CHEMWATCH

BULLETIN

Week of 20 March 2026

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GOSSIP

Clearing the nanoscale bottleneck holding back next-gen electronics

Phys Org · 19 Mar 2026

by Nicole Wilkins, University of California, Los Angeles

Researchers at UCLA have discovered a way to dramatically improve how electrical current enters perovskite semiconductors, an emerging class of materials with enormous potential for next-generation electronics. Their research is published in the journal Nature Materials .

A longstanding challenge has been the metal–perovskite interface, where electrical current often struggles to pass efficiently from the metal electrode into the semiconductor. This interface behaves like a clogged doorway, wasting energy and slowing device performance.

The research team developed a strategy that makes this transition much easier. By creating a very thin, locally modified region under the metal contact, they enabled electrons to pass through the barrier using a quantum mechanical process called tunneling.

This approach reduces the resistance at the contact by shrinking the "blocked" region from about 250 nanometers to less than 25 nanometers. As a result, current can flow more efficiently at lower voltages.

The discovery could enable faster, lower-power and more reliable perovskite electronic devices, marking an important step toward translating these materials from laboratory research into practical technologies.

Perovskites are a promising class of materials for solar cells, sensors, photodetectors and advanced electronics because they are highly efficient and inexpensive to manufacture.

However, a major obstacle has limited their adoption in electronic devices: poor electrical contact between metal electrodes and the perovskite semiconductor.

In most traditional semiconductors, engineers solve this problem using impurity doping, which introduces additional charge carriers to improve conductivity. But this strategy is difficult to implement effectively in perovskites because the materials are relatively soft and chemically sensitive.

This research addresses that bottleneck by rethinking how electrical contacts are engineered.

Instead of modifying the entire material, the researchers focused on engineering the tiny region directly beneath the metal electrode.

They developed a contact-induced charge-transfer doping method using silver oxide nanoclusters formed at the interface.

These nanoclusters act as electron acceptors, pulling electrons away from the perovskite and creating a locally p-doped region beneath the metal contact.

This localized doping dramatically narrows the energy barrier at the interface, enabling charge carriers to pass through via Fowler–Nordheim quantum tunneling rather than traditional thermionic emission.

This work addresses a critical bottleneck in perovskite electronics and offers a new design strategy to improve device performance.

While the work is currently at the laboratory proof-of-concept stage, the results demonstrate a promising route for turning perovskites from research materials into practical electronic...

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Self-healing polymers emerge from the first use of pnictogen bond crosslinks

Chemistry World · 17 Mar 2026

Scientists in China have created the first polymer networks crosslinked using pnictogen bonds.

Crosslinking polymer chains is a common way to tailor a material's mechanical and functional properties. While permanent covalent bonds lock a structure in place, crosslinks made from reversible bonds let a system reorganise itself in response to changing conditions. This topological adaptability is ideal for materials designed to self-heal or respond to external stimuli.

A variety of supramolecular interactions can be harnessed to build crosslinked polymers, and many have been tried and tested. Hydrogen-bonded networks are the best known, but their weak bonding strength and limited solvent compatibility restrict their application. Chalcogen and halogen bonding offer promising alternatives for dynamic polymer materials, but finding the right balance of properties remains a challenge.

Pnictogen bonding was only recently defined as 'a subset of the attractive interactions between an electrophilic region on a pnictogen atom in a molecular entity and a nucleophilic region in another, or the same, molecular entity.' Now, a team led by Wei Wang from Zhengzhou University in China, has taken advantage of this bonding motif to produce materials with controllable self-healing properties, including when under water.

Directional interactions between antimony centres and pyridine-functionalised polymer chains create efficient and reversible interchain crosslinks

The new materials rely on interactions between antimony and pyridine-functionalised polymer chains, with antimony having been chosen for its strong Lewis acidity relative to other pnictogens. By varying the oxidation state of the antimony, the researchers could further tune the system, as the pnictogen bond strengths differ between Sb(iii) and Sb(v) centres.

Because pnictogen bond donors typically have more accessible σ-holes than other non-covalent donors, they enable stronger bonding directionality and greater structural complexity in the polymer, and therefore more control over the properties. Additionally, the excellent water tolerance of pnictogen bonds also broadens the potential applications of such polymers.

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New catalyst makes plastic upcycling 10x more efficient than platinum

Science Daily · 13 Mar 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, β-W2C, 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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Electrostatic decatalysis offers a new way to suppress parasitic side reactions

Chemistry World · 19 Mar 2026

Manipulating coulombic forces could offer an alternative way to steer selectivity in electrocatalytic reactions. Instead of trying to accelerate the desired reaction, the approach – named electrostatic decatalysis – works by suppressing competing pathways by electrostatically engineering the electrode surface, an idea that has been largely overlooked in efforts to address energy and environmental challenges.

In many electrocatalytic reactions, unwanted side reactions compete with the target transformation, consuming reagents and energy, lowering efficiency, and ultimately reducing selectivity. Conventional efforts to improve these reactions typically focus on redesigning the catalyst's structure. But such modifications often involve trade-offs, improving the catalyst's activity for both desired and competing reactions, without regulating the selectivity.

Electrostatic decatalysis takes a different route. Although coulombic (electrostatic) forces are widely recognised in electrochemistry, they have not previously been harnessed to deliberately suppress parasitic reactions. The concept, developed by Musthafa Ottakam Thotiyl at the Indian Institute of Science Education and Research, seeks to manipulate long-range coulombic interactions at the electrode surface to block unwanted pathways. Ottakam Thotiyl likens it to a gate system: the gate is open to only the desired reaction and closed to the competing reaction.

The team tested the concept on the electrochemical nitrate reduction reaction, where the hydrogen evolution reaction usually competes. They coated carbon nanotube electrodes with either the cationic ionomer poly(diallyldimethylammonium chloride) (PDDA), which gives the surface a positive charge, or the anionic ionomer Nafion, which makes it negatively charged. Positively charged PDDA suppressed the hydrogen evolution reaction and boosted ammonia production, while negatively charged Nafion favoured the hydrogen evolution reaction and suppressed ammonia production.

Deliberately introducing positive charges to the electrode surface suppresses the hydrogen evolution reaction while selectively promoting nitrate-to-ammonia conversion

The researchers used multiple experimental techniques and, in collaboration with a colleague at the University of Texas at Arlington, US, computational modelling, to study the reaction kinetics in detail. By systematically ruling out contributing factors such as wettability, electronic conductivity and surface area they confirmed the improved selectivity was due to electrostatic interactions. The positively charged PDDA surface repels protons, limiting hydrogen evolution, while attracting nitrate ions toward the electrode. The study shows that switching surface charge can steer the competing reactions in opposite directions.

The team also demonstrated the approach in a two-electrode ammonia synthesis device conceived to replace the sluggish counter electrode oxygen evolution reaction by a ferrocyanide oxidation reaction. In this setup, PDDA-modified electrodes achieved energy savings...

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Laser-fused 'glass' motor improves drive efficiency

New Atlas · 17 Mar 2026

When you think of glass, you probably picture something fragile and brittle, not a material built for high-stress electromechanical components. However, researchers at Germany's Saarland University

are challenging that assumption, using a glass-like metal to significantly improve the efficiency of electric motors.

Inside every electric motor, from those found in electric toothbrushes to those in electric vehicles, a rotating component (the rotor) spins within a stationary part (the stator), creating a constantly changing magnetic field. This continuous switching of magnetic direction forces tiny magnetic regions within the metal to repeatedly realign. In conventional materials with an ordered crystalline structure, this process is inefficient. The internal structure resists these changes, creating friction at the microscopic level. That resistance leads to energy losses in the form of heat, a phenomenon commonly referred to as iron losses.

“We are looking into ways of cutting these efficiency losses by improving the materials used in electric motors. In today’s motors, the stator and rotor components are made from conventional soft magnetic, coarse-grained iron alloys. Although these alloys are already optimized, they still exhibit relatively high hysteresis losses during re-magnetization. We want to replace these conventional crystalline alloys with amorphous, glass-like alloys, as they lose hardly any energy during re-magnetization,” explains Prof. Ralf Busch, head of the research team.

Unlike conventional metals, metallic glasses do not have a crystal lattice. Their atomic structure is amorphous, with atoms arranged randomly rather than in repeating patterns typical of metals, making them more like glass than metal. Without a rigid crystal structure getting in the way, the magnetic domains can reorient much more freely when the magnetic field changes. As a result, far less energy is wasted during magnetization and demagnetization cycles, dramatically improving motor efficiency and reducing heat generation.

“Because metallic glasses have no crystallites, the magnetic regions – known as Weiss domains – are not obstructed and can reorient freely when the magnetic field changes,” says Busch. “The magnetic properties of metallic glasses are therefore exceptionally well suited for use in electric motors.”

The name “metallic glass” can be a bit deceptive, as glass is typically thought of as brittle and fragile. In reality, metallic glass is often stronger than steel! The term “glass” refers purely to its internal amorphous atomic structure. This structure is achieved by carefully selecting a mix of elements, melting them, and then cooling the molten material rapidly enough that the atoms “freeze”...

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Engineered nanoparticles show enhanced intrinsic luminescence for biomedical imaging and cancer treatment

Phys Org · 19 Mar 2026

The Nanomedicine and Nanotoxicology Group (GNano) at the University of São Paulo's São Carlos Institute of Physics (IFSC-USP) in Brazil has discovered a way to transform hydroxyapatite, a bioceramic material, into a nanoparticle with enhanced intrinsic luminescence. This paves the way for the use of biocompatible, low-cost nanomaterials in biomedical imaging techniques.

"We've demonstrated that the incorporation of carbonate groups into the hydroxyapatite structure increases the concentration of crystal defects, which are responsible for enhancing the intrinsic luminescence of the material. After functionalization with citrate, which improves colloidal stability in

aqueous media, these calcium phosphate nanoparticles can be used as luminescent agents for cellular bioimaging," Thales Rafael Machado, first author of both studies, explained to Agência FAPESP.

Professor Valtencir Zucolotto of the IFSC-USP coordinated the research, which was conducted in collaboration with the Center for Molecular Engineering of Advanced Materials (CEMol).

According to Machado, the findings were achieved by controlling the concentration of structural and point defects in hydroxyapatite nanoparticles by incorporating different levels of carbonate during synthesis. The sample with the highest carbonate content exhibited the most intense luminescence.

"The bioimaging capability was demonstrated by visualizing the internalization of the nanoparticles into cells using confocal fluorescence microscopy , relying exclusively on their intrinsic luminescence. Cellular internalization was also confirmed by flow cytometry, likewise based on the luminescent signal of the particles, while biocompatibility was assessed through cellular cytotoxicity assays," says Machado.

According to Machado, studying defect chemistry and intrinsic luminescence in carbonated hydroxyapatite contributes to developing new hydroxyapatite-based photocatalytic materials for environmental applications. It also provides a foundation for spectroscopic studies of hard tissues, such as bones and teeth. "This knowledge can also be applied to producing luminescent scaffolds for tissue engineering," he adds.

The study was published in the journal ACS Nanoscience Au .

In a parallel study, GNano and CEMol developed an efficient, robust strategy for delivering gemcitabine—a widely used chemotherapy drug for cancers such as pancreatic cancer—via calcium phosphate nanoparticles.

"The system was designed to be dual pH-responsive , keeping the drug inactive under normal physiological conditions, such as in the bloodstream, and releasing the drug in its active form only in more acidic environments, characteristic of tumor regions. This promotes greater bioavailability and therapeutic potential," says Machado.

The study is published in ACS Applied Bio Materials .

Additionally, the group demonstrated the ability to functionalize the surface of the nanoparticles with folic acid via highly...

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Paper mill waste could unlock cheaper clean energy

Science Daily · 29 May 2026

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 cm² 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/Fe3O4@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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Scientists discover tiny rocket engines inside malaria parasites

Science Daily · 1 Oct 2026

Impact: This discovery could open the door to new malaria treatments and inspire advances in microscopic robot technology.

Spinning Crystals Inside Malaria Parasites

Every cell of the deadly malaria-causing parasite Plasmodium falciparum contains a tiny compartment packed with microscopic iron crystals. While the parasite is alive, these crystals are in constant motion. They whirl, bounce, and collide within their confined space like loose change shaking violently in a machine, moving so quickly and unpredictably that standard scientific tools have struggled to track them. When the parasite dies, however, the motion immediately stops.

These iron crystals have long been a key focus for antimalarial drugs, yet their unusual movement has puzzled scientists since it was first observed. "People don't talk about what they don't understand, and because the motion of these crystals is so mysterious and bizarre, it's been a blind spot for parasitology for decades," says Paul Sigala, PhD, associate professor of biochemistry in the Spencer Fox Eccles School of Medicine (SFESOM) at the University of Utah.

Now, Sigala's team has uncovered the mechanism behind this strange behavior. The crystals are driven by a chemical reaction similar to the one used to power rockets.

The discovery could point to new strategies for treating malaria and also offer insights for designing nanoscale robotic systems. The findings were published in PNAS .

Rocket-Like Chemistry Powers Crystal Motion

The researchers found that the crystals, made from an iron-containing compound called heme, are set in motion by the breakdown of hydrogen peroxide into water and oxygen. This reaction releases energy, providing the force needed to keep the crystals moving.

This type of propulsion is well known in aerospace engineering, where hydrogen peroxide is used as a fuel to launch spacecraft, but it had not previously been identified in a biological system. "This hydrogen peroxide decomposition has been used to power large-scale rockets," says Erica Hastings, PhD, postdoctoral fellow in biochemistry in the SFESOM. "But I don't think it has ever been observed in biological systems."

Hydrogen peroxide is abundant within the small compartment that houses the crystals, and the parasite naturally produces it as a byproduct. This made it a strong candidate as a potential energy source. Experiments confirmed that hydrogen peroxide alone could cause isolated crystals to spin, even outside the parasite.

When parasites were grown under low-oxygen conditions, which reduces hydrogen peroxide production, the crystals slowed to about half their usual speed,...

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Scientists discover molecule that stops aggressive breast cancer in its tracks

Science Daily · 22 Jan 2026

Researchers at Oregon Health & Science University have developed a new molecule that may open the door to treating difficult cases of triple-negative breast cancer, a particularly aggressive form of the disease that currently has few effective treatment options.

In a study published in the journal Cell Reports Medicine , the team describes how the experimental molecule, called SU212, blocks an enzyme that plays a key role in cancer progression. The findings come from experiments using a humanized mouse model designed to mimic human disease.

"It's an important step forward to treat triple-negative breast cancer," said senior author Sanjay V. Malhotra, Ph.D., co-director of the Center for Experimental Therapeutics in the OHSU Knight Cancer Institute. "Triple-negative breast cancer is an aggressive form of cancer and there are no effective drugs available right now."

The next stage of development would involve moving the molecule toward human clinical trials. That process requires significant resources to obtain Food and Drug Administration approval and to launch studies involving patients.

Malhotra, the Sheila Edwards-Lienhart Endowed Chair in Cancer Research and a professor of cell, developmental and cancer biology in the OHSU School of Medicine, said the same strategy could potentially be used to treat other types of cancer as well.

Triple-negative breast cancer makes up about 15% of all breast cancer cases.

Targeting a Key Enzyme That Fuels Cancer Growth

To test the new compound, researchers used a humanized mouse model of triple-negative breast cancer. The molecule SU212 attaches to an enzyme called enolase 1, or ENO1. This enzyme helps regulate glucose levels inside human cells and is produced in unusually high amounts by many cancer cells.

Once bound to ENO1, the molecule causes the enzyme to break down. This process ultimately reduced tumor growth and limited metastasis in the mice.

Under normal conditions, the enzyme plays a role in metabolism by helping cells convert glucose into energy. By disrupting this process in cancer cells, SU212 interferes with a critical pathway that tumors use to survive and spread.

Malhotra noted that this mechanism may be particularly relevant for patients who also have metabolic disorders such as diabetes, a chronic disease that leads to high blood sugar levels.

Potential for Treating Multiple Types of Cancer

The researchers believe that drugs targeting enolase 1 may have benefits beyond triple-negative breast cancer. Other cancers that are influenced by this enzyme include glioma, pancreatic cancer, and thyroid carcinoma.

"A...

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Researchers crack the physics of dangerous battery dendrites

New Atlas · 13 Mar 2026

Researchers have uncovered the mechanical properties of the nanoscale "thorns" that develop inside lithium-ion batteries , which can cause them to short circuit and die – or worse, such as spontaneously catch on fire. These thorns, known as dendrites, have been difficult to study and understand – until now.

While scientists have studied dendrites within cells for some time, researchers in Singapore and several US universities, including the New Jersey Institute of Technology (NJIT), have uncovered some key mechanical properties that contribute to their formation and expansion, which opens the door to finding ways to inhibit their growth.

"Despite decades of study, the fundamental nanomechanical properties of lithium dendrites remained a mystery – until now," said co-lead author Qing Ai, a former research scientist at Rice University.

Lithium dendrites – around 100 times thinner than a single human hair – can form inside a battery during charging, growing out from the anode, or the negative terminal. Normally, lithium should spread smoothly across the surface of the negative terminal when charging, but it can instead build up as metallic needle-like structures that slowly penetrate the battery. Inside the cell, the thin separator between the negative and positive electrodes is then at risk of being breached by these dendrites, leaving the positive side of the battery exposed.

Contact can trigger a short circuit – which can also generate heat and damage the battery. From here, there are several possible outcomes – in extreme cases, the heat and chemical reactions from the circuit fail can destroy the battery or ignite a fire. In less severe scenarios, it's still not good – as broken fragments of dendrites are essentially junk, useless lithium stuck in the cell without the ability to store energy anymore.

"Lithium dendrites are widely recognized as one of the biggest obstacles to the commercialization of lithium-metal batteries," said co-lead author Xing Liu, an assistant professor of mechanical and industrial engineering at NJIT. "During battery operation, lithium dendrites can form, break, and become electrically isolated from the lithium metal anode, creating what is known as 'dead lithium.' This process leads to a gradual loss of battery capacity over time. In addition, dendrites can penetrate the separator and create an internal short circuit between the anode and cathode. Both capacity loss and short-circuit risks associated with dendrites are commonly observed in lab studies.

"At present, there is no practical method to 'clear' dendrites...

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CURIOSITIES

Newly identified disease of corn and sorghum may be mistaken for iron deficiency

Phys Org · 19 Mar 2026

A newly identified disease affecting corn and sorghum can closely resemble iron deficiency, potentially leading farmers to apply costly nutrient treatments that do not address the underlying problem. New research published in Plant Health Progress documents the discovery and identification of a bacterial pathogen responsible for the symptoms.

The study, conducted by Ken Obasa of the Texas A&M AgriLife Research and Extension Center and Dennis Coker of Texas A&M AgriLife Extension Services, began in 2023 when bright lemon-green foliar discoloration with interveinal chlorosis was observed on wild grasses in the northwestern Texas Panhandle.

Later that year, identical symptoms appeared in nearby corn and sorghum fields. Affected plants were often stunted and delayed in development, with reduced reproductive growth. In severe cases, plants failed to reach the reproductive stage.

Initial observations suggested iron deficiency, but soil and plant tissue tests showed that symptomatic plants actually had higher iron content than healthy-looking plants. The random distribution of affected plants within fields also suggested a biological cause rather than a nutrient issue.

"Given the similarity of the disease symptoms to those typically associated with iron deficiency, it's not hard to imagine farmers spending extra money to apply supplemental iron, but sadly, only to find out it did not address the underlying issue," Obasa said.

After ruling out fungal pathogens and while exploring the possibility of phytoplasmas, researchers recovered a microorganism using specialized media. Further investigation using microscopy, antibiotic testing, and DNA sequencing identified the organism as the bacterial pathogen Pantoea agglomerans.

This research describes a previously unreported disease affecting corn and sorghum and suggests unusual biological behavior in the bacterium, including dimorphism and a possible distinct genotype of P. agglomerans.

"These findings hopefully will inform agronomists to exercise caution and to undertake testing of symptomatic plants before recommending application of supplemental iron," Obasa said. "Lack of awareness could result in unnecessary increases in production costs with no commensurate return on the additional investments."

Although the pathogen was first observed in the Texas Panhandle, its identification as a pathogen infecting corn and sorghum has cost-saving implications for farmers domestically and around the world.

Researchers are continuing to investigate how the pathogen spreads in the field, which will help guide the development of future disease management recommendations.

Ken Obasa et al, Pantoea-Induced Interveinal Chlorosis (PIC): A New Bacterial Disease of Corn and Sorghum Caused by Pantoea agglomerans Identified in the Texas Panhandle, Plant Health Progress...

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Resurrected 3.2-Billion-Year-Old Enzyme Could Unlock the Origins of Life

Sci Tech Daily · 18 Mar 2026

By reconstructing ancient nitrogen-processing enzymes, scientists are uncovering new clues about how early life survived on a very different Earth.

Nitrogen is essential for life on Earth, yet most organisms cannot use it directly from the atmosphere. Scientists now believe this element may also provide important clues about how life first developed on our planet and how it might arise elsewhere in the universe.

“All living organisms need nitrogen to survive and, though it’s all around us, we can’t access it directly,” says Utah State University biochemist Lance Seefeldt. “Enzymes called nitrogenases enable nitrogen fixation, which converts nitrogen to a form plants, animals, humans, and other life forms can access. And we’re just beginning to understand the extent to which, over the Earth’s four-billion-year history, these nitrogenases have evolved.”

Seefeldt worked with USU senior scientist Derek Harris and other researchers involved in the NASA-funded Metal Utilization and Selection across Eons (MUSE) project at the University of Wisconsin-Madison. Their study used synthetic biology techniques to analyze modern nitrogenases and reconstruct versions that may resemble their ancient ancestors. The team reported the findings in the journal Nature Communications .

“Our role in the study was to characterize a library of the synthetically reconstructed ancestral nitrogenase genes,” says Harris. “Under controlled lab conditions, we measured the nitrogen isotope fractionation in the cell biomass of the engineered strains.”

Seefeldt, professor and head of USU’s Department of Chemistry and Biochemistry, has spent more than 30 years studying how nitrogenase enzymes are structured and how they function. He says recreating ancient versions of these enzymes provides a powerful new approach for exploring the origins of life on Earth and for investigating how life might arise on other worlds.

“Until now, science has relied on ancient rock and fossils to study early life,” he says. “Our planet was vastly different billions of years ago. Modern microbes access atmospheric sources of nitrogen through nitrogenases, which are just one family of enzymes. Study of fossilized enzymes assumes ancient enzymes produced the same isotopic signatures as modern enzymes.”

By resurrecting these enzymes in the laboratory, scientists can investigate how they behaved long ago. According to Seefeldt, these reconstructed nitrogenases provide researchers with new insight into the composition of Earth’s atmosphere and environmental conditions in the distant past.

"Understanding nitrogenases, both ancient and modern, is critical to helping us tackle current agricultural challenges in a changing climate, including areas...

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The surprising cancer link between cats and humans

Science Daily · 18 Mar 2026

The first large-scale analysis of multiple cancer types in cats has uncovered genetic changes that may help guide new treatments for both animals and people.

Researchers examined tumors from nearly 500 pet cats across five countries. The work involved scientists from the Wellcome Sanger Institute, the Ontario Veterinary College in Canada, the University of Bern, and other collaborators. By studying these samples, the team identified key genetic alterations that drive cancer in cats and found that many of these changes closely resemble those seen in human cancers.

Cats often share the same living environments as their owners, which means they can be exposed to similar cancer risk factors. Using DNA sequencing on tissue samples originally collected for veterinary diagnostics, the study, published in Science , showed that several genetic patterns in feline cancers mirror those found in people. One notable example is the similarity between feline mammary cancer and human breast cancer.

The findings suggest that multiple genetic pathways involved in cancer could be explored further through genomics and clinical studies. This could eventually lead to treatments that target the same mutations in both cats and humans.

First Comprehensive Map of Cat Cancer Genomics

Cats are extremely common pets, with more than 10 million living in the UK and nearly a quarter of households owning at least one1. Cancer is also one of the leading causes of illness and death in cats2, yet its genetic basis has remained poorly understood.

This study marks the first time cat tumors have been analyzed at this scale, creating an open resource that researchers can use to advance feline cancer genomics.

The team screened around 1,000 genes known to be linked to human cancer. They compared tumor and healthy tissue samples across 13 different types of feline cancer, allowing direct comparisons with cancers in humans and dogs. In several cases, the genetic drivers of cancer in cats closely matched those found in people.

Mammary carcinoma, an aggressive and common cancer in cats, provided some of the clearest insights. Researchers identified seven driver genes associated with tumor development. The most frequent was FBXW7, which was altered in more than 50 per cent of the tumors studied. In humans, mutations in FBXW7 in breast cancer are linked to poorer outcomes, reflecting a similar pattern seen in cats.

The study also found that certain chemotherapy drugs were more effective in tumor samples with FBXW7 mutations. Although these...

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These dinosaurs had wings but couldn’t fly

Science Daily · 9 Dec 2026

Dinosaur fossils preserved with their feathers suggest that some of these animals had already lost the ability to fly. As the research team explains, "Feather molting seems like a small technical detail -- but when examined in fossils, it can change everything we thought about the origins of flight, highlighting how complex and diverse wing evolution truly was."

A new study led by a researcher from the School of Zoology and the Steinhardt Museum of Natural History at Tel Aviv University analyzed rare fossils with intact feathers and found evidence that these dinosaurs were not capable of flight. This unusual discovery offers a rare look at how animals lived 160 million years ago and sheds new light on how flight evolved in both dinosaurs and modern birds. The researchers note, "This finding has broad significance, as it suggests that the development of flight throughout the evolution of dinosaurs and birds was far more complex than previously believed. In fact, certain species may have developed basic flight abilities -- and then lost them later in their evolution."

The research was led by Dr. Yosef Kiat, alongside collaborators from China and the United States, and published in the journal Communications Biology by Nature Portfolio.

Dr. Kiat, an ornithologist who studies feathers, explains that dinosaurs split from other reptiles about 240 million years ago. Not long after (on an evolutionary timescale), many species developed feathers, which are lightweight, protein-based structures used for flight and temperature regulation. Around 175 million years ago, a group of feathered dinosaurs known as Pennaraptora appeared. These animals are considered distant ancestors of modern birds and were the only dinosaur lineage to survive the mass extinction at the end of the Mesozoic era 66 million years ago.

Scientists believe Pennaraptora evolved feathers for flight, but environmental changes may have led some species to lose that ability over time, similar to flightless birds today such as ostriches and penguins.

Rare Fossils Preserve Feather Color and Structure

The study focused on nine fossils from eastern China belonging to Anchiornis, a feathered Pennaraptoran dinosaur. These fossils are exceptionally rare because they preserved not only the feathers but also their original coloration, thanks to unique fossilization conditions in the region. Each specimen showed wing feathers that were white with a distinct black spot at the tip.

This preserved coloration allowed researchers to closely examine the structure and growth of the feathers in ways...

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Scientists Just Built Atom-Sized Gates That Act Like Living Cells

Sci Tech Daily · 19 Mar 2026

Scientists have built atom-sized pores that act like living ion channels, opening the door to next-generation nanotech.

Ion channels are extremely narrow pathways that are essential for many processes in living systems. To understand how ions move through these confined spaces, scientists need to build artificial

pores at incredibly small scales. The tightest parts of these channels can be only a few angstroms wide, roughly the size of single atoms, which makes precise and repeatable fabrication very difficult with current nanotechnology.

Researchers at the University of Osaka have now tackled this problem. In a study published in Nature Communications , they describe a new approach that uses a miniature electrochemical reactor to form pores that approach subnanometer size.

In living cells, ions pass through protein channels embedded in the cell membrane. This flow of ions creates electrical signals, including nerve impulses that control muscle movement. These protein channels contain extremely narrow regions and can switch between open and closed states. External signals trigger changes in the protein structure, which in turn regulate the flow of ions.

Inspired by these natural mechanisms, the research team created a solid-state system capable of forming pores close in size to biological ion channels. They started by forming a nanopore in a silicon nitride membrane. This nanopore then acted as a tiny reaction chamber where even smaller pores could be generated.

When a negative voltage was applied across the membrane, it triggered a chemical reaction inside the nanopore that produced a solid precipitate. As this material accumulated, it gradually filled and blocked the pore. Reversing the voltage caused the precipitate to dissolve, restoring pathways for ions to pass through.

“We were able to repeat this opening and closing process hundreds of times over several hours,” explains lead author Makusu Tsutsui. “This demonstrates that the reaction scheme is robust and controllable.”

The researchers tracked the flow of ions through the membrane and observed sudden spikes in current. Similar patterns are seen in natural ion channels. Their analysis indicates that these signals likely arise from the formation of many subnanometer pores within the original nanopore.

They also found that the system could be adjusted to change how the pores behave. By modifying the composition and pH of the reactant solutions, they were able to control the size and properties of the ultrasmall pores.

“We were able to vary the behavior and effective size of the ultrasmall pores...

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Near-Earth asteroid samples contain all five nucleobases key to life

Chemistry World · 17 Mar 2026

Samples collected from the near-Earth asteroid Ryugu have been found to contain all five nucleobases, adding to evidence that life’s building blocks exist elsewhere in the solar system. The researchers think that such asteroids may have helped deliver these molecules to Earth, potentially kick-starting life.

Samples from the asteroid Ryugu (bottom left) were found to contain all five nucleobases

The Japan Aerospace Exploration Agency launched a spacecraft to the carbon-rich Ryugu asteroid in December 2014 as part of its Hayabusa 2 mission. The spacecraft made two landings on the asteroid’s surface in 2019, before returning to Earth in December 2020.

Initial analysis of a sample from the mission revealed the presence of the nucleobase uracil , as well as nicotinic acid (vitamin B3), its derivatives and several imidazoles.

Artist's impression of the Hayabusa 2 JAXA probe landing on the asteroid Ryugu

Scientists in Japan have now analysed two other samples collected during the mission, using high-performance liquid chromatography and high-resolution mass spectrometry to determine the type and abundance of molecules in the sample.

Analysis revealed that all five nucleobases – adenine, guanine, cytosine, thymine and uracil – were present in both samples. The team also found that the ratio of purines (A and G) to pyrimidines (C, T and U) was roughly equal, which differs to samples from other asteroids and meteorites that are richer in one type of nucleobase over the others.

The team suggests that high-energy radiation may have been able to convert small nitrogen-containing molecules – like hydrogen cyanide – into nucleobases. Once formed, asteroids may have delivered these molecules to Earth, which may have 'supported prebiotic molecular evolution and ultimately enabled the emergence of RNA and DNA on early Earth'.

T Koga et al , Nat. Astron. , 2026, DOI: 10.1038/s41550-026-02791-z

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Molecules with largest dipole moments aren't due to electronegativity differences

Chemistry World · 18 Mar 2026

Computational analysis has revealed that diatomic molecules with two metal atoms of similar electronegativities can have a much greater dipole moment than those conventionally thought of as polar. This challenges chemists' understanding of what polarity is, with these compounds potentially finding use in ultra-cold experiments that need highly polar gases.

'If you ask any chemist "What is the diatomic molecule with the largest dipole moment?", they're [likely] going to pick fluorine, because it's the halogen with the largest electronegativity, and then they will pick something like caesium [with a very small electronegativity value],' says Jesús Pérez Ríos at Stony Brook University in the US.

However, rationalising a diatomic molecule's dipole moment goes beyond Linus Pauling's idea of electronegativity differences, with bond length and sizes of atoms also influencing bond polarity, says Pérez Ríos. Chemists recently calculated that there are some molecules with higher dipole moments than caesium fluoride (7.88 Debye), even when they have similar electronegativities. 1 This includes copper or silver atoms bonded to group 1 or 2 metals, where these diatomic molecules can have a dipole moment up to 13 Debye.

Pérez Ríos and his team have now developed a machine learning model that analyses all 7021 possible combinations of atoms in diatomic molecules – 6903 heteronuclear and 118 homonuclear pairings – to see if there are any other unusually large dipole moments. 2

The team trained the model using both experimental data of dipole moments of existing diatomic molecules, as well as dipole moments of theorised compounds.

Analysis of modelled molecules that the system hadn't been trained on revealed that heavy halogen atoms – such as iodine or astatine – bonded to large alkali atoms like caesium or francium had some

of the greatest dipole moments. Swapping the halogen atom out for gold also gave unexpectedly high dipole moments, with the caesium–gold bond reaching over 11 Debye. Pérez Ríos explains this is due to gold's partially filled d-orbital 'hole' that can accept electron density – much like a halogen atom.

'[Researchers] are crazy about polar gases with a huge dipole moment so that [they] can study long-range interactions [in cold environments],' says Pérez Ríos. He thinks that caesium–gold could be an alternative to sodium–caesium, which is the current limit for polar gases with a dipole moment around 5 Debye.

While the model is not 'super accurate' at predicting the exact dipole moment of a given molecule, Pérez...

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Scientists link childhood stress to lifelong digestive issues

Science Daily · 19 Feb 2026

A new study published in Gastroenterology suggests that stress during early life may increase the risk of digestive problems later on. Researchers found that these effects are linked to changes in both the gut and the sympathetic nervous system.

"Our research shows that these stressors can have a real impact on a child's development and may influence gut issues long-term. Understanding the mechanisms involved can help us to create more targeted treatments," said study author Kara Margolis, director of the NYU Pain Research Center and professor of molecular pathobiology at NYU College of Dentistry and pediatrics and cell biology at NYU Grossman School of Medicine.

How Early Stress Shapes Brain and Gut Development

Experiences such as emotional neglect and other forms of adversity can significantly influence a child's development. Studies indicate that stress during pregnancy and early childhood can affect how the brain develops and increase the risk of mental health conditions like anxiety and depression.

To better understand this connection, researchers at NYU College of Dentistry's Pain Research Center examined how early stress affects communication between the brain and the gut. This connection plays a key role in digestion, and disruptions can lead to conditions such as irritable bowel syndrome, abdominal pain, and motility issues (e.g., constipation or diarrhea).

"When the brain is impacted, the gut is likely also impacted -- the two systems communicate 24 hours a day, seven days a week," said Margolis. "There's some data showing that early life stress may be linked to gut disorders, but we wanted to take an in-depth look at the mechanisms and how these gut-brain pathways work."

Mouse Studies Reveal Lasting Effects of Early Stress

The research team investigated early life stress using mouse models along with two large studies involving children.

In the animal study, newborn mice were separated from their mothers for several hours each day to simulate early stress. When examined months later (at the equivalent of young adulthood), these

mice showed increased anxiety-like behavior, gut pain, and problems with gut movement. The type of motility issue differed by sex, with females more likely to develop diarrhea and males more likely to experience constipation.

Further experiments showed that different biological pathways appear to control different symptoms. Disrupting sympathetic nerve signaling improved motility issues but did not reduce pain. In contrast, sex hormones influenced pain but not motility. Serotonin-related pathways were involved in both pain and gut movement.

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How our planet's history was shaped when the Earth moved

Phys Org · 19 Mar 2026

The history of Earth is written on the great tablets of tectonic plates. The motions of plates shaped land masses, formed oceans, and created the varied climates and habitats that set the stage for evolution and the diversity of life. But this grand drama begins with a deep mystery: just when did the continental and oceanic plates begin to drift? Did the lithosphere begin to move soon after the formation of Earth 4.5 billion years ago or only in the last billion years?

A new study by Harvard geoscientists shows the oldest direct evidence yet of plate movement by 3.5 billion years ago. In a study published in Science , the team found that plate movements—though not necessarily the modern type—shaped the early history of our planet.

"There has been a huge range of ages suggested for timing," said lead author Alec Brenner, Ph.D., who conducted the research in the Department of Earth and Planetary Sciences (EPS) at Harvard University Kenneth C. Griffin Graduate School of Arts and Sciences. "With this study, we're able to say three and a half billion years ago, we can see plates moving around on Earth's surface."

The new revelations came from some of the oldest well-preserved rocks in the world, the Pilbara Craton in western Australia, which contains formations from the Archean Eon, when Earth was hosting early microbial life and under heavy bombardment by astronomical objects. The Pilbara area contains evidence of some of the earliest known life, stromatolites and microbialite rocks deposited by single-celled organisms such as cyanobacteria.

A team led by Roger Fu, Professor of Earth and Planetary Sciences at Harvard University, has been conducting research in East Pilbara since 2017. Fu specializes in paleomagnetism, a branch of geophysics that examines changes in Earth's magnetic fields to reconstruct the early history of the planet. Last year, they published a paper about an ancient meteor impact at the same site.

In addition to revealing the properties of Earth's magnetic field, paleomagnetism can also be used to track the motions of plates. By analyzing the magnetic signals of ancient mineral grains, the researchers can infer the orientation and latitude of the rocks at the time of formation—thus using the ancient samples like paleo GPS units.

"Almost everything unique about Earth has something to do with plate tectonics at some level," said Fu. "At some point, Earth went from something not that special, just...

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Regulator suspends use of dimethoate insecticide on berries

abc.net.au · 12 Nov 2025

The national farm chemical regulator has suspended the use of the insecticide dimethoate on a range of berries.

The decision follows consumption data showing Australians are eating far more berries than when the chemical's safety levels were last reviewed.

Dimethoate manufacturers have one year to adjust their labels to reflect the APVMA decision.

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What the government knew about SA's toxic algal bloom and what it told the public

abc.net.au · 15 Mar 2026

South Australia's felt the effects of the toxic algal bloom for the last 12 months. (Getty Images: Tracey Nearmy)

The South Australian government took months to update its health advice after the discovery of a potentially harmful toxin in the state's disastrous algal bloom, insisting it posed minimal risk to humans.

For the past year, algae has flared at hotspots along the SA coastline, wiping out vast populations of marine life, closing parts of the fishing industry, and making some who have gone to the beach sick.

Despite the devastation, Premier Peter Malinauskas has remained upbeat and reassuring.

"The reality of the algal bloom sometimes isn't nearly as bad as people's perception of it," Mr Malinauskas told a media conference in October.

"Let's not scare 1.7 million South Australians from visiting the beach," he said the next day.

But documents show the government knew that a potentially dangerous compound, known as brevetoxin, had been found in animals, but didn't update its health advice or tell the public for four months.

That delay put asthmatics and those with compromised immune systems at risk.

The first effects of the algal bloom were felt by a group of surfers near the holiday town of Victor Harbor in March last year. They reported stinging eyes, coughing, rashes, headaches and breathing difficulties.

Local tradie Dale Madden, who had been swimming nearby, was hospitalised with severe gastroenteritis and a bacterial infection.

"It was like razor blades in my gut. I was rolling around on the floor in the emergency room, coughing and spewing blood," he said.

While his illness can't be definitively linked to the algae, an expert from Florida, which has dealt with the effects of toxic algal blooms since the 1950s, has told Four Corners the bloom can bring on an illness like this.

All up, nearly 100 swimmers and surfers said on social media they'd fallen ill, while hundreds of dead fish, birds, a seal, a baby dolphin, and other marine life washed up on the coast nearby.

It settled on a consistent message: While the bloom was devastating to the marine environment, it posed only the mildest of threats to human health.

The state's chief public health officer, Nicola Spurrier, became fond of saying the symptoms were little more than an "irritant" and that "when you're away from that area, that does resolve".

She eventually settled on this analogy: "It's...

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REACH UPDATE

ECHA's Socio-Economic Analysis Committee agrees its draft opinion on PFAS restriction proposal

ECHA · 11 Mar 2026

ECHA/NR/26/14

The European Chemicals Agency's Committee for Socio-Economic Analysis (SEAC) has agreed its draft opinion on the universal restriction proposal on all per- and polyfluoroalkyl substances (PFAS). The draft opinion will be published soon for a 60-day consultation.

Helsinki, 11 March 2026 – SEAC has agreed its draft opinion on a proposal to restrict the manufacture, placing on the market and the use of PFAS in the EU. The draft opinion is based on an extensive and independent assessment of the socio-economic impacts of a potential restriction of PFAS as well as an analysis of available alternatives. The Committee's work builds on the proposal from the national authorities of the Netherlands, Germany, Denmark, Norway and Sweden, which covered all PFAS and all uses.

SEAC is one of ECHA's two scientific committees responsible for evaluating EU-wide restriction proposals under the EU's chemicals regulation, REACH. The Committee evaluates the benefits of the proposal to human health and the environment, the associated costs, and other socio-economic impacts, considering also the availability of alternatives.

The Risk Assessment Committee (RAC) evaluates the risks that PFAS pose to human health and the environment. RAC adopted its final opinion on 2 March.

Next steps

The SEAC draft opinion as well as the final RAC opinion will be published soon, providing full details on the content of the opinions.

SEAC's draft opinion will be subject to a 60-day consultation. The Committee is expected to adopt its final opinion, taking into account new information received in the consultation where relevant, by the end of 2026. This adoption will conclude ECHA's Committees' scientific evaluation of the proposed restriction and the opinions will be formally submitted to the Commission.

Based on the two final opinions, the European Commission will propose a restriction for discussion and vote in the REACH Committee, composed of EU Member States.

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REGULATORY UPDATE

ASIA PACIFIC

Major blow for Aussies hoarding fuel at home

Realestate.com.au · 10 Mar 2026

Panicked Aussies stockpiling fuel at home face a major blow that would hit them with a crippling bill, with the Insurance Council of Australia warning policies could be voided.

Homeowners rushing to store extra petrol and diesel after a surge in fuel prices amid Middle East tensions risk finding themselves without insurance coverage if things go wrong, with standard policies specifically excluding damage from hazardous materials.

A spokesperson for the Insurance Council of Australia warned “policyholders have a duty to disclose anything that materially changes the risk profile of their property and significant fuel storage may constitute such a change”.

“Home insurance policies have exclusions for loss or damage arising from failure to comply with laws,” the spokesperson said.

“Those considering storing large quantities of fuel on premises must comply with applicable standards for storage of dangerous goods.”

“The Insurance Council encourages anyone with questions about their coverage to review their Product Disclosure Statements and to contact their insurer directly.”

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Online portal makes hazardous substances reporting easier

Consolidated Hazardous Substances (Importers and Manufacturers) Notice 2015 | EPA · 11 Mar 2026

We have launched a new online portal to help importers and manufacturers of hazardous substances meet new notification and reporting requirements, which came into effect on 1 January 2026.

Under the new requirements, importers and manufacturers of certain hazardous substances are required to file an annual report for the 2025 calendar year by 31 May 2026.

All importers and manufacturers of hazardous substances will need to provide their business details, however, not everyone needs to submit an annual report, just those importing or manufacturing certain substances.

For more information about the new requirements, including which types of substances require annual reports please visit: Consolidated Hazardous Substances (Importers and Manufacturers) Notice 2015 | EPA

To assist businesses with these new requirements we hosted a webinar on 25 February 2026, where we provided a run through on how to use the portal to submit an annual report, and answered a range of questions.

A recording of this seminar can be found here: Hazardous substances annual reporting

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Restricting three new Stockholm Convention POPs

EPA NZ · 11 Mar 2026

Three new chemicals were recently added to the Stockholm Convention. Because New Zealand signed this convention, we must restrict the chemicals here.

We are preparing to consult on the proposal to restrict three persistent organic pollutants (POPs). Details will soon be available on our open consultations page.

The proposal is to restrict:

Chlorpyrifos is an organophosphate pesticide used as a broad-spectrum insecticide in a range of agricultural crops and for biosecurity purposes. The EPA has recently completed a reassessment of this substance.

MCCPs are a complex group of chemicals widely used as plasticisers, additives in metalworking fluids, and in paints, sealants, and adhesives.

LC-PFCAs are a group of long-chain per- and polyfluoroalkyl substances (PFAS), used in firefighting foams, textiles, cosmetics, and food packaging materials.

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EPA NZ approves biological control agent to combat invasive Chilean flame creeper

EPA NZ · 26 Feb 2026

The Environmental Protection Authority (EPA) has approved the release of a leaf-feeding beetle to combat invasive weed Chilean flame creeper.

Chilean flame creeper (Tropaeolum speciosum), is an invasive pest plant that spreads quickly and smothers native plants. It is now a threat in many regions, especially Southland, Otago, and Canterbury. It can be found on Stewart Island/Rakiura and the Chatham Islands. It is also becoming a problem plant in Manawatū-Whanganui.

Environment Southland, on behalf of the National Biocontrol Collective, applied to import a leaf-eating beetle (Blaptea elguetai) as removing the weed by hand or using herbicides is not very effective, takes a lot of time, and can harm nearby plants.

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AMERICA

ATSDR Updates Chemical Mixtures Interaction Profiles: Why They Matter for Risk Assessment and Regulation

Bergeson & Campbell · 12 Mar 2026

The U.S. Agency for Toxic Substances and Disease Registry (ATSDR) recently released two new Interaction Profiles for Toxic Chemical Mixtures, continuing a long-running federal effort to better understand the health effects of exposures to combinations of hazardous substances rather than individual chemicals in isolation.

The two new profiles evaluate mixtures commonly encountered in environmental and indoor air contexts:

Chloroform, 1,1-dichloroethylene (1,1-DCE), trichloroethylene (TCE), and vinyl chloride; and

Carbon monoxide, formaldehyde, methylene chloride, nitrogen dioxide, and tetrachloroethylene.

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FDA To Hold Food Allergen Threshold Meeting

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

On January 21, 2026, the U.S. Food and Drug Administration (FDA) announced that it will convene a virtual public meeting entitled “Food Allergen Thresholds and Their Potential Applications” on February 18, 2026, followed by listening sessions on February 19-20, 2026. FDA is hosting events with industry representatives, consumer groups, healthcare professionals, individual firms, retailers, and academic researchers to “help inform the FDA’s next steps, prioritize potential options, and advance our food allergen threshold approaches to benefit public health.” Registration details and event materials are available online. Registration for the February 18, 2026, public meeting will remain open until the meeting begins. Beginning on February 18, 2026, a Regulations.gov docket will open for comments related to the event topic. Electronic comments must be submitted on or before May 19, 2026. FDA will review input received at the public meeting, in the listening sessions, and in response to the Regulations.gov docket to determine next steps.

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Opportunities to Strengthen Oversight of Toxic Substances in Children's Products

GAO · 23 Feb 2026

The Consumer Product Safety Commission (CPSC) uses risk-based approaches to target children’s products that may contain toxic substances for examination at U.S. ports. For example, it uses U.S. Customs and Border Protection systems that analyze national shipment and law enforcement data to target high-risk products. Examinations include screening products with handheld devices for lead

and other toxic substances and reviewing importer documentation to verify that products were tested by third-party labs and meet CPSC safety standards.

Starting July 2026, CPSC will require importers to electronically submit ("e-file") key data (including product identification and place of testing) when products enter U.S. ports. According to CPSC officials, e-filing may help address challenges, such as delays in completing examinations when importers lack lab testing documentation. However, CPSC has not developed an oversight plan to ensure that importers file timely, accurate data. Establishing such a plan would help CPSC ensure that e-filing achieves its intended objectives, such as making targeting more effective and examinations more efficient.

CPSC has review processes to verify that third-party labs that test children's products meet its accreditation and other requirements. For example, labs owned or controlled by a manufacturer or government entity must provide information about their safeguards from undue influence. However, CPSC has not proactively analyzed data across all types of labs to assess potential risks, such as inaccurate testing or misreported results. CPSC recently began analyzing violations data for labs owned by manufacturers to better evaluate their safeguards from undue influence, but it does not do so for independent or government labs. By better leveraging its violations data for these labs, CPSC would be better positioned to identify and address potential problems associated with all types of labs, which could help prevent violative products from entering the market.

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FDA Releases 2026 Deliverables For Human Foods Program

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

On January 23, 2026, FDA released its priority deliverables for 2026 for its Human Foods Program (HFP) that include a focus on food chemical safety, nutrition, and microbiological food safety. Deliverables under food chemical safety include:

Generally Recognized As Safe (GRAS) Reform: FDA specifically states that "[i]n 2026, FDA will publish a proposed regulation to require the submission to FDA of GRAS notices for all new substances claimed to be GRAS."

Post-market Safety Reviews of Marketed Food Chemicals: FDA intends to start with safety reviews of "phthalates, propylparaben, butylated hydroxyanisole (BHA), and butylated hydroxytoluene (BHT), among others." In a separate news release on February 10, 2026, FDA announced the launch of a comprehensive re-assessment of BHA.

Microplastics: FDA's HFP intends to "carry-out research to identify methods that accurately and reproducibly detect, quantify, and characterize microplastics in human food."

Adoption of Natural Color Additives: FDA is prioritizing a shift from petroleum-based food dyes to natural alternatives and intends to publish draft guidance on when fruit- and vegetable-derived juices qualify as color additives under FDA regulations.

Consumer Exposure to Contaminants in Food: HFP intends to continue to study exposure to certain heavy metals, PFAS, and other contaminants in food.

FDA Releases New Total Diet Study Tool

On January 27, 2026, FDA announced the release of the Total Diet Study Interface (TDSi). TDSi is a tool for accessing data from FDA's Total Diet Study. FDA views the TDSi tool as "a significant advancement in data accessibility and transparency" that offers data visualization, enhanced transparency, increased scope, and ongoing updates.

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FDA Releases New Seal

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

On January 28, 2026, FDA unveiled its first ever official agency seal, in honor of marking FDA's 120th year of service. The seal incorporates, among other features, a snake-entwined staff symbolizing medicine, a badge signifying enforcement and protection, and an eagle representing FDA's sweeping mission of protecting public health. Additional information is available at the link here.

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EUROPE

Key figures for Great Britain 2024 to 2025

UK HSE · 12 Mar 2026

1.9 million working people suffering from a work-related illness, of which

964,000 workers suffering work-related stress, depression or anxiety

511,000 workers suffering from a work-related musculoskeletal disorder

2,218 mesothelioma deaths due to past asbestos exposures (2023)

124 workers killed in work-related accidents

680,000 working people sustained an injury at work according to the Labour Force Survey

59,219 injuries to employees reported under RIDDOR

40.1 million working days lost due to work-related illness and workplace injury

£22.9 billion estimated cost of injuries and ill health from current working conditions (2023/24)

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HAZARD ALERT

Creosote

20 Mar 2026

Creosote is the name used for a variety of products: wood creosote, coal tar creosote, coal tar, coal tar pitch, and coal tar pitch volatiles. These products are mixtures of many chemicals created by high-temperature treatment of beech and other woods, coal, or from the resin of the creosote bush. [1]

Wood creosote is a colourless to yellowish greasy liquid with a characteristic smoky odour and sharp burned taste. It is relatively soluble in water. Creosote prepared from coal tar is the most common form of creosote in the workplace and at hazardous waste sites in the United States. Coal tar creosote is a thick, oily liquid that is typically amber to black in colour. It is easily set on fire and does not dissolve easily in water. Coal tar and coal tar pitch are the by-products of the high-temperature treatment of coal to make coke or natural gas. They are usually thick, black or dark brown liquids or semisolids with a smoky or aromatic odour. Chemicals in the coal tar pitch can be given off into the air as coal tar pitch volatiles when coal tar pitch is heated. [2]

Uses [3]

Wood creosote has been used as a disinfectant, a laxative, and a cough treatment, but is rarely used these ways today in the United States. It is still available as an herbal remedy, and is used as an expectorant and a laxative in Japan. Coal tar creosote is the most widely used wood preservative in the United States. It is also a restricted use pesticide and is found in medicines used to treat skin diseases such as psoriasis. Because of the current widespread use of coal tar creosote as a wood preservative and its past pesticidal applications, it is the form of creosote most likely to be present at hazardous waste sites and landfills. Coal tar, coal tar pitch, and coal tar pitch volatiles are used in several industries, including road-paving, roofing, aluminium smelting, and coking.

Sources & Routes of Exposure

Sources of Exposure [4]

General Populations

- The general population will only be exposed to creosote at low levels. Coal tar creosote is restricted for use to certified applicators only.
- Potential sources of exposure to creosote include contact with creosote-treated wood products, incineration of creosote-treated scrap lumber, or ingestion of contaminated ground water.
- Exposure may also occur during the therapeutic use of coal tar dandruff shampoos, coal tar ointments for treatment of eczematous dermatitis or psoriasis.

- Exposure may also occur through ingestion of dietary supplements or tea that contains leaves from the creosote bush.

Occupational Populations

- Individuals who work in the wood-preserving industry make up the largest percent of the population that might be exposed to coal tar creosote.
- Exposure to coal tar pitch and coal tar pitch volatiles may occur in asphalt workers; rubber, aluminium, iron, steel and tire factory workers; and in coke-producing industries.

Routes of Exposure [4]

The routes of exposure to creosotes are as follows:

- Inhalation – Minor route of exposure for the general population. Predominant route of occupational exposure.
- Oral – Major route of exposure for the general population.
- Dermal – Major route of exposure for the general and occupational populations

Health Effects [5]

Acute Effects

Creosote has been involved in incidental or accidental poisoning incidents, mainly due to its use as a pesticide. Deaths occurred following ingestion of about 1 to 2 g (children) or about 7 g (adults). Symptoms included salivation, vomiting, respiratory difficulties, vertigo, headache, loss of pupillary reflexes, hypothermia, cyanosis, convulsion accompanied by oropharyngeal, intestinal, pericardial, liver and kidney damage.

Contact with creosote or creosote vapour may cause irritation of the skin. The skin may become red, papular, vesicular or ulcerated, depending on the period of exposure. Increased photosensitisation may occur, particularly on the face or hands. Vapours and contact can produce an intense burning of the membranes of the eyes and respiratory tract. Eye contact can lead to conjunctivitis and keratitis. One or more of the following effects may be evident on short-term exposure to high concentrations of creosote:

- systemic – nausea and vomiting, diarrhoea, anorexia and difficulty in swallowing, salivation, abdominal discomfort, respiratory distress, cyanosis, pupillary changes, convulsive movements, rapid pulse or vascular collapse;
- neurological – headaches, fainting, vertigo and mental disturbances.

Chronic Effects

Chronic exposure may provide sufficient absorption to show the systemic effects listed above.

Carcinogenicity

Increased risks of developing lip and skin cancers have been observed in cohort studies of Swedish and Norwegian wood impregnators and in Finnish round timber workers. A cohort study examining 922 Swedish and Norwegian wood impregnators from 13 plants (for example railroad cross ties and telegraph poles) found a standardised incidence ratio (SIR) of 250 for lip cancers and an SIR of 237 for non-melanoma skin cancer. The risk increased with the latency; analysis by duration of exposure was not provided. According to the authors, the significantly elevated risk for lip and skin cancer could probably be attributed to the combination of exposure to creosote and sunlight. In a

population-based record linkage study in Finland, elevated risks for lip cancer, SIR = 306, and non-melanoma skin cancer, SIR = 464, were found for round-timber workers [5]; the mortality for cancer of the scrotum was elevated among brick makers exposed to creosote. Prolonged skin exposure to soot and coal tar creosote has been associated with cancer of the scrotum in chimney sweeps.

Single epidemiological studies suggested a possible risk for bladder cancer, multiple myeloma, and lung cancer due to exposure to creosote. Two case-control studies suggested an increased risk of brain tumours and neuroblastoma among offspring of male workers with possible creosote exposure.

All of the epidemiological studies were based on qualitative estimations of exposure rather than on measurements. There is consistent evidence from human studies that creosote causes skin cancer, but the studies do not allow dose-response analysis.

Creosote, from distillation of coal tar, is classified according to the GHS as Carcinogenicity Category 1B (May cause cancer).

Safety

First Aid Measures

- Skin: Wash thoroughly with waterless hand cleaners, olive oil or soap and water. Avoid solvents.
- Eyes: Flush eyes immediately with large amounts of water or olive oil for at least 15 minutes. Call a physician
- Inhalation: Remove to fresh air. If not breathing, give artificial respiration; preferably mouth-to-mouth. If breathing is difficult, give oxygen. Call a physician.
- Ingestion: If conscious, first induce vomiting, then take 2 tablespoons of activated charcoal (USP drug grade) in water. Get immediate medical attention. Do not induce vomiting, or give anything by mouth to an unconscious person.

Exposure Controls & Personal Protection

Engineering Controls

Use in areas with adequate natural or local exhaust ventilation.

Personal Protective Equipment

The following personal protective equipment should be used when handling creosotes:

- Skin Protection: Avoid skin contact whenever possible by using non-porous type gloves. For outdoor work use a waterproof sunscreen (SPF 25 or greater); reapply every 90 minutes while in direct sun. For exposed skin, use protective creams (for example: MSA's Fend AE-2, Kerodex 51, Jergens SBS-46).
- Eye Protection: Safety glasses, goggles and/or face shield.
- Respiratory Protection: Not required for properly ventilated areas. Use a NIOSH approved respirator with suitable organic vapor cartridge as necessary to control exposures above the TLV of PEL.
- Additional Recommendations: Do not take contaminated work clothing home. It is recommended that a complete soap and water shower and/or steam bath be taken at the end of each working day.

Regulation [2,7]

United States

OSHA: The Occupational Safety and Health Administration has set an exposure limit of 0.2 milligrams of coal tar pitch volatiles per cubic metre of air (0.2 mg/m3) in the workplace during an 8-hour workday, 40-hour workweek.

ACGIH: The American Conference of Governmental Industrial Hygienists recommends the same level for coal tar pitch volatiles.

NIOSH: The National Institute for Occupational Safety and Health recommends a maximum level of 0.1 mg/m3 of coal tar pitch volatiles for a 10-hour workday, 40-hour workweek.

EPA: The Environmental Protection Agency requires that spills or accidental releases into the environment of 1 pound or more of creosote be reported to the EPA.

Australia

Safe Work Australia: Safe Work Australia has established a time weighted average (TWA) concentration for coal tar pitch of 0.2 mg/m3 for a 40-hour workweek.

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JANET'S CORNER

Who Am I?

20 Mar 2026

I am humanity's silent monument, found in nearly every structure you walk past, yet most people never stop to wonder what I'm truly made of.

My origins trace back to the Romans, who mixed volcanic ash with lime and seawater to build aqueducts that still stand over two millennia later.

I'm born from a chemical reaction between cement, water, and aggregates, and I actually grow stronger as I age—a process called hydration that can take decades.

Mix me with Portland cement, sand, gravel, and water, and you've got the world's most widely used construction material by mass.