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ASIA PACIFIC

Safe Work Australia has released the model Code of Practice: Elevating Work Platforms. The model Code of Practice: Elevating Work Platforms (EWP) provides practical guidance to employers and other duty holders on how to manage the risks to health and safety associated with elevating work platforms.

2026-01-27

Elevating work platforms (EWPs) are powered mobile plant designed to lift or lower people and equipment from a base support.

The new model Code is designed to support employers and other duty holders in understanding and fulfilling their responsibilities. It outlines:

- common risks associated with EWP use
- examples of effective control measures
- guidance on inspection, maintenance, and the proper use of EWPs.

The model Code of Practice will replace two existing guides – the guide to managing the risks of elevating work platforms and the guide to inspecting and maintaining elevating work platforms.

Learn more and download the model Code of Practice: Elevating Work Platforms.

Read More

Safe Work Australia, 27-01-26

https://www.safeworkaustralia.gov.au/doc/model-code-practice-elevating-work-platforms

AMERICA

Revised risk management scope for phenol, methylstyrenated

2026-01-16

This document outlines the proposed risk management options under consideration for phenol, methylstyrenated (MSP) (CAS RN 68512-30-1), which has been proposed to be harmful to the environment.

For the purposes of paragraph 77(1)(a) of the Canadian Environmental Protection Act, 1999 (CEPA), the Government of Canada proposes to recommend that MSP be added to Part 1 of Schedule 1 to CEPA.

The exposure source of concern for MSP is the use of paints and coatings products that contain MSP, more specifically, as protective coatings applied for routine maintenance on ships and during fabrication of large equipment.

The Government of Canada is considering the following new risk management action:

Amending the Prohibition of Certain Toxic Substances Regulations, 2025, to prohibit the manufacture, use, sale, offer for sale, and import of the substance MSP and products containing it.

Upon prohibition of MSP, such as through its addition to the Prohibition of Certain Toxic Substances Regulations, 2025, the Government of Canada would also add MSP to Part 3 of the Export Control List in Schedule 3 to CEPA to subject its export to the Export of Substances on the Export Control List Regulations.

To inform risk management decision-making, information on the following topics should be provided (ideally on or before March 18, 2026), to the contact details identified in section 8 of this document:

Socio-economic and technical impacts of the proposed risk management.

Alternative substances to MSP in consumer and commercial products (for example, paints and coatings products, adhesives and sealants)

Alternative products to those that may or could contain MSP

Imports of manufactured items that are made with, coated with, or that contain MSP

Analytical methods to detect levels of MSP and/or its representative component in the aquatic environment, in paints and coatings, and/or in other products

Achievable timelines for a company to complete a phase out of MSP or MSP-containing products; and/or

Information that could help establish an incidental presence concentration threshold in products

Read More

Government of Canada, 16-01-26

https://www.canada.ca/en/environment-climate-change/services/evaluating-existing-substances/revised-risk-management-scope-phenol-methylstyrenated.html

EUROPE

Fast fashion's bloody catwalk faces a halt – if Brussels lets France act

2026-01-21

As EU executives meet with Shein and H&M in the same week, civil society urges the European Commission to let a trailblazing French law against fast fashion pass.

France is taking on ultra-fast fashion with a new law that seeks to rein in the most harmful commercial practices in the textile sector. The French initiative could inspire other European countries to address the social and environmental impacts of the industry, but the adoption of the law is hanging by a thread, currently blocked by the European Commission.

As Environment Commissioner Jessika Roswall met representatives of fashion industry giants Shein and H&M, civil society hit the streets of Brussels with a clear message: "Stop fast fashion's bloody catwalk. Europe needs the French law. Let it pass."

Read More

New Leaf, 21-01-26

https://meta.eeb.org/2026/01/21/fast-fashion-bloody-catwalk-faces-a-halt-if-brussels-lets-france-act/

New EU-wide protections against PFAS in drinking water come into effect

2026-01-12

Under new rules entering into application today (Jan 12), Member States must monitor, in a harmonised way, per- and polyfluoroalkyl substances (PFAS) levels in drinking water to ensure compliance with the new EU limit values under the recast Drinking Water Directive.

They will also have to inform the Commission of these monitoring results. This includes data on exceedances of the limit values, incidents and any granted derogations.

The new reporting system is simpler than under the previous Drinking Water Directive and reduces the amount of data to be reported. It is the first time systematic monitoring of PFAS in drinking water is being implemented in the EU.

If the limit values are exceeded, Member States must take action to reduce the level of PFAS and protect public health, while also informing the public. These measures may include closing contaminated wells, adding treatment steps to remove PFAS, or restricting the use of drinking water supplies for as long as the exceedance continues.

Read More

European Commission, 12-01-26

https://environment.ec.europa.eu/news/new-eu-rules-limit-pfas-drinking-water-2026-01-12_en

European Commission | Final technical report on the revision of the EU Ecolabel criteria for indoor and outdoor paints and varnishes

2026-01-21

This Science for Policy Report is intended to provide the background information for the revision of the existing EU Ecolabel criteria for indoor and outdoor paints and varnishes (Commission Decision 2014/312/EU). The study has been carried out by the Joint Research Centre (JRC) Unit B.5 – Circular Economy and Sustainable Industry with the technical support of Viegand Maagøe A/S. The work was developed for the European Commission's Directorate-General for Environment.

The EU Ecolabel criteria for indoor and outdoor paints and varnishes set out in Decision 2014/312/EU were established in 2014. Commission Decision (EU) 2022/1229 prolonged their validity until 31 December 2025.

The main purpose of this Technical Report is to examine whether the criteria are still appropriate and up-to-date, or whether some of them should be revised, amended or removed; and finally, whether any new criteria should be added. The Technical Report provides elements supporting the proposal for revised EU Ecolabel criteria for decorative paints, varnishes, and related products, performance coatings and related products, and new products such as water-based aerosol spray paints.

Read More

European Commission, 21-01-26

https://publications.jrc.ec.europa.eu/repository/handle/JRC145239

Defra Water White Paper Published

2026-01-20

On 20 January 2026, the Department for Environment, Food and Rural Affairs (Defra) published a Water White Paper in response to the Independent Water Commission's (IWC's) 2025 report, which set out 88 recommendations to reform and improve the water sector regulatory system in England and Wales.

Defra's White Paper outlines plans to abolish Ofwat and consolidate key water system functions from existing regulators into a single new regulator. It also sets out measures to upgrade infrastructure, with increased investment in storm overflow controls and wastewater treatment to address phosphorus pollution. The paper signals reforms to the legislative framework, including updates to the Urban Wastewater Treatment Regulations and the Water Framework Directive Regulations. It proposes a shift in focus to pre-pipe solutions, such as rainwater management and tackling sewer misuse. A Transition Plan will be published in 2026, providing a roadmap for implementing these changes.

Although the report does not specifically mention cosmetic products, companies rely on water supply and infrastructure for production and therefore this remains an important topic.

Read More

DEFRA, 20-01-26

https://www.ctpa.org.uk/news/

Ship recycling: New certificate formats to reduce administrative burden

2026-01-19

Ship owners who wish to have their vessels recycled will now be able to fulfil their legal obligations using a single administrative form.

The European Commission has today (Jan 19) adopted new formats for the certificates used to list all hazardous material present on board a vessel and to confirm that a ship is ready for recycling.

The update will enable ship owners to fulfil their obligations under both the EU's Ship Recycling Regulation and the Hong Kong Convention with a single certificate, thereby reducing administrative burden without lowering the EU requirements.

Background

European ship owners possess around 30% of the world's fleet in terms of tonnage. However, many ships are dismantled outside the EU, mainly in South Asia, under conditions that are often harmful to workers' health and the environment.

The EU's Ship Recycling Regulation was adopted in 2013 to provide a regulatory framework for the recycling of large seagoing vessels sailing under an EU Member State flag.

The Regulation includes:

Requirements for ships and recycling facilities;

Limits and prohibitions on the installation and use of hazardous materials on ships (i.e. asbestos);

The European List of compliant ship recycling facilities located in the EU and the rest of the world.

Read More

European Commission, 19-01-26

https://environment.ec.europa.eu/news/streamlining-ship-recycling-new-certificate-formats-2026-01-19_en

Upcoming GB active substance expiry date

2026-01-30

Biocidal products must be phased off the GB market.

The active substance/product type combinations listed are due to expire under the GB Biocidal Products Regulation (GB BPR) on the following date:

30 June 2026

- Bacillus thuringiensis subsp. israelensis, strain SA3A (CAS N/A EC N/A) in product type 18
- Bacillus sphaericus 2362, strain ABTS-1743 (CAS 143447-72-7 EC N/A) in product type 18

Once the approvals expire, the active substances will no longer be able to be used in biocidal products of the relevant product type in GB.

In addition articles treated with such products will no longer be able to be placed on the market in GB.

Read More

HSE UK, 30-01-26

https://www.hse.gov.uk/

INTERNATIONAL

HEAL comments on the harmonised classification of sodium fluoride

2026-01-19

HEAL supports the French proposal for the harmonised classification (CLH) of sodium fluoride (NaF) as a presumed human reproductive toxicant (Reprotox. 1B) and a known or presumed endocrine disruptor for human health (ED HH 1) and has submitted comments to the public consultation on this proposal.

Read More

HEAL, 19-01-26

https://www.env-health.org/heal-comments-on-the-harmonised-classification-of-sodium-fluoride/

European business associations celebrate the signature of EU-Mercosur FTA

2026-01-20

Some cut flowers in the Netherlands are grown in Africa or South America. These flowers often contain many pesticides. People working with cut flowers or placing them in vases at home can be exposed to these substances. Therefore, the Dutch Food and Consumer Product Safety Authority (NVWA) conducted measurements on roses. Preliminary research by RIVM shows that some of the detected substances could be harmful to the health of workers.

The NVWA took a sample of 177 rose specimens from outside the EU European Union (European Union). A laboratory examined the roses and analyzed the substances found. Based on the amount of substances found, RIVM explored whether these flowers could be harmful to people working with them and to consumers. The rose was chosen as an example because it is the most imported flower.

Read More

RIVM, 20-01-26

https://openrijk.nl/en/rijksinstellingen/rivm/artikel/schadelijkegewasbeschermingsmiddelenoprozenvanbuiteneuropeseunie/harmful-pesticides-on-roses-from-outside-the-european-union

European business associations celebrate the signature of EU-Mercosur FTA

2026-01-17

Today marks a historic milestone with the signing of the EU-Mercosur Trade Agreement, creating the biggest trading block in the world. European business – represented by more than 28 associations across a wide range of sectors – warmly welcomes this signature. It sends a strong and timely signal that the EU remains open and is committed to rules-based global trade. In a time of global uncertainty, this agreement is a key growth booster.

By opening access to over 270 million consumers via the elimination of trade barriers and the removal of tariffs on over 90% of EU exports, the agreement provides the thrust European companies need to export, invest, and grow, as well as to diversify their supply chains, sourcing essential products and raw materials from Mercosur. By 2040, according to DG Trade's calculations, the agreement is expected to add 77.6 billion euros to the EU GDP, resulting in a 39% increase in EU exports to Mercosur.

With the agreement now signed, the ball is firmly in the court of the European Parliament in ensuring rapid ratification. We therefore call on Members of the European Parliament to give their consent and allow Europe's engine of economic growth and prosperity to be switched on and move ahead decisively. After over 25 years of negotiations, we are finally in sight of the finish line. We cannot afford to wait any longer.

List of participants

European Automobile Manufacturers' Association (ACEA)

AmCham EU

BusinessEurope

CAOBISCO – Association of Chocolate, Biscuit and Confectionery Industries of Europe

CEC – European Footwear Confederation

CECE – Committee for European Construction Equipment

CECIMO – European Association of Manufacturing Technologies

CEEV – Comité Vin

CEFIC – European Chemical Industry Council

Cepi – Confederation of European Paper Industries

Cerame-Unie – European Ceramic Industry Association

CIUS – European Sugar Users

CLEPA – European Association of Automotive Suppliers

COTANCE – Confederation of National Associations of Tanners and Dressers of the European Community

EBCA – European Branded Clothing Association

EDA – European Dairy Association

ESF – European Services Forum

ESRA – European Sugar Refineries Association

Eucolait

EURATEX – European Apparel and Textile Confederation

Eurochambres

European Entrepreneurs CEA-PME

European Metals

Medicines for Europe

Orgalim – Europe's Technology Industries

spiritsEUROPE

The Brewers of Europe

Toy Industries of Europe (TIE)

Read More

EURATEX, 17-01-26

https://euratex.eu/news/european-business-associations-celebrate-the-signature-of-eu-mercosur-fta/

Policy for the Prevention and Management of potential Conflicts of Interest at ECHA

2026-01-15

The management of situations involving (actual, potential and perceived) conflicts of interest is a key element of the governance and management of all EU institutions, bodies or agencies, and is crucial for maintaining the trust of stakeholders and citizens in their integrity. For ECHA to play a pivotal role in ensuring that chemicals legislation, the decision making processes underlying it, and the scientific basis are credible amongst all stakeholders, it is essential that conflicts of interest are managed effectively to ensure ECHA's independence and transparency. To achieve this, ECHA has to strike a delicate balance between getting the right expertise to guarantee high quality science-based decision making and at the same time strictly avoiding conflicting interests influencing or seen as influencing the decision-making process. Important tools to achieve this balance are awareness raising, methods for detecting risks to the Agency's integrity, the establishment of clear boundaries for (un) acceptable interests and the appropriate management of conflict of interest situations, including underlying clear procedures. In this, it is not so much a matter of eliminating any possibility of conflict of interest, but also of detecting them at an early stage, recording them and handling them appropriately.

Read More

ECHA, 15-01-26

https://echa.europa.eu/documents/10162/17207/pol-0027_prevention_and_management_of_potential_conflicts_of_interest_en.pdf

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Who Am I?

2026-02-06

I am a noble gas that is often mixed with helium for deep-sea diving gas tanks due to my low solubility in blood.

(Send in your answers and get a surprise Chemwatch merch from us for free)

I am a noble gas that is often mixed with helium for deep-sea diving gas tanks due to my low solubility in blood.

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Acetophenone

2026-02-06

Acetophenone is the organic compound with the chemical formula C6H5C(O)CH3. It is the simplest aromatic ketone. It occurs as a colourless liquid that is slightly soluble in water. Acetophenone has a sweet pungent odour of orange blossom or jasmine, with an odour threshold of about 0.83 milligrams per cubic metre. It is a precursor to useful resins and fragrances. [1,2]

USES [2,3]

Acetophenone is used:

- In perfumery as a fragrance ingredient in soaps, detergents, creams, lotions, and perfumes;
- As a flavouring agent in foods, non-alcoholic beverages, and tobacco;
- As a specialty solvent for plastics and resins;
- As a catalyst for the polymerisation of olefins; and
- In organic syntheses as a photosensitiser.

EXPOSURE SOURCES & ROUTES OF EXPOSURE [3]

Exposure Sources

Acetophenone is found in emissions from vehicular exhaust, waste incineration, and residential fuel oil, and coal combustion. It is also found in the vaporisation of certain perfumes. The primary sources of acetophenone emissions reported in the United States Environmental Protection Agency's 1995 Toxics Release Inventory Public Data Release Report were the primary metal industries. Acetophenone was registered for use as a pesticide, however as of 31 December 1991, it is no longer registered for pesticidal use in California.

Routes of Exposure

Occupational exposure to acetophenone may occur during its manufacture and use. Acetophenone has been detected in ambient air and drinking water; exposure of the general public may occur through the inhalation of contaminated air or the consumption of contaminated water. Probable routes of human exposure to acetophenone are inhalation, ingestion, and dermal contact.

HEALTH EFFECTS [4]

Acute Health Effects

- Acute exposure of humans to acetophenone vapour may produce skin irritation and transient corneal injury. One study noted a decrease in light sensitivity in exposed humans.
- Acute oral exposure has been observed to cause hypnotic or sedative effects, haematological effects, and a weakened pulse in humans.
- Congestion of the lungs, kidneys, and liver were reported in rats acutely exposed to high levels of acetophenone via inhalation.
- Tests involving acute exposure of rats, mice, and rabbits have demonstrated acetophenone to have moderate acute toxicity from oral or dermal exposure.

Carcinogenicity

- No information is available on the carcinogenic effects of acetophenone in humans or animals.
- EPA has classified acetophenone as a Group D, not classifiable as to human carcinogenicity.

Other Effects

- No information is available on the reproductive or developmental effects of acetophenone in humans.
- In one study of pregnant rats exposed dermally, no effects on reproduction or development were noted.

SAFETY

First Aid Measures [5]

- **Eye Contact:** Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Cold water may be used. Get medical attention immediately.
- **Skin Contact:** In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Cold water may be used. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.
- **Serious Skin Contact:** Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

- **Inhalation:** If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.
- **Ingestion:** Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Personal Protective Equipment [4]

The following personal protective equipment is recommended when handling acetophenone:

- Splash goggles;
- Lab coat;
- Gloves.

Personal Protection in Case of a Large Spill:

- Splash goggles;
- Full suit;
- Boots;
- Gloves;
- Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

REGULATION

United States

ACGIH: The American Conference of Governmental Industrial Hygienists have set a Threshold Limit Value (TLV) for acetophenone of 10 ppm, 49 mg/m^3 Time Weighted Average (TWA)

REFERENCES

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2. http://www.epa.gov/ttn/atw/hlthef/acetophe.html
3. http://scorecard.goodguide.com/chemical-profiles/html/acetophenone.html
4. http://www.sciencelab.com/msds.php?msdsId=9922778
5. https://www.osha.gov/dts/chemicalsampling/data/CH_216750.html

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Scientists unlocked a superconductor mystery under crushing pressure

2025-12-21

The challenge is that superconductivity usually occurs only at very low temperatures, far below everyday conditions. This limitation has prevented widespread practical use. That picture began to change with the discovery of superconductivity in hydrogen-rich materials. Hydrogen sulfide (H3S) becomes superconducting at 203 Kelvin (-70°Celsius), while lanthanum decahydrid (LaH10) reaches superconductivity at 250 Kelvin (-23°Celsius). These temperatures are far higher than those of earlier superconductors and are above the boiling point of liquid nitrogen, which is why scientists classify them as high temperature superconductors. Their discovery marked a major step toward the long-standing goal of room-temperature superconductivity.

The Superconducting Gap and Why It Is Crucial

At the heart of superconductivity is a feature known as the superconducting gap. This property reveals how electrons join together to form the superconducting state and serves as a clear signature that distinguishes a superconductor from an ordinary metal.

Understanding the superconducting gap is essential because it directly reflects how electrons interact inside the material. Without measuring this gap, scientists cannot fully explain why a material becomes superconducting or what mechanism makes resistance disappear.

Why Measuring Hydrogen Superconductors Is So Difficult

Despite their importance, hydrogen-rich superconductors such as H3S have been extremely challenging to study. These materials can only be created under enormous pressures that exceed atmospheric pressure by more than a million times. Because of these extreme conditions, widely used techniques like scanning tunneling spectroscopy and angle-resolved photoemission spectroscopy cannot be applied.

As a result, the superconducting gap in these materials had remained unmeasured, leaving a major gap in scientists' understanding of how high-temperature superconductivity works in hydrogen-rich compounds.

A New Tunneling Technique Breaks the Barrier

To solve this problem, researchers at the Max Planck Institute in Mainz developed a planar electron tunneling spectroscopy method that can operate under these extreme pressures. This new approach made it possible to directly probe the superconducting gap in H3S for the first time.

With this technique, the team obtained a clear picture of the superconducting state in hydrogen-rich materials, overcoming a barrier that had limited progress in the field for years.

What the Measurements Revealed

The researchers found that H3S has a fully open superconducting gap of approximately 60 millielectronvolt (meV). They also studied its deuterium counterpart, D3S, which showed a smaller gap of about 44 meV. Deuterium is a hydrogen isotope and has one more neutron.

This difference is significant because it confirms that superconductivity in H3S is driven by interactions between electrons and phonons. Phonons are quantized vibrations of a material's atomic lattice. The results support long-standing theoretical predictions about the mechanism behind superconductivity in hydrogen-rich compounds.

Why This Breakthrough Matters

For the researchers in Mainz, the achievement goes beyond technical success. It provides a foundation for uncovering the fundamental origins of high-temperature superconductivity in hydrogen-based materials. "We hope that by extending this tunneling technique to other hydride superconductors, the key factors that enable superconductivity at even higher temperatures can be pinpointed. This should ultimately enable the development of new materials that can operate under more practical conditions," states Dr. Feng Du, first author of the now published study.

Dr. Mikhail Eremets, a leading figure in high-pressure superconductivity research who deceased in November 2024, described the study as "the most important work in the field of hydride superconductivity since the discovery of superconductivity in H3S in 2015." Vasily Minkov, project leader of High-Pressure Chemistry and Physics at the Max Planck Institute for Chemistry, added: "Mikhail´s vision of superconductors operating at room temperature and moderate pressures comes a step closer to reality through this work."

A Brief History of Superconductivity

Superconductivity refers to the ability of certain materials to conduct electrical current without resistance. It was first discovered in pure mercury in 1911 by Heike Kamerlingh Onnes. For many decades, scientists

believed this phenomenon could only occur at temperatures near absolute zero (-273 °C).

That assumption changed in the late 1980s when Georg Bednorz and Karl Alexander Müller discovered copper-oxide superconductors, also known as cuprates, that exhibited high-temperature superconductivity under normal atmospheric pressure. This discovery sparked worldwide research efforts.

Over time, scientists reached critical temperatures (Tc) of about 133 K at ambient pressure and 164 K under high pressure. Progress then stalled until hydrogen-rich compounds entered the picture.

Hydrogen-Rich Materials Push the Limits

The discovery of superconductivity in H3S at megabar pressures, with a Tc = 203 K by the research group led by Dr. Mikhail Eremets, represented a turning point. Soon after, even higher critical temperatures were observed in hydrogen-rich metal hydrides such as YH9 (Tc ≈ 244 K) and LaH10 (Tc ≈ 250 K).

Current theoretical models now suggest that superconductivity above room temperature may be possible in several hydrogen-dominated systems when subjected to extreme pressure.

Cooper Pairs and the Meaning of the Superconducting Gap

In normal metals, electrons near the Fermi level can move freely. The Fermi level represents the highest energy level electrons can occupy in a solid at absolute zero. When a material becomes superconducting, electrons instead form paired states known as Cooper pairs and enter a collective quantum state.

In this state, paired electrons move together without scattering off phonons or impurities in the crystal lattice, which eliminates electrical resistance. This pairing creates an energy gap near the Fermi level called the superconducting gap. The gap represents the minimum energy required to break a Cooper pair and plays a protective role by stabilizing the superconducting state against disturbances.

The superconducting gap is a defining feature of superconductivity. Its size and symmetry provide critical insight into how electrons interact and pair, making it a key fingerprint of the underlying superconducting mechanism.

Science Daily, 21 December 2026

https://sciencedaily.com

Microbial system to convert CO_2 into eco-friendly butanol

2026-02-05

With increasing urgency to address climate change, converting greenhouse gases into valuable resources has become a key focus of sustainable innovation. Microbial conversion offers a sustainable solution, as microbes naturally consume CO_2, producing useful compounds with minimal energy and without relying on expensive catalysts.

A joint research team from UNIST and the University of California, Berkeley, has unveiled a novel microbial process to convert carbon dioxide (CO_2) into butanol, an environmentally friendly fuel. This innovative approach utilizes a continuous bioprocess involving two specialized microorganisms working in tandem.

This work was led by Professors Douglas S. Clark and Peidong Yang of UC Berkeley's Department of Chemical and Biomolecular Engineering and Department of Chemistry, respectively, with Professor Jinhyun Kim of UNIST serving as the first author. The research was published in Bioresource Technology on December 24, 2025.

The system links two microorganisms in a streamlined production line. The first stage utilizes S. ovata to produce acetate (CH_3COOH) from CO_2 and H2 autotrophically. This simple molecule then serves as the sole carbon source for metabolically engineered E. coli, which synthesizes butanol (C_4H_9OH)—a versatile liquid fuel. This division of labor addresses the limitations of single-microbe systems in converting gaseous CO_2 directly into complex fuels.

The team further improved E. coli's butanol production efficiency by approximately 3.8 times through targeted genetic modifications. By optimizing acetate uptake and redirecting metabolic energy toward butanol synthesis, they enhanced overall productivity.

The continuous system operated stably for more than 90 hours, producing butanol solely from CO_2 and hydrogen, without the need for external organic carbon sources. Hydrogen fuels the initial conversion of CO_2 into acetate, which is then transformed into butanol by the engineered bacteria.

Professor Kim from the Department of Materials Science and Engineering at UNIST stated, "Successfully integrating two continuously operating bioreactors to sustain steady input and output demonstrates a significant advance. With further optimization, this platform has the potential to serve as a sustainable alternative to fossil fuels and help accelerate a transition to a carbon-neutral future."

Phys Org, 5 February 2026

https://phys.org

Adhesive made from wood works in a standard glue gun

2025-06-04

A by-product of the timber industry has been turned into a safe and reusable hot-gun glue that could replace solvent-based adhesives that are toxic to humans and the environment.

Ziwen Lv at Beijing Forestry University in China and colleagues created the glue from a xylan, a component of plant cell walls.

"Xylan is the material that holds cellulose together, although it is not itself a 'glue' in the traditional sense," says Nick Aldred at the University of Essex, UK, who wasn't involved in the study. "This work aims to re-purpose it as a glue."

Lv's team used sodium periodate and sodium borohydride to chemically modify the xylan, turning it into dialcohol xylan.

They say the resulting glue, which is extruded from a hot gun, has a bonding strength of 30 megapascals, surpassing conventional adhesives, including epoxy resin. The glue could also be reused by re-melting it, and maintained its original adhesion strength even after 10 cycles.

The team also constructed plywood, with three sheets of thin walnut timber held together by the xylan glue, and found it performed comparably with those made with phenol–formaldehyde resin adhesives.

But the xylan plywood had a significant drawback. After soaking in water for one hour, the glue dissolved, causing the layers to separate. The researchers didn't respond to New Scientist's requests for comment.

Jonathan Wilker at Purdue University, Indiana, says sustainable replacements are needed for all of the petroleum-based adhesives currently in use.

“[The] bonding performance [of the new glue] looked to be substantial, particularly with wood substrates,” says Wilker . “The life cycle assessment and water resistance results fell a bit short of incumbent glues now in use.”

“If it can be rolled out at scale in the plywood industry, it could be transformative,” says Aldred. “Plywood is one of the last remaining consumer products containing materials like phenol and formaldehyde, which were banned in products like cosmetics years ago.”

New Scientist, 4 June 2025

https://newscientist.com

mRNA Nanoparticles Show Promise for Treating Infertility

2026-01-20

Researchers from the Wilmer Eye Institute, Johns Hopkins Medicine Center for Nanomedicine — which designs nanotechnology-based platforms for clinical translation across specialties — developed a strategy for delivering therapeutic messenger RNA (mRNA) to the inner lining of the uterus (endometrium) in mice via modified lipid nanoparticles (LNPs), which are small capsules made of fatty molecules.

In a report funded by the National Institutes of Health and published in Nature Nanotechnology Jan. 19, the investigators say their results using an endometrial injury model show they can improve embryo implantation and highlight a new possible treatment for some forms of infertility.

Specifically, the research team says their experiments demonstrate a targeted ability to deliver therapeutic mRNA — molecular instructions produced by cells to create proteins and control cell functions — to damaged uterine linings for a controlled amount of time.

Numerous gynecologic conditions, such as endometriosis and Asherman syndrome, can cause infertility by making embryos less likely to attach to the endometrium, a necessary step for pregnancy to proceed, even with the use of assisted reproductive technologies (ART) such as in vitro fertilization. According to Laura Ensign, Ph.D., principal investigator and Marcella E. Woll Professor of Ophthalmology at Johns Hopkins Medicine, patients who cannot begin or maintain a pregnancy with ART do not have effective FDA-approved options to turn to.

“What we’re doing [with our study] is establishing a new standard of care for people to explore.”

mRNA therapies work by presenting existing cells with instructions to create highly specific functional proteins without changing the DNA in their nuclei. This approach is the basis of newer cancer therapies and the mRNA COVID-19 vaccines. Experimentally, researchers designing mRNA therapeutics encounter challenges ensuring it reaches the treatment site at concentrations high enough to provide therapeutic benefit and avoid systemic toxicity.

For the new experiments at Johns Hopkins Medicine, Saed Abbasi, Ph.D., the study’s lead author and research associate currently working in Ensign’s laboratory, says they designed their experiments to see if delivery of the fragile, fast-degrading mRNA molecules specifically to the endometrium using LNPs was possible, and if so, what conditions could be improved with it.

Because mRNA breaks down easily on its own and living cells contain enzymes that actively seek out and degrade naked mRNA, the researchers used an LNP delivery system to protect and carry the mRNA code of an immune protein called granulocyte-macrophage colony-stimulating factor (GM-CSF). GM-CSF is believed to improve embryo attachment by increasing the thickness of the endometrium. However, while recombinant GM-CSF protein can easily be manufactured in large amounts from bacterial colonies, its short protein half-life and potential for off-target distribution have limited therapeutic application.

In their first set of experiments, the research team administered GM-CSF mRNA to the mouse endometrium via intrauterine infusion, a minimally invasive method used to administer embryos and therapeutics in ART, and observed that conventional mRNA-LNPs spread beyond their initial delivery site, resulting in liver and spleen toxicity.

To reduce the chance of off-target mRNA delivery, the researchers decorated their LNPs with a peptide — a type of small protein — called RGD (arginylglycylaspartic acid). RGD attaches to integrins, also known as cell surface proteins, that are expressed on the endometrium during the window of implantation (WOI), a period when the tissue is receptive to embryos. Modification of the mRNA LNPs helped ensure the treatment targeted the endometrium precisely, enhanced GM-CSF’s expected therapeutic benefits and minimized side effects when infused during the WOI.

After infusing mice with their tailored mRNA-LNP, the researchers discovered that GM-CSF protein expression in the mouse endometrium remained high for up to 24 hours — and was nearly threefold higher eight hours afterward versus individuals who received the recombinant GM-CSF protein infusion. GM-CSF protein levels were also sixtyfold lower in the blood of mice that received the mRNA-LNP compared to the recombinant protein group, indicating an improved safety profile with a reduced risk of unintended organ toxicity.

“While the human menstrual cycle is unusual compared to mice and other mammals, the window of implantation is one process that is shared and comparable between mice and humans,” says Ensign, “So, our findings are expected to translate to other model systems as well.”

Using the same tailored mRNA-LNP treatment in a mouse model of endometrial injury that mimicked fertility-reducing structural disturbances of the human endometrium, the researchers found embryo attachment was restored to levels comparable to those in healthy mice, while untreated mice showed 67% fewer implantation sites on average. Additionally, in the treated mice, the researchers did not find toxicity in the uterus and other mouse organs.

In future experiments, Ensign and Abbasi plan on using their LNP delivery system to test additional cytokines, growth hormones and other molecules that could potentially improve fertility. The group also believes their mRNA delivery system could address other endometrial disorders, such as endometriosis and endometrial cancer.

The study was supported by the National Institutes of Health (R01HD103124, R01HD108905), an unrestricted departmental grant from Research to Prevent Blindness, Maryland E-Nnovation Initiative Fund via the Endowed Fund in Honor of Marcella E. Woll, and the Johns Hopkins University President’s Frontier Award.

Saed Abbasi, Justin Hanes and Laura M. Ensign are inventors on patent application (PCT/US2025/043687) filed by The Johns Hopkins University, which is related to the study. The authors declare no competing interests.

Other Johns Hopkins researchers who contributed to this study include Marina Better, Kimberly Bockley, Emily Chen, Charles Eberhart, Hongyu

Feng, Justin Hanes, Neomi Jerry, Jordan Miller, Jairo Ortiz and James H. Segars.

Technology Networks, 20 January 2026

https://technologynetworks.com

Orange, camphor-smelling solid could be a key to the next generation grid-storage batteries

2026-02-04

An orange solid with a camphor-like odor has helped aqueous zinc-iodide batteries move a large step closer to supplying safe and economic grid and household energy storage.

Researchers from the ARC Center of Excellence for Carbon Science and Innovation based at Adelaide University have used ferrocene, an electroactive cation, and that orange, camphor-smelling solid, to solve two key problems plaguing the ability of the aqueous zinc-iodide battery to become an alternative energy storage to lithium-ion batteries: the shuttling effect of reaction intermediates that corrode the anode and the need to boost energy density.

The research is published in Nature Chemistry.

Rechargeable zinc (Zn) aqueous batteries have attracted attention because of their low cost, affordable energy density and high safety. Porous carbon materials in zinc-iodide (Zn-I) batteries, which feature high electronic conductivity and physical adsorption, make them suitable to host iodine to improve the reversibility (charge-discharge) of Zn-I batteries.

The problem is that in Zn-I batteries, the I-/I2 conversion generates soluble polyiodides (essentially a string of iodine atoms) that shuttle to the anode on cycling, leading to corrosion of the Zn anode and significant self-discharge.

The porous carbon has typically been used to confine the polyiodides, but this adsorption is weak and shuttling effects cannot be completely avoided. Limiting the amount of iodide in the porous carbon has been used as a tradeoff but that compromises the energy density. Other cations employed to confine the polyiodides have been electrochemically inactive.

Center of Excellence Deputy Director and Chief Investigator, Prof Shizhang Qiao and his team developed an electroactive redox coupling strategy that introduced ferrocene, an electroactive, organometallic compound, into the I2 cathodes.

"The ferrocene effectively captures the polyiodides, transforming the soluble polyiodide-mediated liquid phase into an insoluble ferrocenium-polyiodide complex that stops the shuttling effect," says Professor Qiao.

Without ferrocene, it is only the iodine that provides the energy capacity. But the ferrocene-ferrocenium redox improves the active mass ratios of iodine cathodes from typically less than 70% in traditional porous carbon to 90%, which has significantly enhanced the energy density and minimized capacity loss of the batteries.

"This value surpasses reported Zn-I batteries. Our Zn-I batteries also surpass traditional aqueous systems in both energy density and lifespan, demonstrating its great potential in commercial application," says Professor Qiao.

In addition, Zn-I has very long-term cycling stability that is superior to the lithium-ion battery, which will further reduce the overall cost of the batteries.

"As we seek greater reliance on batteries for storage of grid energy, the safety concerns and high cost of lithium-ion batteries are creating opportunities for alternative technologies. Aqueous batteries are cheaper, stable and therefore safer, are recyclable and have a longer lifespan," says Prof Qiao.

"The introduced functional redox materials that reconciled shuttle suppression with high energy density, offers a promising route to the development of advanced aqueous Zn–I2 batteries.

We still have a lot of work to do before commercialization. At the fundamental level, we are working on improving the energy density further and we are exploring the ability to scale up the system from the ampere-hour (Ah) Zn–I2 pouch cells," he says.

Phys Org, 4 February 2026

https://phys.org

Amino acids weave organic molecules into chiral knots

2026-02-03

Attaching amino acids to a hydrophobic organic molecule allows them to self-assemble into rare, knotted structures with defined handedness, sidestepping the need for external templates or chiral resolution. The approach delivers chiral, mechanically interlocked molecules in a single step, opening new possibilities for molecular recognition, sensing and asymmetric catalysis.

Producing large interlocked molecules in a single mirror-image form is a long-standing challenge in chemistry. Chirality underpins everything from drug activity to biological recognition, yet controlling it becomes increasingly difficult as molecular architectures grow more complex. This is especially true for mechanically interlocked molecules, such as catenanes, knots and links, that are held together by their topology rather than by covalent bonds.

Solomon links are among the most intricate examples. Comprising two double interlocked rings with four crossing points, they are inherently chiral because of the way the strands cross. While few synthetic routes to these structures exist, they typically rely on predesigned templates that offer limited control over handedness and function.

Now, a team led by Yong Cui and Jinqiao Dong at Shanghai Jiao Tong University, China, together with Anthony Davis at the University of Bristol, UK, has demonstrated a biologically inspired strategy that uses amino acids to programme tetraphenylethylene molecules into spontaneously forming chiral Solomon links.

The researchers synthesised molecular building blocks comprising a rigid aromatic core flanked by amino acids with pyridyl groups that bind zinc ions. When mixed with zinc salts, the components self-assemble into Solomon links – but only when the amino acid residues share the same chirality. Networks of hydrogen bonds between the amino acids align the molecular strands precisely, determining which strand passes over or under another at key points, fixing the crossings needed to generate the knotted topology. Metal coordination then closes the rings, mechanically locking the structure in place. By contrast, achiral components or mixtures of left- and right-handed amino acids form simple, unentangled coordination polymers. 'It is remarkable how different structures could be obtained through modulation of the enantiopurity of the ligands used,' comments Jamie Lewis, from the University of Birmingham, UK, who was not involved in the work.

X-ray crystallography confirmed the formation of the doubly interlocked topology and revealed multiple layers of chirality, from the amino acid stereocentres to the overall molecular topology. Changing the amino acid side chains allowed the researchers to tune the size and chemical environment of the cavity formed at the centre of the Solomon link, which in turn affects function. The link selectively binds short peptides and can discriminate between enantiomers. When incorporated into polymer membranes, they can even detect biologically relevant targets, including the inflammatory biomarker interleukin-6, at nanomolar concentrations.

The researchers write that this amino-acid-driven approach offers a simple, one-step route to complex, chiral interlocked molecules. 'Although it may not be trivial to generalise this approach to other classes of mechanically interlocked molecules, there is no inherent reason why this wouldn't be successful,' says Lewis. 'Gaining detailed understanding of the interactions between fragments that allow transfer of chiral information will be critical to designing alternative systems using this approach.'

Chemistry World, 3 February 2026

https://chemistryworld.com

Chemists discover 'anti-spice' that could make chilli peppers less hot

2025-05-14

Accidentally made your food too spicy? One day, you might be able to reach for an "anti-spice" condiment to tame the heat of a dish, thanks to the discovery of chemicals found in chilli peppers that counteract their spicy sensation.

A chilli's heat comes from compounds called capsaicinoids, which bind to receptors on nerve fibres within your mouth, sending impulses to the brain that create a burning sensation similar to those caused by a fire's heat or a sting.

Chilli aficionados compare the heat of different strains using the Scoville scale, which is based on the concentration of capsaicinoids, yet some varieties aren't quite as hot as their Scoville rating suggests they should be. To investigate, Devin Peterson at the Ohio State University and his colleagues used an analytical method known as liquid chromatography-mass spectrometry to determine how much of two capsaicinoids – capsaicin and dihydrocapsaicin – were in powdered samples of 10 types of peppers, including chile de árbol, African bird's eye and Scotch bonnet.

Then they gave samples of tomato juice containing powder from the different chillis to a panel of tasters. Each contained the same amount of capsaicin and dihydrocapsaicin – which should have been enough to give all the samples a relatively mild kick of 800 Scoville units.

But the tasters perceived the heat from the 10 peppers as different, so Peterson and his colleagues performed additional chemical analyses. This identified three compounds in the chilli powder – capsianoside I, roseoside and gingerglycolipid A – that were present in high quantities in the chillies that weren't as intense as they should have been according to the Scoville scale. All three compounds are glucosides, molecules that contain the sugar glucose.

A group of 37 tasters then tested two samples at once, one containing these suspected spice-killing compounds and one without, placed on either side of their tongue to stop an enflamed tongue affecting a second taste test. Their feedback revealed that the compounds decreased the chilli intensity by between 0.7 and 1.2 points on a 15-point scale, on average.

"They are effectively anti-spice compounds," says Peterson. He isn't yet sure how they work, but says they could be altering receptors on nerve fibres in the mouth in a way that results in a reduction in their burning signals.

Knowing about these anti-spice chemicals could allow growers to breed or genetically modify plants so they lack them to create valuable, even hotter chillis, or breed very mild fruit with higher amounts of anti-spice, says Peterson.

Using the compounds could also enable the creation of a household ingredient to tone down excessive heat in dishes, he says, or they could work as relievers for severe pain by blocking pain signals.

"Sometimes when I've ordered food with my kids and it's too spicy, that's a no-go," says Peterson. "So, the idea of having some kind of a natural compound to dial it back may be appealing."

"The way the study was done using the half tongue was very clever," says Barry Smith at the University of London's School of Advanced Study, adding that it shows the Scoville scale isn't a very precise instrument for describing how hot a chilli is.

Smith also wonders if the perceived intensity of menthol or mint, which cause a cooling sensation in a similar way to how capsaicinoids cause a burning one, could also be muted by these kinds of compounds.

New Scientist, 14 May 2025

https://newscientist.com

Weight-loss drugs are creating an environmental disaster—a new water-based method aims to change that

2026-02-23

The world is in the middle of a peptide drug revolution. These short chains of amino acids—the building blocks of proteins—sit at the heart of some of the most successful medicines ever created, from weight-loss injections to advanced cancer therapies. Peptides are also used as crop treatments, veterinary drugs and even some cosmetic ingredients.

In 2023, the global peptide therapeutics market was valued at more than USD $50 billion. By 2030, it is expected to exceed USD $70 billion, growing at around 9% each year.

Blockbuster drugs, including GLP-1 receptor agonists like Ozempic and related medicines, have fueled much of this growth.

Pharmaceutical companies are investing billions to expand production and develop new peptide-based treatments across oncology, metabolic disease and rare disorders.

But behind this success story lies a largely invisible problem: peptide manufacturing is extraordinarily dirty.

For decades, scientists and industry have relied on a technique called solid phase peptide synthesis (SPPS). It is fast, reliable and scalable, but also creates serious environmental problems.

Our international research collaboration has now demonstrated a way to change that—by replacing toxic organic solvents with water, without sacrificing quality or scalability.

Reducing the environmental footprint of peptide drug production

The idea for this new technique grew from frustration.

Peptide synthesis is essential, but it depends heavily on organic solvents and plastic supports that do not break down.

SPPS works by anchoring the first amino acid building block to a resin, often polystyrene beads.

The following amino acids are then added in sequence with the chemical steps requiring copious organic solvents for both the amino acid coupling and intermediate washings.

These materials are costly to dispose of and increasingly restricted by environmental regulations. At the same time, many industries are under pressure to substantially reduce their environmental footprint.

Our water-based method breakthrough grew out of a long-standing collaboration between my team at the University of Melbourne and the team of Dr. Don Wellings, an eminent peptide and polymer chemist and founder of the UK-based enterprise, SpheriTech Ltd.

Over decades of research, it became clear: peptides were becoming central to modern medicine, but the chemistry used to make them remained highly unsustainable.

It prompted a key question.

Why are we still making life-saving medicines using chemical processes that produce mountains of toxic waste, and could water—the cleanest and most familiar solvent of all—offer a way out?

Developing clean, efficient peptide drug synthesis in water

Water is a demanding environment for chemistry.

Chemists have tried using water-based synthesis before, but the obstacle was well known and deeply entrenched.

The core building blocks of peptide synthesis, called Fmoc-protected amino acids, simply do not dissolve in water.

Without dissolving, they cannot react.

This single limitation has locked peptide synthesis into heavy reliance on toxic organic solvents—principally dimethylformamide (DMF)—for decades.

Our breakthrough, now published in Nature Sustainability, came when we discovered that these amino acids can be made water-soluble by pairing them with specific salts.

This simple but previously unexplored step completely changes their behavior, allowing them to dissolve in water at high concentrations while remaining fully functional.

To complete the system, we developed a compatible, water-soluble activating agent and combined it with a new solid support made from hydrophilic (water-attracting) and biodegradable material.

This replaced conventional non-degradable supports and enabled clean, efficient peptide synthesis entirely in water, without the unwanted side reactions that have long discouraged chemists from pursuing water-based methods.

As the chemistry began to develop, the team was joined by Professor Morten Meldal from the University of Copenhagen, who was co-awarded the Nobel Prize in Chemistry in 2022.

Professor Meldal and his team contributed extensive expertise in organic chemistry, helping refine the reactions, ensure robustness, and position the technology for realistic industrial-scale up.

Ultimately, we were able to synthesize three challenging peptides as proof of principle, each with yields and purities equal to or superior to those achieved by traditional SPPS.

Remarkably, the amount of DMF used was reduced to zero, highlighting the enormous sustainability potential that industry could adopt.

Urgent need to tackle the environmental cost of peptide manufacturing

The timing could not be more critical.

The explosive success of GLP-1 drugs like Ozempic, Wegovy and Rybelsus has laid bare the environmental cost of peptide manufacturing.

Depending on peptide length, producing just 1 kilogram of a GLP-1 receptor agonist can require up to 14,000 kilograms of toxic organic solvent, most commonly DMF.

By comparison, producing a typical small-molecule drug uses roughly 300 kilograms of solvent per kilogram of product.

With an annual production of semaglutide alone approaching 4,000 kilograms, this single class of medicines is estimated to generate at least 56 million kilograms of toxic solvent waste every year.

And this is just one of more than 80 peptide therapeutics currently on the market.

As environmental regulations tighten and solvent use comes under increasing scrutiny worldwide, the pharmaceutical industry is facing mounting pressure to change how these medicines are made.

Reshaping how some of our most important medicines are made

The implications of this new method are enormous, offering a direct pathway to replacing toxic organic solvents with water in peptide manufacturing.

This could dramatically reduce chemical waste, lower disposal and compliance costs, and make production more resilient to regulatory change.

Pharmaceutical companies gain cleaner, more future-proof manufacturing processes. Researchers gain safer, simpler tools for peptide synthesis. Patients benefit from more sustainable production of life-changing medicines.

And the environment benefits from a dramatic reduction in toxic waste.

Next, our team will focus on extending the method to automation and to longer and more complex peptides, working closely with industry partners to validate it at full manufacturing scale.

What began as a shared concern among three long-time international collaborators has become an exciting technology with the potential to reshape how some of the most important medicines of our time are made: cleanly, responsibly and ready for the future.

Phys Org, 3 February 2026

https://phys.org

Scientists Discover How Iron Minerals Secretly Lock Away Carbon for Centuries

2025-12-27

Scientists have uncovered new details explaining why iron oxide minerals are such effective long-term carbon traps in soils.

Scientists have known for years that iron oxide minerals play a major role in storing carbon by keeping it out of the atmosphere. A new study from Northwestern University now explains the underlying reasons these minerals are so effective at holding onto carbon.

Focusing on ferrihydrite, a widely found iron oxide mineral, engineers found that it relies on several distinct chemical processes to capture and retain carbon. Rather than using a single mechanism, the mineral applies multiple approaches that work together to secure organic material.

The researchers also discovered that ferrihydrite's electrical properties are more complex than previously assumed. While the mineral carries an overall positive charge, its surface is made up of tiny regions with both positive and negative charges. In addition to electrical attraction, ferrihydrite binds carbon through stronger chemical bonds and hydrogen bonding, creating durable connections with organic compounds.

This combination of binding methods allows iron oxide minerals to interact with a wide range of organic molecules. As a result, they can preserve carbon in soils for decades or even centuries, reducing the amount that returns to the atmosphere as climate-warming greenhouse gases.

The study was published in the journal Environmental Science & Technology. It offers the most detailed examination so far of ferrihydrite's surface chemistry and its role as a key type of iron oxide minerals.

"Iron oxide minerals are important for controlling the long-term preservation of organic carbon in soils and marine sediments," said Northwestern's Ludmilla Aristilde, who led the study. "The fate of organic carbon in the environment is tightly linked to the global carbon cycle, including the transformation of organic matter to greenhouse gases. Therefore, it's important to understand how minerals trap organic matter, but the quantitative evaluation of how iron oxides trap different types of organic matter through different binding mechanisms has been missing."

An expert in the dynamics of organics in environmental processes, Aristilde is a professor of civil and environmental engineering at Northwestern's McCormick School of Engineering. She also is a member of the International Institute for Nanotechnology, the Paula M. Trienens Institute for Sustainability and Energy and Center for Synthetic Biology. Jiaxing Wang is the study's first author, and Benjamin Barrios Cerda is the study's second author. Both Wang and Barrios Cerda are currently postdoctoral associates in Aristilde's laboratory.

Keeping carbon buried

Holding approximately 2,500 billion tons of sequestered carbon, soil is one of Earth's largest carbon sinks — second only to the ocean. But even though soil is all around us, scientists are only just beginning to understand how it locks in carbon to remove it from the active carbon cycle.

By combining laboratory experiments with theoretical modeling, Aristilde and her team have spent years studying minerals and soil-dwelling microbes with the goal of determining the factors that cause soil to either trap or release carbon. In previous works, Aristilde and her team explored how clay minerals bind organic matter and how soil microbes preferentially turn non-sugar organics into carbon dioxide.

In the new study, Aristilde's group turned its focus to iron oxide minerals, which are associated with more than one-third of the organic carbon stored in soils. Specifically, the team examined ferrihydrite, a type of iron oxide mineral commonly found in soils near plant roots or in soils and sediments with abundant organic matter. Although ferrihydrite appears to be positively charged under many environmental conditions, it manages to bind a wide variety of organic compounds — some negatively charged, some positively charged and some neutral.

Watching molecules stick

To understand how this occurs, Aristilde and her team first used high-resolution molecular modeling and atomic force microscopy to gain a detailed look at the mineral's surface. While the mineral's charge is positive overall, the researchers found its surface actually contains intermixed patches of positive and negative charges. The finding explains why ferrihydrite can attract negatively charged species like phosphate and positively charged species like metal ions.

"It is well documented that the overall charge of ferrihydrite is positive in relevant environmental conditions," Aristilde said. "That has led to assumptions that only negatively charged compounds will bind to these minerals, but we know the minerals can bind compounds with both negative and positive charges. Our work illustrates that it is the sum of both negative and positive charges distributed across the surface that gives the mineral its overall positive charge."

After mapping ferrihydrite's surface charges, Aristilde and her team tested how molecules bind to it, allowing them to connect surface chemistry directly to carbon trapping. They introduced ferrihydrite to organic molecules commonly found in soils, including amino acids, plant acids, sugars, and ribonucleotides. Then, they measured how much of these molecules stuck to the ferrihydrite and used infrared spectroscopy to examine exactly how each molecule attached.

More than attraction

Ultimately, the team found that compounds bind to ferrihydrite using multiple strategies. While positively charged amino acids bonded to negative patches on ferrihydrite's surface, negatively charged amino acids bonded to the positively charged patches. Other compounds, like ribonucleotides, are first drawn to ferrihydrite by electrostatic attraction and then go on to form much stronger chemical bonds with iron atoms. And sugars, which form the weakest bonds, are attached to the mineral through hydrogen bonding.

"Collectively, our findings provide a rationale, on a quantitative basis, for building a framework for the mechanisms that drive mineral-organic associations involving iron oxides in the long-term preservation of organic matter," Aristilde said. "These associations may help explain why some organic molecules remain protected in soils while others are more vulnerable to being broken down and respired by microbes."

Next, the team plans to investigate what happens after organic molecules are attached to mineral surfaces. Some compounds may undergo chemical transformations to products that are available for further degradation or to even more stable products that could be resistant to decomposition.

Sci Tech Daily, 27 December 2025

https://scitechdaily.com

Bioactive Glass Toothpaste Provides Rapid Relief From Tooth Sensitivity

2026-02-03

A clinical trial conducted by the ADA Forsyth Institute, a global leader in oral health research, demonstrated significant reduction in dentin hypersensitivity (DH) from a novel bioactive glass incorporated in a toothpaste.

The first-in-human trial established the safety and efficacy of Sensi-IP, a bioactive glass technology developed by IR Scientific. Researchers compared tooth sensitivity and pain scores in patients using the bioglass-incorporated toothpaste versus a sodium fluoride (NaF) toothpaste over a two-week period. Schiff Airblast Sensitivity scores, widely accepted and validated clinical measures of DH, served as the study's primary endpoint, with Visual Analog Scale and Yeaple Probe also measured.

The Test group showed statistically significant improvements in tooth sensitivity. Patients reported pain relief within two days. The results indicated both immediate and cumulative effects to reduce sensitivity.

"Our clinical trial demonstrated that the novel bioglass addresses tooth sensitivity quickly and offers long-term protection," said ADA Forsyth Professor and Director of the Center for Clinical and Translational Research Hatice Hasturk, D.D.S., Ph.D. "We found that patients experienced prompt symptom relief, and results suggest that more durable relief could be possible with this technology's dual-action mechanism."

Sensi-IP is a deliberately soluble bioactive glass engineered for rapid ion release and apatite precipitation. It drives fast, progressive dentin tubule occlusion. The study's results establish viability for Sensi-IP to treat dentin hypersensitivity.

"The initial results are a significant milestone for IR Scientific, providing clinical validation that Sensi-IP works to resolve dentin hypersensitivity," said IR Scientific Chairman Peter Hickey. "We are now positioned to advance further development and pursue regulatory approval for products leveraging this technology. We are one step closer to helping patients relieve dentin hypersensitivity."

Technology Networks, 3 February 2026

https://technologynetworks.com

The compleximer: New type of plastic mixes glass-like shaping with impact resistance

2026-02-05

Researchers at Wageningen University & Research have developed a new type of plastic that, according to materials theory, should not be able to exist. Its properties sit somewhere between those of glass and plastic: it is easy to (re)shape, yet resistant to impact. This unusual combination is possible because the building blocks of the material are not held together by chemical bonds, but by physical forces. As a result, the material is easier to shape and repair than conventional plastics. The researchers have published their findings in Nature Communications.

Drop a drinking glass and you will have to grab a dustpan and brush to sweep up the shards. A plastic cup, by contrast, bounces lightly off the floor and can go straight back into the cupboard. Convenient, but plastics have their drawbacks too: they are difficult to form into precise shapes and typically require a mold. Glass, on the other hand, can be blown and shaped at high temperatures. Wageningen researchers have now combined the best of both worlds in a novel material.

For now, the team only has a few grams, but the effect is clear. The amber-colored plastic can be kneaded and blown like glass once heated, while remaining impact-resistant like plastic. The researchers call this new class of material a compleximer.

A mystery in physics

The researchers themselves were surprised when they first saw the results. “It cast a completely new light on something scientists have been trying to understand for decades,” says Jasper van der Gucht, Professor of Physical Chemistry and Soft Matter.

For years, a rule of thumb has applied to so-called glassy materials—a category that includes both plastics and glass: the more slowly a material melts, and the easier it is to process, the more brittle it becomes. “But now we have something that completely defies that rule,” says Van der Gucht. A material that melts slowly yet can withstand impact.

For Van der Gucht, the real excitement lies in this fundamental discovery, which challenges long-standing assumptions in materials science. Still, he also sees future possibilities if he allows his imagination to roam. Because compleximers are impact-resistant and easy to process, they can also be repaired quickly and easily. Think of roofing panels, garden furniture or even a car body made from compleximers. “Got a serious crack? Just heat it up with a hairdryer, press it together, and the gap is sealed again.”

The difference from conventional plastics lies in how their molecular building blocks are connected. On a molecular scale, plastics consist of long chains. Normally, these chains are “glued” together by chemical cross-links. In the new material, the chains are held together by physical attractive forces instead. One half of the chains carries a positive charge, the other a negative charge. These opposite charges attract each other, much like magnets.

“That’s how the chains stay together, without being chemically fixed,” explains Sophie van Lange, first author of the publication.

Space between the chains

The researchers compared their material with substances described in the literature that also contain charged components, such as so-called ionic liquids, which conduct electricity and are used in applications including solar panels and batteries. They found that other charged materials also seemed to behave differently, although scientists had not previously considered this.

“That was strange, but at the same time exciting,” says Van der Gucht. Materials with charges, it seems, can display an entirely new kind of behavior.

Exactly why this happens is not yet clear. The researchers suspect it has to do with the distance between the molecular chains that make up the plastic. In traditional plastics, chemical crosslinks pull the long chains tightly together. The attraction between positively and negatively charged chains works over a greater distance, leaving more space between them. On a molecular scale, this gives the material a very different structure, which may explain its unusual behavior.

“But,” Van Lange stresses, “for now this is only a hypothesis.”

A biobased version

The research team is keen to take the work further. In follow-up studies, two researchers will delve deeper into the underlying physics to better understand these mysterious materials. They will also investigate how the properties of compleximers can be tuned for specific applications.

Sustainability is another priority. For the time being, the compleximers are made from fossil-based raw materials, but Van der Gucht wants to change that. “We have several ideas for a biobased version that we want to develop over the coming years,” he says.

For now, (biobased) compleximers will not yet appear on the market. Even so, applied plastics researchers at WUR are already eager to explore their potential. “I’m very enthusiastic about the work of our colleagues,” says Wouter Post, senior researcher in Sustainable Plastic Technology. “Their research contributes to a fundamentally better understanding of materials, and plastics in particular. That is essential for the transition to more sustainable use.”

According to Post, the study also highlights a blind spot in current plastics research. “Most applied research focuses on improving recycling, whereas this work opens the door to plastics that are easy to repair or even break down biologically very quickly.”

For now, Van der Gucht and Van Lange are not too focused on practical applications. For them, the greatest value lies elsewhere. “Showing that charged materials can behave fundamentally differently from what we expected is what excites me most at this stage,” says Van der Gucht. “We started with a material that, according to current theory, should not exist, and we end with new questions about how materials behave. That is where the real work begins.”

Phys Org, 5 February 2026

https://phys.org

More Than 30,000 Prescribed Cholesterol Drugs Recalled Nationwide

2026-01-29

Only 50% of the Americans eligible for medications to lower cholesterol are actually taking them, according to 2025 research from experts at Johns Hopkins. Still, the number of Americans taking statins continues to rise—and now two nationwide recall announcements from the U.S. Food and Drug Administration (FDA) expose problems for them to beware of.

The first, a January 20 recall from pharmaceutical company AvKARE, involves 7,991 50-tablet cartons of 10-milligram Rosuvastatin tablets. The Mayo Clinic explains this drug works to lower “bad” cholesterol (LDL) and triglycerides while also increasing “good” cholesterol (HDL). Crestor happens to be the brand name for one rosuvastatin product, though it is not involved in this recall and is made by AstraZeneca.

“Out of specification for dissolution” is the stated reason behind the Rosuvastatin recall, likely meaning the drugs did not properly dissolve during testing, which could impact how they are absorbed in the body.

The second recall affects 22,896 bottles of 1-gram Icosapent Ethyl capsules distributed by Zydus Pharmaceuticals (USA) Inc, with each bottle contains 120 capsules. Cleveland Clinic experts say Icosapent Ethyl capsules are prescribed to treat high triglyceride levels, though the drug may also be used to lower the risk of heart attack or stroke.

Made public on January 22, the recalling reason behind the Icosapent Ethyl capsules describes a scenario where taking the drug could result in certain side effects. The report first described the drug as “subpotent,” indicating the capsules do not provide the promised strength. The FDA goes on to describe the problem as: “Due oxidation caused by leakage of the contents of the Icosapent Ethyl 1g capsules. Use of the affected product may lead to inconsistent therapeutic effects and an increase in potential gastrointestinal side effects in some patients.” [sic]

The FDA also provided the following details for each recall:

Rosuvastatin Tablets, USP, 10 milligrams (mg)

- 50 Tablets (5 x 10) Unit Dose per carton, Rx only
- Lot #: 49124
- Expiration Date: 12/31/2026
- Manufactured for: AvKARE, Pulaski, TN 38478
- National Drug Code (NDC): 50268-709-15
- 7,991 5×10 cartons

Icosapent Ethyl capsules, 1 gram

- 120-count bottles, Rx only
- Lot # and Expiration Dates: S2520304, S2520333, Exp 2/28/2027; S2540186, Exp 4/30/2027
- Manufactured by: Softgel Healthcare Pvt. Ltd., India
- Distributed by: Zydus Pharmaceuticals (USA) Inc., Pennington, NJ 08534
- National Drug Code (NDC): 70710-1592-07
- 22,896 bottles

Both recalls have been categorized as Class II events by the FDA, meaning the agency has determined both situations "may cause temporary or medically reversible adverse health consequences or where the probability of serious adverse health consequences is remote."

The Healthy, 29 January 2026

https://thehealthy.com

Did Thomas Edison Accidentally Make Graphene in the 1870s?

2026-01-27

What do Thomas Edison and Nobel Prize in physics winners Konstantin Novoselov and Andre Geim have in common? According to a recent publication from the lab of Rice University's James Tour, it could be graphene - an answer that might have confused Edison, who died almost 20 years before physicist P.R. Wallace proposed such a substance could exist and nearly 80 years before Novoselov and Geim were awarded a Nobel Prize for isolating and characterizing it.

Graphene is a transparent, remarkably strong substance, as thin as a single atom and useful in a number of modern applications like semiconductors. One type of graphene, called turbostratic graphene, can be produced by applying a voltage across a resistant carbon-based material and rapidly heating it to 2,000-3,000 degrees Celsius.

In modern terms, that method is called flash Joule heating. But for Edison in 1879, the method available to him was simply turning on one of his newly patented, stable light bulbs. Unlike modern incandescent light bulbs that rely on tungsten filaments, early versions often used resistant carbon-based filaments like Japanese bamboo. Flipping a switch applied a voltage that rapidly heated the filaments, producing light. Or, perhaps, graphene. It depends on the century.

"I was developing ways to mass produce graphene with readily available and affordable materials," explains Lucas Eddy, first author on the paper and a former Rice graduate student in Tour's lab. "I was looking at everything from arc welders, which were more efficient than anything I'd ever built, to lightning struck trees, which were complete dead ends." But then, as his lab mate put it, he had a light bulb moment. "I was trying to figure out the smallest, easiest piece of equipment you could use for flash Joule heating, and I remembered that early light bulbs often used carbon-based filaments."

Why Edison's light bulbs? Unlike many other early light bulbs, Edison's patented design reached the critical 2,000-degree Celsius temperature. As a bonus, Edison's 1879 patent gave Eddy a precise blueprint to work from when replicating the experiment.

Eddy's first few attempts to procure an Edison-style light bulb proved unsuccessful with "carbon" filaments turning out to be tungsten in disguise. "You can't fool a chemist," laughs Eddy. "But I finally found a small art store in New York City selling artisan Edison-stylelight bulbs." The artisan light bulbs were exactly like Edison's, down to the Japanese bamboo filaments. Even the diameters of the filaments were close with Eddy's filaments measuring only 5 micrometers larger than Edison's.

Just like Edison, Eddy attached the light bulb to a 110-volt DC electricity source. He flipped the switch on for only 20 seconds. Longer periods of heating, he explains, can result in graphite forming rather than graphene.

The modern lenses of an optical microscope, a tool centuries older than Edison, showed the carbon filament had gone from a dark gray to a "lustrous silver." A transformation had likely occurred, but to what?

To characterize the change, Eddy reached for a technique developed in the 1930s: Raman spectroscopy. This technique uses lasers to identify the substances through their atomic signatures, like reading a barcode. Advances over the last century allow it to do so with rather extreme precision. The spectroscopy confirmed what Eddy had hoped - parts of the filament had turned into turbostratic graphene. Edison, in his quest to develop a practical light bulb that could be used in everyday life, may just have produced a substance that is quickly becoming key to the technology-dependent 21st century.

Of course, there is no way to know what really happened with Edison's long-ago experiment. Even if the original light bulb Edison used was available to analyze, any graphene produced likely would have turned to graphite during its first 13-hour test.

"To reproduce what Thomas Edison did, with the tools and knowledge we have now, is very exciting," said Tour, the T.T. and W.F. Chao Professor of Chemistry and corresponding author on the paper. "Finding that he could have produced graphene inspires curiosity about what other information lies buried in historical experiments. What questions would our scientific forefathers ask if they could join us in the lab today? What questions can we answer when we revisit their work through a modern lens?"

Technology Networks, 27 January 2026

https://technologynetworks.com

Scientists Finally Solve a 30-Year-Old Cancer Mystery Hidden in Rye Pollen

2026-02-04

Nearly 30 years after rye pollen molecules were shown to slow tumor growth in animals, scientists have finally determined their exact three-dimensional structures.

Nearly 30 years ago, researchers noticed something surprising in rye pollen: two naturally occurring molecules seemed to slow tumor growth in animal studies. The finding drew interest, but the science hit a wall because no one could pin down a crucial detail that determines how a compound behaves in the body: its exact three dimensional shape.

Chemists at Northwestern University now report that they have solved that long running structural puzzle. By assembling the molecules step by step in the lab, the team confirmed the true 3D structures of secalosides A and B, giving researchers a reliable starting point for the next phase of work.

That "blueprint" matters because biology is shape driven. Once scientists know how a molecule is arranged in space, they can begin testing how it might interact with immune cells and other biological targets, and they can design close variants to see which features are important. In this case, it could help clarify whether specific components of rye pollen, a staple cereal crop grown for its grain, might eventually inspire new ideas for cancer treatment.

The study was recently published in the Journal of the American Chemical Society.

"In preliminary studies, other researchers found that rye pollen could help different animal models clear tumors through some unknown, non-toxic mechanism," said Northwestern's Karl A. Scheidt, who led the study. "Now that we confirmed the structure of these molecules, we can find the active ingredient — or what part of the molecule is doing the work. This is an exciting starting point to make better versions of these molecules that could possibly inform approaches to cancer therapy."

Scheidt is a professor of chemistry at Northwestern's Weinberg College of Arts and Sciences and a professor of pharmacology (by courtesy) at Northwestern University Feinberg School of Medicine. He also is a member of the Chemistry of Life Processes Institute and of the Robert H. Lurie Comprehensive Cancer Center of Northwestern University.

Nature as inspiration for medicine

Nature has repeatedly provided starting points for major medical advances, even when the raw materials were not ready to be used as drugs in their original form. Many familiar medicines trace back to compounds first found in plants and microbes, which scientists later refined to make them safer, more effective, or easier for the body to use.

Morphine, a long used treatment for severe pain, comes from the opium poppy. Taxol, a key cancer therapy, was first obtained from the Pacific yew tree. Statins, widely taken to lower cholesterol and reduce heart disease risk, were developed from molecules discovered in fungi.

"Natural products aren't necessarily effective drugs on their own, but they are great leads," Scheidt said. "We can find inspiration in natural products and use chemistry to make better versions that are orally available, survive the metabolism and hit the right targets."

Eventually, rye pollen potentially could join these ranks. Many consumers around the world already ingest rye pollen extract in supplement form to protect prostate health. But scientists haven't yet optimized it for use as a pharmaceutical drug. Understanding how it works required knowing the molecules' precise three-dimensional shape — information that proved elusive.

A molecular mystery

Using traditional techniques, such as advanced nuclear magnetic resonance spectroscopy, scientists could not fully reveal the orientation of the molecules' key parts. As a result, two competing structural models persisted for decades.

Those two proposed structures had the same atoms, same connections and same overall shape. But a central part of the molecules are mirror images of each other. That subtle distinction can change how the molecule fits into a biological target and determine whether a molecule is biologically active or inert.

"It's like your hands," Scheidt said. "They are mirror images of each other, but you need a different glove for each. If you had two left-handed gloves, it wouldn't work because your hands can't be superimposed on top of one another."

Building from scratch

To settle the question once and for all, the Northwestern team turned to total synthesis, or the step-by-step process of constructing a natural molecule in the laboratory. The approach was incredibly complicated and challenging. At their cores, secalosides A and B contain an extremely rare and highly strained feature: a tightly compressed, 10-membered ring that is notoriously difficult to build.

Scheidt and his team devised a clever workaround. They first built a larger, more flexible ring and then triggered a reaction that snapped it into a smaller, strained shape in a single step. After synthesizing both competing structural versions of the secalosides, the scientists compared them to samples isolated from rye pollen. Only one version matched perfectly, finally revealing the true molecular structure.

"We've demonstrated we can make the core of this natural product," Scheidt said. "Now, we're trying to find potential collaborators in immunology who could help us translate this to a possible clinical endpoint."

Sci Tech Daily, 4 February 2026

https://scitechdaily.com

Natto fermentation actively produces health-promoting supersulfide molecules, study reveals

2026-02-05

Supersulfide molecules, metabolites from plants that are important in cellular metabolism, are attracting attention in the medical and nutritional fields for their potential in supporting health and disease prevention. Natto, a Japanese food made from soybeans fermented with the Bacillus subtilis var. natto microorganism, is rich in these molecules. However, the mechanism by which they are produced during fermentation has remained unclear.

To better understand this complex process, a research group led by Professor Hideshi Ihara at Osaka Metropolitan University's Graduate School of Science extensively analyzed supersulfide content in natto fermentation using various methods. The researchers first compared supersulfides in dried soybeans from three different suppliers and four commercial natto brands. The supersulfides in the soybean variants did not have significant differences.

Comparatively, the natto samples showed higher supersulfide content and varying levels between brands. The team then observed supersulfides during the fermentation process using Bacillus subtilis var. natto in homemade natto from two dried bean samples.

Results revealed an increase in soybean supersulfides, indicating that natto bacteria actively convert other sulfur molecules into supersulfide molecules by breaking down soybean proteins and other substances. Further, it was found that soybeans that underwent heat treatment had an increase in supersulfides before fermentation.

"This achievement is the world's first demonstration that microbial fermentation dramatically alters the supersulfide molecule profile of plants," said Professor Ihara, "Advances in understanding the mechanisms behind natto's health benefits could contribute to maintaining and improving people's health, such as reducing the risk of cardiovascular disease."

The study was published in Nitric Oxide.

Phys Org, 5 February 2026

https://phys.org

Embodying polymer chemistry with a purpose by upcycling plastics and trapping PFAS

2026-02-06

For Frank Leibfarth, focussing on reactivity and selectivity helps him bridge the gap between fundamental and applied research

'There's a lot of groups who develop new chemistry, who struggle to know exactly what application it will be best for. And there's a lot of groups working on important problems without fundamental innovations on the reactivity or selectivity front,' says Frank Leibfarth. But he thrives on both fronts.

Leibfarth's philosophy is to use and develop synthetic chemistry to tackle societal challenges with simplicity. This approach has resulted in new ways to upcycle plastics and remove PFAS from drinking water.

He credits a slightly unconventional training route for helping him operate at the intersection of fundamental and applied polymer chemistry so effectively. He earned a PhD in polymer chemistry, then moved – against his PhD advisor's recommendation – into an organic chemistry postdoc. 'Organic chemistry, as you may know, is a very intimidating field full of traditionally very big personalities. To step in as an outsider was a big leap.'

Today he runs a group of around 20 people at the University of North Carolina at Chapel Hill with a clear mission: 'We want to be one of the best polymer chemistry groups internationally.' Supporting that mission is what Leibfarth calls the lab's 'special sauce': the way they pursue reactivity. 'We look at reactivity, usually in medicinal chemistry or older physical organic literature, and think how that could make an impact in polymer science,' he says.

That approach works because the group is intentionally interdisciplinary. It develops new catalysts but is also 'darn good' at characterising new materials. 'If a material has a certain property, we know the application it fits, what matters in that application, and how to tune the material to get there,' he explains.

From trash to treasure

A key focus of the Leibfarth group's research is polymer upcycling. For example, they've developed a general strategy to functionalise aliphatic C(sp^3)–H bonds, which can create elastomers with the tensile properties of polyolefin ionomers from postconsumer plastic waste.

The process was inspired by the way medicinal chemists apply late-stage functionalisation to drug-like molecules and uses a shelf-stable O-alkenylhydroxamate reagent that, under mild heating or visible light, generates nitrogen-centred radicals.1 These radicals abstract hydrogen from aliphatic C–H bonds to form carbon radicals that then react with an external trapping agent, allowing diverse functional groups to be installed, such as carboxylates to make polyolefin ionomers or enamines to make reprocessable polymer networks. The team demonstrated this approach by converting postconsumer polyethylene foam into polyolefin ionomers. Notably, the process works in a reactive extruder without any solvent – a technique widely used to manufacture other polymers.

'I think that's a very clear example of upcycling … it's a direct way to turn something without value into something considerably more valuable,' says Leibfarth.

But while the reagent can successfully introduce new functional groups without degrading the parent polymer, which has previously been a limitation in the field, Leibfarth is upfront that it's currently too costly and required at impractically high loadings. 'Those are things we're definitely working on,' he says.

Another strand of the group's upcycling work focuses on turning waste polyolefins into vitrimers – materials that combine the durability of crosslinked polymers with the reprocessability of thermoplastics.2 Traditionally, vitrimers are made by mixing and curing specialty monomers, but Leibfarth's group can make them by using C–H functionalisation to add crosslinking groups to polyethylene and polypropylene. Unlike conventional vitrimers, which often creep over time, these materials resist deformation thanks to crosslinks organised into discrete domains separated by crystalline regions.

Targeting PFAS

Leibfarth is also known for his work developing adsorbents to remove PFAS from drinking water. That began after a representative from the state government attended a faculty meeting, 'which rarely happens, as you can imagine', to say PFAS levels 70 times above new regulatory limits had been detected in the Cape Fear River – a major local drinking water source. They asked for ideas to remove these forever chemicals and Leibfarth had one.3 It combined two concepts – ion exchange and fluorophilicity – to give a resin that could selectively pull PFAS out of water. It led to him and his colleague, environmental engineer Orlando Coronell, being allocated $10 million from the state to fund a centre to scale up and test new materials at real treatment plants.

But scaling up meant rethinking everything. The original resin cost up to $1000 (£743) per kilogram and was made from fluorinated compounds that raised environmental concerns of their own. So Leibfarth and Coronell pivoted to common, inexpensive monomers – though the details remain proprietary information.

In year-long pilot tests at four municipal water treatment plants, the new resin removed short-chain PFAS for three times longer than activated carbon and 40% longer than the best commercial ion-exchange resins without releasing trapped PFAS back into the water, which is a flaw in existing systems.

To bring this technology to market, Leibfarth co-founded Sorbenta with Coronell, which licensed the IP and is scaling production from kilograms to tonnes while working with utility companies to test real-world water sources.

Science that serves

Leibfarth's PFAS removal and plastic upcycling work saw him named the chemical science laureate at the 2025 Blavatnik National Awards for Young Scientists in the US. He describes his journey to this point as surreal. 'My mom was a nurse, my dad drove a semi … But luckily through education I was offered lots of wonderful opportunities, and I feel like I took advantage of them. When I got this job, I was so excited to have a thing I got to do every day that I also enjoyed.'

'I am proud to have done this at a public university, especially with my PFAS work. I recognise our obligation to the people of the state who give us a lot of our funding and to do research that has a direct impact on my community, but also be recognised internationally for it, is something that I'm really proud of.'

Chemistry World, 6 February 2026

https://chemistryworld.com

Second-Hand Vape Smoke May Form Lung-Damaging Radicals

2026-02-02

Electronic cigarettes - or vapes - can release puffs of vapor in aromatic clouds. The health risks of breathing in this secondhand or passive vapor aren't fully understood. So, researchers reporting in ACS' Environmental Science & Technology conducted a preliminary study on lingering vape plumes in indoor environments. They found that aged vapor contained fine particles with several metals and highly reactive compounds, which together produce radicals that might damage lung tissue if inhaled.

"Our study reveals that the chemical cocktail of metal nanoparticles and reactive peroxides in aged e-cigarette aerosols creates a unique profile of respiratory health risks, highlighting that secondhand vapor is something by-standers shouldn't have to breathe," says Ying-Hsuan Lin, the corresponding author of the study from the University of California, Riverside.

Unlike traditional cigarettes, e-cigarettes don't create smoke; they create vapors that could expose non-users to harmful substances. Early studies showed that these secondhand vape aerosols contain volatile organic compounds that react with indoor ozone, creating new compounds, such as peroxides. Additionally, vape liquids and puffs commonly contain heavy metals, as well as other metals that could easily react with peroxides to produce potentially damaging compounds like free radicals.

In another step toward understanding the potential health effects of secondhand vape plumes, Lin and colleagues examined how ozone indoors impacts the metal and peroxide composition of vape aerosols. They also wanted to see what happens when these substances react in wet environments, simulating what might happen inside the lungs.

For their experiments, the researchers created a simplified vape liquid with one flavoring ingredient (a floral-smelling terpene) and no nicotine, loaded it into two different vape pens with refillable cartridges, and puffed it into a chamber with ozone in the air. After 90 minutes, they collected the aged aerosols for analysis. The particles from both pens contained iron, aluminum and zinc ions, as well as trace amounts of heavy metals such as lead, arsenic and tin. And the two sets of aged aerosols had similar levels of peroxides. The smallest particles, classified as ultrafine particles, contained higher percentages of metals and peroxide compounds compared to larger aerosols.

To preliminarily understand how aged aerosols react with lung fluids, the researchers placed the samples in a water-based solution. The aged aerosols created radicals with the ultrafine particles producing 100 times more radicals relative to their weight as compared to larger particles. Because ultrafine particles can get deep into humans' lungs and enter the sensitive, fluid-lined alveoli, the researchers say the results indicate these particles' potential to damage lung tissues and lower respiratory function.

The researchers acknowledge that the study was done under controlled laboratory conditions, and more research is needed using real-world indoor environments and commercially available e-cigarette liquids. Regardless, these results suggest that repeated exposure to aged vape plumes could negatively impact lung health, especially for individuals with pre-existing lung conditions such as asthma or chronic obstructive pulmonary disease, commonly referred to as COPD.

Technology Networks, 2 February 2026

https://technologynetworks.com

Platinum nanostructure sensor can differentiate mirror-image volatile scent compounds

2026-02-04

Terpenes are volatile organic compounds that are responsible for, among other things, the typical scents of plants, resins or citrus fruits. These compounds occur naturally in the environment and influence chemical processes in the atmosphere. At high concentrations, they can irritate the respiratory tract and contribute to the formation of harmful derivatives. Many terpenes exist in two mirror-image forms, known as enantiomers, which can differ significantly in terms of their effects and how they are perceived—but which are difficult to distinguish between using technical means.

Platinum-based nanostructures as sensors

Now, researchers from the Department of Chemistry at the University of Basel have presented a new approach that allows these mirror-image forms of the molecules to be detected specifically.

“Our work focused on a specially developed platinum-based molecule that works as a sensor,” explains Dr. Annika Huber, first author of the study and a former doctoral student at the Swiss Nanoscience Institute’s Ph.D. School. “This sensor molecule has a fixed, three-dimensional shape and aggregates with a large number of identical molecules to form tiny stack-like nanostructures that react differently to the two mirror-image forms of the terpenes.”

When volatile molecules interact with the sensor, the arrangement of the platinum molecules changes—and this response differs depending on which enantiomer is present. The researchers were able to measure this difference based on the absorption of specific wavelengths of light in the ultraviolet and visible region.

At the same time, the change in the sensor molecule can also be reversed. Once the scent compounds are removed, the molecule returns to its initial state and can be used again.

Suitable also for detecting nonpolar and unfunctionalized molecules

The study, which was recently published in the journal Angewandte Chemie, shows that the method can be used to differentiate various volatile compounds, including alcohols and some terpenes. “Most notably, we succeeded in differentiating nonpolar and unfunctionalized molecules, which cannot be detected using many conventional sensors,” says Professor Oliver Wenger, who supervised the work together with Professor Christof Sparr.

The new approach therefore provides a basic functional principle for future sensor systems that could work as an “artificial nose.” Systems of this kind would have potential applications in environmental analysis, quality control or the investigation of atmospheric processes—without the need for elaborate measuring equipment.

Phys Org, 4 February 2026

https://phys.org

New catalyst turns carbon dioxide into clean fuel source

2026-02-03

A new study from scientists at Yale University and the University of Missouri shows that catalysts made with manganese can efficiently convert carbon dioxide into formate. Manganese is widely available and low cost, making it an attractive alternative to expensive metals. Formate is considered a promising material for storing hydrogen, which could help power the next generation of fuel cells.

The research was published in the journal Chem. The lead authors are Yale postdoctoral researcher Justin Wedal and University of Missouri graduate research assistant Kyler Virtue. Senior authors include Yale professor Nilay Hazari and University of Missouri professor Wesley Bernskoetter.

Why Hydrogen Fuel Cells Matter

Hydrogen fuel cells work by turning chemical energy from hydrogen into electricity, similar to how a battery operates. Although the technology holds promise for clean energy, large-scale adoption has been limited by the difficulty and cost of producing and storing hydrogen efficiently.

“Carbon dioxide utilization is a priority right now, as we look for renewable chemical feedstocks to replace feedstocks derived from fossil fuel,” said Hazari, the John Randolph Huffman Professor of Chemistry, and chair of chemistry, in Yale’s Faculty of Arts and Sciences (FAS).

Formate as a Hydrogen Carrier

Formic acid, the protonated form of formate, is already manufactured at an industrial scale. It is commonly used as a preservative, an antibacterial agent, and in leather tanning. Many scientists also see it as a practical source of hydrogen for fuel cells, provided it can be made in a sustainable and efficient way.

Today, most industrial formate production relies on fossil fuels, which limits its long-term environmental benefits. Researchers say a cleaner alternative would be to produce formate directly from carbon dioxide in the air. This approach would both reduce greenhouse gas levels and create a useful chemical product.

The Catalyst Challenge

Transforming carbon dioxide into formate requires a catalyst, and that has been a major obstacle. Many of the most effective catalysts developed so far depend on precious metals that are costly, scarce, and often toxic. More abundant metals tend to break down quickly, which reduces their ability to drive the chemical reaction.

How Manganese Outperformed Expectations

The research team developed a new strategy to overcome this problem. By redesigning the catalyst structure, they significantly extended the working lifetime of manganese-based catalysts. As a result, these catalysts performed better than most precious metal alternatives.

According to the researchers, the key improvement came from adding an extra donor atom to the ligand design (ligands are atoms or molecules that bond with a metal atom and influence reactivity). This change helped stabilize the catalyst and maintain its effectiveness.

"I'm excited to see the ligand design pay off in such a meaningful way," said Wedal.

Broader Implications for Clean Chemistry

The team believes this approach could be applied beyond carbon dioxide conversion. Similar design principles may improve catalysts used in other chemical reactions, potentially expanding the impact of the work.

Yale researchers Brandon Mercado and Nicole Piekut also contributed to the study. Funding for the research was provided by the U.S. Department of Energy's Office of Science.

Science Daily, 3 February 2026

https://sciencedaily.com

What Is Driving the Most Impactful Change in Proteomics?

2026-01-30

Proteomics is in the middle of a transition: from an exploratory, technology-driven discipline to one increasingly defined by robustness, scale, and real-world impact.

To capture how this moment is being interpreted by leaders shaping the field, Technology Networks asked a group of industry experts the same foundational question: "From your perspective, what technological or methodological advances are driving the most impactful change in proteomics right now?"

Their responses span a wide range of innovations, from mass spectrometry (MS), affinity-based platforms, sample preparation, computational analysis, and clinical translation, which together are redefining what proteomics can deliver.

Jenny Samskog, PhD, head of product management, Olink Proteomics, part of Thermo Fisher Scientific.

The most significant advances are being driven by a clearer, more quantitative understanding of what is actually measured and how different proteomic technologies correlate with one another. Progress in data standardization and harmonization is crucial, as is the integration of large, heterogeneous datasets through machine learning approaches.

These developments are enabling more accurate comparisons across studies and platforms, facilitating reproducibility, and allowing researchers to connect proteomic measurements to functional and clinical phenotypes with greater precision.

Katherine Tran, senior global market development and marketing manager, Proteomics, SCIEX.

I'm seeing five major trends shaping proteomics right now:

1. Ultra-sensitive / single-cell level proteomics is changing the proteomics landscape as it allows the discovery of biological variation that would otherwise be hidden in bulk averages, such as rare cell-states and early disease signatures, etc. In addition, ultra-sensitive single-cell proteomics resolves cell-to-cell differences rather than population-based, enabling proteomics to play a role closer to what single-cell RNA-seq has done for transcriptomics.

This area facilitates better precision/personalized medicine as single-cell proteomics enables profiles of individual patient cells or microenvironmental niches, rather than homogenized samples.

2. Advancements in SWATH DIA (data independent acquisition) continue to expand the depth of proteomic insight from MS analyses, including better coverage, better quantitation and reproducibility, and better accuracy of results, all while requiring less sample and faster time for analysis. Advancements in SWATH DIA expand proteomics from "discovery only" towards more routine, robust workflows such as clinical applications.
3. Spatial proteomics and context-aware protein profiling are impactful to the advancements in proteomics, as biological function is often spatially dependent. Therefore, the ability to map protein-to-protein interactions, post-translational modifications (PTMs), and such, in which cell, which compartment, and which tissue microenvironment helps interpret the proteome.
4. AI, machine learning, and computational proteomics unlock actionable insight from large and complex datasets without strong computational resources. AI can be utilized to push forward proteomics from an ID-based analysis to a predictive/functional proteomics context (what are the proteins doing, how do they interact, how do they change under perturbation).
5. Multiomics integration and proteoform-level complexity enable richer, more biologically meaningful insights. For example, you might see a mutation in a gene or an increased transcript, but unless you see the protein and its PTMs, the functional consequence remains unclear.

For translational, clinical research, multiomics plus proteomics gives you more of a holistic molecular phenotyping, which better supports biomarker discovery and therapeutic stratification. Understanding proteoforms means more precise mechanistic insight (not just upregulation of a particular protein, but which version of the protein and with which PTM(s) are upregulated).

Henrik Everberg, PhD, chief executive officer, ProteomEdge.

The biggest change in proteomics today is the move from exploratory measurements to robust, quantitative, and specific multi-protein analysis. Targeted liquid chromatography-MS combined with stable isotope–labeled standards is gaining more interest as it promises to deliver absolute and reproducible protein quantification, which is essential for clinical and applied use.

Large-scale discovery proteomics remains essential as the first step to identify and prioritize candidate biomarkers, while targeted proteomics is becoming the method of choice for follow-up and future applications in a clinical setting. At the same time, clinical translation introduces new challenges around throughput, automation, and standardization, as future applications will involve very large numbers of samples analyzed in routine settings.

Sameer Vasantgadkar, senior manager, Omics Solutions at Covaris.

I would say that there are multiple levels at which this can be viewed. Everyone talks about the rapid advancements that have been made in the MS space, and all of those do help drive the technology forward significantly, but I think focus is also shifting on the front end—the sample prep. If you have a good quality sample and sample prep, the results are good quality results.

That is also one of the key driving factors, especially as we go into new domains such as single-cell workflows, or in any of those where you're trying to do multiple workflows or multiple sample matrices. I think in that case, the sample prep does play a big role in terms of the versatility that is needed by most labs, the flexibility that is needed to work with different volumes, and with different buffer schemes. Having that kind of approach really helps in scaling up the capabilities of different labs and the impact they can have.

Stephen Williams, PhD, chief scientific officer, Alamar Biosciences.

What we are learning is that proteins act in networks as patterns and therefore technologies—which can precisely and sensitively measure large numbers of proteins (1000s or many 1000s of proteins at once) and are sensitive and specific enough—are leading to a greater understanding of human physiology.

The analogy I make is that the protein network patterns are like the internet; you need bandwidth, and you need search engines. The combination of high-plex, sensitive, precise measurement tools with machine learning and AI is going to identify the patterns themselves that can then be translated into products for health care or for clinical trials.

Yuling Luo, chief executive officer and founder, Alamar Biosciences.

I think there are two areas of change.

One area is the expansion of content, and this is what both MS technology and affinity-based technologies are doing. MS is improving to enable more and more proteins to be discovered in a variety of sample types, particularly the plasma proteomes. Similarly with the affinity-based approach, they are also increasing the number of contents they can cover, for example, Olink has moved from 1500–3000 to 5400. Improving the breadth of coverage of the proteome is certainly one of the major trends.

I think this will continue, because people always want to know what's out there.

On the other hand, there is a sensitivity improvement, like what Alamar has been doing to improve the sensitivity of the protein detection technology. Biomarkers may be present in very low abundance, but many of them have extremely high value. For example, the biomarkers for neurodegenerative disease, which, due to the blood–brain barrier, are in extremely low abundance, require a technology platform that requires high sensitivity. For applications such as early disease detection and minimal residual disease, you need to have the technology with the capability to detect those early disease markers, likely in low abundance, with sensitivity, robustness, and precision.

Technology Networks, 30 January 2026

https://technologynetworks.com

(NOTE: OPEN YOUR WEB BROWSER AND CLICK ON HEADING TO LINK TO SECTION)

CHEMICAL EFFECTS

Developmental toxicity and cytotoxic/genotoxic potential of PM10 rural extracts using Xenopus laevis embryos and A549 lung epithelial cells

Seasonally different toxicity drivers in a river system revealed by insights from POCIS, bioassays, and suspect screening

Unraveling structure-Toxicity relationships of PFAS: Insights from quantum chemical descriptors and QSAR models

ENVIRONMENTAL RESEARCH

Size-resolved and seasonal assessment of the undersized fraction of municipal solid waste: Resource potential and environmental risks

PHARMACEUTICAL/TOXICOLOGY

Spatial transcriptomic profiling uncovers the molecular effects of the neurotoxicant polychlorinated biphenyls (PCBs) in the brains of adult mice

A novel metabolic gene signature induced by Di-(2-ethylhexyl) phthalate and Mono-(2-ethylhexyl) phthalate exposure predicts prognosis in breast cancer: An integrative bioinformatics and experimental study

OCCUPATIONAL

The Impact of Military Occupational Combustion Smoke Inhalation on Neuroinflammation and Brain Health

Exposure to hexavalent chromium and 1800 MHz electromagnetic radiation can synergistically induce intracellular DNA damage in mouse embryonic fibroblasts

Associations of prenatal exposure to organophosphate, pyrethroid, and neonicotinoid insecticides with maternal and infant urinary reproductive hormones

Military Exposures Research: A State-of-the-Art Review