

# Bulletin Board

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OCT. 31, 2025

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## Regulatory Update

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## ASIA PACIFIC

**As Europe proposes a ban on all PFAS, some researchers say Australia should do the same**

2025-10-23

Rachael Wakefield-Rann knows how "terrifying" it can be for parents to manage their kids' exposure to toxic chemicals, both at home and in their surrounding environment.

Dr Wakefield-Rann, who has sons aged 11 months and three years, has spent a lot of time thinking about chemicals in consumer products.

She said a baby would put anything in their mouth, so toys and household products in reach of children should be safe.

PFAS chemicals are used in a vast number of waterproof, non-stick and stain-resistant products. But concerns about their environmental and potential health impacts have intensified in recent years.

Dr Wakefield-Rann, a social science researcher with the Institute for Sustainable Futures at University of Technology Sydney, is concerned about chemicals added to plastics, plasticisers, and other substances that act as flame retardants.

Read More

ABC, 23-10-25

<https://www.abc.net.au/news/2025-10-23/calls-to-ban-entire-pfas-class-in-australia/105787430>

**FSSAI moots, PFAs not to be used in mfg of food contact materials**

2025-20-23

The Food Safety and Standards Authority of India (FSSAI) has proposed removal of Poly- and perfluoroalkyl substances (PFAs) from the list of general requirements under the FSS Packaging Regulations.

The food authority, in this regard, has issued a draft regulation to amend the FSS Packaging Regulations, 2018, wherein it has proposed that Poly- and perfluoroalkyl substances (PFAs) shall not be used in manufacturing of food contact materials.

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The stakeholders may comment on the draft over the next 60 days since the publishing of the draft.

Further, the food authority has proposed to add a requirement for manufacturing of the food contact packaging material that food contact materials manufactured with polycarbonate and epoxy resins shall be free from Bisphenol A (BPA) and its derivatives.

As per experts, both BPA and PFAs were under scrutiny for some time for potential health risk associated with them. While BPA is used widely in lining of cans and plastic containers and is linked with hormonal imbalances along with reproductive issues, PFAs are often associated with immune suppression, thyroid imbalance and so on.

Read More

FnBnews, 23-10-25

<https://www.fbnews.com/Top-News/fssai-moots-pfas-not-to-be-used-in-mfg-of-food-contact-materials-85054>

## AMERICA

### Governor vetoes California PFAS ban bill, citing affordability issues

2025-10-23

Governor Gavin Newsom has vetoed SB 682, warning its broad scope could rapidly change cookware availability and undermine household affordability.

California Governor Gavin Newsom has vetoed SB 682, a proposal to widen the state's PFAS ban to more consumer products, citing concerns about the availability and cost of cooking products.

The decision on 13 October 2025 sends the bill back to the Senate and leaves existing rules for food packaging and other categories in place.

#### What SB 682 proposed

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SB 682 aimed to prohibit the sale or distribution of products with intentionally added PFAS—often called “forever chemicals”—across cookware, cleaning products, dental floss, juvenile products, food packaging and ski wax.

Read More

Packaging gateway, 23-10-25

<https://www.packaging-gateway.com/news/governor-vetoes-california-pfas-ban-bill-citing-affordability-issues/>

### New Mexico's Efforts To Regulate PFAS Attracts National Industry Pushback: Officials To Hold Meetings To Discuss New Rules, Blood Tests

2025-10-22

New Mexico is the third state to pass a law implementing a gradual phasing out of so-called ‘forever chemicals’ in new products, and is now facing industry pushback. Photo by Spencer Platt/Getty Images

New Mexico officials this week will share information about forthcoming laws requiring labeling for products that contain so-called “forever chemicals.”

The virtual meeting on Wednesday follows recent proposed rulemaking for both labeling and restricting such products, and comes amid national pushback from industry.

The proposed rules come via House Bill 212—the PFAS Protection Act—passed by lawmakers in the 2025 legislative session. The bill institutes the phasing out of most intentionally added per and poly fluoroalkyl substances— PFAS—from in everyday items.

Read More

Los Alamos Reporter, 22-10-25

<https://losalamosreporter.com/2025/10/22/new-mexicos-efforts-to-regulate-pfas-attracts-national-industry-pushback-officials-to-hold-meetings-to-discuss-new-rules-blood-tests/>

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### EPA Announces Proposed Registration of New Biopesticide and Biopesticides Webpage

2025-10-24

Today, the U.S. Environmental Protection Agency (EPA) released for public comment its proposed registration decision for products containing the new active ingredient *Priestia megaterium* strain SYM36613, a broad-spectrum fungicide proposed for use on Brassica vegetables, bulb vegetables, root and tuber vegetables, cereal grains, corn, cotton, legumes, oil seeds, peanuts and soybeans. EPA is also highlighting the biopesticides webpage, where information on this and other biopesticides under review by the agency can be found.

*Priestia megaterium* strain SYM36613 is a biopesticide from a new microbial species that controls a wide range of seed and soilborne plant diseases and can address pest management needs for niche uses, such as crops for which pests have developed resistance to other pesticides, crops where fungal diseases are present, or where consumer demand requires use of lower-risk pesticides. Biopesticides are usually inherently lower risk compared to conventional pesticides since they generally only target pest and closely related organisms rather than many different organisms (e.g., birds, insects, and mammals).

In addition to its proposed registration decision, EPA is releasing human health and ecological risk assessments for the fungicide. EPA's assessments found no risks of concern to humans or non-target organisms.

Read More

Regulations.gov, 24-10-25

<https://www.regulations.gov/docket/EPA-HQ-OPP-2023-0621/document>

## EUROPE

### Commission gathers views on the future Advanced Materials Act

2025-10-23

The European Commission has launched a call for evidence and a public consultation on the upcoming Advanced Materials Act, a key initiative under the Competitiveness Compass.

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The act will establish a strategic framework for the development, deployment and production of advanced materials. This is crucial for Europe's industrial leadership, strategic autonomy and competitiveness. Advanced materials are intentionally designed and engineered materials with innovative properties and functionalities, which can be used in products from wearable electronic devices to electric vehicles.

Ekaterina Zaharieva, Commissioner for Startups, Research and Innovation, said: "We want Europe to be at the forefront of developing advanced materials that are key to today's and tomorrow's innovations. We want to hear from everyone interested, researchers, businesses, small and medium businesses, and policymakers, to build a strong framework that supports industrial innovation and competitiveness."

The act is expected to be proposed in 2026, supporting the full research and innovation lifecycle, from design and development to manufacturing and deployment. At the same time, it will address key challenges such as the lengthy time from the design until deployment and commercialisation, as well as the expansion of production capacities of advanced materials in the EU. It will also streamline regulatory processes, boost EU competitiveness, and foster a more sustainable and circular economy.

Read More

European Commission, 23-10-25

[https://ec.europa.eu/commission/presscorner/detail/en/mex\\_25\\_2461](https://ec.europa.eu/commission/presscorner/detail/en/mex_25_2461)

### European Parliament seals the deal of first-ever EU law on soils

2025-10-23

Today, EU lawmakers listened to citizens and science and rubber stamped the deal on the Soil Monitoring Law, the EU's first ever law on soil health, after months of negotiations. Despite severe shortcomings of the endorsed text, this is an important milestone towards addressing Europe's crisis of soil degradation. Its success will depend on impactful implementation.

By adopting this long-overdue and much-needed law [1], EU lawmakers listened to the overwhelming wave of support from stakeholders and society at large [2]. The Soil Monitoring Law will establish an EU-wide soil health monitoring system, enhancing the availability and comparability of key soil health data. It will also improve advice and support to landowners

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and landmanagers and require Member States to clean up their contaminated sites.

The deal had already been endorsed by the Environment Committee on Monday, and by EU Member States in September, both votes with strong majorities. It is the result of months of political negotiations and intense disinformation campaigns by vested interests [3]. Far-reaching compromises were made, which limited the scope of the Directive to mostly observing rather than actively restoring soils. NGOs, many scientists and other stakeholders were calling for stronger provisions [4], mostly for robust monitoring of biodiversity and pollution, clear targets and binding provision on soil management. While it is clear that further action will be needed to truly restore Europe's soils, this law is nevertheless an important starting point.

Read More

EEB, 23-10-25

<https://us2.campaign-archive.com/?u=1777448aafe85ef675bd9ea87&id=11d926251f>

### Independent panel recommends creation of environmental regulator in Northern Ireland

2025-10-23

An independent panel has called for the establishment of a separate environmental regulator in Northern Ireland, as part of its review of the region's environmental governance.

The panel, chaired by Dr Viviane Gravey and including Diane Ruddock and John McCallister, launched its final report on Tuesday 21 October 2025, presenting its findings to DAERA Minister Andrew Muir.

The report contains 32 recommendations grouped under four themes: clarity and coherence; meaningful independence; better compliance; and transparency and accountability. Many of the proposals aim to strengthen the separation between policy-making and regulation, in order to improve public confidence in governance arrangements.

A central recommendation is that Northern Ireland's environmental regulator should operate independently of government as a Non-Departmental Public Body. The panel suggests the regulator should have oversight of issues including air and water quality, waste management,

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biodiversity, and the marine environment, although the precise remit would need to be defined.

Dr Gravey said the report was issued at a time when Northern Ireland's environment is under increasing pressure. "Governance reform is an essential element of our response to the climate and nature crises," she said. She described the report as a "call to action" for those seeking a sustainable environment to underpin a thriving society.

Read More

Water Magazine, 23-10-25

<https://www.watermagazine.co.uk/2025/10/22/independent-panel-recommends-creation-of-environmental-regulator-in-northern-ireland/>

## INTERNATIONAL

### Makeup, shampoos and hair care products still contain toxic chemicals. Experts call out ingredients to look for

2025-10-23

In an episode of "The Pitt," a hospital drama on HBO Max, a young TikTok beauty influencer named Nandi is found roaming the streets of Pittsburgh, walking dangerously into traffic while screaming at cars and people.

(HBO Max is owned by CNN's parent company, Warner Bros. Discovery.)

Nandi is experiencing severe insomnia, tremors and psychosis, and her quickly deteriorating condition bewilders the emergency room staff. Finally, an enterprising resident finds she has mercury poisoning from an unusual source — an imported facial moisturizer she promotes in her videos.

In the spirit of art imitating life, the episode calls attention to the proliferation of potentially toxic chemicals in the products many of us slather daily on our face, body and hair.

According to a 2021 analysis of 231 cosmetics purchased in the United States and Canada, 52% contain chemicals called PFAS, or per- and polyfluoroalkyl compounds — known hormone disruptors that have been linked to numerous health concerns.

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~dREACH Update

### Consultation on PFAS draft opinion – Guidance for respondents

2025-10-23

The European Chemicals Agency plans to launch a consultation on the draft opinion of its Committee for Socio-Economic Analysis (SEAC) on the proposed EU-wide restriction of per- and polyfluoroalkyl substances (PFAS) following the Committee's meeting in March 2026.

The consultation will use a structured survey format, inviting participants to respond to questions on the potential impacts of restricting the use of PFAS across various sectors. Participants will also be asked to provide specific information about the availability and feasibility of alternatives to these widely used chemicals.

We will explain:

- The purpose of the consultation
- How the consultation survey is structured
- What type of information is requested in the survey
- How to prepare your data for the consultation

Read More

ECHA, 23-10-25

<https://echa.europa.eu/-/webinar-consultation-on-pfas-draft-opinion>

### Take a look: New QSAR toolbox video tutorials available

2025-10-22

Following the recent update of the QSAR toolbox, we have now published ten video tutorials to help users with the new features of the tool.

The OECD QSAR Toolbox is a collaborative project between ECHA, OECD and its member and partner countries. It is used worldwide in hazard assessment of chemicals to avoid unnecessary animal testing.

This comprehensive playlist features in-depth video tutorials covering a wide range of topics related to the Quantitative Structure-Activity Relationship (QSAR) Toolbox. Whether you're a seasoned expert or just starting with the QSAR Toolbox, these tutorials are designed to help you master various aspects of this powerful software. Each tutorial is designed

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to provide you with valuable insights and practical guidance, whether you're conducting chemical assessments, predicting properties, or working with databases. Start watching the videos now and elevate your QSAR Toolbox skills! More on <https://qsartoolbox.org/>

Read More

ECHA, 22-10-25

<https://qsartoolbox.org/>

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## Janet's Corner

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### Who am I?

2025-10-31

I am a soft, shiny metal used in nuclear reactors as fuel and in certain types of antique pottery glazes.

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

I am a soft, shiny metal used in nuclear reactors as fuel and in certain types of antique pottery glazes.

- 

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## Hazard Alert

OCT. 31, 2025

### Nickel carbonyl

2025-10-31

Nickel carbonyl is the organonickel compound with the formula  $\text{Ni}(\text{CO})_4$ . [1] It is a volatile, yellow liquid with a musty odour. Nickel carbonyl is flammable and explosive. It is slightly soluble in water, but soluble in other organic solvents. [2] Nickel carbonyl is formed when metallic nickel combines with carbon monoxide. It is considered to be one of the most toxic chemicals used industrially and the magnitude of its morbidity and mortality has been compared to that of hydrogen cyanide. [1,2]

### USES [2,3]

Nickel carbonyl is used in refining nickel ore, forming nickel films and coatings, as a catalyst in various chemical reactions, and in glass plating.

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

#### Exposure Sources

- **Industry sources:** The primary sources of nickel carbonyl are the industries that manufacture it or use it in production, such as nickel mining and refining, the chemical industry, glass and metal plating companies.
- **Diffuse sources:** Sub-threshold facilities in the industries that use the substance.
- **Natural sources:** Nickel carbonyl is not expected to be found occurring naturally.
- **Transport sources:** There are no known sources of mobile emissions of nickel carbonyl.
- **Consumer products:** There are no known consumer products containing nickel carbonyl.

#### Routes of Exposure

Nickel carbonyl enters the body via:

- inhalation,
- ingestion,
- skin absorption,
- skin and/or eye contact

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### HEALTH EFFECTS [4]

#### Acute Health Effects

- Initial exposure to nickel carbonyl can cause headache, chest tightness, dizziness, weakness, sweating, cough, nausea and vomiting.
- These may improve, but hours later (12 hours to five days) following a severe exposure, lung (pulmonary) symptoms may appear including fever, pneumonia, respiratory failure, cerebral oedema and death.
- At lower concentrations these vapours cause irritation, congestion, and oedema of the lung.

#### Carcinogenicity

- Nickel carbonyl has been reported to produce lung tumours in rats exposed via inhalation.
- EPA has classified nickel carbonyl as a Group B2, probable human carcinogen.

### SAFETY

#### First Aid Measures [5]

- **Inhalation:** If adverse effects occur, remove to uncontaminated area. Give artificial respiration if not breathing. If breathing is difficult, oxygen should be administered by qualified personnel. Get immediate medical attention.
- **Skin Contact:** Wash skin with soap and water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention, if needed. Thoroughly clean and dry contaminated clothing and shoes before reuse.
- **Eye Contact:** Flush eyes with plenty of water for at least 15 minutes. Then get immediate medical attention.
- **Ingestion:** If vomiting occurs, keep head lower than hips to help prevent aspiration. If person is unconscious, turn head to side. Get medical attention immediately.
- **Antidote:** dimercaprol/oil, intramuscular.
- **Note to Physician:** For inhalation, consider oxygen. For ingestion, consider gastric lavage.

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### Workplace Controls & Practices [4]

- **Ventilation:** Ventilation equipment should be explosion-resistant if explosive concentrations of material are present.
- Provide local exhaust or process enclosure ventilation system. Ensure compliance with applicable exposure limits.

### Personal Protective Equipment [5]

The following personal protective equipment is recommended when handling nickel carbonyl:

**Eye protection:** Wear splash resistant safety goggles with a face-shield. Provide an emergency eye wash fountain and quick drench shower in the immediate work area.

**Clothing:** Wear appropriate chemical resistant clothing.

**Gloves:** Wear appropriate chemical resistant gloves.

**Respirator:** The following respirators and maximum use concentrations are drawn from NIOSH and/or OSHA.

#### At any detectable concentration

- Any self-contained breathing apparatus that has a full-face piece and is operated in a pressure-demand or other positive-pressure mode.
- Any supplied-air respirator with a full-face piece that is operated in a pressure-demand or other positive pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure demand or other positive-pressure mode.

#### Escape

- Any air-purifying full-face piece respirator (gas mask) with a chin-style, front-mounted or back-mounted canister providing protection against the compound of concern.
- Any appropriate escape-type, self-contained breathing apparatus.

#### For Unknown Concentrations or Immediately Dangerous to Life or Health

- Any supplied-air respirator with a full-face piece that is operated in a pressure-demand or other positive pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure demand or other positive-pressure mode.

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- Any self-contained breathing apparatus that has a full-face piece and is operated in a pressure-demand or other positive-pressure mode.

### REGULATION

#### United States

**OSHA:** The Occupational Safety & Health Administration has set the following Permissible Exposure Limits (PEL) for nickel carbonyl:

- General Industry: 29 CFR 1910.1000 Z-1 Table -- 0.001 ppm, 0.007 mg/m<sup>3</sup> TWA (PEL listed under Nickel carbonyl (as Ni))
- Construction Industry: 29 CFR 1926.55 Appendix A -- 0.001 ppm, 0.007 mg/m<sup>3</sup> TWA (PEL listed under Nickel carbonyl (as Ni))
- Maritime: 29 CFR 1915.1000 Table Z-Shipyards -- 0.001 ppm, 0.007 mg/m<sup>3</sup> TWA (PEL listed under Nickel carbonyl (as Ni))

**ACGIH:** The American Conference of Governmental Industrial Hygienists has set a Threshold Limit Value (TLV) for nickel carbonyl of 0.05 ppm, 0.12 mg/m<sup>3</sup> TWA (TLV listed under Nickel carbonyl, as Ni)

**NIOSH:** The National Institute for Occupational Safety and Health has set a Recommended Exposure Limit (REL) for nickel carbonyl of 0.001 ppm, 0.007 mg/m<sup>3</sup> TWA; Appendix A - NIOSH Potential Occupational Carcinogens

### REFERENCES

1. [https://en.wikipedia.org/wiki/Nickel\\_tetracarbonyl](https://en.wikipedia.org/wiki/Nickel_tetracarbonyl)
2. <http://www.npi.gov.au/resource/nickel-carbonyl>
3. <http://www.ncbi.nlm.nih.gov/pubmed/8383493>
4. <http://www.cdc.gov/niosh/npg/npgd0444.html>
5. <http://www.epa.gov/ttn/atw/hlthef/nickel.html>
6. <https://www.mathesongas.com/pdfs/msds/MAT16290.pdf>
7. [https://www.osha.gov/dts/chemicalsampling/data/CH\\_256150.html](https://www.osha.gov/dts/chemicalsampling/data/CH_256150.html)

# Bulletin Board

## Gossip

OCT. 31, 2025

The hidden dangers of protein powders

2022-08-15

They may contain added sugar, calories, or even toxic chemicals.

Adding protein powder to a glass of milk or a smoothie may seem like a simple way to boost your health. After, all, protein is essential for building and maintaining muscle, bone strength, and numerous body functions. And many older adults don't consume enough protein because of a reduced appetite.

But be careful: a scoop of chocolate or vanilla protein powder can harbor health risks. "I don't recommend using protein powders except in a few instances, and only with supervision," says registered dietitian Kathy McManus, director of the Department of Nutrition at Harvard-affiliated Brigham and Women's Hospital.

### What is protein powder?

Protein powders are powdered forms of protein that come from plants (soybeans, peas, rice, potatoes, or hemp), eggs, or milk (casein or whey protein). The powders may include other ingredients such as added sugars, artificial flavoring, thickeners, vitamins, and minerals. The amount of protein per scoop can vary from 10 to 30 grams. Supplements used for building muscle contain relatively more protein, and supplements used for weight loss contain relatively less.

### What are the risks?

There are numerous risks to consider when using a protein powder. Among them:

- A protein powder is a dietary supplement. The FDA leaves it up to manufacturers to evaluate the safety and labeling of products. So, there's no way to know if a protein powder contains what manufacturers claim.
- We don't know the long-term effects. "There are limited data on the possible side effects of high protein intake from supplements," McManus says.
- It may cause digestive distress. "People with dairy allergies or trouble digesting lactose [milk sugar] can experience gastrointestinal discomfort if they use a milk-based protein powder," McManus points out.

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- It may be high in added sugars and calories. Some protein powders have little added sugar, and others have a lot (as much as 23 grams per scoop). Some protein powders wind up turning a glass of milk into a drink with more than 1,200 calories. The risk: weight gain and an unhealthy spike in blood sugar. The American Heart Association recommends a limit of 24 grams of added sugar per day for women and 36 grams for men.

### A new risk revealed

Earlier this year, a nonprofit group called the Clean Label Project released a report about toxins in protein powders. Researchers screened 134 products for 130 types of toxins and found that many protein powders contained heavy metals (lead, arsenic, cadmium, and mercury), bisphenol-A (BPA, which is used to make plastic), pesticides, or other contaminants with links to cancer and other health conditions. Some toxins were present in significant quantities. For example, one protein powder contained 25 times the allowed limit of BPA.

How could protein powder contain so many contaminants? The Clean Label Project points to manufacturing processes or the existence of toxins in soil (absorbed by plants that are made into protein powders).

Not all of the protein powders that were tested contained elevated levels of toxins. You can see the results at the Clean Label Project's website ([www.cleanlabelproject.org](http://www.cleanlabelproject.org)).

### What you should do

McManus says that in certain cases, chemical-free protein powders may be helpful—but only with medical supervision. Such cases could include:

- difficulty eating or an impaired appetite (as a result of cancer treatment or frailty from older age)
- a surgical incision or a pressure wound that is not healing well (your body needs protein to repair cells and make new ones)
- a serious condition requiring additional calories and protein in order for you to get better (such as burns).

Otherwise, get protein from whole foods: nuts, seeds, low-fat dairy products (yogurt, milk, cheese), legumes (beans, lentils), fish, poultry, eggs,

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and lean meat. "You'll find," McManus says, "that there are many ways to get protein without turning to a powder."

Harvard Health Publishing, 15 August 2022

<https://health.harvard.edu>

### Outdoor Air Pollution Linked to Higher Incidence of Breast Cancer

2025-10-29

Women living in parts of the United States with lower air quality, especially neighborhoods with heavy emissions from motor vehicles, are more likely to develop breast cancer, according to a multiyear analysis involving more than 400,000 women and 28,000 breast cancer cases.

The research, which included Veronica Irvin of the Oregon State University College of Health, was published in the American Journal of Public Health.

The project combined data from five large breast cancer studies conducted over multiple decades that tracked individuals even as they changed addresses and followed them for as long as 10 years prior to their diagnosis. The researchers overlaid outdoor air quality information from more than 2,600 monitors to look for an association between air pollution and breast cancer.

The scientists found that a 10-parts-per-billion increase in nitrogen dioxide concentrations in the air equated to a 3% increase in overall breast cancer incidence; nitrogen dioxide is a proxy for pollution from car traffic, Irvin said, and based on the estimated 316,950 cases of female breast cancer expected to be diagnosed in the United States this year, a 3% reduction would mean 9,500 fewer cases.

Irvin and collaborators also found that a 5-microgram-per-cubic-meter rise in the concentration of fine particulate matter, known as PM2.5, was associated with a higher incidence of hormone receptor-negative breast cancer. Cancer cells lacking receptors for the sex hormones estrogen and progesterone are generally harder to treat and more deadly.

"It's often not realistic for people to leave their homes and relocate in areas with better air quality in search of less health risk, so we need more effective clean air laws to help those who are most in need," said Irvin, noting that the average nitrogen dioxide concentrations observed in the research were below current Environmental Protection Agency guidelines.

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“We also need policies that help to reduce car traffic and promote alternative forms of transportation.”

The incidence of breast cancer in the United States, where air pollution levels are lower than they are in other populous countries, has been generally on the rise over the past 40 years, the researchers note. It's the second leading cause of cancer death among women, after lung cancer. About one woman in eight in the U.S. will develop breast cancer during her lifetime, and the nation's population includes more than 4 million breast cancer survivors.

Alexandra White of the National Institutes of Health led the study, which also included scientists from Harvard University; the University of Washington; Indiana University; Stony Brook University, the University of California San Diego, La Jolla; The Ohio State University; and the University of North Carolina, Chapel Hill.

The NIH, the EPA, the National Institute of Environmental Health Sciences, the National Institute of Aging, and the National Heart, Lung, and Blood Institute supported the research.

Irvin is the Celia Strickland Austin and G. Kenneth Austin III Endowed Professor in Public Health in the OSU College of Health, which will host a free online panel discussion, “Our Health & Breast Cancer,” at noon Pacific time on Thursday, Oct. 30. Irvin will be one of the panelists for the discussion, which will look at screening and survivorship, early detection, research, and support and mentorship for those affected by breast cancer.

Technology Networks, 29 October 2025

<https://technologynetworks.com>

### Artificial tongue uses milk to determine heat level in spicy foods

2025-10-29

The appearance of a hot sauce or pepper doesn't reveal whether it's mild or likely to scorch someone's taste buds, but researchers have now created an artificial tongue to quickly detect spiciness. Inspired by milk's casein proteins, which bind to capsaicin and relieve the burn of spicy foods, the researchers incorporated milk powder into a gel sensor.

The prototype, reported in ACS Sensors, detected capsaicin and pungent-flavored compounds (like those behind garlic's zing) in various foods.

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“Our flexible artificial tongue holds tremendous potential in spicy sensation estimation for portable taste-monitoring devices, movable humanoid robots, or patients with sensory impairments like ageusia, for example,” says Weijun Deng, the study's lead author.

Currently, measuring flavor compounds in foods requires taste testers and complex laboratory methods. As an alternative, scientists are developing artificial tongues, which can measure tastes including sweet and umami, among others.

However, capsaicin in chili peppers, piperine in black pepper, and allicin in garlic produce stinging, tingling or burning sensations that are hard to replicate and measure with synthetic materials. Researcher Jing Hu and colleagues noted that the heat of peppers, for example, can be neutralized when their capsaicin is bound by casein proteins in milk. So, the team wanted to create an artificial tongue by adding casein to an electrochemical gel material and measuring spiciness through an electrical current change that occurs when casein binds to capsaicin.

The researchers created a tongue-shaped film by combining acrylic acid, choline chloride and skim milk powder, and then they exposed the solution to UV light. The resulting flexible and opaque gel conducted an electrical current. Ten seconds after the researchers added capsaicin on top of the film, the current decreased, showing its potential as an artificial, spice-detecting tongue.

Initial tests showed that the milk-containing material responded to capsaicin concentrations ranging from below human detection to beyond levels perceived as painful (called the oral pain threshold). Additionally, the material detected other pungent-flavored compounds found in common hot sauce ingredients, including ginger, black pepper, horseradish, garlic and onion.

As a proof-of-concept, the researchers tested eight pepper types and eight spicy foods (including several hot sauces) on the artificial tongue and measured how spicy they were by changes in electrical current. A panel of taste testers rated the spiciness of the same items. Results from the artificial tongue and the tasting panel matched well.

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Therefore, the researchers say, the casein-containing artificial tongue could be used to quickly test a food's spiciness level—without putting one's taste buds at risk.

Phys Org, 29 October 2025

<https://phys.org>

### What makes a scientific breakthrough truly chemical?

2025-10-29

Why MOFs are a great choice for the Nobel prize in chemistry?

When I read about the winners of this year's Nobel prize in chemistry, I breathed a sigh of relief. This year's recipients are all chemists and were acknowledged for producing work that is truly chemical. Funnily enough, I'm not the only one to point this out – Derek Lowe has said exactly the same elsewhere in Chemistry World. Susumu Kitagawa, Richard Robson and Omar Yaghi jointly received the prize for developing metal-organic frameworks (MOFs), materials that are highly porous and can be used to capture and store a wide array of molecules.

What makes this discovery so refreshingly chemical? The first – perhaps obvious – requirement is for the target of discovery to be something chemical: this could be a new structure, a new chemical property, a new element or a new substance. It could also be a new technique to make (or break) something.

A characteristic example is the synthesis of urea from inorganic material in 1828 by German chemist Friedrich Wöhler. This has been lauded as an immense chemical breakthrough. In fact, it received significant attention from historians of chemistry who still debate whether (and to what extent) it contributed to the rejection of vitalism (the idea that living entities are fundamentally different in composition from non-living things).<sup>1</sup>

But this is not enough. Another thing that seems to be important when talking of genuinely chemical discoveries is the extent to which a breakthrough involves activities in a controlled environment, namely the laboratory.

#### Lab experiments

Indeed, this seems to be a very important feature of chemistry, more so than other experimental sciences like physics or even biology. Even if nowadays there are parts of chemistry that are not centered around

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laboratory work (most notably theoretical chemistry), it still holds true that one cannot really learn nor practice chemistry without spending some time in a laboratory. Experiments can of course vary in complexity: they may involve simply mixing stuff together and observing them with one's senses, to carefully isolating materials and analysing them using very expensive and delicate machinery.

Interestingly, it is alchemy that chemistry inherited this feature from. Despite the mysterious metaphysical connotations that alchemy holds, the centrality of performing experiments and manipulating matter in a closed environment with the use of tools and apparatuses was initially developed by alchemists. Later on, with the emergence of modern science this was made explicit. For example, Denis Diderot and Jean le Rond d'Alembert defined chemistry in the Encyclopedie as 'a science which occupies itself with the separations and union of the constituent principles of bodies, whether these are effected by nature, or the result of the operations of art, with a view to discovering the properties of bodies, or to render them suitable for a variety of uses'.<sup>2</sup>

Guillaume Francois Rouelle, an 18th century French chemist, made the role of experimental processes even more apparent: 'Chemistry is a physical art which, by means of certain operations and instruments, teaches us to separate the various substances which enter into the composition of bodies, and to recombine these again, either to reproduce the former bodies, or to form new ones from them'.<sup>2</sup>

#### Practical purpose

It is within this framework that in 1993, historian William Brock said, rather beautifully, that 'if chemistry had so much to offer through its variety of aims, then, like some religion, it was necessary to practice it rather than to expect a knowledge of it ex cathedra'.<sup>3</sup> Experimentation and laboratory practice play prominent roles in chemistry, so much so that it has been associated with its very identity. Perhaps it should not come as a surprise that the first chemical laboratories (or workshops, as they were initially called) are found in the late 16th century.<sup>4</sup> Nor that the first laboratories were created for chemical purposes and later on acted as a model for other laboratory sciences.<sup>5</sup>

However, there is also one more aspect to this year's Nobel recipients that warrants calling their contribution truly chemical, namely that chemical discoveries have the potential to impact humanity in a wide variety of ways. MOFs are expected to be of value for purposes relating to gas storage, carbon capture, catalysis, electrochemistry and fluorescence-

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based imaging. They are expected to help with problems relating to climate change, the food industry, the energy sector and technology.

For better and for worse, innovations in chemistry have transformed all facets of our lives, bringing irreversible changes both within our personal space and within the public sphere.<sup>6</sup> Viewed from this perspective, the development of MOFs seems to be one such example of a truly chemical breakthrough. Let's hope it will be used wisely!

Cheistry World, 29 October 2025

<https://chemistryworld.com>

### Wetland Plant-Fungus Combo Cleans Up "Forever Chemicals"

2025-10-20

Wetlands act as nature's kidneys: They trap sediments, absorb excess nutrients and turn pollutants into less harmful substances. Now, the list of pollutants wetland plants can remove includes per- and polyfluoroalkyl substances (PFAS).

From a greenhouse study, researchers in ACS' Environmental Science & Technology report that moisture-loving yellow flag irises and fungi on their roots are a promising combination for PFAS removal. As part of a constructed wetland, this pair could effectively treat contaminated wastewater.

"Our study shows that a type of fungus (*Rhizophagus irregularis*) boosts wetlands' ability to remove PFAS and greatly reduces the environmental risks from 'forever chemicals' left in the outflowing water," said Bo Hu, a corresponding author of the research. "These results are key for developing stronger wetland-based cleanup methods and could inspire new technologies for removing PFAS."

Symbiotic relationships between plants and underground microbes, such as a group of fungi named arbuscular mycorrhizal fungi (AMF), are vital for wetland ecosystems. As fungi colonize roots, they break down nutrients in exchange for beneficial carbohydrates from the plants.

Previously, Bo Hu and colleagues found more benefits of this relationship: AMF helped wetland plants tolerate the presence of PFAS. PFAS are long-lasting compounds that pose potential health risks to people, animals and plants. So, Bo Hu, Feng Zhao and additional researchers wanted to study how well wetland plants, specifically yellow flag iris (*Iris pseudacorus* L.),

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remove PFAS in the presence and absence of one symbiotic fungus (*R. irregularis*). They aimed to develop guidance for constructed wetlands as a natural water treatment strategy.

Inside greenhouses, the researchers built small, wetland-like systems with yellow flag irises in tall plastic tubes. The flowers were planted in a sand-soil microbe mixture either with the fungus or without it for the control treatment. They watered the miniature wetlands with a solution that mimicked wastewater, and some were also watered with one of four individual PFAS at realistic concentrations.

Plant health declined when exposed to PFAS, with less growth and more signs of physiological distress (e.g., lower activity of antioxidant enzymes), compared to irises grown without PFAS exposure. In contrast, the researchers observed that adding the fungus improved growth for plants that were both exposed and not exposed to PFAS. For those wetland systems watered with the PFAS-containing solutions, the AMF-treated plants:

- Removed 10-13% more of the individual PFAS than those with the control treatment, incorporating more long-chain PFAS than short-chain PFAS in their shoots and roots.
- Boosted breakdown of PFAS into smaller compounds that had lower toxicity than their parent compounds, which the researchers suggest is because the fungi stimulate nearby microbial activity.

They also tested the water draining out of the wetland tubes exposed to PFAS. All the outflow samples contained PFAS, but those from the fungal tubes had 17-28% less total PFAS compared to samples from the bacterial tubes. These results indicate that adding AMF, specifically *R. Irregularis*, in constructed wetlands could improve their removal of PFAS, say the researchers.

Their next steps are to test the constructed wetlands in more realistic scenarios, moving from the contained greenhouse environment to the natural world and using actual PFAS-contaminated wastewater.

Technology Networks, 20 October 2025

<https://technologynetworks.com>

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**A faster way to find new medicines—without the limitations of big DNA barcodes**

2025-10-30

Leiden researchers, led by Sebastian Pomplun, have developed a new method to screen hundreds of thousands of molecules for drug discovery, using mass spectrometry instead of DNA tags. “We wanted to make drug discovery faster and more accessible,” said the researcher.

Finding a new medicine often starts with finding a molecule that binds to the right protein—a process that can take years and cost millions. Now, a team of researchers in Leiden has developed a faster and more flexible way to search for promising drug candidates, without the need for DNA barcodes. The findings are published in Nature Communications.

“In drug discovery, you usually start with a huge collection of molecules and hope that one of them sticks to your target protein,” explains Pomplun. “Traditionally, pharmaceutical companies test these molecules one by one in enormous robotic facilities, so-called high throughput screening. It’s effective, but it’s also incredibly expensive and slow.”

**What if we could do the same kind of screening, but without the DNA?**

Over the past decade, many labs have turned to DNA-encoded libraries (DELs). In this method, each small molecule is tagged with a short piece of DNA that acts like a barcode, recording what the molecule looks like. If a molecule binds to a target protein, researchers can simply read the DNA to find out which one it was.

“It’s a brilliant technology,” says Pomplun, “but it also has some big drawbacks.” The bulky DNA tag can block molecules from binding properly, especially to proteins that interact with DNA or RNA—and it limits the kinds of chemical reactions that can be used. “We thought, what if we could do the same kind of screening, but without the DNA at all?”

**The ones that stick to the target protein are isolated and analyzed**

Their new method replaces the barcode with mass spectrometry, a technique that can detect and identify tiny molecules based on their weight and how they break into fragments. The team designed chemical libraries with hundreds of thousands of compounds, each built from slightly different combinations of molecular building blocks. When these compounds are mixed with a target protein, the ones that stick are isolated and analyzed by mass spectrometry.

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“It’s like each molecule leaves behind a unique fingerprint,” Pomplun explains. “Even if two compounds have the same mass, the way they fragment tells us which is which.”

**A library of a half-million compounds in just a few days**

Working with computational experts from the University of Jena, the Leiden team also developed software to interpret the complex spectra and match them to the right molecular structures. “That was a big step, turning all those signals into something we can actually use.”

The first results are promising: the method successfully identified nanomolar binders, or very strong hits, for cancer-related proteins, including targets that DNA-based methods can’t handle. “What excites me most is the speed,” says the researcher. “We can make a library of half a million compounds in just a few days.”

**Making drug discovery more accessible for companies and academia**

In the future, the team hopes their “self-encoded” approach will make drug discovery more accessible beyond big pharmaceutical companies. “With our method, academic labs could also more easily take part in early-stage drug discovery,” Pomplun says. “It’s faster, simpler, and opens the door to exploring new kinds of molecules that we couldn’t study before.”

Phys Org, 30 October 2025

<https://phys.org>**Computationally accelerated organic synthesis: Optimal ligand prediction for generating reactive alkyl ketone radicals**

2025-10-30

Because ketones are widespread in organic molecules, chemists are eager to develop new reactions that use them to form chemical bonds. One challenging reaction is the one-electron reduction of ketones to generate ketyl radicals.

Ketyl radicals are reactive intermediates used in natural product synthesis and pharmaceutical chemistry; however, most methodologies are optimized for aryl ketones while simple alkyl ketones remain challenging for chemists. Alkyl ketones are considerably more abundant but intrinsically more difficult to reduce than aryl ketones.

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To this end, a team of specialized organic chemists and computational chemists from WPI-ICReDD at Hokkaido University has developed a new catalytic method for generating alkyl ketyl radicals.

This research is published in the Journal of the American Chemical Society.

WPI-ICReDD researchers have previously demonstrated a palladium catalyst with phosphine ligands that could transform aryl ketones photochemically (reaction activated by shining light) but was ineffective with alkyl ketones.

Their data suggested that alkyl ketyl radicals would form, however, the ketyl radical would transfer an electron back to the palladium, i.e. back electron transfer (BET), before a ketyl radical reaction could occur. This resulted in no changes to the starting material.

Just like in conventional palladium catalysis, the reactivity of photoexcited palladium catalysts depends greatly on the type of phosphine ligand used.

Therefore, the team hypothesized they could identify an appropriate phosphine ligand capable of engendering reactivity towards alkyl ketones. However, since thousands of phosphine ligands are known, identifying the optimal one for an unknown reaction through experimentation alone would be difficult, time-consuming, and environmentally burdensome due to chemical waste.

The researchers effectively circumvented these issues by utilizing computational chemistry to efficiently search for optimal ligands with minimal experiments. Specifically, they employed the Virtual Ligand-Assisted Screening (VLAS) method developed by Associate Professor Wataru Matsuoka and Professor Satoshi Maeda from WPI-ICReDD. For 38 different phosphine ligands, the VLAS generated a heat map that predicted which ligands could best engender reactivity based on their electronics and sterics.

Based on this heat map, the team selected just three promising ligands for experimental testing and successfully identified L4 as the optimal ligand—tris(4-methoxyphenyl)phosphine ( $P(p\text{-OMe-C}_6\text{H}_4)_3$ ). Using this ligand effectively suppresses BET, enabling the generation of ketyl radicals from alkyl ketones and achieves versatile reactions with high yield.

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This work provides chemists with facile access to alkyl ketyl radical reactivity and highlights the effectiveness of VLAS to rapidly develop and optimize new chemical reactions.

Phys Org, 30 October 2025

<https://phys.org>

### Adhesive made from wood works in a standard glue gun

2025-06-04

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

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

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

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

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

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

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

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

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

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

New Scientist, 4 June 2025

<https://newscientist.com>

### This Wonder Material Could Revolutionize Renewable Energy

2025-10-29

A team of researchers has explored how two-dimensional materials known as MXenes could revolutionize renewable energy and sustainable chemical production.

Scientists searching for cleaner and more sustainable technologies are turning their attention to two-dimensional materials that could transform renewable energy systems. Their work may make it possible to create essential compounds like ammonia, a key ingredient in fertilizers, through cleaner and more efficient methods.

Among the most promising of these materials are MXenes, an emerging class of low-dimensional compounds. MXenes can act as catalysts that convert elements from the air into ammonia, a process that could improve energy efficiency in both agricultural and transportation applications.

One of the remarkable features of MXenes is their highly adaptable chemical makeup. Their compositions can be finely adjusted, allowing scientists to precisely control their structural and functional properties for different uses.

This research, featured in the Journal of the American Chemical Society, was conducted by chemical engineering professors Drs. Abdoulaye Djire and Perla Balbuena, along with Ph.D. candidate Ray Yoo.

Djire's team is questioning a long-held belief in materials science: that the performance of transition metal-based materials depends only on the specific metal used. Instead, they aim to uncover a deeper understanding of how various structural factors influence catalytic performance.

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### Understanding Catalytic Functionality

"We aim to expand our understanding of how materials function as catalysts under electrocatalytic conditions," Djire said. "Ultimately, this knowledge may help us identify the key components needed to produce chemicals and fuels from earth-abundant resources."

The structure of MXenes plays a key role in how they behave. By adjusting the lattice nitrogen reactivity, specifically by replacing a carbon atom with a nitrogen atom, researchers can modify the material's vibrational properties. These properties describe how molecules move and vibrate based on the energy within them.

According to Yoo, this ability to fine-tune MXenes makes them highly adaptable for targeted uses in renewable energy. Their customizable nature positions them as strong contenders to replace current electrocatalyst materials that are often expensive and less efficient.

"MXenes are the ideal candidates as transition metal-based alternative materials. They have promising potential due to their many desirable qualities," Yoo said. "Nitride MXenes play an important role in electrocatalysis, as shown through their improvement in performance compared to the widely studied carbide counterparts."

### Computational and Experimental Insights

The work was complemented by first-principles computational analyses performed by Ph.D. student Hao-En Lai in Dr. Balbuena's group. The group evaluated changes in the surface vibrational modes caused by energy-relevant solvents in contact with MXenes. With these additional findings, the authors quantified the interactions of molecules, especially in the context of ammonia synthesis.

Throughout this research, Djire, Yoo, and the team have investigated the vibrational properties of titanium nitride using Raman spectroscopy, a non-destructive chemical analysis technique that provides detailed information about chemical structure.

"I feel that one of the most important parts of this research is the ability of Raman spectroscopy to reveal the lattice nitrogen reactivity," Yoo said. "This reshapes the understanding of the electrocatalytic system involving MXenes."

Studies involving Raman spectroscopical characterization with nitride MXenes and polar solvents could lead to major breakthroughs, Yoo said.

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“We demonstrate that electrochemical ammonia synthesis can be achieved through the protonation and replenishment of lattice nitrogen,” Djire said. “The ultimate goal of this project is to gain an atomistic-level understanding of the role played by the atoms that constitute a material’s structure.”

Sci Tech Daily, 29 October 2025

<https://scitechdaily.com>

### Vapour-sniffing drug detector tested at the US-Mexico border

2025-07-07

The US Customs and Border Protection agency is testing technology that sniffs out illegal substances in the air, no contact required. The device could screen objects at the border within seconds to help combat the trafficking of drugs like fentanyl, which is driving the opioid crisis in the US.

Drugs and explosive chemicals are difficult to detect because they release relatively few molecules into the ambient air, which is already filled with other vapours. To solve this problem, Robert Ewing and his colleagues at the US Pacific Northwest National Laboratory (PNNL) in Washington state spent the past decade developing an extremely sensitive system called VaporID. It can accurately identify specific substances from 0.6 to 2.4 metres away at levels of 10 parts per quadrillion – comparable to finding a single coin in a stack of pennies 17 million times higher than Mount Everest.

The scientists achieved this by giving molecules from substances of interest more time to randomly bump into other molecules and produce a detectable chemical reaction. Most devices for identifying unknown substances give molecules only a few milliseconds to react, says Ewing. “We made the atmospheric flow tube, which provided 2 or 3 seconds of reaction time and gave three orders of magnitude increase in sensitivity.”

That technology is now incorporated into an 18-kilogram commercial device the size of a microwave oven. The miniaturised machine, developed by California-based company BaySpec, is less sensitive than the PNNL lab version, which weighs more than 100 kilograms and is the size of a small refrigerator. But it is still “more accurate and more sensitive than a canine”, says William Yang, CEO of BaySpec.

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BaySpec and PNNL researchers tested the portable device at a Customs and Border Protection (CBP) facility in Nogales, Arizona, in October 2024. The team opened sample vials containing liquid or powder forms of seized drugs – including cocaine, heroin, fentanyl and methamphetamine – and held the open vials near the device inlet. In separate tests, researchers swiped the surface of seized pills and heated the swabs to generate vapor for detection. “Both methods produced strong, reliable results,” says Krisztian Torma at BaySpec.

The prototype is still undergoing evaluation and requires more scientific data review, says a CBP spokesperson.

Alex Krotulski at the Center for Forensic Science Research & Education, a non-profit organisation in Pennsylvania, says he remains “sceptical until the device has proven itself through research and rigorous evaluations, because we have seen far too many other devices in recent years that overpromised and underdelivered”.

There are already portable techniques, such as X-rays, for detecting hidden drugs, says Richard Crocombe, an independent consultant in Massachusetts. He calls the new tool “another valuable technique in the arsenal”, but cautions that “no one technique meets all needs”. For example, the CBP spokesperson notes that although it could potentially speed up drug testing in field labs, the new device would still require analysis by a trained chemist.

Such screening methods also risk raising false positives because “sometimes it feels like drug residue is pretty much everywhere”, says Joseph Palamar at New York University. Past research shows it has contaminated most US paper money, for example. “If it reacts as ‘positive’ for someone who has been near people using fentanyl and thus has minuscule traces on their clothes or shoes, then I worry about people who have nothing to do with drug trafficking being detained or penalised,” says Chelsea Shover at the University of California, Los Angeles.

Catching drugs before they enter the country is just part of a broader strategy necessary for curbing the opioid crisis, says Shover. However, solving this will also require robust public health agencies, access to healthcare and widespread treatment options, she says, which are currently being cut under the Trump administration. “To save lives, we

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### Chemists Develop Blood Test Method To Detect Dementia Earlier

2025-10-29

Early detection of Alzheimer's disease has come a step closer thanks to a new measurement method developed by chemists at Utrecht University. For the first time, they have made the growth of the notorious protein clumps involved in dementias such as Alzheimer's, Parkinson's, and Huntington's directly measurable — even in blood. Chemists Françoise Dekker, Júlia Aragonès Pedrola, and Stefan Rüdiger are publishing their discovery today, together with international colleagues, in the journal PNAS.

#### "Paint" makes proteins measurable

With a new technique that effectively "paints" proteins, it is now possible to clearly visualise the very first, tiny protein clumps. It can even measure their length, which indicates how far the disease has progressed. This means the course of the disease could be tracked in detail.

The Utrecht chemists Françoise Dekker, Júlia Aragonès Pedrola, and Stefan Rüdiger developed the method together with colleagues from Utrecht University and other research institutes.

The method revolves around a family of molecules designed by Rüdiger's team and their collaborators, called FibrilPaint. These molecules bind exclusively to the long, thread-like protein structures that accumulate in the brains of dementia patients. These structures are known as amyloid fibrils.

#### Directly measurable

FibrilPaint is also fluorescent: it emits light when studied with special measuring equipment. In this way, it reveals the size of the fibrils, from the very first, tiny clumps to fully developed structures. A major advantage is that blood or cerebrospinal fluid from patients can be assessed directly, whereas normally, extensive pre-treatment steps are required to reliably measure proteins.

"We could already see such fibrils under an electron microscope, but this method is not suitable to monitor body fluids" says Stefan Rüdiger, Professor of Protein Chemistry of Disease at Utrecht University. "With FibrilPaint, we can now follow their growth step by step in liquid form."

#### Medicines against dementia

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The researchers expect FibrilPaint to help improve the development of dementia drugs. "With our technique, we will soon be able to monitor the progression of the disease much more precisely and determine whether a treatment is effective," says Dekker. The team has already founded a start-up called NeuroTidal Diagnostics to bring FibrilPaint into practical use. This will allow them to contribute to clinical trials of dementia medications.

#### Too ambitious?

For Rüdiger, this is also a personal milestone. "Three years ago, I described the idea for FibrilPaint when applying for a major research grant. It was rejected at the time for being too ambitious. But I persevered and sought other ways to develop FibrilPaint. Reaching this point now feels like a real milestone."

Technology Networks, 29 October 2025

<https://technologynetworks.com>

### Unique enzymes use never-before-seen mechanism to resist antibiotics

2025-10-30

Life just got more difficult for those fighting antibiotic-resistant superbugs. Researchers at McGill University have discovered two enzymes that use a never-before-seen mechanism to confer resistance, opening a whole new front in the battle against antimicrobial resistance (AMR), one of the top 10 global public health issues.

Albert Berghuis, a professor at McGill University, and Mark Hemmings, a Ph.D. student in his lab, were studying the types of enzymes that cause antibiotic resistance when they saw a structure that no one had ever seen before. Many resistance enzymes work by mimicking the antibiotic's target inside the bacterial cell, intercepting and deactivating the drug before it can do its job.

But they found two enzymes that attack aminoglycoside antibiotics without using this target-mimicry approach. Aminoglycosides are a class of broad-spectrum antibiotics used to treat severe bacterial infections.

"We found two enzymes that don't mimic the target at all," says Berghuis. "So, we wondered, are these still superbugs?"

The researchers used the Canadian Light Source at the University of Saskatchewan to examine the molecular structure of the enzymes and

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the drugs they bind to. They saw that the enzymes—called AAC(3)-Ia and AAC(3)-XIa—bind to the drug when its central ring structure is twisted into a pretzel shape rather than its usual flat disk.

This didn't seem like a particularly effective mechanism for resistance. Aminoglycoside molecules only spend about 0.1% of their time in the pretzel shape, says Berghuis, which doesn't leave many opportunities for the enzymes to grab and deactivate them.

"We didn't expect them to be very good enzymes," says Hemmings, but the results were a surprise: AAC(3)-XIa seriously outperformed their expectations. "One of them was pretty bad, but the other is actually just as good as the ones that do target mimicry." The researchers say more research is required to determine how the enzyme can be effective when it's so rarely in "attack" mode. The team's findings are published in the journal *Communications Chemistry*.

Berghuis says the work should help in the fight against antibiotic resistance, by highlighting the fact that there are more kinds of enzymes that can cause resistance than we thought. Researchers will need to take these unconventional enzymes more seriously when they are identified in the genomes of bacteria.

"Before, we would have ignored enzymes like this, but now we have to take them into account," he says. "The problem (of antibiotic resistance) has grown and made life more complicated."

*Phys Org*, 30 October 2025

<https://phys.org>

### Extra-hard hexagonal diamonds can now be grown in a lab

2025-07-30

A harder form of diamond that has eluded scientists for decades can now be synthesised in the laboratory, and could be used to make extremely tough cutting and drilling tools.

Diamonds as we know them have a cubic arrangement of atoms in their crystalline structure. But for at least 60 years, we have been aware of another form – hexagonal diamond – that is much tougher, thanks to its crystals having no uniform shear lines along which breaks can propagate.

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Natural hexagonal diamond occurs in meteorites, where it is known by the mineral name lonsdaleite, but only in mixtures with cubic diamond. Previous attempts to synthesise hexagonal diamonds have yielded only tiny traces that are similarly impure.

Now, Ho-Kwang Mao at the Center for High Pressure Science and Technology Advanced Research in Beijing and his colleagues have succeeded in creating a relatively large sample of hexagonal diamond that is 1 millimetre in diameter and 70 micrometres thick, with purity close to 100 per cent.

While normal diamond has been synthesised for some time, the researchers explored a range of pressures and temperatures to find a sweet spot in which hexagonal diamonds were produced. This ended up being 1400°C at 20 gigapascals – 200,000 times the atmospheric pressure on Earth.

Such a material has never been made before, so it will need to be thoroughly studied to determine its properties, says Mao. "It's incredibly valuable," he says. "But once we know how to make it, anyone can produce it. So then the important thing is to get a patent and find a way to make it less expensive."

Hexagonal diamonds are predicted to be about 60 per cent harder than regular diamonds based on their structure. Cubic diamond has a hardness of around 115 gigapascals when measured in a Vickers hardness test. The hexagonal diamond created by Mao and his team measures 120 gigapascals, but they believe they can improve this significantly as they develop their technique further.

If hexagonal diamond can be synthesised with sufficient thicknesses, it could be used to make harder and more resilient tools for a range of uses in industry, such as drilling for geothermal energy, says James Elliott at the University of Cambridge. "Obviously, the deeper you go, the hotter it gets, [and] it could enable them to go deeper underground."

*New Scientist*, 30 July 2025

<https://newscientist.com>

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### Outdoor Air Pollution Linked to Higher Incidence of Breast Cancer

2025-10-29

Women living in parts of the United States with lower air quality, especially neighborhoods with heavy emissions from motor vehicles, are more likely to develop breast cancer, according to a multiyear analysis involving more than 400,000 women and 28,000 breast cancer cases.

The research, which included Veronica Irvin of the Oregon State University College of Health, was published in the American Journal of Public Health.

The project combined data from five large breast cancer studies conducted over multiple decades that tracked individuals even as they changed addresses and followed them for as long as 10 years prior to their diagnosis. The researchers overlaid outdoor air quality information from more than 2,600 monitors to look for an association between air pollution and breast cancer.

The scientists found that a 10-parts-per-billion increase in nitrogen dioxide concentrations in the air equated to a 3% increase in overall breast cancer incidence; nitrogen dioxide is a proxy for pollution from car traffic, Irvin said, and based on the estimated 316,950 cases of female breast cancer expected to be diagnosed in the United States this year, a 3% reduction would mean 9,500 fewer cases.

Irvin and collaborators also found that a 5-microgram-per-cubic-meter rise in the concentration of fine particulate matter, known as PM2.5, was associated with a higher incidence of hormone receptor-negative breast cancer. Cancer cells lacking receptors for the sex hormones estrogen and progesterone are generally harder to treat and more deadly.

"It's often not realistic for people to leave their homes and relocate in areas with better air quality in search of less health risk, so we need more effective clean air laws to help those who are most in need," said Irvin, noting that the average nitrogen dioxide concentrations observed in the research were below current Environmental Protection Agency guidelines. "We also need policies that help to reduce car traffic and promote alternative forms of transportation."

The incidence of breast cancer in the United States, where air pollution levels are lower than they are in other populous countries, has been generally on the rise over the past 40 years, the researchers note. It's the second leading cause of cancer death among women, after lung cancer.

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About one woman in eight in the U.S. will develop breast cancer during her lifetime, and the nation's population includes more than 4 million breast cancer survivors.

Alexandra White of the National Institutes of Health led the study, which also included scientists from Harvard University; the University of Washington; Indiana University; Stony Brook University, the University of California San Diego, La Jolla; The Ohio State University; and the University of North Carolina, Chapel Hill.

The NIH, the EPA, the National Institute of Environmental Health Sciences, the National Institute of Aging, and the National Heart, Lung, and Blood Institute supported the research.

Irvin is the Celia Strickland Austin and G. Kenneth Austin III Endowed Professor in Public Health in the OSU College of Health, which will host a free online panel discussion, "Our Health & Breast Cancer," at noon Pacific time on Thursday, Oct. 30. Irvin will be one of the panelists for the discussion, which will look at screening and survivorship, early detection, research, and support and mentorship for those affected by breast cancer.

Technology Networks, 29 October 2025

<https://technologynetworks.com>

### A Strange Discovery in Snake Pee Could Change Medicine

2025-10-30

If you've never cared for a reptile, you might be surprised to learn that many species don't urinate liquid at all. Instead, they release solid white crystals made of uric acid.

A recent study published in the Journal of the American Chemical Society examined the solid waste of more than 20 reptile species and found uric acid spheres in every sample. The discovery sheds light on how reptiles safely eliminate waste in a crystalline form and could eventually lead to new ways of treating human diseases linked to uric acid buildup, such as kidney stones and gout.

### A Unique Waste System That Conserves Water

All animals have some way of removing waste from their bodies, since whatever goes in must come out. In humans, nitrogen-containing compounds like urea, uric acid, and ammonia are dissolved in water

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and expelled as urine. Reptiles and birds, however, have evolved a more efficient system.

They convert some of those same compounds into solid crystals called “urates,” which are expelled through a single opening known as the cloaca. Scientists think this solid waste process developed as a way for these animals to conserve water, an essential advantage in hot or arid environments.

### What Helps Snakes Survive Can Harm Humans

For reptiles, turning waste into crystals is an adaptation that prevents dehydration, but in humans, uric acid crystals cause painful health problems. When uric acid levels rise too high, they can crystallize in the joints and trigger gout or form kidney stones in the urinary tract. To explore how reptiles avoid these complications, Jennifer Swift and her research team analyzed urates from more than 20 reptile species to understand how their bodies handle crystalline waste safely.

“This research was really inspired by a desire to understand the ways reptiles are able to excrete this material safely, in the hopes it might inspire new approaches to disease prevention and treatment,” says Swift, the study’s corresponding author.

### Tiny Crystals With Big Medical Potential

Microscopic imaging revealed that three species—ball pythons, Angolan pythons, and Madagascan tree boas—produce urates made of textured microscopic spheres ranging from 1 to 10 micrometers across. Further X-ray analysis showed that these spheres are built from even smaller nanocrystals of uric acid and water.

The researchers also found that uric acid helps neutralize ammonia by turning it into a less harmful solid. They suspect uric acid might play a similar protective role in the human body. Although more research is needed, this work on reptile waste could ultimately provide valuable insights for treating conditions caused by uric acid buildup, improving health outcomes for millions of people.

Sci Tech Daily, 30 October 2025

<https://scitechdaily.com>

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### Electrochemical system converts plant compound into two valuable products at once

2025-10-30

A research team has created a new kind of electrochemical “two-in-one” system that turns plant-based molecules into two useful products at once. Using a finely tuned single-atom ruthenium catalyst, the process combines two chemical reactions, oxidation and hydrogenation, inside a single electrolytic cell, much like cooking two dishes in the same pot without mixing up the flavors. Details of the research were published in the journal *Advanced Energy Materials* on October 15, 2025.

The system works on 5-hydroxymethylfurfural (HMF), a compound made from biomass that scientists view as a key ingredient for building a sustainable chemical industry. With this approach, HMF is transformed into two products: 2,5-furandicarboxylic acid (FDCA), which can be used to make renewable plastics, and 2,5-dihydroxymethylfuran (DHMF), a valuable intermediate for fine chemicals and fuels.

Traditionally, these two reactions happen in separate systems; one on the positive electrode and one on the negative. The team’s “symmetrical” setup brings the two sides together, reducing waste and energy consumption. It also operates under normal temperature and pressure, offering a more energy-efficient alternative to the conventional high-temperature, high-pressure chemical processes used in industry.

At the heart of this innovation is a catalyst made by placing ruthenium atoms onto a cobalt hydroxide surface. These single atoms enhance the way electrons and molecules interact, known scientifically as d-p orbital hybridization, allowing the reactions to run more smoothly. The result is a system that not only performs both reactions efficiently but also keeps the active sites stable during long operation.

Tests in a continuous-flow reactor showed that the system could run reliably for more than 240 hours without losing performance. During this time, the researchers achieved full conversion of HMF into the two desired products, reaching a combined yield of over 170%.

Beyond its technical success, the team also found the process could make economic sense. Their calculations suggest that every ton of FDCA produced could generate about 5,800 U.S. dollars in revenue, pointing toward possible industrial applications if scaled up.

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“This research is a bit like turning a traditional single-lane road into a two-way street,” said Hao Li, a professor from Tohoku University’s Advanced Institute for Materials Research (WPI-AIMR) who led the study. “Instead of separating the oxidation and hydrogenation processes, we let them flow together efficiently in one system. It’s a step toward smarter and more sustainable ways of producing chemicals from renewable resources.”

Next, the researchers plan to scale up their reactor to pilot-level systems and develop greener separation methods to purify the products more sustainably. They also aim to assess the process’s environmental and economic performance through a detailed life cycle analysis.

By combining efficiency, durability, and simplicity, the study opens a pathway toward more practical and sustainable chemical manufacturing, using renewable feedstocks and clean electricity to get more value out of every reaction.

Phys Org, 30 October 2025

<https://phys.org>

### Vapour-sniffing drug detector tested at the US-Mexico border

2025-07-07

The US Customs and Border Protection agency is testing technology that sniffs out illegal substances in the air, no contact required. The device could screen objects at the border within seconds to help combat the trafficking of drugs like fentanyl, which is driving the opioid crisis in the US.

Drugs and explosive chemicals are difficult to detect because they release relatively few molecules into the ambient air, which is already filled with other vapours. To solve this problem, Robert Ewing and his colleagues at the US Pacific Northwest National Laboratory (PNNL) in Washington state spent the past decade developing an extremely sensitive system called VaporID. It can accurately identify specific substances from 0.6 to 2.4 metres away at levels of 10 parts per quadrillion – comparable to finding a single coin in a stack of pennies 17 million times higher than Mount Everest.

The scientists achieved this by giving molecules from substances of interest more time to randomly bump into other molecules and produce a detectable chemical reaction. Most devices for identifying unknown substances give molecules only a few milliseconds to react, says Ewing.

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“We made the atmospheric flow tube, which provided 2 or 3 seconds of reaction time and gave three orders of magnitude increase in sensitivity.”

That technology is now incorporated into an 18-kilogram commercial device the size of a microwave oven. The miniaturised machine, developed by California-based company BaySpec, is less sensitive than the PNNL lab version, which weighs more than 100 kilograms and is the size of a small refrigerator. But it is still “more accurate and more sensitive than a canine”, says William Yang, CEO of BaySpec.

BaySpec and PNNL researchers tested the portable device at a Customs and Border Protection (CBP) facility in Nogales, Arizona, in October 2024. The team opened sample vials containing liquid or powder forms of seized drugs – including cocaine, heroin, fentanyl and methamphetamine – and held the open vials near the device inlet. In separate tests, researchers swiped the surface of seized pills and heated the swabs to generate vapor for detection. “Both methods produced strong, reliable results,” says Krisztian Torma at BaySpec.

The prototype is still undergoing evaluation and requires more scientific data review, says a CBP spokesperson.

Alex Krotulski at the Center for Forensic Science Research & Education, a non-profit organisation in Pennsylvania, says he remains “sceptical until the device has proven itself through research and rigorous evaluations, because we have seen far too many other devices in recent years that overpromised and underdelivered”.

There are already portable techniques, such as X-rays, for detecting hidden drugs, says Richard Crocombe, an independent consultant in Massachusetts. He calls the new tool “another valuable technique in the arsenal”, but cautions that “no one technique meets all needs”. For example, the CBP spokesperson notes that although it could potentially speed up drug testing in field labs, the new device would still require analysis by a trained chemist.

Such screening methods also risk raising false positives because “sometimes it feels like drug residue is pretty much everywhere”, says Joseph Palamar at New York University. Past research shows it has contaminated most US paper money, for example. “If it reacts as ‘positive’ for someone who has been near people using fentanyl and thus has minuscule traces on their clothes or shoes, then I worry about people who have nothing to do with drug trafficking being detained or penalised,” says Chelsea Shover at the University of California, Los Angeles.

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Catching drugs before they enter the country is just part of a broader strategy necessary for curbing the opioid crisis, says Shover. However, solving this will also require robust public health agencies, access to healthcare and widespread treatment options, she says, which are currently being cut under the Trump administration. "To save lives, we want treatment – evidence-based, effective treatment – to be easier to access than illicit drugs," says Shover.

New Scientist, 7 July 2025

<https://newscientist.com>

### Astronomers just captured the sharpest view of a distant star ever seen

2025-10-25

#### A Breakthrough View From a Single Telescope

For the first time, astronomers have used a new imaging method on a ground-based telescope to capture the most detailed look ever at the disk surrounding a distant star. Led by UCLA researchers, the achievement revealed hidden structures that had never been seen before. This breakthrough paves the way for scientists to study finer details of stars, planets, and other celestial objects, potentially transforming how we explore the universe.

A telescope's ability to reveal faint or distant objects depends on its size. Larger telescopes can collect more light, allowing them to see dimmer targets and produce sharper images. The highest levels of detail are usually reached by linking multiple telescopes together to form an array. Building these large instruments, or connecting them, has long been the key to achieving the precision needed for discovering new cosmic features.

#### Harnessing Light With a Photonic Lantern

Using a device called a photonic lantern, astronomers can now make better use of the light gathered by a telescope to produce extremely high-resolution images. The details of this breakthrough appear in *Astrophysical Journal Letters*.

"In astronomy, the sharpest image details are usually obtained by linking telescopes together. But we did it with a single telescope by feeding its light into a specially designed optical fiber, called a photonic lantern. This device splits the starlight according to its patterns of fluctuation, keeping

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subtle details that are otherwise lost. By reassembling the measurements of the outputs, we could reconstruct a very high-resolution image of a disk around a nearby star," said first author and UCLA doctoral candidate Yoo Jung Kim.

The photonic lantern divides the incoming light into multiple channels based on how the light wavefront is shaped, much like separating the notes of a musical chord. It also divides light by color, creating a rainbow-like spectrum. The device was designed and built by the University of Sydney and the University of Central Florida, and it forms part of the instrument FIRST-PL, developed and led by the Paris Observatory and the University of Hawai'i. This system is installed on the Subaru Coronagraphic Extreme Adaptive Optics instrument at the Subaru Telescope in Hawai'i, which is operated by the National Astronomical Observatory of Japan.

"What excites me most is that this instrument blends cutting-edge photonics with the precision engineering done here in Hawai'i," said Sebastien Vievard, a faculty member in the Space Science and Engineering Initiative at the University of Hawai'i who helped lead the build. "It shows how collaboration across the world, and across disciplines, can literally change the way we see the cosmos."

#### Pushing Beyond Traditional Imaging Limits

This method of separating and analyzing light enables a new way to see fine detail, achieving sharper resolution than traditional telescope cameras.

"For any telescope of a given size, the wave nature of light limits the fineness of the detail that you can observe with traditional imaging cameras. This is called the diffraction limit, and our team has been working to use a photonic lantern to advance what is achievable at this frontier," said UCLA professor of physics and astronomy Michael Fitzgerald.

"This work demonstrates the potential of photonic technologies to enable new kinds of measurement in astronomy," said Nemanja Jovanovic, a co-leader of the study at the California Institute of Technology. "We are just getting started. The possibilities are truly exciting."

At first, the researchers faced a major challenge: turbulence in Earth's atmosphere. The same shimmering effect that makes distant horizons appear wavy on a hot day causes starlight to flicker and distort as it travels through the air. To correct for this, the Subaru Telescope team used

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adaptive optics, a technology that continuously adjusts to cancel out these distortions and stabilize the light waves in real time.

“We need a very stable environment to measure and recover spatial information using this fiber,” said Kim. “Even with adaptive optics, the photonic lantern was so sensitive to the wavefront fluctuations that I had to develop a new data processing technique to filter out the remaining atmospheric turbulence.”

### Exploring Beta Canis Minoris in Stunning Detail

The team put their technique to the test by observing the star beta Canis Minoris ( $\beta$  CMi), located about 162 light-years away in the constellation Canis Minor. This star is surrounded by a fast-spinning hydrogen disk. As the gas in the disk moves, the side rotating toward Earth appears bluer, while the side moving away looks redder, a result of the Doppler effect (the same phenomenon that changes the pitch of a moving car’s sound). These color shifts slightly alter the apparent position of the starlight depending on its wavelength.

By applying new computational methods, the researchers measured these color-based position shifts with about five times more precision than ever before. In addition to confirming the rotation of the disk, they discovered that it is lopsided.

“We were not expecting to detect an asymmetry like this, and it will be a task for the astrophysicists modeling these systems to explain its presence,” said Kim.

### A New Way to See the Universe

This innovative approach will allow astronomers to observe smaller and more distant objects with unprecedented clarity. It may help solve long-standing cosmic mysteries and, as in the case of the lopsided disk around  $\beta$  CMi, uncover entirely new ones.

The project involved an international collaboration that included scientists from the Space Science and Engineering Initiative at the University of Hawai’i, the National Astronomical Observatory of Japan, the California Institute of Technology, the University of Arizona, the Astrobiology Center in Japan, the Paris Observatory, the University of Central Florida, the University of Sydney, and the University of California Santa Cruz.

Science Daily, 25 October 2025

<https://sciencedaily.com>

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### Supramolecular robotics enables soft materials to move, adapt and self-assemble

2025-10-29

From cells that migrate to tissues that heal, nature abounds with systems capable of sensing and adapting to their surroundings. Replicating this level of adaptability in synthetic systems has remained a grand challenge in chemistry and materials science. Most artificial materials, though inspired by biology, still react to only one stimulus and lack the integrated responsiveness that characterizes living matter.

The research team from Japan proposed a new framework called supramolecular robotics, which allows soft materials to exhibit motion, transformation, and self-assembly by dynamically modulating molecular interactions.

The team was led by Associate Professor Taisuke Banno of the Department of Applied Chemistry of Keio University, in collaboration with Dr. Tomoya Kojima, JSPS Postdoctoral Fellow of Tokyo University of Agriculture and Technology; and Shoi Sasaki, Ph.D. Student of the School of Science for Open and Environmental Systems of Keio University.

“While many bioinspired materials mimic specific biological functions, most respond to only a single stimulus and lack the integrated responsiveness seen in living systems,” explains Dr. Banno.

“In nature, organisms achieve complex behaviors such as motility, signaling, and regeneration through coordinated molecular recognition, signal processing, and actuation. Our concept of supramolecular robotics extends molecular robotics by emphasizing the role of noncovalent interactions—like hydrophobic, electrostatic, and hydrogen bonding forces—as the driving elements for adaptive, life-like behavior.”

In this approach, molecules act as adaptive building blocks that can organize, disassemble, and reorganize based on subtle chemical cues. The resulting materials display programmable motion, shape transformation, and cooperative assembly—functions that bridge molecular chemistry and robotic behavior.

The researchers outlined three key principles that underpin supramolecular robotics: motility, phase transition, and prototissue formation.

At the micrometer-scale, motility was achieved using reactive oil droplets in aqueous environments. Here, spontaneously generating convection

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based on the heterogeneity of interfacial tension at the droplet surface—a phenomenon known as the Marangoni effect—propels droplets autonomously.

Depending on the stimulus, the droplets could move directionally or form collective patterns, resembling microbial swarms. Such chemically powered motion systems may serve as the foundation for microscale robots capable of environmental sensing or targeted transport.

The second phenomenon, phase transition, captured how supramolecular assemblies dynamically switch between structural states—such as micelles, vesicles, or gels—in response to stimuli like light or pH. These transformations, either reversible or irreversible, emulate how biological systems adapt to changing surroundings.

The ability to couple chemical reactions with structural reorganization could enable self-healing materials and controlled drug-release platforms that function far from equilibrium.

The final stage involved prototissue formation, where multiple protocell-like vesicles assembled into larger, tissue-like structures due to non-covalent intermolecular interactions. These assemblies exhibited reversible collective motion and communication between compartments—behaviors reminiscent of living tissues.

By programming such cooperative dynamics, the team demonstrated how soft materials could self-organize and repair themselves without external control.

“In natural environments where chemical conditions are constantly changing, our approach could lead to molecular assemblies that autonomously adapt and perform optimal functions,” says Dr. Banno.

“This could pave the way for applications in targeted drug delivery, environmental remediation, and the development of soft robotic systems that move and respond on their own.”

By merging supramolecular chemistry with systems thinking, the team has provided a roadmap for constructing materials that go beyond simple responsiveness. Instead of being passive objects, these materials process information and adapt dynamically—a defining characteristic of intelligence in living systems.

Looking ahead, this molecular-level engineering could transform a wide range of fields. In medicine, adaptive soft materials could deliver

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therapeutics precisely where and when they are needed. In environmental science, responsive microsystems could monitor or neutralize pollutants in real time. And in robotics, molecularly driven motion could lead to truly soft, self-regulating machines.

Overall, this research opens the door to bioinspired materials capable of sensing, moving, and evolving. As the field of supramolecular robotics matures, such systems could one day lead to programmable therapeutic materials, environmental microswimmers, and self-powered robotic devices—signaling a new era where molecules themselves form the basis of intelligent machines.

Phys Org, 29 October 2025

<https://phys.org>

### What makes a scientific breakthrough truly chemical?

2025-10-29

When I read about the winners of this year’s Nobel prize in chemistry, I breathed a sigh of relief. This year’s recipients are all chemists and were acknowledged for producing work that is truly chemical. Funnily enough, I’m not the only one to point this out – Derek Lowe has said exactly the same elsewhere in Chemistry World. Susumu Kitagawa, Richard Robson and Omar Yaghi jointly received the prize for developing metal-organic frameworks (MOFs), materials that are highly porous and can be used to capture and store a wide array of molecules.

What makes this discovery so refreshingly chemical? The first – perhaps obvious – requirement is for the target of discovery to be something chemical: this could be a new structure, a new chemical property, a new element or a new substance. It could also be a new technique to make (or break) something.

A characteristic example is the synthesis of urea from inorganic material in 1828 by German chemist Friedrich Wöhler. This has been lauded as an immense chemical breakthrough. In fact, it received significant attention from historians of chemistry who still debate whether (and to what extent) it contributed to the rejection of vitalism (the idea that living entities are fundamentally different in composition from non-living things).<sup>1</sup>

But this is not enough. Another thing that seems to be important when talking of genuinely chemical discoveries is the extent to which a breakthrough involves activities in a controlled environment, namely the laboratory.

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### Lab experiments

Indeed, this seems to be a very important feature of chemistry, more so than other experimental sciences like physics or even biology. Even if nowadays there are parts of chemistry that are not centered around laboratory work (most notably theoretical chemistry), it still holds true that one cannot really learn nor practice chemistry without spending some time in a laboratory. Experiments can of course vary in complexity: they may involve simply mixing stuff together and observing them with one's senses, to carefully isolating materials and analysing them using very expensive and delicate machinery.

Interestingly, it is alchemy that chemistry inherited this feature from. Despite the mysterious metaphysical connotations that alchemy holds, the centrality of performing experiments and manipulating matter in a closed environment with the use of tools and apparatuses was initially developed by alchemists. Later on, with the emergence of modern science this was made explicit. For example, Denis Diderot and Jean le Rond d'Alembert defined chemistry in the Encyclopedie as 'a science which occupies itself with the separations and union of the constituent principles of bodies, whether these are effected by nature, or the result of the operations of art, with a view to discovering the properties of bodies, or to render them suitable for a variety of uses'.<sup>2</sup>

Guillaume Francois Rouelle, an 18th century French chemist, made the role of experimental processes even more apparent: 'Chemistry is a physical art which, by means of certain operations and instruments, teaches us to separate the various substances which enter into the composition of bodies, and to recombine these again, either to reproduce the former bodies, or to form new ones from them'.<sup>2</sup>

### Practical purpose

It is within this framework that in 1993, historian William Brock said, rather beautifully, that 'if chemistry had so much to offer through its variety of aims, then, like some religion, it was necessary to practice it rather than to expect a knowledge of it ex cathedra'.<sup>3</sup> Experimentation and laboratory practice play prominent roles in chemistry, so much so that it has been associated with its very identity. Perhaps it should not come as a surprise that the first chemical laboratories (or workshops, as they were initially called) are found in the late 16th century.<sup>4</sup> Nor that the first laboratories were created for chemical purposes and later on acted as a model for other laboratory sciences.<sup>5</sup>

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However, there is also one more aspect to this year's Nobel recipients that warrants calling their contribution truly chemical, namely that chemical discoveries have the potential to impact humanity in a wide variety of ways. MOFs are expected to be of value for purposes relating to gas storage, carbon capture, catalysis, electrochemistry and fluorescence-based imaging. They are expected to help with problems relating to climate change, the food industry, the energy sector and technology.

For better and for worse, innovations in chemistry have transformed all facets of our lives, bringing irreversible changes both within our personal space and within the public sphere.<sup>6</sup> Viewed from this perspective, the development of MOFs seems to be one such example of a truly chemical breakthrough. Let's hope it will be used wisely!

Chemistry World, 29 October 2025

<https://chemistryworld.com>

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## Technical Notes

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

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[In-Plane Exposed Metal Sites in Covalent Organic Frameworks for High-Performance Lithium Sulfur Batteries](#)

[Associations between emerging endocrine-disrupting chemicals and thyroid hormone homeostasis in pregnant women](#)

[Prognosis of simplified metal and organic sites resembling a quasi-MOF structure for hydrogen storage: investigation and insight](#)

### ENVIRONMENTAL RESEARCH

[Impact of carbon nanotubes on pulmonary disorders attributed to occupational and environmental exposures](#)

[Endocrine Disrupting Phenolic Plasticizers in the Bay of Bengal Coastal Waters, India: Occurrence, Distribution and Environmental Risk Assessment](#)

### PHARMACEUTICAL/TOXICOLOGY

[Long-term exposure of mice to sodium fluoride and to a mixture of endocrine disruptors causes tooth enamel and retina abnormalities associated with changes in hepatic metabolism](#)

[Longitudinal characterization of clinical, developmental, and behavioral phenotypes in 101 children and adults with FOXP1 syndrome](#)

[Long-term exposure of mice to sodium fluoride and to a mixture of endocrine disruptors causes tooth enamel and retina abnormalities associated with changes in hepatic metabolism](#)

### OCCUPATIONAL

[Adaptive resistance and defense evolution in microplastics-mediated biological exposure interfaces in municipal wastewater treatment systems](#)

[Space radiation and risk for ocular surface malignancies: Exposure risk, current mitigation strategies, and management considerations for a mission to Mars](#)