

# Bulletin Board

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AUG. 01, 2025

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### ASIA PACIFIC

#### UNEP, Australia announce landmark study to improve understanding of coal and steel sector methane emissions

2025-07-16

The UN Environment Programme's International Methane Emissions Observatory (IMEO), with the support of Australia, today launched a new research project aimed at improving the accuracy of methane emissions data from coal mines.

The study will be the first of its kind in the world. Using a simulated open-cut coal mine, where coal is dug up from the surface, scientists will evaluate the capabilities of innovative measurement technologies — from ground-based sensors to aircraft and satellites — for tracking emissions and guiding mitigation efforts across the coal and steel sectors.

A major source of methane emissions, coal mines represent a significant climate opportunity — particularly for the steel industry, which uses metallurgical coal as a fuel source. Last year, the coal sector released around 40 million tonnes of methane across the globe, making it the energy sector's second-largest methane emitter. But globally emissions from coal mines remain poorly monitored and reported and emissions from open-cut coal mines are particularly difficult to measure.

The study's findings will improve methane monitoring and inform the development of regulatory frameworks and strategies to reduce methane emissions, which drive roughly a third of current global warming.

Read More

UNEP, 16-07-25

<https://www.unep.org/news-and-stories/press-release/unep-australia-announce-landmark-study-improve-understanding-coal>

#### Japan Seeks Feedback on Proposed Revisions to JIS Z 7252 and JIS Z 7253 to Align with UN GHS Rev. 9

2025-07-22

The proposed revisions aim to update and align these standards with the content of the 9th revised edition of the UN GHS.

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Recently, the Japanese Industrial Standards Committee (JISC) released draft revisions for two Japanese Industrial Standards (JIS): JIS Z 7252: Classification of chemicals based on GHS and JIS Z 7253: Hazard communication of chemicals based on GHS — Labelling and Safety Data Sheet (SDS). The drafts have been published on the JISC website for public consultation with relevant domestic industries. The deadline for submitting comments is August 9, 2025.

Read More

Chemlinked, 22-07-25

<https://chemical.chemlinked.com/news/chemical-news/japan-seeks-feedback-jis-z-7252-z-7253-revisions-2025>

#### Consultation on the draft model Code of Practice: Managing the risks of biological hazards at work

2025-07-24

Safe Work Australia (SWA) is developing a model Code of Practice (model Code) which provides practical guidance for employers on how to manage the risks of biological hazards at work.

Biological hazards, such as viruses, bacteria, parasites and some types of fungi (like mould), can be found in all industries. The draft model Code is broad in nature and intended to apply to all workplaces covered by the WHS laws where there is a risk to workers or others of exposure to one or more biological hazards.

The draft model Code has been developed with the support of Safe Work Australia Members and other subject matter experts. This consultation seeks to gain a wide range of views on the draft model Code. Responses from this consultation will be used to further refine the draft Code to ensure:

- the format and detail included in the draft Code provides an appropriate level of guidance, and
- the draft Code is broadly applicable across all industries.

Safe Work Australia welcomes submissions from all interested stakeholders, including duty holders, regulators, government agencies, unions, workers, legal professionals, researchers, employer representatives, employers, members of the public and other parties.



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Please support your views with evidence or data where possible. There is no obligation to answer any or all of the questions, and there is no limit to the length of submissions. You can raise any matter relevant to the draft model Code.

[Read More](#)

Safe Work Australia, 24-07-25

<https://consult.swa.gov.au/biohazards-model-code>

### Swissmedic and the APVMA agree on closer cooperation in the regulation of veterinary medicines

2025-07-24

The Australian Pesticides and Veterinary Medicines Authority and Swissmedic have signed a Memorandum of Understanding (MoU) that will facilitate collaboration in the regulation of veterinary medicinal products.

The aim of the MoU is to promote an understanding of each other's regulatory circumstances, requirements and processes for veterinary medicinal products, and to facilitate the sharing of information and documents. This will promote collaboration between the two authorities both on bilateral initiatives and as part of multilateral bodies such as the International Cooperation on Harmonisation of Technical Requirements for Registration of Veterinary Medicinal Products (VICH). In particular, this MoU will help to increase exchanges in policies, practices, standards, pre-market assessment, post-market surveillance, pharmacovigilance, scientific advice market compliance, regulation of manufacturers and requirements for the regulation of veterinary medicinal products and undertake collaborative activities.

Swissmedic Executive Director, Dr Raimund Bruhin, reflected on their growing partnership base.

"For several years now, Swissmedic has been pursuing the goal of systematically expanding collaboration with international partner authorities in various areas, and this collaboration, our third that applies exclusively to veterinary medicinal products, lays the foundation for closer collaboration with the APVMA."

"Partnerships such as this help to promote greater global regulatory cooperation," said APVMA Executive Director, Dr Maria Trainer.

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"This helps to improve the efficiency and effectiveness of our regulatory system here in Australia while encouraging innovation, reducing trade barriers, and increasing Australian's access to safe and effective veterinary medicines.

[Read More](#)

APVMA, 24-07-25

<https://www.apvma.gov.au/news-and-publications/news/swissmedic-and-apvma-agree-closer-cooperation-regulation-veterinary-medicines>

## AMERICA

### Notice of Extension of Comment Period

2025-07-25

The California Department of Toxic Substances Control (DTSC) proposes to amend regulations in California Code of Regulations, title 22, division 4.5, chapter 12 section 66262.20. Specifically, the proposal pertains to regulations that will allow generators to transport hazardous waste between noncontiguous properties, when the properties are owned and controlled by the same person and are connected by a right-of-way or road, without a manifest.

To view the proposed regulatory text and all other rulemaking documents, visit DTSC's Proposed Regulations webpage.

#### Comment Period

The written comment period, originally set to close on July 28, 2025, is extended to August 27, 2025.

[Read More](#)

US EPA, 25-07-25

<https://dtsc.ca.gov/dtsc-proposed-regulations/>



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### **EPA Releases Draft Charge Questions For SACC Meeting On Phthalates And Memorandum On Proposed Refinement For Estimating Dibutyl Phthalate (DBP) Skin Exposures**

2025-07-24

On June 16, 2025, EPA announced the release of the draft charge questions for discussion at the upcoming Science Advisory Committee on Chemicals (SACC) meeting to review all documents released thus far on the risk evaluations of five phthalates. EPA will hold the virtual public meeting of SACC on August 4-8, 2025, where the charge questions will guide the discussion. EPA will also hold a preparatory virtual public meeting on July 21, 2025, for SACC and the public to consider and ask questions regarding the scope and clarity of the draft charge questions. If the public would like their comments on the documents related to the phthalates to be considered by the SACC during the peer review meeting, they must be submitted by July 21, 2025. Registration for the meetings is available on the SACC website.

[Read More](#)

JD Supra, 24-07-25

<https://www.jdsupra.com/legalnews/wrap-up-of-federal-and-state-chemical-4822550/>

### **PHMSA Proposes To Update Definition Of An Aerosol**

2025-07-24

The Pipeline and Hazardous Materials Safety Administration (PHMSA) published a notice of proposed rulemaking (NPRM) on July 1, 2025, proposing to update the definition of an aerosol to eliminate unnecessary regulatory burdens and maintain consistency with current international transportation standards. 90 Fed. Reg. 28540. PHMSA notes that the Hazardous Materials Regulations (HMR) currently define an aerosol as "an article consisting of any non-refillable receptacle containing a gas compressed, liquefied or dissolved under pressure, the sole purpose of which is to expel a nonpoisonous (other than a Division 6.1 Packing Group III material) liquid, paste, or powder and fitted with a self-closing release device allowing the contents to be ejected by the gas." In September 2017, PHMSA received a petition to revise the HMR definition to align with the definitions found in the United Nations Recommendations on the Transport of Dangerous Goods — Model Regulations (UNMR), the

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International Maritime Dangerous Goods (IMDG) Code, the International Civil Aviation Organization Technical Instructions on the Safe Transport of Dangerous Goods by Air (ICAO TI), and the Regulations governing European Road Transport (ADR).

[Read More](#)

JD Supra, 24-07-25

<https://www.jdsupra.com/legalnews/wrap-up-of-federal-and-state-chemical-4822550/>

### **FDA Launches Artificial Intelligence Tool**

2025-07-24

On June 2, 2025, the U.S. Food and Drug Administration (FDA) announced the launch of an artificial intelligence (AI) tool that reportedly is designed to "help employees—from scientific reviewers to investigators—work more efficiently." The tool, named "Elsa," allows FDA employees to access information securely and to assist in reading, writing, and summarizing information to "support safety profile assessments, perform faster label comparisons, and generate code to help develop databases for nonclinical applications." FDA intends to integrate AI further in additional processes, such as data processing and generative-AI functions to further support FDA's mission.

[Read More](#)

JD Supra, 24-07-25

<https://www.jdsupra.com/legalnews/wrap-up-of-federal-and-state-chemical-4822550/>

### **HHS, FDA and USDA Address the Health Risks of Ultra-Processed Foods**

2025-07-23

Under the leadership of the U.S. Department of Health and Human Services Secretary Robert F. Kennedy, Jr. and the U.S. Department of Agriculture Secretary Brooke L. Rollins, the U.S. Food and Drug Administration and U.S. Department of Agriculture are accelerating federal efforts to address the growing concerns around ultra-processed foods and the current epidemic of diet-related chronic disease that is plaguing America. The agencies are announcing a joint Request for Information (RFI) to gather information and data to help establish a federally recognized



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uniform definition for ultra-processed foods—a critical step in providing increased transparency to consumers about the foods they eat.

“Ultra-processed foods are driving our chronic disease epidemic,” said HHS Secretary Robert F. Kennedy, Jr. “We must act boldly to eliminate the root causes of chronic illness and improve the health of our food supply. Defining ultra-processed foods with a clear, uniform standard will empower us even more to Make America Healthy Again.”

Currently, there is no single authoritative definition for ultra-processed foods for the U.S. food supply. Creating a uniform federal definition will serve as a key deliverable on the heels of the recently published Make Our Children Healthy Again Assessment, which recognizes that the overconsumption of ultra-processed foods is one of the driving factors of the childhood chronic disease crisis.

“President Trump has made it a priority to improve health outcomes for American families and communities. And this Request for Information is yet another step in seeking commonsense ways to foster improved and more informed consumer choice. A unified, widely understood definition for ultra processed foods is long overdue and I look forward to continued partnership with Secretary Kennedy to Make America Healthy Again. As this process unfolds, I will make certain the great men and women of the agriculture value chain are part of the conversation,” said U.S. Secretary of Agriculture Brooke L. Rollins.

“I am delighted to lead this critical effort at the FDA,” said FDA Commissioner Marty Makary, M.D., M.P.H. “The threats posed to our health by foods often considered ultra-processed are clear and convincing, making it imperative that we work in lockstep with our federal partners to advance, for the first time ever, a uniform definition of ultra-processed foods.”

It is estimated that approximately 70% of packaged products in the U.S. food supply are foods often considered ultra-processed, and that children get over 60% of their calories from such foods. Dozens of scientific studies have found links between the consumption of foods often considered ultra-processed with numerous adverse health outcomes, including cardiovascular disease, Type 2 diabetes, cancer, obesity and neurological disorders. Helping to address overconsumption of ultra-processed foods is a key element to Make America Healthy Again.

A uniform definition of ultra-processed foods will allow for consistency in research and policy to pave the way for addressing health concerns

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associated with the consumption of ultra-processed foods. The RFI will be publicly available in the federal register on July 24 and seeks information on what factors and criteria should be included in a definition of ultra-processed foods.

Alongside developing a uniform definition, the FDA and National Institutes of Health are investing in high-quality research to help answer remaining questions about the health impacts of ultra-processed foods through its recently announced Nutrition Regulatory Science Program. The Department will also continue to pursue developing and implementing other key policies and programs that seek to, collectively, dramatically reduce chronic disease and help ensure a healthy future for our nation.

Read More

US FDA, 23-07-25

<https://www.fda.gov/news-events/press-announcements/hhs-fda-and-usda-address-health-risks-ultra-processed-foods>

## EUROPE

### Commission strengthens Europe's chemical industry

2025-07-08

Today, the European Commission presented an Action Plan for the Chemicals Industry to strengthen the competitiveness and modernisation of the EU chemical sector. The Action Plan addresses key challenges, namely high energy costs, unfair global competition, and weak demand, while promoting investment in innovation and sustainability. The Action Plan is accompanied by a simplification omnibus on chemicals – the sixth that the Commission has presented in this mandate so far – to further streamline and simplify key EU chemicals legislation, alongside a proposal to strengthen the governance and financial sustainability of the European Chemicals Agency (ECHA).

#### The Action Plan proposes the following measures:

- **Resilience and level playing field:** The Commission will establish together with Member States and stakeholders a Critical Chemical Alliance to address the risks of capacity closures in the sector. The Alliance will identify critical production sites needing policy support and tackle trade issues like supply chain dependencies and distortions. The Commission will also swiftly apply trade defence measures to



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ensure fair competition, while expanding chemical import monitoring through the existing Import Surveillance Task Force. The Alliance will align investment priorities, coordinate EU and national projects, including Important Projects of Common European Interest (IPCEIs) and support EU critical production sites to boost innovation and regional growth.

- **Affordable energy and decarbonisation:** The Commission will implement at full speed the Affordable Energy Action Plan to help reduce high energy and feedstock costs. It has introduced clear rules for low-carbon hydrogen and will update state aid to lower electricity costs for more chemical producers by the end of the year. The plan also encourages using clean carbon sources like carbon capture, biomass, and waste, alongside support for renewables. A public consultation on improving chemical recycling has also been launched today.

[Read More](#)

European Commission, 08-07-25

[https://ec.europa.eu/commission/presscorner/detail/en/ip\\_25\\_1755](https://ec.europa.eu/commission/presscorner/detail/en/ip_25_1755)

### Simplification of administrative burdens in environmental legislation

2025-07-22

#### Summary

Following the Commission's commitment to reduce administrative burden for European companies and public authorities, this initiative will simplify and streamline administrative requirements related to the environment in the areas of waste, products, and industrial emissions. The initiative will reduce administrative burden without affecting the policy objectives pursued by the legislation. Also, the initiative will consider permitting challenges relating to environment assessments.

#### Topic

Environment

#### Type of act

Proposal for a regulation

#### Category

REFIT

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#### Call for evidence

**Feedback:** Open

#### Feedback period

22 July 2025 - 10 September 2025 (midnight Brussels time)

The Commission would like to hear your views.

This call for evidence is open for feedback. Your input will be taken into account as we further develop and fine-tune this initiative. Feedback received will be published on this site and therefore must adhere to the feedback rules.

[More about call for evidence](#)

[Read More](#)

European Commission, 22-07-25

[https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/14794-Simplification-of-administrative-burdens-in-environmental-legislation-\\_en](https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/14794-Simplification-of-administrative-burdens-in-environmental-legislation-_en)

## INTERNATIONAL

### EFTA and MERCOSUR conclude negotiations on a Free Trade Agreement

2025-07-02

Joint Statement by the Signatory State Parties of MERCOSUR (Argentina, Brazil, Paraguay and Uruguay) and the EFTA States (Iceland, Liechtenstein, Norway and Switzerland) on the conclusion of the negotiations of a Free Trade Agreement

The Signatory State Parties of MERCOSUR (the Republic of Argentina, the Federative Republic of Brazil, the Republic of Paraguay and the Oriental Republic of Uruguay) and the EFTA States (Iceland, the Principality of Liechtenstein, the Kingdom of Norway and the Swiss Confederation) have announced, at the MERCOSUR Summit Meeting (Buenos Aires, 2 and 3 July 2025), the conclusion of the negotiations of a Free Trade Agreement.

The MERCOSUR - EFTA Free Trade Agreement will create a free-trade zone of almost 300 million people and a combined GDP of more than US\$ 4.3 trillion. Both sides will benefit from improved market access for more than



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97% of their exports, which will increase bilateral trade and translate into benefits for businesses and individuals.

The FTA will create new business opportunities for economic operators in the MERCOSUR and EFTA States, including for the high number of small and medium-sized enterprises present in each jurisdiction. It provides for improved market access and modernised regulations for custom clearance and cumulation of origin. Economic operators in the MERCOSUR and EFTA States will benefit from greater predictability and legal certainty in trade between their member countries.

[Read More](#)

EFTA, 02-07-25

<https://www.efta.int/media-resources/news/efta-and-mercosur-conclude-negotiations-free-trade-agreement>

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## REACH Update

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### Next EU-wide REACH enforcement project on safe use of chemicals in workplaces

2025-06-17

ECHA's Enforcement Forum agreed that the next EU-wide enforcement project will address the safety of workers. A new pilot project will control export of hazardous substances from the European Union.

Helsinki, 17 June 2025 – As part of the next EU-level enforcement project (REF-15), inspectors will check safe use information in safety data sheets and that risk management measures recommended in them are implemented in the workplace. The project will include checking that companies with an authorisation to use a substance of very high concern apply the required conditions. Controls will also cover the use of certain restricted hazardous substances for which special conditions apply for use in the workplace (e.g. diisocyanates, NMP, DMF).

This project will improve the safety of workers and strengthen enforcement by enhancing collaboration between enforcement authorities responsible for REACH and those responsible for occupational safety and health legislation. Inspections will take place in 2027 and the report is planned for 2028.

The Forum agreed to run a pilot project to control the requirements of the Prior Informed Consent (PIC) Regulation. This includes checking that banned chemicals are not exported, verifying that exports of hazardous chemicals are notified according to the rules, and accompanied by appropriate information. Inspectors will also check that exports have received a consent from third parties, when required by the Regulation. Inspections are planned for 2026 and the report will be published in 2027.

The Forum and its biocides subgroup (BPRS) gave steer to their ongoing projects and exchanged experiences from national enforcement campaigns. The Forum covered, for example, control of online sales of chemicals and checks of restrictions on hazardous substances, such as diisocyanates, phthalates in consumer products or substances used in tattoo inks. The Forum also agreed to further expand its work on analytical methods used for enforcement of restrictions. The BPRS discussed national campaigns focused on use of pest control products and disinfectants for veterinary use.



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[Read More](#)

ECHA, 17-06-25

<https://echa.europa.eu/-/next-eu-wide-reach-enforcement-project-on-safe-use-of-chemicals-in-workplaces>

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## Janet's Corner

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### Who Am I?

2025-08-01

I am a **rare earth element**, specifically a **lanthanide**, with atomic number **63**. I am a soft, silvery metal, but my true claim to fame comes from my unique **luminescent properties**. When exposed to ultraviolet light, I **glow a brilliant red**, making me essential for producing the vivid red color in older television screens and current smartphone displays, as well as in some lasers. Despite my rarity, I'm vital for modern display technology.

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

**I am a rare earth element, specifically a lanthanide, with atomic number 63.**



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## Hazard Alert

AUG. 01, 2025

### Hydrazine

2025-08-01

There are many kinds of hydrazine compounds, including hydrazine, 1,1-dimethylhydrazine, and 1,2-dimethylhydrazine.

Hydrazine is very hygroscopic liquid at room temperature and is a highly polar solvent. Anhydrous hydrazine is a very strong reducing agent. It is a very reactive molecule, which can decompose at incredible speed, very exothermically, which makes it ideal as a rocket fuel. Hydrazine is reasonably stable to store if protected from air although the smaller hydrazines are very flammable.

Some nitrogen-fixing bacteria may create hydrazine as a by-product while some derivatives (N-methyl-N-formylhydrazine and agaritine) have been obtained from edible mushrooms. Despite these few natural occurrences, hydrazine is primarily manufactured. [1,2]

### USES [2,3]

Hydrazine can be used in nickel plating, the removal of halogens from wastewaters, as an inhibitor to corrosion, and in photograph development. It has also been used in boiler water treatment, in blowing agent manufacturing for producing plastics used in vinyl flooring and auto foam cushions, in the production of agricultural chemicals such as maleic hydrazide, as a reducing agent in nuclear fuel reprocessing, and even used for medicinal purposes as a medication for sickle cell and cancer. Hydrazine is also contained in tobacco and cigarette smoke. in the form of pentafluorobenzaldehyde.

### EXPOSURE SOURCES & ROUTES OF EXPOSURE [3]

#### Exposure Sources

- Breathing contaminated air in or near a facility that makes, processes, or uses hydrazines.
- Eating fish contaminated with hydrazines.
- Drinking or swimming in water that has been contaminated with hydrazines.
- Touching soil contaminated with hydrazines, such as near some military bases or hazardous waste sites.
- Breathing cigarette smoke indirectly or using tobacco products may expose you to small amounts of hydrazine or 1,1-dimethylhydrazine.

**Hydrazine is an inorganic compound with the formula  $N_2H_4$ . It is a colourless flammable liquid with an ammonia-like odour. It is highly toxic and dangerously unstable unless handled in solution.**

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- Working in greenhouses where the chemical Alar is used may result in your being exposed to small amounts of 1,2-dimethylhydrazine.

### Routes of Exposure

The routes of exposure to hydrazine are as follows:

- Eye and skin contact;
- Inhalation;
- Ingestion;

### HEALTH EFFECTS [4]

#### Acute Health Effects

- Symptoms of acute exposure to high levels of hydrazine include irritation of the eyes, nose, and throat, temporary blindness, dizziness, headache, nausea, pulmonary oedema, seizures, and coma in humans. Acute exposure can also damage the liver, kidneys, and the central nervous system (CNS) in humans.
- The liquid is corrosive and may produce chemical burns and severe dermatitis from skin contact.
- Acute animal tests in rats, mice, rabbits, and guinea pigs have demonstrated hydrazine to have high acute toxicity from inhalation and ingestion and extreme acute toxicity from dermal exposure.

#### Carcinogenicity

- Adequate information is not available on the carcinogenic effects of hydrazine in humans.
- Increased incidences of lung and liver tumours have been observed in mice exposed to hydrazine by inhalation, in their drinking water, via gavage and injection.
- Tumours in the nasal cavity were observed in rats and hamsters exposed by inhalation.
- EPA has classified hydrazine as a Group B2, probable human carcinogen.

### 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



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open. Cold water may be used. Do not use an eye ointment. Seek medical attention.

- **Skin Contact:** If the chemical got onto the clothed portion of the body, remove the contaminated clothes as quickly as possible, protecting your own hands and body. Place the victim under a deluge shower. If the chemical got on the victim's exposed skin, such as the hands: Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cold water may be used. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.
- **Serious Skin Contact:** Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.
- **Inhalation:** Allow the victim to rest in a well-ventilated area. Seek immediate medical attention.
- **Serious Inhalation:** Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. WARNING: It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek immediate medical attention.
- **Ingestion:** Do not induce vomiting. Examine the lips and mouth to ascertain whether the tissues are damaged, a possible indication that the toxic material was ingested; the absence of such signs, however, is not conclusive. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

### Workplace Controls & Practices [4]

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

### Personal Protective Equipment [5]

The following personal protective equipment is recommended when handling hydrazine:

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- Face shield;
- Full suit;
- Vapour respirator (be sure to use an approved/certified respirator or equivalent);
- Gloves;
- Boots.

Personal Protective Equipment in Case of a Large Spill:

- Splash goggles;
- Full suit;
- Vapour respirator,
- Boots;
- Gloves;
- A self-contained breathing apparatus should be used to avoid inhalation of the product.
- Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

### REGULATION

#### United States

**OSHA:** The Occupational Safety & Health Administration has set the following Permissible Exposure Limit (PEL) for hydrazine:

- General Industry: 29 CFR 1910.1000 Table Z-1 - 1 ppm, 1.3 mg/m<sup>3</sup>; Skin
- Maritime: 29 CFR 1915.1000 Table Z-Shipyards - 1 ppm, 1.3 mg/m<sup>3</sup>; Skin

**ACGIH:** The American Conference of Governmental Industrial Hygienists has set a Threshold Limit Value (TLV) for hydrazine of 0.01 ppm TWA; Skin; Appendix A3 (Confirmed Animal Carcinogen with Unknown Relevance to Humans)

**NIOSH:** The National Institute for Occupational Safety and Health has set a Recommended Exposure Limit (REL) for hydrazine of 0.03 ppm, 0.04 mg/m<sup>3</sup> Ceiling (120 Minutes); Appendix A - Potential Occupational Carcinogen

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## Hazard Alert

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One diet soda a day increases type 2 diabetes risk by 38%

2025-07-29

In a landmark 14-year study, researchers have found that artificially sweetened drinks raise the risk of developing type 2 diabetes by more than a third, significantly higher than those loaded with sugar. It challenges the long-standing perception of diet drinks being a healthier alternative and suggests they may carry metabolic risks of their own.

In the first longitudinal study of its kind, led by Monash University, researchers tracked 36,608 participants over an average period of 13.9 years to assess how both sugar-sweetened beverages (SSBs) and artificially sweetened beverages (ASBs) impacted health outcomes. The self-reported health data, from the Melbourne Collaborative Cohort Study, was drawn from participants aged 40 to 69 years at the time of recruitment.

The researchers categorized both ASB and SSB intake into distinct groups: never or less than once a month; one to three each month; one to six drinks a week; and more than one beverage a day. Then, the association of sweetened beverage intake with the incidence of type 2 diabetes was assessed using modified Poisson regression and adjusted for lifestyle, obesity, socioeconomic and other confounding factors.

What they found was that drinking just one can of artificially sweetened soda increased the risk of developing type 2 diabetes by 38%, compared to people who didn't consume these drinks at all. For those consuming the same amount of sugary drinks, the risk was 23% higher.

"Artificial sweeteners are often recommended to people at risk of diabetes as a healthier alternative, but our results suggest they may pose their own health risks," said senior author Barbora de Courten, a professor at Monash University and RMIT, which was also involved in the study.

After the researchers adjusted the sugar-sweetened drinks data to account for BMI and waist-to-hip ratio, the statistical association was lost, suggesting that obesity is a mediating factor in this cohort. Essentially, the SSB-diabetes link appears to be driven largely by weight gain.

The same could not be said for the artificial sweetener group, however.

When the ASB data was adjusted to factor in BMI, the risk went from an unadjusted 83% to 43%, and when it was again scaled to account for waist-to-hip ratio, it remained at 38%. This suggests there's more than obesity at play. The researchers believe this result is due to an independent



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metabolic effect, possibly gut microbiome disruption or a change in glucose metabolism.

While the study didn't identify which artificial sweeteners were at play, likely types include aspartame, saccharin and sucralose. Of these, some are poorly absorbed (sucralose), others are metabolized quickly (aspartame), and some are excreted in urine (acesulfame potassium, or ace-k), which may influence metabolic pathways differently.

There have been several recent studies looking into artificial sweeteners and diabetes, including a 2023 paper that linked the dietary additive with an elevated risk of type 2 diabetes mellitus (T2DM). While a 2024 meta-analysis found that, so far, the association is not well understood.

The researchers point to earlier studies that have shown some evidence of aspartame triggering postprandial insulin responses similar to sucrose (sugar), and saccharin and sucralose being linked to gut microbiome disruption and impaired glucose tolerance in as little as two weeks.

Evidence suggests that artificial sweeteners can alter the composition and function of gut bacteria, leading to glucose intolerance – a precursor to type 2 diabetes. And that some sweeteners may trigger insulin release, desensitize metabolic responses over time, or confuse the body's glucose regulation system – even without actual sugar in the picture.

Another hypothesis is that regular exposure to the kind of intense sweetness that artificial products deliver may condition the body to anticipate sugar calories that never come, affecting appetite regulation, insulin sensitivity and broader metabolic pathways. However, the authors suggest that how sweeteners affect the gut microbiota and glucose regulation are the most likely drivers of increased diabetes risk.

The study is yet more evidence that argues artificial sweeteners may not be "safer" than refined sugar, when it comes to broader health risks – and as such, the researchers highlight, they should be under more scrutiny when it comes to public policy and dietary recommendations.

"We support measures like sugary drink taxes, but our study shows we also need to pay attention to artificially sweetened options," said de Courten. "These are often marketed as better for you; yet may carry their own risks. Future policies should take a broader approach to reducing intake of all non-nutritive beverages."

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The study was published in the journal Diabetes & Metabolism.

New Atlas, 29 July 2025

<https://newatlas.com>

### "Elephant Ear" Building Materials Could Make Houses More Energy Efficient

2025-07-16

Drawing inspiration from the veinous ears of jackrabbits and elephants, Drexel University researchers have come up with a new approach to passive heating and cooling that could one day make buildings more energy efficient. Their concept, recently published in the Journal of Building Engineering, embeds a vascular network within cement-based building materials that, when filled with paraffin-based material, can help passively regulate the surface temperature of walls, floors and ceilings.

The approach is an effort to address the substantial contribution of building energy demand — nearly 40% of all energy use — to the production of greenhouse gas. About half of a building's energy use is spent maintaining a comfortable temperature. And while new insulation products and techniques have helped to shore up walls, windows and ceilings, these surfaces remain the biggest challenge when it comes to holding or losing heat — contributing to about 63% of energy loss in buildings.

"Architecturally, it looks nice to have a lot of window area on a building, but this also results in diminished insulation properties," said Rhythm Osan, an undergraduate student in the College of Engineering who was a co-author of the research. "In an ideal world, a building wouldn't lose any heat, but from a realistic constructability standpoint, issues like thermal bridging, air leakage from ducts, material performance and joint detailing will always pose some heat loss."

Turning this frustrating reality on its head, the Drexel team devised a way for these surfaces to contribute to maintaining a desired indoor temperature, rather than being an impediment to it.

"Look at the way our circulatory system is used to regulate temperature. When it's hot out, blood runs to the surface – we might get a little red in the face and begin to sweat through our glands and this cools us down through a phase-change process — sweat evaporation," said Amir Farnam, PhD, an associate professor in Drexel's College of Engineering who was



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a leader of the research. "This is a very effective, natural process that we wanted to replicate it in building materials."

Farnam's Advance Infrastructure Materials (AIM) Lab is a leader in research focused on nature-inspired methods for making infrastructure materials more durable. They have previously developed concrete that uses phase-change material — similar to the paraffin used to make candles — to melt snow and ice from its surface; self-healing concrete that employs special bacteria that produce calcium carbonate; and 3D printed polymers that strengthen concrete structures.

To create the thermally responsive building materials, the group drew inspiration from several of these endeavors — using a printed polymer matrix to create the grid of channels in the concrete surface before filling them with a paraffin-based material to enable their responsive temperature regulation.

Phase-change materials, like paraffin, are uniquely suited for this application because they absorb and release thermal energy as they shift between liquid and solid states. So as temperatures drop, and the material transitions from liquid to solid, it releases heat energy; conversely, when ambient temperatures rise the material is able to absorb heat energy, producing a cool surface.

"We have previously used paraffin-based material as the phase-change ingredient for self-warming concrete, so we knew that it was a reliable, natural substance that could affect the surface temperature of concrete building materials," said Robin Deb, PhD, a research scientist in the AIM Lab and a co-author of the research. "For this application we selected a phase-change material with a melting temperature around 18 degrees Celsius, a relatively low melting point, to test its effectiveness in cold climates. But this system would allow for tailoring the phase-change material to be responsive in warmer climates as well."

Using a dissolvable, or "sacrificial," polymer template, the team created a series of cement samples with varying vascular channel patterns, including a single channel, multiple channels, parallel channels perpendicular to the edges of the surface, diagonal parallel channels and a diamond-shaped grid of channels; and ranging in thickness from 3 to 8 millimeters.

They tested each sample to determine its mechanical behavior, as well as their ability to slow surface warming and cooling, in relation to ambient environmental conditions, when the channels were filled with phase-change material.

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The most effective combination of strength and thermal regulation proved to be the sample with diamond-shaped grid channel architecture. This sample was able to maintain its structural integrity during tests to stretch and compress it, while also slowing the heating and cooling of its surface — to 1-1.25 degrees Celsius per hour — with respect to its environment.

"We found, perhaps not surprisingly, that more vasculature surface area equates to better thermal performance. This observation is similar to physiology of elephant and jackrabbit ears, which contain extensive areas of vasculature to help regulate their body temperature," Deb said. "We believe that our vascular materials could play a similar role in a building by helping to offset temperature shifts and reduce energy demand from HVAC to maintain thermal comfort."

To further bolster the strength of the materials — despite being partially hollowed out by the channels — the team showed adding a fine aggregate material to the cement could improve its durability without affecting the vasculature's ability to circulate the phase-change material.

"While this study was intended to show a proof of concept, these results are promising and something we can build on," Farnam said. "This shows both the effectiveness of this method for regulating surface temperature in cementitious materials, as well as a simple and cost-effective method for producing them. With additional testing and scaling we believe this has the potential to make a significant contribution to the many ongoing efforts to improve the energy efficiency of buildings."

The team's future research will entail testing different phase-change materials and channel configurations in larger cementitious material samples over a longer period of time and a wider range of environmental temperatures, among other variables.

Technology Networks, 16 July 2025

<https://technologynetworks.com>

## Scientists create first programmable single-atom catalyst that adapts chemical activity

2025-07-31

A research team at the Politecnico di Milano has developed an innovative single-atom catalyst capable of selectively adapting its chemical activity.



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This is a crucial step forward in sustainable chemistry and the design of more efficient and programmable industrial processes.

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

This achievement is novel in the field of single-atom catalysts. For the first time, scientists have demonstrated the possibility of designing a material that can selectively change its catalytic function depending on the chemical environment. It involves a sort of “molecular switch” that allows complex reactions to be performed more cleanly and efficiently, using less energy than conventional processes.

The research focuses on a palladium-based catalyst in atomic form encapsulated in a specially designed organic structure. This structure allows the material to “switch” between two key reactions in organic chemistry—bioreaction and carbon-carbon coupling—simply by varying the reaction conditions.

“We have created a system that can modulate catalytic reactivity in a controlled manner, paving the way for more intelligent, selective and sustainable chemical transformations,” explains Gianvito Vilé, lecturer in the Giulio Natta Department of Chemistry, Materials and Chemical Engineering at the Politecnico di Milano and coordinator of the study.

In addition to its reaction flexibility, the new catalyst stands out for its stability, recyclability and reduced environmental impact. The “green” analyses conducted by the team show a significant decrease in waste and hazardous reagents.

The study results from an international collaboration with the University of Milan-Bicocca, the University of Ostrava (Czech Republic), the University of Graz (Austria) and Kunsan National University (South Korea).

Phys Org, 31 July 2025

<https://phys.org>

### Scientists discover that tomato is ‘mother’ of potato

2025-08-01

BEIJING -- A surprising discovery by scientists has revealed that an ancient genetic marriage roughly 9 million years ago gave rise to what is now the world’s third-largest staple crop: the potato. And the tomato, it turns out, is the mother of the potato.

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The study was conducted by a research team from the Agricultural Genomics Institute in Shenzhen, the Chinese Academy of Agricultural Sciences and a domestic researcher from Lanzhou University, in collaboration with scientists from Canada and the UK. It showed that the potato originated from an ancient hybridization event between the tomato plant and a potato-like plant about 9 million years ago. This cross also led to the creation of a novel organ: the tuber.

Published in the latest issue of the Cell journal, these findings provide a groundbreaking theoretical perspective for the genetic breeding of potatoes.

As the world’s most important tuber crop, the potato is native to South America. Valued for its high nutritional content and wide adaptability, it has spread worldwide.

Huang Sanwen, who led the study, explained that the potato’s origin had long puzzled scientists. In appearance, modern potato plants are almost identical to a potato-like species called *Etuberosum*, which does not carry tubers. However, potato plants are more closely related to tomatoes based on phylogenetic analysis.

To unravel the mystery of the potato’s origin, the research team analyzed 101 genomes and 349 resequenced samples from cultivated potatoes and their 56 wild relatives -- effectively a comprehensive DNA paternity test for all potatoes.

They found that all potatoes examined carried stable, balanced genetic contributions from both the *Etuberosum* and the tomato. From this, they inferred that the potato was the hybrid offspring of the two.

To validate this hypothesis, the team further assessed the divergence times of the three species. Their results showed that the *Etuberosum* and the tomato began diverging around 14 million years ago. Approximately 5 million years after their divergence, the two hybridized, leading to the emergence of the earliest tuber-bearing potato plants around 9 million years ago.

“The tomato served as the maternal parent of the potato, while the *Etuberosum* was the paternal parent,” Huang said.

However, what continued to puzzle the researchers was why only the potato develops tubers, while its parents lack them. The tomato has neither underground stems nor tubers, and the *Etuberosum* has underground stems but no swollen tubers.



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Huang's team proposed a bold explanation: The tuber could be the product of genomic rearrangement. After the two ancestral lineages crossed, their genes recombined in a way that accidentally created the tuber as a new organ.

The team further traced the origin of the key tuber formation genes, which are a combination of genetic material from each parent. They found the SP6A gene, which acts like a master switch that tells the plant when to start making tubers, came from the tomato side of the family. Another important gene, IT1, which helps control the growth of the underground stems that form tubers, came from the Etuberosum side. Without either piece, the hybrid offspring would be incapable of producing tubers.

This ancient marriage not only produced the tuber but also enriched the genetic diversity of the potato plant's lineage.

The team also discovered that different potato individuals exhibit a "mosaic" pattern of parental genetic contributions.

When subjected to varying environmental stresses, this mosaic genetic combination allows for the selection of optimal gene sets, enabling potatoes to adapt to diverse habitats ranging from temperate grasslands to alpine meadows.

The tuber has an underground survival advantage. It stores water and starch, helping potatoes endure drought and cold, and allows reproduction without seeds or pollination, as new plants can sprout directly from the buds on tubers.

"Evolving a tuber gave potatoes a huge advantage in harsh environments, fueling an explosion of new species and contributing to the rich diversity in the potatoes we see and rely on today," Huang said.

China Daily, 1 August 2025

<https://chinadaily.com.cn>

### Landmark study flips decades of cholesterol panic aimed at eggs

2025-07-20

In a groundbreaking clinical trial, researchers have unraveled the effects of cholesterol and saturated fat, finding that eggs may be far less harmful – and potentially more beneficial – than previously thought. It's the latest

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research, using robust scientific work, to recast a nutritional villain in a new light.

In a world-first study, University of South Australia (UniSA) researchers investigated the independent impact of dietary cholesterol and saturated fat on "bad" cholesterol – low-density lipoprotein, or LDL – levels. What they found was that even eating two eggs a day, in an overall high-cholesterol but low-saturated-fat diet, lowered LDL levels and cardiovascular disease risk.

"Eggs have long been unfairly cracked by outdated dietary advice," said lead researcher Jon Buckley, a professor at UniSA. "They're unique – high in cholesterol, yes, but low in saturated fat. Yet it's their cholesterol level that has often caused people to question their place in a healthy diet."

In the randomized, controlled, cross-over trial, 61 healthy adults each tried three different diets for five weeks, with breaks in between to allow for a reset. While all diets contained the same amount of daily calories, the cholesterol and saturated fat content differed. An egg diet (two eggs a day) was high in cholesterol but low in saturated fat; an egg-free diet was low in cholesterol (no eggs) but high in saturated fat; and a control was high in both cholesterol and saturated fat, but included only one egg per week.

The egg diet featured 600 mg/day of cholesterol (6% saturated fat), the egg-free diet contained 300 mg/day (12% saturated fat), and the control plan included 600 mg/day (12% saturated fat).

They found that the egg diet significantly lowered LDL cholesterol, compared to the control (103.6 µg/dL compared to 109.3 µg/dL), while the egg-free plan saw LDL levels stay roughly the same as the control, even though it was lower much lower in dietary cholesterol. Across the board, saturated fat appeared to be the common denominator when it came to LDL shifts.

Investigating the mechanisms involved in this change, the scientists found that things got a little more complex. LDL cholesterol is made up of distinctly sized particles: large, fluffy LDL particles, which are generally considered less risky, and small, dense ones, which are more likely to sneak into artery walls and cause plaque buildup. The egg diet reduced overall LDL but changed the particle makeup – fewer large ones and a slight increase in the small ones. While this isn't necessarily negative, looking at the LDL drop overall compared to not eating any eggs, it's certainly something that isn't well understood and needs more research.



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It's also worth noting that the no-eggs diet also saw a rise in small particles and a slight drop in large ones, but overall did nothing impactful in lowering LDL cholesterol levels.

However, the results revealed that the real culprit for raising LDL levels appears to be saturated fat, not the cholesterol in eggs as has long been believed. Cutting eggs out of a diet for health reasons, without also reining in saturated fat intake, is unlikely to shift the needle when it comes to LDL cholesterol.

Secondary results from the study also found that the egg diet raised levels of lutein and zeaxanthin – carotenoids in egg yolk known to support brain and eye health, and help protect the body from inflammation – in plasma. The scientists also found a link between a spike in these levels and an increase in incidental movement among the participants. While not causal, the researchers hypothesized that the carotenoids, known antioxidants, could play a role in regulating the brain's motivation or energy systems.

"In this study, we separated the effects of cholesterol and saturated fat, finding that high dietary cholesterol from eggs, when eaten as part of a low saturated fat diet, does not raise bad cholesterol levels," said Buckley. "Instead, it was the saturated fat that was the real driver of cholesterol elevation."

This research follows on from the results of an observational study conducted by Monash University researchers in February, which found that eating up to six eggs a week was linked to a 29% lower likelihood of developing heart disease compared to no or infrequent consumption.

While some cynical readers might be quick to write off these studies as good PR work from "Big Yolk," they lift the lid on a broader discussion that needs to be had about how, in Western societies in particular, the villainization of certain foods was a byproduct of the "nutrient reductionism" era. Think "fat-free" trends and how cow's milk is a non-negotiable for human health.

From the 1950s, as the link between high blood cholesterol and cardiovascular disease risk became established, it was quickly accepted that eating high-cholesterol foods (like eggs) would also raise blood cholesterol levels and, in turn, jeopardize heart health. Dietary guidelines promoting low-cholesterol diets became entrenched in health messaging over the next few decades – despite limited scientific evidence that foods high in cholesterol were driving the rise in heart disease. And egg yolks – with around 185 mg of cholesterol in each – became "bad" for heart health.

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Then, in the 1980s and 1990s, as low-fat, calorie-counting diets rose to prominence, eggs endured another identity crisis. Egg whites – low in calories and with almost no fat content – were embraced, while the yolks – with around 60 calories each and plenty of fat – were to be avoided. What that simplified good/bad approach ignored, however, was that the fat in yolks was largely healthy fats (unsaturated) and it housed most of the egg's nutrients (vitamins A, D, E, K, and choline).

The egg is a great example of nutrient reductionism, which focuses on a single nutrient – fat, protein, carbohydrates, cholesterol – in isolation, rather than assessing the entire package or considering the person consuming it. While nutritional guidelines are moving away from the good/bad dichotomy, we've lived through decades of poor scientific evidence and strong marketing campaigns that tell us where to get calcium (milk) and protein (meat), and that bread (carbs) will sabotage weight loss. After sugar was cast out, the rise of sugar-free artificial sweeteners became the healthy replacement – and there's growing scientific evidence linking various types to a host of health issues.

What this reductive approach missed is that our bodies don't metabolize isolated nutrients in a vacuum – they're absorbed and processed in a much more complex way, affecting health over time. Food exists in the context of meals, habits, microbiome and timing. While we're not advocating for an all-egg diet (as a vegan, I actually belong to the egg-free cohort), the UniSA research underpins the fact that, scientifically speaking, how food impacts our long-term health is far more nuanced.

"So, when it comes to a cooked breakfast, it's not the eggs you need to worry about – it's the extra serve of bacon or the side of sausage that's more likely to impact your heart health," Buckley added.

That said, this research also demonstrates how more work is needed to better understand how eggs don't just impact LDL levels but the composition of that "bad" cholesterol itself.

Currently, the American Heart Association says that healthy people can eat one egg each day and that "older people with healthy cholesterol levels can have two" because of the nutritional value they provide.

The study was published in The American Journal of Clinical Nutrition.

New Atlas, 20 July 2025

<https://newatlas.com>



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### Scalable Technique Produces New Battery Cathodes Using 92% Recycled Materials

2025-07-18

In a major step forward for sustainable energy technology, researchers at Worcester Polytechnic Institute (WPI), led by Professor Yan Wang, William B. Smith Professor of Mechanical and Materials Engineering, have developed a new, scalable method to recycle lithium-ion batteries in a way that is both efficient and environmentally friendly.

The team's research, titled Upcycling Mixed Spent Ni-Lean Cathodes into Ni-Rich Polycrystalline Cathodes, was recently published in *Energy Storage Materials*, a multidisciplinary peer-reviewed journal focused on the topics of materials and energy. The paper details an innovative hydrometallurgical upcycling approach that offers both environmental and performance advantages over traditional recycling methods.

The process specifically targets spent mixed nickel-lean (Ni-lean) cathode materials, which are commonly found in used lithium-ion batteries. Traditional recycling methods struggle to recover these materials effectively and often rely on energy-intensive processes that produce lower-value outputs. In contrast, Wang's approach recovers more than 92% of critical metals—nickel, cobalt, and manganese—and turns them into high-performance cathode powders.

Testing shows that batteries made with these recycled materials perform on par with those made from virgin materials, retaining 88% of their capacity after 500 charge cycles and over 85% capacity after 900 cycles in commercial-scale pouch cells. The new process also uses 8.6% less energy than conventional hydrometallurgical methods and significantly reduces carbon emissions—by 13.9% when compared with traditional recycling, slightly more than with direct upcycling.

"This work not only addresses the environmental challenges of battery waste but also helps reduce our dependence on mining for critical materials," said Wang. "We've shown that it's possible to create high-performance batteries from recycled materials at scale, which is essential for building a more sustainable and resilient battery supply chain."

This innovation directly tackles two major challenges: the growing volume of battery waste and the global demand for critical materials used in electric vehicles and other clean energy technologies. With industry and policymakers focused on sustainable solutions, this advancement could

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play a key role in building a more circular and climate-conscious battery economy.

Technology Networks, 18 July 2025

<https://Technologynetworks.com>

### Light-powered nano-motor winds molecular strands into chain-like structures

2025-07-31

Threads or ropes can easily be used for braiding, knotting, and weaving. In chemistry, however, processing molecular strands in this way is an almost impossible task. This is because molecules are not only tiny, they are also constantly in motion and therefore cannot be easily touched, held or precisely shaped.

A research group at the Institute of Chemistry at Humboldt-Universität zu Berlin (HU) led by Dr. Michael Kathan has now succeeded in precisely winding two molecular strands around each other using an artificial, light-driven molecular motor, thereby creating a particularly complex structure: a catenane (from Latin "catena" = chain). Catenanes consist of two ring-shaped molecules that are intertwined like the links of a chain—without being chemically bonded to each other. The research results are published in the journal *Science*.

"What we have developed is basically a mini-machine that is powered by light and rotates in one direction," says Kathan.

"We use this controlled movement to mechanically wind two molecular strands around each other and connect them—regardless of whether they would do so on their own or not. Our motor now brings a kind of mechanical control to the world of molecules, which we previously only knew from the macroscopic world."

### New method can form a large variety of specific three-dimensional structures

In synthetic chemistry, it has previously been extremely difficult to intertwine molecules in a targeted manner, especially if this arrangement contradicts the natural process of molecular self-organization. In nature, molecules are constantly in motion and can form three-dimensional structures in this process.



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Structural components of cells such as proteins or the genetic molecule DNA are assembled in this way. However, these are usually not fixed and permanent structures. In the laboratory, molecular templates have often been used to define specific structures, but they typically only work with certain molecules.

The new method takes a different approach: the artificial molecular machine can force a wide variety of molecules into precisely defined three-dimensional structures. Driven by light, the rotating motor generates a mechanically defined twist with each step, which is then chemically fixed. The movement is directional and programmable.

“Our method is the first template-free approach that allows such precise mechanical control, and it is also easily generalizable,” says Kathan.

### New possibilities for the design of innovative materials

The catenanes synthesized in the laboratory using the new method are considered the fundamental building blocks for mechanically intertwined structures such as molecular chains, fabrics or networks.

The study shows for the first time that such structures can in principle be produced from very different molecules and thus provides a fundamental and generalizable conceptual approach: complex, mechanically defined architectures are technically feasible at the molecular level. This broadens the scope of chemical synthesis and opens the door to designing entire materials from mechanically intertwined molecules.

These materials would possess unique properties: high flexibility combined with exceptional robustness due to their molecular architecture.

Phys Org, 31 July 2025

<https://phys.org>

### Ultra-thin sound-blocking material effectively dampens traffic noise

2025-07-25

If you live in a noisy urban area, you're gonna love the sound of this. Researchers in Switzerland have developed a material that can dampen street noise while being four times thinner than similar-performing absorbers used in construction.

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This new material from the Acoustics/Noise Reduction lab at the Swiss Federal Laboratories for Materials Science and Technology (EMPA) institute in Dübendorf doesn't yet appear to have a name.

But beyond its ultra-thin profile, it has a neat trick up its sleeve: it can be tuned to specific frequency ranges, depending on what's causing a din outside, and what kind of space it's being installed in.

It's essentially a mineral gypsum or cement foam that's specially produced to have pores of different sizes, and it's packed in multiple thin layers to create more variation.

“The varying pore structure of the mineral foams forces air particles to take a longer route to get into the material and out again. Despite the low thickness, this creates the impression of a much thicker absorber for the sound waves,” EMPA researcher Bart Van Damme explained.

Using a numerical model, the researchers can “simulate and even specifically influence the acoustic behavior of the entire material by varying pore size, perforation and layer structure.”

The team tested this new material by fitting enough 2.1-inch (5.5-cm)-thick panels to cover about 130 sq ft (12 sq m) of a driveway in Zurich, where one end opens out on a public street and the other opens into a courtyard. The panels helped reduce traffic noise by 4 decibels, and was particularly effective at dampening the sound of cars approaching or leaving the driveway.

A significantly thinner sound absorption material like this allows builders and architects greater flexibility in designing and constructing living spaces, since they don't gobble up as many inches as traditional insulation materials.

The material's pore size, perforation, and layer structure can also be varied to change its acoustic behavior to suit different kinds of spaces – like stairwells, offices, large halls, and classrooms.

What's more, it's weatherproof, fireproof, and recyclable, making it a versatile choice for indoor and outdoor use.

That said, the material isn't yet perfect in its current form. It's not as performant at quietening high frequencies as rock wool, and the perforation process is presently done by hand and therefore labor-intensive. To address the latter, the EMPA team's next step will be to streamline mass production. It's already collaborating with Swiss material



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maker De Cavis on this material, so hopefully it will be able to help make the world a little less noisy soon enough.

New Atlas, 25 July 2025

<https://newatlas.com>

### Dye-free blue fluorescence enables easy viewing for interface sciences

2025-07-31

Fluorescent markers are extremely useful in science as tools to track molecules or processes as they carry out their unique activities, revealing unknown facts along the way. However, physically introducing fluorescent markers into targets can result in strong background signals, and even when chemically bound, the target's hydrophobicity may increase, making the process far from straightforward. Moreover, fluorescent markers are often affected by the properties of the solvent in which they operate.

To address these challenges, researchers have developed a method to track the behavior of cellulose nanofibers (CNFs) by conjugating water-compatible fluorescent amino acids to the CNFs. As a result, observers can now microscopically visualize CNFs by following the blue fluorescence emitted from them.

Researchers published their results in Carbohydrate Polymer Technologies and Applications.

Cellulose nanofibers (CNFs) are a more eco-friendly alternative to conventional polymers, typically comprised of plastics, and are instead made from cellulose, a structural material found in plant cell walls. Researchers attached fluorescent amino acid acridon-2-yl-alanine, or Acd, to a CNF to produce a blue fluorescent CNF that retains the original structure and dispersibility of the materials it is acting upon and is known as Acd-CNF.

The importance of this lies in its ingenuity: conventional methods often contain hydrophobic components that can alter the thixotropic nature of some materials. Thixotropy refers to a property seen in some fluids or gels where, at rest, the material is viscous and thick but upon movement becomes more fluid (less viscous). These characteristics are essential when viewing and studying the ability of two different substances to be mixed, and can broaden the usability of CNFs.

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"We aimed to address the challenge of visualizing the interfacial behavior and distribution of cellulose nanofibers in aqueous systems, particularly at oil-water interfaces, without relying on external dyes," said Izuru Kawamura, senior researcher, author and professor at Yokohama National University.

The covalent bond, or bond between two atoms by sharing electrons, is a strong bond between two molecules. Acd-CNF takes advantage of this bond to increase its stability and visibility when viewing without the added "junk" that conventional dye-based methods might leave or introduce into a system. The importance of unobstructed viewing cannot be understated when attempting to understand the way substances interact with each other, as even subtle disruptions can leave the observer with biased data.

Interface science is concerned with the interactions of physical and chemical phenomena occurring at the boundary of two differing phases of matter. Acd-CNF retains the original properties of the material it acts on while being easily visible upon microscopic observation, opening up opportunities for various fields of study.

Results showed that even when the viscosity of a material was increased by 10, Acd-CNF still retained the original properties of the material. This can be attributed to its increased capacity for hydration (mitigating the hydrophobic tendencies of the conventional method) and a sturdy network of cellulose nanofibers.

Researchers would like to take this work further to explore the use of Acd-CNF in other systems, such as emulsified food products and cosmetics, and study the effects various conditions have on the product's behaviors. Additionally, the novelty of functional fluorescent nanomaterials made out of cellulose can allow for ecofriendly nanomaterials to be put into widespread use in a variety of fields and applications.

Yuto Ito, Daisuke Sato, Azusa Kikuchi and Kawamura of the Graduate School of Engineering Science at Yokohama National University with Noriko Kanai of the Graduate School of Environment and Information Sciences at Yokohama National University contributed to this research.

Phys Org, 31 July 2025

<https://phys.org>



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### Forget the Big Bang: Gravitational waves may have really created the Universe

2025-07-31

A team of scientists led by expert Raúl Jiménez, ICREA researcher at the University of Barcelona's Institute of Cosmos Sciences (ICCUB), in collaboration with the University of Padua (Italy), has presented a revolutionary theory about the origins of the Universe. The study, published in the journal Physical Review Research, introduces a radical change in the understanding of the first moments after the Big Bang, without relying on the speculative assumptions that physicists have traditionally assumed.

#### Unraveling the mystery of the origins of the Universe

For decades, cosmologists have worked under the inflationary paradigm, a model that suggests that the Universe expanded extremely rapidly, in a fraction of a second, thus paving the way for everything we observe today. But this model includes too many adjustable parameters -- the free parameters -- which can be modified. Scientifically, this poses a problem, as it makes it difficult to know whether a model is truly predicting or simply adapting to the data. In a significant breakthrough, the team has proposed a model in which the early Universe does not require any of these arbitrary parameters. Instead, it begins with a well-established cosmic state called De Sitter space, which is consistent with current observations of dark energy.

#### Gravitational waves: the key to understanding cosmic structure

The new model does not rely on hypothetical fields or particles such as inflation. It suggests that natural quantum fluctuations in space-time, gravitational waves, were sufficient to seed the small density differences that eventually gave rise to galaxies, stars, and planets. These ripples evolve non-linearly, interacting and generating complexity over time, allowing for verifiable predictions with real data.

"For decades, we have tried to understand the early moments of the Universe using models based on elements we have never observed," says Raúl Jiménez. "What makes this proposal exciting is its simplicity and verifiability. We are not adding speculative elements, but rather demonstrating that gravity and quantum mechanics may be sufficient to explain how the structure of the cosmos came into being."

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Understanding the origin of the Universe is not just a philosophical question, but helps us answer fundamental questions about who we are and where we come from. This new proposal offers a minimalist but powerful, elegant and potentially refutable vision. This is science at its best: clear predictions that future observations -- such as measurements of gravitational waves and cosmic structure -- can confirm or reject.

These new results suggest that we may not need speculative elements to explain the cosmos, but only a deep understanding of gravity and quantum physics. If the model is confirmed, it could mark a new chapter in the way we think about the birth of the Universe.

Science Daily, 31 July 2025

<https://sciencedaily.com>



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### Tokamak fusion reactor turns mercury into gold

2025-07-24

The dream of the ancient alchemists may come true as Marathon Fusion announces that its tokamak fusion reactor technology can turn common mercury into gold as a byproduct of fusion operations in quantities that would make Auric Goldfinger blush.

Since the days of the ancient Greeks, practitioners of alchemy pursued the goal of learning how to make the fabled Philosopher's Stone that would allow them to turn base metals like lead, tin, iron, copper, and mercury into gold. Using techniques that mixed crude chemistry with esoteric metaphysics, it was an exercise that was as much a seeking of spiritual enlightenment as a get-rich-quick scheme.

However, though they made many discoveries and formed the foundations of modern chemistry, the only gold these alchemists created was what the more unscrupulous among them could con out of greedy backers with dreams of avarice.

In the 20th century, physicists cracked the secret of transmutation using the power of the atom, but the amount of gold produced in the laboratory was so minuscule and the process so expensive that it was hardly worth the effort.

Today, chrysopoeia, as the process of transmutation is called in more refined circles that have an aggravating desire to make people reach for the dictionary, may become a practical reality. And like many technological advances these days, it's the side benefit of another creation.

According to Marathon Fusion – a company dedicated to the development of fusion energy components – a tokamak fusion reactor can not only produce limitless clean energy, but five tonnes of gold out from mercury for every gigawatt (~2.5 GWth) of electricity generated.

Put simply, the method is similar to one proposed to allow reactors to manufacture their own tritium fuel. This is done by lining the reactor vessel with a layer of lithium. When the lithium absorbs a neutron from the fusion reaction, it splits into an alpha particle and a tritium atom. If you replace the lithium with the very common mercury-198 isotope (or better yet, a lithium/mercury alloy), a fast neutron will turn it into unstable mercury-197. This then undergoes an electron decay that turns into (ta da!) gold-197. Oh, and there's tritium as well, if you're using the alloy.

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In a recent preprint paper still awaiting peer review, Marathon scientists suggest using mercury that has been enriched to 90% of the desired isotope for the best reaction results. After being exposed to the reactor, the amalgam can be treated chemically to separate the gold. Since gold is a nearly inert noble element, this is a relatively simple process.

As to the economics, since gold is now selling for US\$3,388.50 per troy ounce, five tonnes per year works out to US\$544,792,869.75. That would defray a lot of reactor operating costs with enough left over for a very nice lunch with a bottle of Pol Roger Brut Champagne 1982 to wash it down.

New Atlas, 24 July 2025

<https://newatlas.com>

### New Compound Defies Fundamental Principle of Organometallic Chemistry

2025-07-08

For over a century, the well-known 18-electron rule has guided the field of organometallic chemistry. Now, researchers at Okinawa Institute of Science and Technology (OIST) have successfully synthesized a novel organometallic compound that challenges this longstanding principle. They have created a stable 20-electron derivative of ferrocene, an iron-based metal-organic complex, which could lead to exciting possibilities in chemical science.

"For many transition metal complexes, they are most stable when surrounded by 18 formal valence electrons. This is a chemical rule of thumb on which many key discoveries in catalysis and materials science are based," said Dr. Satoshi Takebayashi, lead author of the paper published in Nature Communications, in collaboration with scientists from Germany, Russia, and Japan. Ferrocene is a classic example that embodies this rule. "We have now shown for the first time that it is possible to synthesize a stable 20-electron ferrocene derivative," he added.

This breakthrough improves our understanding of the structure and stability of metallocenes, a class of compounds known for their characteristic "sandwich" structure, in which a metal atom sits between two organic rings.

### Rebuilding our conceptual understanding

First synthesized in 1951, ferrocene revolutionized chemistry with its unexpected stability and unique structure, eventually earning its



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discoverers the 1973 Nobel Prize in Chemistry. In many ways, ferrocene opened a new chapter in our understanding of metal–organic bonding and launched the modern field of organometallic chemistry, which continues to inspire generations of scientists to explore metal–organic compounds.

This new study builds on that foundation. By designing a novel ligand system, the team was able to stabilize a ferrocene derivative with 20 valence electrons, coordination chemistry that was previously considered improbable. “Moreover, the additional two valence electrons induced an unconventional redox property that holds potential for future applications,” Dr. Takebayashi noted.

This is important because even though ferrocene is already used in reactions involving electron transfer, known as redox reactions, it has traditionally been limited to a narrow range of oxidation states. By enabling access to new oxidation states through the formation of an Fe–N bond in this derivative, it expands the ways in which ferrocene can gain or lose electrons. As a result, it could become even more useful as a catalyst or functional material across a variety of fields, from energy storage to chemical manufacturing.

Understanding how to break and rebuild the rules of chemical stability enables researchers to design molecules with tailor-made properties. These insights could inspire new research aimed at advancing sustainable chemistry, including the development of green catalysts and next-generation materials.

### A platform for future innovation

Ferrocene derivatives have already made their way into various technologies, from solar cells and pharmaceuticals to medical devices and advanced catalysts. By expanding the conceptual toolkit available to chemists, this latest breakthrough could help build on and diversify these applications while inspiring entirely new ones.

The Organometallic Chemistry Group at OIST focuses on uncovering the fundamental principles that govern metal–organic interactions and applying them to real-world challenges. The team has a special interest in unconventional compounds that defy standard chemical rules, such as the 20-electron ferrocene derivative reported in this study.

Technology networks, 8 July 2025

<https://technologynetworks.com>

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### Biotechnology method uses peptides for efficient, eco-friendly mineral separation

2025-07-31

Researchers at the Australian Research Council (ARC) Center of Excellence for Enabling Eco-Efficient Beneficiation of Minerals (COEMinerals) have made a significant breakthrough in the recovery of critical and rare earth minerals and metals, advancing Australia’s sustainability goals and strengthening its strategic industries.

Led by Center researcher Professor Chun-Xia Zhao from the University of Adelaide’s School of Chemical Engineering, the Center has applied learnings from multiple scientific disciplines to mimic how a cancer-targeting drug finds cancer cells—but in this case finding a one-in-a-billion peptide molecule targeting a given mineral or metal.

“We knew nature contained molecules with selective binding properties,” said Professor Zhao. “By harnessing these properties, we were able to find precise peptide matches for specific minerals, each one fitting like a jigsaw puzzle.”

This advancement has the potential to unlock the equivalent of a “DNA code” for every mineral and metal on planet Earth and revolutionize mineral processing. It also heralds environmental benefits.

“Current mineral separation processes can require hundreds of stages. This is not only inefficient and costly but involves toxic solvents that harm the environment. In contrast, the Center’s new biomolecule approach offers selective and recyclable peptides as a single-stage process, reducing both complexity and waste,” Professor Chun-Xia Zhao added.

The biotechnology approach was tested on silver, which resulted in selective separation of silver particles from silica, a common waste byproduct, and achieving over 98% silver purity, with a recovery rate of more than 95%, as published in *Advanced Functional Materials*. Broader testing is now underway, with early indications that the peptide-matching approach offers promising performance, especially for rare earth minerals.

ARC Chief Executive Officer Professor Ute Roessner commented, “This achievement shows how government support for research can lead to real-world outcomes that boost innovation, improve productivity, and benefit Australia in the long run.”



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Propelling the move from idea to industry impact, a license agreement is in place with Theia Metals Pty. Ltd. to progress the next stage of technology development.

Theia Metals CEO Russell J. Howard, an Australian entrepreneur, scientist and executive who is a pioneer in the field of molecular science, formally based in California, said, "Partnership and licensing to Theia Metals begins the process of investor and corporate mining partner-led development of this technology to the marketplace."

Phys Org, 31 July 2025

<https://phys.org>

### Engineered enzyme enables precise assembly of single-handed complex molecules

2025-07-30

Researchers at the University of Basel have repurposed a natural enzyme so that it catalyzes a highly challenging chemical reaction. Their approach opens new possibilities for synthesizing complex molecules—such as pharmaceuticals and fine chemicals—in a more environmentally friendly and efficient way. The findings are published in the journal Nature.

Catalysts are among the most important tools for achieving more sustainable green chemistry. They accelerate chemical reactions, making them more efficient and easier to control. As a result, energy, waste and costs can be saved when manufacturing a wide variety of products. The search for new catalysts has kept the field of chemistry busy since the 20th century.

As nature's catalysts, enzymes have garnered increasing attention for their exceptional ability to enhance both the reactivity and selectivity of chemical reactions, as well as for their environmentally benign properties.

#### Promising method with a catch

Recently, metal hydride hydrogen atom transfer (MHAT) has emerged as a promising catalytic method to efficiently build complex molecules. A compound consisting of metal hydride—a metal atom bonded with a hydrogen atom—transfers a hydrogen atom to a double bond within the organic compound, producing a reactive intermediate that triggers the subsequent bond formation.

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MHAT can convert a flat, two-dimensional substrate into a complex molecule with a three-dimensional architecture. However, achieving precise control over the three-dimensional arrangement of the atoms within the molecule—particularly the mirror-image configurations of the molecule, akin to left and right hands—remains challenging.

In pharmaceutical and fine chemicals manufacturing, however, it is crucial that a single-handed configuration is created. This is because the two mirror-image molecules can exhibit different biological properties—one may be therapeutically beneficial while the mirror-image counterpart can be inactive or even toxic.

#### Enzyme produces single-handed configuration

Researchers at the University of Basel have now succeeded in combining MHAT chemistry with enzymatic catalysis to produce three-dimensional molecules with single-handed configuration. The groundbreaking research is part of the National Center of Competence in Research "Molecular Systems Engineering," which is led by Prof. Dr. Thomas R. Ward at the University of Basel.

The research team has managed to repurpose a hemoprotein—an enzyme that is widely present in nature—to carry out MHAT reactions within its catalytic site. Thanks to the sophisticated enzyme scaffold, it produces almost exclusively the desired single-handed form of the molecule (up to a 98 to 2 ratio of left- and right-handed molecules). Notably, such transformations are very challenging to achieve with conventional chemical tools.

"Until now, no enzyme that could carry out such a MHAT reaction was known," explains first author Dr. Xiang Zhang.

#### Specificity—both a curse and a blessing

This breakthrough paves the way for a more sustainable and efficient production of a variety of complex chemicals. By repurposing a natural enzyme to catalyze this versatile chemical transformation, the researchers aim to streamline the synthesis of pharmaceuticals and other high-added value chemicals.

However, the specificity of the enzyme is both a curse and a blessing: if using a structurally different starting material, the enzyme scaffold might require further engineering to achieve high specificity. Additionally, in



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order to make this transformation even more useful, the researchers are looking for a more sustainable way for metal hydride formation.

Phys Org, 30 July 2025

<https://phys.org>

### Belly fat-melting jab is now one step away from FDA approval

2024-08-01

What if you could inject a drug into a “problem area” – like abdominal fat – that could kill off fat cells and reduce fat stores in that localized spot? That’s what a novel drug from Taiwan’s Caliway Pharmaceuticals offers, the world’s very first injection that triggers programmed fat-cell death in a targeted area, like the belly or the thighs.

Known as CBL-514, this small-molecule drug induces adipocyte apoptosis, which kills fat cells rather than starves them, meaning different regions of subcutaneous fat stores can be rapidly reduced in just a few weeks after a single dose. It’s currently being tested for three uses: Non-surgical fat reduction, Dercum’s disease – which causes painful fatty tumors to build up around the body, and cellulite.

“Administered via subcutaneous injection, CBL-514 has demonstrated a favorable safety and tolerability profile, enabling significant localized fat reduction without surgery and delivering results comparable to liposuction,” Caliway has stated.

While it’s being investigated for various applications, the leading one – and the one expected to be on the market first – is for the non-surgical reduction of problematic abdominal fat.

CBL-514 has completed two successful Phase 2b studies (CBL-0204 and CBL-0205) and is about to undertake two pivotal global Phase 3 clinical trials in the second half of 2025.

In the most recent CBL-0205 Phase 2b trial, 75% saw their abdominal fat reduce by at least one grade on the Abdominal Fat Rating Scale (AFRS) four weeks after the initial single shot. This meant it passed its efficacy endpoint to satisfy the US Food and Drug Administration (FDA), which it had already demonstrated (along with safety and tolerability) in the previous 2b trial.

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Right now, the only drug approved for localized fat reduction is ATX-101 – or deoxycholic acid injection – which has been effective in reducing adipose stores in small areas but comes with serious side effects including skin necrosis, ulceration, nerve injury and infections. CBL-514 hasn’t caused any of these issues even with multiple doses across much larger areas of the body.

In the last trial, more than 75% of participants reached their target fat volume loss after one or two injections, and the mean fat loss was more than double this. It closely mirrored the results from the initial Phase 2b trial, with results released in December 2024 detailing how 76.7% of its 107 participants who received the treatment improved by at least one grade on the five-grade AFRS. Three quarters of those participants only needed a single shot for this.

“CBL-514, a first-in-class small-molecule drug, is a lipolysis injectable that can induce adipocyte apoptosis and lipolysis to reduce subcutaneous adiposity in treatment areas without causing any systematic side effects on the central nervous system, cardiovascular system, and respiratory system,” the company noted. “Caliway’s preclinical studies have shown that CBL-514 upregulates the apoptosis mediators caspase 3 and Bax/Bcl-2 ratio and then induces adipocyte apoptosis in vivo and in vitro.”

While it has obvious aesthetic application – non-surgical body-sculpting – the first-in-class drug stands to have broader benefits. Abdominal fat, particularly in midlife and later in life, has been implicated in a number of serious conditions including chronic pain, stroke and cardiovascular disease. While CBL-514 doesn’t specifically target the deeper visceral fat in the region, it can reduce subcutaneous fat by more than 25%, which reduces chronic disease risk and positively impacts hard-to-treat visceral fat.

A safe, localized, non-surgical fat-loss treatment has so far eluded scientists.

Back in 2023, the FDA approved CBL-514 as an Investigational New Drug (IND). A year later, it received European Medicines Agency (EMA) approval, being granted Orphan Drug Designation status for the treatment of Dercum’s disease.

In May, the company got the seal of approval to move on to its final clinical trial stage; the first Phase 3 trial will take place in the US and Canada, and a second in the US, Canada and Australia – both are in the recruitment stage



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now. The first Phase 3 cohort will feature around 300 participants across close to 30 clinical sites in North America.

“We are pleased to have reached alignment with the FDA on both study design and indication,” said Vivian Ling, Chief Executive Officer of Caliway. “The Agency agrees that the ‘reduction of abdominal subcutaneous fat’ as the proposed indication reinforces our confidence in CBL-514’s differentiated value, and its potential to redefine standards in aesthetic medicine.”

If it delivers in these larger trials, it could be on the market within 12 months.

The results of the most recent Phase 2b clinical trial was published in the *Aesthetic Surgery Journal*.

New Atlas, 1 August 2025

<https://newatlas.com>

### Fat melts away—but so does muscle: What Ozempic users need to know

2025-07-31

Popular GLP-1 drugs help many people drop tremendous amounts of weight, but the drugs fail to provide a key improvement in heart and lung function essential for long-term good health, University of Virginia experts warn in a new paper.

The researchers emphasize that weight loss associated with GLP-1 drugs has many clear health benefits for people with obesity, type 2 diabetes and heart failure, including improving blood-sugar control, short-term cardiorenal benefits and improvements in survival outcomes. But doctors may need to consider recommending exercise programs or develop other approaches, such as nutrition supplements or complementary medications, to help GLP-1 patients get the full cardiorespiratory benefits of substantial weight loss over the long-run, the researchers say.

“Some patients literally told me that they felt that they were losing muscle or muscle was slipping away from them while they were on these medications,” said researcher Zhenqi Liu, MD, Professor of Medicine and James M. Moss Professor of Diabetes at the University of Virginia School of Medicine and former chief of UVA Health’s Division of Endocrinology and Metabolism. “This is a serious concern. Muscle, especially axial muscle, is essential for posture, physical function and overall well-being.

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Losing lean body mass can increase the risk of cardiovascular disease, all-cause mortality and diminished quality of life. We need to make sure that patients prescribed these medications aren’t already at risk for malnutrition or low muscle mass.”

### About GLP-1 Drugs

While GLP-1 drugs help people lose fat, this comes with loss of fat-free mass, of which muscle makes up 40% to 50%. In fact, fat-free mass lost accounts for 25-40% of the total pounds lost, while age-related declines in fat-free mass are only 8% per decade.

Liu and his collaborators, graduate student Nathan R. Weeldreyer and Siddhartha S. Angadi, PhD, Associate Professor of Kinesiology at UVA’s School of Education and Human Development, wanted to better understand the potential long-term consequences of this muscle loss, so they reviewed available data on the drugs’ effects on cardiorespiratory fitness, or CRF.

CRF (or VO<sub>2</sub>max) is a measure of how well the body can use oxygen during exercise. It is a handy way for doctors to assess how well the heart, lungs, muscle and blood vessels work together, and it is used to predict all-cause and cardiovascular mortality (risk of death).

Patients with obesity often have low CRF. In some cases, this is because the person lacks muscle mass; in others, a person may have enough muscle, but the quality of that muscle is compromised by fat that has penetrated it.

“Cardiorespiratory fitness is a potent predictor of all-cause and cardiovascular mortality risk across a range of populations, including obesity, diabetes and heart failure,” said Angadi, a cardiovascular exercise physiologist with UVA’s Department of Kinesiology. “In a recent study by our group that examined mortality outcomes from almost 400,000 individuals across the world, we found that CRF was far superior to overweight or obesity status for predicting the risk of death. In fact, once CRF was factored in, body weight failed to predict the risk of mortality. This is why it’s so important to understand the effects of this new class of drugs on it.”

In their review of the available medical literature, the researchers found that GLP-1 drugs improve certain measures of heart function, yet those improvements don’t translate into significant improvements in VO<sub>2</sub>max.



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Some small studies, they note, have suggested that exercise can help improve VO2max for patients taking GLP-1 drugs, but these had poor controls and larger, well-designed studies are needed to bear that out.

### Ensuring Healthy Weight Loss

The researchers ultimately conclude that GLP-1 drugs “significantly reduce body weight and adiposity, along with a substantial FFM [fat-free mass] loss, but with no clear evidence of CRF enhancement.” They remain concerned that this could take a toll on patients’ metabolic health, healthspan/frailty and overall longevity. They are urging additional research to better understand the effects of the drugs and ensure patients get the best possible outcomes.

They note, however, that there are promising signs that we may be able to develop medications to help, such as a monoclonal antibody already in the pipeline that may be able to offset lean-muscle loss.

“This is an area of active research, and we are hopeful that better solutions are coming soon,” Liu said. “But for now it is important that patients prescribed GLP-1 drugs have conversations with their healthcare providers about strategies to preserve muscle mass. The American Diabetes Association recommends screening for malnutrition and low muscle mass risk before starting these medications and promoting adequate protein intake and regular exercise throughout treatment.”

“Finally,” Angadi added, “exercise training during GLP1 therapy remains to be assessed in its ability to preserve or improve VO2max during GLP1 therapy.”

### Findings Published

The researchers have published their findings in JCEM, the Journal of Clinical Endocrinology & Metabolism. The work was supported by the National Institutes of Health, grants R01DK124344 and R01DK125330.

Science Daily, 31 July 2025

<https://sciencedaily.com>

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### Scalable Technique Produces New Battery Cathodes Using 92% Recycled Materials

2025-07-18

In a major step forward for sustainable energy technology, researchers at Worcester Polytechnic Institute (WPI), led by Professor Yan Wang, William B. Smith Professor of Mechanical and Materials Engineering, have developed a new, scalable method to recycle lithium-ion batteries in a way that is both efficient and environmentally friendly.

The team’s research, titled Upcycling Mixed Spent Ni-Lean Cathodes into Ni-Rich Polycrystalline Cathodes, was recently published in Energy Storage Materials, a multidisciplinary peer-reviewed journal focused on the topics of materials and energy. The paper details an innovative hydrometallurgical upcycling approach that offers both environmental and performance advantages over traditional recycling methods.

The process specifically targets spent mixed nickel-lean (Ni-lean) cathode materials, which are commonly found in used lithium-ion batteries. Traditional recycling methods struggle to recover these materials effectively and often rely on energy-intensive processes that produce lower-value outputs. In contrast, Wang’s approach recovers more than 92% of critical metals—nickel, cobalt, and manganese—and turns them into high-performance cathode powders.

Testing shows that batteries made with these recycled materials perform on par with those made from virgin materials, retaining 88% of their capacity after 500 charge cycles and over 85% capacity after 900 cycles in commercial-scale pouch cells. The new process also uses 8.6% less energy than conventional hydrometallurgical methods and significantly reduces carbon emissions—by 13.9% when compared with traditional recycling, slightly more than with direct upcycling.

“This work not only addresses the environmental challenges of battery waste but also helps reduce our dependence on mining for critical materials,” said Wang. “We’ve shown that it’s possible to create high-performance batteries from recycled materials at scale, which is essential for building a more sustainable and resilient battery supply chain.”

This innovation directly tackles two major challenges: the growing volume of battery waste and the global demand for critical materials used in electric vehicles and other clean energy technologies. With industry and policymakers focused on sustainable solutions, this advancement could



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play a key role in building a more circular and climate-conscious battery economy.

Technology Networks, 18 July 2025

<https://technologynetworks.com>

### Reversing Alzheimer's damage: Two cancer drugs demonstrate surprising power

2025-07-31

Scientists at UC San Francisco and Gladstone Institutes have identified cancer drugs that promise to reverse the changes that occur in the brain during Alzheimer's, potentially slowing or even reversing its symptoms.

The study first analyzed how Alzheimer's disease altered gene expression in single cells in the human brain. Then, researchers looked for existing drugs that were already approved by the Food and Drug Administration (FDA) and cause the opposite changes to gene expression.

They were looking specifically for drugs that would reverse the gene expression changes in neurons and in other types of brain cells called glia, all of which are damaged or altered in Alzheimer's disease.

Next, the researchers analyzed millions of electronic medical records to show that patients who took some of these drugs as part of their treatment for other conditions were less likely to get Alzheimer's disease.

When they tested a combination of the two top drugs -- both of which are cancer medications -- in a mouse model of Alzheimer's, it reduced brain degeneration in the mice, and even restored their ability to remember.

"Alzheimer's disease comes with complex changes to the brain, which has made it tough to study and treat, but our computational tools opened up the possibility of tackling the complexity directly," said Marina Sirota, PhD, the interim director of the UCSF Bakar Computational Health Sciences Institute, professor of pediatrics, and co-senior author of the paper. "We're excited that our computational approach led us to a potential combination therapy for Alzheimer's based on existing FDA-approved medications."

The findings appeared in *Cell* on July 21. The research was funded in part by the National Institutes of Health and the National Science Foundation.

**Big data from patients and cells points to a new Alzheimer's therapy**

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Alzheimer's disease affects 7 million people in the U.S. and causes a relentless decline in cognition, learning, and memory. Yet decades of research have only produced two FDA-approved drugs, neither of which can meaningfully slow this decline.

"Alzheimer's is likely the result of numerous alterations in many genes and proteins that, together, disrupt brain health," said Yadong Huang, MD, PhD, senior investigator and director of the Center for Translational Advancement at Gladstone, professor of neurology and pathology at UCSF, and co-senior author of the paper. "This makes it very challenging for drug development -- which traditionally produces one drug for a single gene or protein that drives disease."

The team took publicly available data from three studies of the Alzheimer's brain that measured single-cell gene expression in brain cells from deceased donors with or without Alzheimer's disease. They used this data to produce gene expression signatures for Alzheimer's disease in neurons and glia.

The researchers compared these signatures with those found in the Connectivity Map, a database of results from testing the effects of thousands of drugs on gene expression in human cells.

Out of 1,300 drugs, 86 reversed the Alzheimer's disease gene expression signature in one cell type, and 25 reversed the signature in several cell types in the brain. But just 10 had already been approved by the FDA for use in humans.

Poring through records housed in the UC Health Data Warehouse, which includes anonymized health information on 1.4 million people over the age of 65, the group found that several of these drugs seemed to have reduced the risk of developing Alzheimer's disease over time.

"Thanks to all these existing data sources, we went from 1,300 drugs, to 86, to 10, to just 5," said Yaqiao Li, PhD, a former UCSF graduate student in Sirota's lab who is now a postdoctoral scholar in Huang's lab at Gladstone and the lead author of the paper. "In particular, the rich data collected by all the UC health centers pointed us straight to the most promising drugs. It's kind of like a mock clinical trial."

### A combination therapy poised for primetime

Li, Huang, and Sirota chose 2 cancer drugs out of the top 5 drug candidates for laboratory testing. They predicted one drug, letrozole, would remedy Alzheimer's in neurons; and another, irinotecan, would help



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glia. Letrozole is usually used to treat breast cancer; irinotecan is usually used to treat colon and lung cancer.

The team used a mouse model of aggressive Alzheimer's disease with multiple disease-related mutations. As the mice aged, symptoms resembling Alzheimer's emerged, and they were treated with one or both drugs.

The combination of the two cancer drugs reversed multiple aspects of Alzheimer's in the animal model. It undid the gene expression signatures in neurons and glia that had emerged as the disease progressed. It reduced both the formation of toxic clumps of proteins and brain degeneration. And, importantly, it restored memory.

"It's so exciting to see the validation of the computational data in a widely used Alzheimer's mouse model," Huang said. He expects the research to advance soon to a clinical trial so the team can directly test the combination therapy in Alzheimer's patients.

"If completely independent data sources, such as single-cell expression data and clinical records, guide us to the same pathways and the same drugs, and then resolve Alzheimer's in a genetic model, then maybe we're onto something," Sirota said. "We're hopeful this can be swiftly translated into a real solution for millions of patients with Alzheimer's."

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<https://sciencedaily.com>

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### New nonstick coating acts like Teflon – but without the forever chemicals

2025-07-28

Using a new chemistry technique called nanoscale fletching, scientist have created a high-performance nonstick coating that repels water and oil and, importantly, provides a safer and more environmentally friendly surface – ideal for cookware and other everyday uses.

University of Toronto (U of T) engineers have designed a super-thin coating that begins with polydimethylsiloxane (PDMS), a flexible silicone polymer used widely in everything from contact lenses to medical devices. It's transparent, inert, nontoxic and has a high temperature resistance. On its own, however, it can't repel oils like coatings made from per- and polyfluoroalkyl substances (PFAS) – forever chemicals. One of the most famous PFAS for this kind of use is, of course, Teflon (the brand name for polytetrafluoroethylene, or PTEE).

"The material we've been working with as an alternative to PFAS is called polydimethylsiloxane or PDMS," said Kevin Golovin, a professor at U of T Engineering. "PDMS is often sold under the name silicone, and depending on how it's formulated, it can be very biocompatible – in fact it's often used in devices that are meant to be implanted into the body. But until now, we couldn't get PDMS to perform quite as well as PFAS."

Looking much closer at PFAS, the group's molecules are made of chains of carbon atoms, each one bonded to several fluorine atoms. The inertness of these bonds is what gives PFAS its enviable nonstick properties.

To make PDMS behave like PFAS, the team developed an entirely new chemistry technique – nanoscale fletching – which essentially rearranges some important molecules. So, instead of using long PFAS chains (bad for the environment), the researchers added a few single fluorinated chemical (-CF<sub>3</sub>) groups. These are tiny – one carbon and three fluorine atoms – and are the least harmful kind of PFAS-related molecule we currently know of.

Because PDMS is flexible, the "slippery" -CF<sub>3</sub> groups naturally move and settle on the outer surface of the treated PDMS – and this gives it an oil-repellent skin like PFAS.

"Unlike typical silicone, we bond short chains of PDMS to a base material – you can think of them like bristles on a brush," explained researcher Samuel Au. "To improve their ability to repel oil, we have now added in the shortest possible PFAS molecule, consisting of a single carbon with three



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fluorines on it. We were able to bond about seven of those to the end of each PDMS bristle."

The engineers called this process nanoscale fletching, because it's like – well, in chemistry terms – fletching feathers to an arrow for performance.

"If you were able to shrink down to the nanometre scale, it would look a bit like the feathers that you see around the back end of an arrow, where it notches to the bow," he added. "That's called fletching, so this is nanoscale fletching."

The result is an ultra-thin layer that repels water and grease on par with existing nonstick coatings – but with a much lower PFAS content. This large group of human-made chemicals, used in everything from cookware to electronics and fast food packaging, are known as forever chemicals as they don't degrade easily. As such, they spread through water, soil and our bloodstream and can stick around for decades.

And despite the hard work of researchers across the globe looking for safer, greener options, nothing has come close to the likes of Teflon, which has been in heavy use since the 1930s. These forever chemicals have so far been implicated in a wide range of medical studies, and scientists are only just beginning to unpack the health risks of long-chain PFAS exposure.

The researchers' new nonstick coating underwent tests and scored a six on a scale developed by the American Association of Textile Chemists and Colorists to rate performance. This was on par with existing PFAS-based coatings.

Sure, it's not entirely PFAS-free, but the researchers are hoping to cook that up in the lab as they work on reducing the coating's environmental and biological footprint further.

"While we did use a PFAS molecule in this process, it is the shortest possible one and therefore does not bioaccumulate," said Golovin. "What we've seen in the literature, and even in the regulations, is that it's the longest-chain PFAS that are getting banned first, with the shorter ones considered much less harmful. Our hybrid material provides the same performance as what had been achieved with long-chain PFAS, but with greatly reduced risk."

The team is now hoping to work with industry and manufacturers looking to ditch standard nonstick coatings. And while there are some current scaling challenges, the new coating has already been applied to nylon, polyester, aluminum and stainless steel, hinting at wide applicability.

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"The holy grail of this field would be a substance that outperforms Teflon, but with no PFAS at all," said Golovin. "We're not quite there yet, but this is an important step in the right direction."

The study was published in the journal Nature Communications.

New Atlas, 28 July 2025

<https://newatlas.com>

### Discovery of bumblebee medicine's simple structure makes synthetic production viable

2025-07-31

Researchers at the University of Chemistry and Technology, Prague have successfully developed a method to chemically synthesize callunene, a natural compound that protects bumblebees from a deadly gut parasite. In a recent discovery, the team also determined that the naturally occurring compound is a 50/50 mixture of its mirror-image forms, meaning the synthetic version can be used directly to safeguard vital pollinator colonies.

The study, published in the Journal of Natural Products, addresses the threat posed by the parasite *Crithidia bombi*. This protozoan infects bumblebees, impairing their ability to find nectar-rich flowers, which ultimately leads to starvation, reduced colony fitness, and death. The problem is especially acute in commercial indoor farming operations that rely on healthy pollinator colonies. Not only because of the farming effectiveness, but also because parasites might be spread from indoor pollinators to wild colonies.

Nature provides a defense in the form of callunene, a compound found in the nectar of heather (*Calluna vulgaris*). Bumblebees that forage on heather are prophylactically protected from *Crithidia* infection. However, the loss of heathland habitats and the difficulty of isolating the compound from natural sources have made this solution impractical on a large scale.

The UCT Prague team, led by Dr. Pavla Perlíková, overcame this challenge by developing a five-step synthesis to produce callunene in the lab. More importantly, they solved a long-standing chemical mystery about the compound's three-dimensional structure.

"We saw a clear threat to our vital pollinators from parasites like *Crithidia bombi*," said Dr. Perlíková, a lead researcher at UCT Prague. "Nature offered



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a solution in callunene, but it wasn't a practical one due to its scarcity. Our goal was to make this natural protection accessible.”]

Using advanced analytical techniques, including nuclear magnetic resonance (NMR) spectroscopy, the researchers analyzed both their synthetic callunene and the compound isolated from heather honey. They found that natural callunene exists as a racemic mixture—an equal blend of its “left-handed” and “right-handed” molecular forms (enantiomers).

“The most exciting part of this work was solving the stereochemical puzzle of callunene,” Dr. Perlíková explained. “Discovering that natural callunene is a racemic mixture was a game-changer. It means our synthetic version is essentially bio-identical for this purpose, and we can now produce it in the quantities needed for prophylactic studies to demonstrate its potential for use in protecting pollinator colonies. This removes a major economic and technical barrier to its use.”

This finding is significant because it means the synthetic callunene does not require an additional, often complex and expensive, step to separate the two enantiomers. The synthetic mixture can be used directly as an additive to the food of pollinators, offering a way to protect them from parasitic infections. The research opens the door for further studies and the development of new prophylactic treatments to ensure the health of these essential insects.

Phys Org, 31 July 2025

<https://phys.org>

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