500.

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## **EPA Requests Nominations For e-Manifest Advisory Board**

Bergeson & Campbell, P.C., 17-02-26 · 17 Feb 2026

On February 6, 2026, EPA requested the public to nominate experts in Information Technology (IT) to be considered for a three-year membership appointment to the Hazardous Waste Electronic Manifest System (e-Manifest) Advisory Board. 91 Fed. Reg. 5472. Pursuant to the e-Manifest Establishment Act, EPA established the Board to provide practical and independent advice, consultation, and recommendations on the activities, functions, policies, and regulations associated with the e-Manifest System. In accordance with the Act, the EPA Administrator or designee will serve as Chair of the Board. EPA may also consider nominations received through this solicitation to fill any unanticipated future vacancies on the Board for the following positions including an industry representative member with experience in using or representing users of the manifest system and a state representative member responsible for processing manifests. Nominations of candidates considered for appointment are due March 9, 2026.

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# HAZARD ALERT

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## n-Hexane

6 Mar 2026

Hexane is an alkane of six carbon atoms, with the chemical formula C<sub>6</sub>H<sub>14</sub>. There are 5 hexane isomers; n-hexane is the unbranched isomer. [1] n-Hexane is a chemical made from crude oil. Pure n-hexane is a colourless liquid with a slightly disagreeable odour. It evaporates very easily into the air and dissolves only slightly in water. n-Hexane is highly flammable, and its vapours can be explosive. [2]

### Uses [3]

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It is used in laboratories, primarily when it is mixed with similar chemicals to produce solvents. Common names for these solvents are commercial hexane, mixed hexanes, petroleum ether, and petroleum naphtha. The major use for solvents containing n-hexane is to extract vegetable oils from crops such as soybeans, flax, peanuts, and safflower seed. They are also used as cleaning agents in the textile, furniture, shoemaking, and printing industries, particularly rotogravure printing. N-hexane is also an ingredient of special glues that are used in the roofing, shoe, and leather industries. n-Hexane is used in binding books, working leather, shaping pills and tablets, canning, manufacturing tires, and making baseballs.

### Sources of Emission & Routes of Exposure

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#### Sources of Emission [3]

Industry sources: Releases from industries producing, using or handling hexane. For example, rubber and plastics products industries, oil refineries, chemical plants, footwear manufacturing, petrol, and paints and adhesives.

Diffuse sources: Releases from service stations; evaporation of fuels during petrol refilling; underground storage tanks that leak. Releases during use of adhesives, paints, and paint thinners.

Natural sources: Hexane is a natural constituent of crude petroleum. It also occurs naturally as a plant volatile and can be released from volcanoes. Furthermore, n-hexane occurs naturally in, forest fires, and some plants.

Transport sources: Vehicle exhaust. Evaporation of vehicle fuels from motors and vehicle fuel tanks.

Consumer products: Consumer products that contain small amounts of n-hexane include petrol, rubber cement, type-over correction fluids, non-mercury (low temperature) thermometers, alcohol preparations, and aerosols in perfumes. n-Hexane is also a component of preparations such as paint thinners, general-purpose solvents, degreasing agents, and cleaners.

#### Routes of Exposure [3,4]

n-Hexane evaporates very quickly and so the most common exposure is from breathing air-containing hexane. It can also enter via the skin. The most probable route of human exposure to hexane is by inhalation. Since it is in gasoline, nearly everyone is exposed to very small amounts of n-hexane in the air. Exposure can occur at home if you use products containing n-hexane without proper ventilation.

Individuals are most likely to be exposed to hexane in the workplace. Monitoring data indicate that hexane is a widely occurring atmospheric pollutant.

## Health Effects

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### Acute Effects

Acute inhalation exposure of humans to high levels of hexane causes mild CNS depression. CNS effects include dizziness, giddiness, slight nausea, and headache in humans.

Acute exposure to hexane vapours may cause dermatitis and irritation of the eyes and throat in humans.

Acute animal tests in rats have demonstrated hexane to have low acute toxicity from inhalation and ingestion exposure.

### Chronic Effects

Chronic inhalation exposure to hexane is associated with sensorimotor polyneuropathy in humans, with numbness in the extremities, muscular weakness, blurred vision, headache, and fatigue observed.

Rats, chronically exposed by inhalation, have exhibited neurotoxic effects.

Mild inflammatory, erosive, and degenerative lesions in the olfactory and respiratory epithelium of the nasal cavity have been observed in mice chronically exposed by inhalation. Pulmonary lesions have also been observed in chronically exposed rabbits.

The Reference Concentration (RfC) for hexane is 0.2 milligrams per cubic metre (mg/m<sup>3</sup>) based on neurotoxicity in humans and epithelial lesions in the nasal cavity in mice.

EPA has not established a Reference Dose (RfD) for hexane.

EPA has calculated a provisional RfD of 0.06 milligrams per kilogram body weight per day (mg/kg/d) based on neurological and reproductive effects in rats.

### Reproductive/Developmental Effects

No information is available on the reproductive or developmental effects of hexane in humans.

Testicular damage has been observed in male rats exposed to hexane via inhalation.

Teratogenic effects were not observed in the offspring of rats chronically exposed via inhalation in several studies.

### Cancer Risk

No information is available on the carcinogenic effects of hexane in humans or animals.

EPA has classified hexane as a Group D, not classifiable as to human carcinogenicity, based on a lack of data concerning carcinogenicity in humans and animals. (3,5)

## Safety [6]

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### 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 if irritation occurs.

Skin Contact: Wash with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops.

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 and Explosion Information**

n-Hexane is flammable.

Auto-ignition temperature is 225°C (437°F)

Flash Points: CLOSED CUP: -22.5°C (-8.5°F).

Carbon monoxide (CO) and carbon dioxide (CO<sub>2</sub>) are produced upon combustion.

Highly flammable in presence of open flames and sparks, of heat.

Non-flammable in presence of shocks.

n-hexane is a flammable liquid that is insoluble in water.

Dry chemical powder should be used to extinguish small fires

Water spray or fog should be used to extinguish large fires.

Special Remarks on Fire Hazards: Extremely flammable liquid and vapour. Vapour may cause flash fire.

### **Exposure Controls & Personal Protection**

#### ***Engineering 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 following personal protective equipment is recommended when handling n-hexane:

Safety glasses;

Lab coat;

Vapour respirator (be sure to use an approved/certified respirator or equivalent);

Gloves (impervious).

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.

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

### **Regulation**

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#### **United States [4,7]**

NIOSH: The National Institute of Occupational Safety and Health has established a Recommended Exposure Limit (REL) of no more than 50 parts per million (ppm) in workplace air or 180 mg/m<sup>3</sup>.

OSHA: The Occupational Health and Safety Administration has set a Permissible Exposure Limit of 500 ppm for n-hexane in workplace air or 1800 mg/m<sup>3</sup>).

EPA: The Environmental Protection Agency requires that spills or accidental releases of 5,000 pounds or more of n-hexane be reported to the EPA.

### **Australia [3]**

Safe Work Australia has set a maximum 8-hour time weighted average (TWA) exposure for n-hexane of 176 mg/m<sup>3</sup>.

### **References**

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<http://en.wikipedia.org/wiki/N-hexane>

<http://www.atsdr.cdc.gov/phs/phs.asp?id=391&tid=68>

<http://www.npi.gov.au/resource/n-hexane-sources-emissions>

<http://www.atsdr.cdc.gov/toxfaqs/tf.asp?id=392&tid=68>

<http://www.epa.gov/ttn/atw/hlthef/hexane.html>

<http://www.sciencelab.com/msds.php?msdsId=9927187>

# JANET'S CORNER

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## Who Am I?

5 Mar 2026

*I am born from an ancient Roman recipe that has outlasted empires, yet I remain humanity's most widely used construction material today.*

*My strength comes from a chemical marriage between Portland cement, aggregates, and water—a reaction that actually grows harder over decades.*

*I am poured as a liquid but transform into stone-like solidity through hydration, a process that releases heat and can crack if I'm not carefully cured.*

*I am found in skyscrapers, bridges, dams, and sidewalks worldwide; my carbon footprint troubles environmentalists, yet civilization quite literally stands on me.*