

# Bulletin Board

## Contents

JUN. 14, 2024

(click on page numbers for links)

### REGULATORY UPDATE

#### ASIA PACIFIC

Switches in food and beverage product purchases can reduce greenhouse gas emissions in Australia .....	4
Annual Review: Data Analysis of Chemical Fertilizers Registered in China in 2023 .....	4

#### AMERICA

U.S. Department of Labor's Occupational Safety and Health Administration (OSHA) has issued a final rule to update the agency's Hazard Communication Standard (HCS). .....	5
Federal environmental quality guidelines - Iron .....	6

#### EUROPE

Four new UK driving laws now in force .....	6
Businesses urge Belgian Presidency to deliver on Nature Restoration Law 7	
Indicators for sustainable management of chemicals .....	8
Green transition: Council gives its final approval to the ecodesign regulation .....	9
Industrial policy: Council gives final approval to the net-zero industry act .....	10

#### INTERNATIONAL

The End of Greenwashing Is Now Within Sight .....	11
Menstruation is starting earlier and earlier – does chemical exposure play a role? .....	12

### REACH UPDATE

New IUCLID format package and updated manual for C&L notifications ..	13
---	----

### JANET'S CORNER

Theory vs Reality .....	14
-------------------------	----

### HAZARD ALERT

Cadmium .....	15
---------------	----

### CONTACT US

subscribers@chemwatch.  
net  
tel +61 3 9572 4700  
fax +61 3 9572 4777

1227 Glen Huntly Rd  
Glen Huntly  
Victoria 3163 Australia

**\* While Chemwatch has taken all efforts to ensure the accuracy of information in this publication, it is not intended to be comprehensive or to render advice. Websites rendered are subject to change.**

## Bulletin Board

## Contents

JUN. 14, 2024

## GOSSIP

Looking for a new battery platform? Focus on the essentials .....	24
Vitamin B6: New compound could delay degradation .....	26
Fast-charging sodium-ion battery uses anodes made from trees.....	27
How Do Milk Proteins Interact With Caffeine in Your Espresso? .....	29
Nanosized blocks spontaneously assemble in water to create tiny floating checkerboards .....	30
Sweaty cattle may boost food security in a warming world .....	32
Pan-cancer approval shows huge potential for antibody–drug conjugates .....	33
Life’s vital chemistry may have begun in hot, cracked rock.....	37
Engineered plants produce human milk sugars that could lead to healthier baby formula.....	39

## CURIOSITIES

Erectile Dysfunction Drug May Improve Brain Blood Flow and Help Prevent Dementia .....	42
A ‘liquid battery’ advance—strategies for electrocatalytic hydrogenation.....	43
World-first tooth-regrowing drug will be given to humans in September.....	45
Dark Chocolate May Pose Slight Heavy Metal Risk to Children.....	46
Water droplets accelerate formation of mineral nanoparticles essential for life .....	48
Are plant-based burgers really bad for your heart? Here’s what’s behind the scary headlines.....	50
First US state bans PFAS, other chemicals from period products .....	54
Study reveals antiviral properties of solid wood surfaces .....	56
Mobile monitoring for an airborne carcinogen in Louisiana’s ‘Cancer Alley’ .....	58
Eggshell Waste Recovers Rare Earth Elements Needed for Green Energy .....	59

## TECHNICAL NOTES

(Note: Open your Web Browser and click on Heading to link to section) ..	61
CHEMICAL EFFECTS .....	61
ENVIRONMENTAL RESEARCH .....	61
PHARMACEUTICAL/TOXICOLOGY .....	61

## Bulletin Board

## Contents

JUN. 14, 2024

OCCUPATIONAL.....	61
-------------------	----

# Bulletin Board

## Regulatory Update

JUN. 14, 2024

### ASIA PACIFIC

#### Switches in food and beverage product purchases can reduce greenhouse gas emissions in Australia

2024-05-28

Switching between similar food and beverage products may reduce greenhouse gas emissions (GHGe). Here, using consumer data linked to 23,550 product-specific GHGe values, we estimated annual GHGe attributable to product purchases consumed at home in Australia and calculated reductions from specific switches. Potential changes to mean Health Star Rating, mean energy density and the proportion of ultraprocessed foods purchased were assessed. Approximately 31 million tonnes of GHGe were attributable to products consumed at home in 2019, the three highest contributors of GHGe being 'meat and meat products' (49%), 'dairy' (17%) and 'non-alcoholic beverages' (16%). Switching higher-emission products for 'very similar' lower-emission products could reduce total emissions by 26%. Switches to 'less similar' lower-emission products could lead to a 71% reduction. Switches had little impact on the average Health Star Rating, energy density of purchases and proportion of ultraprocessed foods purchased. Directing manufacturing and marketing towards lower-environmental-impact products and signposting such options to consumers are key.

Read More

Nature Food, 28-05-24

<https://www.nature.com/articles/s43016-024-00971-6>

#### Annual Review: Data Analysis of Chemical Fertilizers Registered in China in 2023

2024-05-27

Based on statistical data, 772 chemical fertilizers were newly registered in China in 2023. Among these registrations, the predominant types of fertilizers were water-soluble fertilizers containing amino acids, water-soluble fertilizers containing humic acids, and organic water-soluble fertilizers. In order to facilitate a comprehensive understanding of the registered chemical fertilizers in China during 2023, we have diligently organized the data from various perspectives. Our aim is to assist fertilizer

# Bulletin Board

## Regulatory Update

JUN. 14, 2024

companies in gaining valuable insights into the landscape of registered chemical fertilizers in China.

Read More

CIRS, 27-05-24

<https://www.cirs-group.com/en/agrochemicals/annual-review-data-analysis-of-chemical-fertilizers-registered-in-china-in-2023>

### AMERICA

#### U.S. Department of Labor's Occupational Safety and Health Administration (OSHA) has issued a final rule to update the agency's Hazard Communication Standard (HCS).

2024-05-20

OSHA has issued a final rule that updates the Hazard Communication Standard (HCS) to align primarily with the seventh revision of the United Nations' Globally Harmonized System of Classification and Labelling of Chemicals (GHS). The final rule was published on May 20, 2024 and takes effect on July 19, 2024.

The updated standard will improve the standard's effectiveness by better informing employees about chemical hazards in the workplace. This final rule will increase worker protections and reduce the incidences of chemical-related occupational illnesses and injuries by further improving the information on the labels and safety data sheets for hazardous chemicals. The final rule will also address issues arising since implementation of the 2012 standard and improve alignment with other federal agencies and Canada. Please see the Highlights for more information.

OSHA is also providing a redline strikeout version of the regulatory text and appendices for stakeholders which can be found under Highlights.

Established in 1983, the HCS provides a standardized approach to communicating workplace hazards associated with exposure to dangerous chemicals. OSHA updated the standard in 2012 to align with the third revision of the GHS. The system provides a common and

# Bulletin Board

## Regulatory Update

JUN. 14, 2024

coherent approach to classifying chemicals and communicating hazard information.

[Read More](#)

US OSHA, 20-05-24

<https://www.osha.gov/hazcom/rulemaking>

### Federal environmental quality guidelines - Iron

2024-05-27

Federal Environmental Quality Guidelines (FEQGs) describe acceptable quality of the ambient environment. They are based solely on the toxicological effects or hazard of specific substances or groups of substances. FEQGs serve 3 functions: first, they can be an aid to prevent pollution by providing targets for acceptable environmental quality; second, they can assist in evaluating the significance of concentrations of chemical substances currently found in the environment (monitoring of water, sediment, soil and biological tissue); and third, they can serve as performance measures of the effectiveness of risk management activities. The use of FEQGs is voluntary unless prescribed in permits or other regulatory tools. Thus FEQGs, which apply to the ambient environment, are not effluent limits or "never-to-be-exceeded" values but may be used to derive effluent limits. The development of FEQGs is the responsibility of the Minister of Environment under the Canadian Environmental Protection Act, 1999 (CEPA) (Canada 1999). The intent is to develop FEQGs as an adjunct to risk assessment or risk management of priority chemicals identified in the Chemicals Management Plan (CMP) or other federal initiatives.

[Read More](#)

Government of Canada, 27-05-24

<https://www.canada.ca/en/environment-climate-change/services/evaluating-existing-substances/federal-environmental-quality-guidelines-iron.html>

# Bulletin Board

## Regulatory Update

JUN. 14, 2024

### EUROPE

#### Four new UK driving laws now in force

2024-06-03

Motorists are being warned about four new driving laws that have now come into effect. The changes, which started from Saturday, June 1, could result in hefty fines for some drivers if ignored.

Local authorities currently conducting e-scooter trials can now request modifications to the trial area and fleet size. Any approved changes will take effect from yesterday (Saturday, June 1).

In other developments, Significant rule changes will be experienced in three Scottish cities where petrol and diesel drivers will be impacted by the introduction of Low Emission Zones (LEZ). These zones, which will operate continuously, will use Automatic Number Plate Recognition (ANPR) cameras linked to local and national vehicle licensing databases.

The Manchester Evening News reports vehicles that do not meet the required standards will be identified and fines issued. This regulation will be enforced 24 hours a day, every day of the year.

[Read More](#)

Bristol Live, 03-06-24

<https://uk.news.yahoo.com/four-uk-driving-laws-now-154241786.html>

#### Businesses urge Belgian Presidency to deliver on Nature Restoration Law

2024-05-29

In light of the current deadlock on the Nature Restoration Law, companies have mobilised once again to reiterate their support for the law and remind decision-makers about a strong business case for nature restoration in Europe as 3 million companies in the Euro area are highly dependent on at least one ecosystem service [1].

"We, the undersigned Belgian and European businesses and business associations, are calling for the Belgian Presidency of the Council to ensure an urgent adoption of the EU Nature Restoration Law, as agreed upon by the co-legislators in November 2023 and adopted by the European Parliament in February 2024," reads the letter.

# Bulletin Board

## Regulatory Update

JUN. 14, 2024

This is a follow-up initiative from the business statement signed last year by over 100 major companies, calling on Member States to adopt the long-awaited law. The letter piles up pressure on Member States and the Belgian Presidency to bring the law across the finish line, following another powerful letter from environment ministers, urging their counterparts to adopt the law, and poll results showing that 75% of citizens in countries opposing the law are in favour of it.

The Nature Restoration Law, adopted by the European Parliament in February this year, has been in a deadlock since Hungary, later followed by Slovakia, revoked their previous support for the law. Despite a new government in Poland and hopeful signs from Austria, the two countries' unwillingness to support the NRL has further added to the stalemate. For the law to pass, it is necessary that these two countries, Belgium or other Member States countries currently not supporting the law (Finland, Italy, the Netherlands, and Sweden) switch their position.

Read More

WWF, 29-05-24

<https://www.wwf.eu/?13937916/Businesses-urge-Belgian-Presidency-to-deliver-on-Nature-Restoration-Law>

### Indicators for sustainable management of chemicals

2024-05-29

Contributions to upcoming development work under the new Global Framework for Chemicals

At the end of September 2023, the World Conference on Chemicals (ICCM5) decided on the follow-up framework for SAICM by adopting the Global Framework on Chemicals (GFC). The GFC aims to ensure the sustainable use of chemicals worldwide throughout their entire life cycle, including the products and waste produced from them. In this study, indicators were developed using the concept of sustainable chemistry. To this end, established indicators were screened for their applicability and characterized on the basis of criteria. The criteria take into account, among other things, relevance, clarity, measurability and availability of data as well as important criteria of sustainable chemistry.

# Bulletin Board

## Regulatory Update

JUN. 14, 2024

Read More

UBA, 29-05-24

<https://www.umweltbundesamt.de/en/publikationen/indicators-for-sustainable-management-of-chemicals>

### Green transition: Council gives its final approval to the ecodesign regulation

2024-05-27

The Council has today adopted the ecodesign regulation, which sets requirements for sustainable products. The regulation replaces the existing ecodesign directive and enlarges its scope, beyond energy products, to all kind of goods placed in the EU market. This is the last step in the decision-making procedure.

Green requirements for sustainable products

The regulation affects all kinds of products, with only a few exceptions (i.e. cars or defence and security related products). The new regulation introduces new requirements such as product durability, reusability, upgradability and reparability, rules on the presence of substances that inhibit circularity; energy and resource efficiency; recycled content, remanufacturing and recycling; carbon and environmental footprints; and information requirements, including a Digital Product Passport. The Commission will be empowered to set ecodesign requirements by delegated acts and the industry will have 18 months to comply with them.

Ecodesign criteria will be applicable in public procurement to incentivise the public purchase of green products. The new regulation introduces a direct-ban on the destruction of unsold textiles and footwear (SMEs will be temporarily excluded) and empowers the Commission to introduce similar bans for other products in the future. The ecodesign regulation will be aligned to the digital services act, when it comes to products sold online.

#### Next steps

Following the Council's approval today, the legislative act has been adopted. After being signed by the President of the European Parliament and the President of the Council, the regulation will be published in the Official Journal of the European Union and will enter into force on the 20th day following that of its publication. It will apply from 24 months after the entry into force.

# Bulletin Board

## Regulatory Update

JUN. 14, 2024

### Background

The current Ecodesign Directive 2009/125/EC established energy efficiency requirements covering 31 product groups. According to the Commission's calculations, this has saved EUR 120 billion in energy expenditure and led to a 10% lower annual energy consumption by the products covered within its scope.

The new regulation was proposed by the Commission on 30th March 2022. The Council adopted its general approach on 23 May 2023, and reached a provisional agreement with the Parliament on 4 December 2023.

- Commission Proposal
- Council's general approach/negotiating mandate
- Circular economy (background information)

Read More

Council of the European Union, 27-05-24

<https://www.consilium.europa.eu/en/press/press-releases/2024/05/27/green-transition-council-gives-its-final-approval-to-the-ecodesign-regulation/>

### Industrial policy: Council gives final approval to the net-zero industry act

2024-05-27

The Council has today adopted a regulation on establishing a framework of measures for strengthening Europe's net-zero technology manufacturing ecosystem, better known as the 'net-zero industry act'.

This is the last step in the decision-making process.

The regulation aims to boost the industrial deployment of net-zero technologies that are needed to achieve the EU's climate goals, using the strength of the single market to reinforce Europe's position as a leader in industrial green technologies.

### Boosting green technologies

The net-zero industry act will create favourable conditions for investment in green technologies by:

- simplifying the permit-granting process for strategic projects

# Bulletin Board

## Regulatory Update

JUN. 14, 2024

- facilitating market access for strategic technology products (in particular in public procurement or the auctioning of renewable energies)
- enhancing the skills of the European workforce in these sectors (i.e. with net-zero industry academies and high-concentration industrial areas or 'valleys')
- creating a platform to coordinate EU action in this area

To foster innovation, the legal act proposes to create favourable regulatory frameworks for developing, testing and validating innovative technologies (known as 'regulatory sandboxes').

Progress towards the objectives of the net-zero industry act will be measured by two indicative benchmarks. Firstly, manufacturing capacity of net-zero technologies, such as solar photovoltaic panels, wind turbines, batteries and heat pumps, reaching 40% of the EU's deployment needs. Secondly, a specific target for an increased Union share for these technologies with a view to reaching 15 % of world production by 2040.

In addition, the net-zero industry act sets up an annual injection capacity of at least 50 million tonnes of CO<sub>2</sub> to be achieved by 2030 in geological storage sites located in the territory of the Union.

Read More

Council of the EU, 27-05-24

<https://www.consilium.europa.eu/en/press/press-releases/2024/05/27/industrial-policy-council-gives-final-approval-to-the-net-zero-industry-act/>

## INTERNATIONAL

### The End of Greenwashing Is Now Within Sight

2024-05-28

The Biden administration's new plan to overhaul the voluntary carbon market is an important step forward.

The problem of climate change cannot be solved without capitalism. Governments have tried for more than three decades with little to show for it. And while more of them are now engaging partners in the private sector, the world is still lagging in deploying the full power of the market. An announcement by the Biden administration this week can help to

# Bulletin Board

## Regulatory Update

JUN. 14, 2024

change that, by beginning a much-needed overhaul of the market for carbon credits.

Global investment in clean energy has accelerated but is far below what is required to restrain rising temperatures, and governments will not make up that difference on their own. Much of the capital will need to come from the private sector. And while businesses and investors are eager to provide it, in one crucial area — carbon credits — a market failure is keeping them on the sidelines.

Carbon credits, which are bought and sold in what's called the voluntary carbon market, offer companies and investors many ways to reduce greenhouse-gas emissions. In addition to helping finance new clean-energy installations, these credits can drive capital toward projects with high upfront costs but high potential rewards, such as scaling up new technologies like green hydrogen. They can also play an important role in funding reforestation and ecological preservation, as well as financing the early retirement of coal plants.

Read More

Bloomberg, 28-05-24

<https://www.bloomberg.com/opinion/articles/2024-05-28/michael-bloomberg-climate-change-needs-to-harness-power-of-markets>

## Menstruation is starting earlier and earlier – does chemical exposure play a role?

2024-05-31

Girls are starting to menstruate earlier and their cycles are taking longer to become regular than in previous decades, according to a recent peer-reviewed study. The trend disproportionately affects people who are non-Hispanic Black, Asian, or of other or multiple races, although the authors say the reason is not clear.

But one explanation may be racial disparities in chemical exposures, which have been linked to early onset menarche – a girl's first period.

The research was conducted by scientists from the Harvard T.H. Chan School of Public Health, the National Institute of Environmental Health Sciences and Apple.

# Bulletin Board

## REACH Update

JUN. 14, 2024

### New IUCLID format package and updated manual for C&L notifications

2024-05-29

We have published a new IUCLID format package for submitting classification and labelling (C&L) notifications through ECHA's system-to-system submission service.

The latest IUCLID update includes, for example, information on new hazard classes, following the amendment of the Classification, Labelling and Packaging Regulation.

Also the submission manual has been updated with new business and quality rules.

Read More

ECHA, 29-05-24

<https://echa.europa.eu/system-to-system-submission-service>

## Bulletin Board

## Janet's Corner

JUN. 14, 2024

## Theory vs Reality

2024-06-14

SCIENCE:

Theory vs. Reality



Toothpaste For Dinner.com

www.toothpastefordinner.com

## Bulletin Board

## Hazard Alert

JUN. 14, 2024

## Cadmium

2024-06-14

Cadmium (CAS no. 7440-43-9) is a chemical element with the symbol Cd and atomic number 48. It is found naturally in the earth's crust, where it commonly exists in combinations with other elements. For example, cadmium oxide (a mixture of cadmium and oxygen), cadmium chloride (a combination of cadmium and chlorine), and cadmium sulphide (a mixture of cadmium and sulphur) are commonly found in the environment. Cadmium is a lustrous, silver-white, ductile, very malleable metal. Its surface has a bluish tinge and the metal is soft enough to be cut with a knife, but it tarnishes in air. It is soluble in acids but not in alkalis. Cadmium doesn't have a distinct taste or smell. [1, 2]

## USES [2,3]

- Leather tanning agent/pigment in dye (until 1990's)
- Rechargeable Ni-Cd batteries
- Solar cells
- Solder alloys
- Paint and plastic production
- Engraving
- Cadmium vapour lamps
- Parasite treatment in farm animals
- Old television tubes
- Electroplate other metals

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

## Exposure Sources

- **Industry sources:** Cadmium is obtained as a by-product from the treatment of zinc, copper, lead, and iron ores, therefore facilities that treat these ores may emit cadmium compounds to the environment (mainly water). Coal and oil burning power plants may emit cadmium compounds to air.
- **Diffuse sources:** Small industrial domestic use of cadmium products will emit low levels of cadmium to the environment.
- **Natural sources:** Cadmium is a naturally occurring element in the crust of the earth. Coal and other fossil fuels contain cadmium and their combustion releases the element into the atmosphere. Cadmium

**Cadmium is a chemical element with the symbol Cd and atomic number 48. It is a lustrous, silver-white, ductile, very malleable metal. It is soluble in acids but not in alkalis and doesn't have a distinct taste or smell.**



# Bulletin Board

## Hazard Alert

JUN. 14, 2024

is found naturally in various ores: lead and copper containing zinc, some iron ores, and in sulfide ore. These can result in emissions to water. Volcanic emissions contain cadmium-enriched particles.

- **Transport sources:** The combustion of motor fuels (petrol) in cars, trucks, and planes result in emissions to air, and particles from tire wear may result in emissions to air, land and water.
- **Consumer products:** Cadmium is found in many domestic products, e.g. tobacco products, phosphate fertilisers, polyvinyl chloride (PVC) products, photocells, petrol, oils, tyres, automobile radiators, some textile dyes and colours, electronic components, heating elements in electric kettles and hot water systems, batteries, and ceramic glazes.

### Routes of Exposure

The main routes of exposure to cadmium are:

- Inhalation
- Ingestion
- Skin exposure
- Eye exposure

### HEALTH EFFECTS [4]

#### Acute Health Effects

The following acute (short-term) health effects may occur immediately or shortly after exposure to phenanthrene:

Acute exposure to cadmium fumes may cause flu like symptoms including chills, fever, and muscle ache sometimes referred to as “the cadmium blues.” Symptoms may resolve after a week if there is no respiratory damage. More severe exposures can cause tracheo-bronchitis, pneumonitis, and pulmonary oedema. Symptoms of inflammation may start hours after the exposure and include cough, dryness and irritation of the nose and throat, headache, dizziness, weakness, fever, chills, and chest pain. Inhaling cadmium-laden dust quickly leads to respiratory tract and kidney problems, which can be fatal (often from renal failure). Ingestion of any significant amount of cadmium causes immediate poisoning and damage to the liver and the kidneys. The bones become soft (osteomalacia), lose bone mineral density (osteoporosis) and become weaker. This causes the pain in the joints and the back, and also increases the risk of fractures. In extreme cases of cadmium poisoning, mere body weight causes a fracture. The kidneys lose their function to remove

# Bulletin Board

## Hazard Alert

JUN. 14, 2024

acids from the blood in proximal renal tubular dysfunction. The kidney damage inflicted by cadmium poisoning is irreversible. The proximal renal tubular dysfunction creates low phosphate levels in the blood (hypophosphatemia), causing muscle weakness and sometimes coma. The dysfunction also causes gout, a form of arthritis due to the accumulation of uric acid crystals in the joints because of high acidity of the blood (hyperuricemia). Another side effect is increased levels of chloride in the blood (hyperchloremia). The kidneys can also shrink up to 30%. Other patients lose their sense of smell (anosmia).

### Carcinogenicity

There is evidence that cadmium causes prostate and kidney cancer in humans, it has been shown to cause lung and testicle cancer in animals. [6]

The United States Department of Health and Human Services determined that cadmium and certain cadmium compounds are probable or suspected carcinogens.[2]

### SAFETY

#### First Aid Measures [5]

- **Eye exposure:** Direct contact may cause redness or pain. Wash eyes immediately with large amounts of water, lifting the upper and lower eyelids. Get medical attention immediately.
- **Skin exposure:** Direct contact may result in irritation. Remove contaminated clothing and shoes immediately. Wash affected area with soap or mild detergent and large amounts of water. Get medical attention immediately.
- **Ingestion:** Ingestion may result in vomiting, abdominal pain, nausea, diarrhoea, headache and sore throat. Medical personnel must administer treatment for symptoms. Under no circumstances should the employer allow any person whom he retains, employs, supervises or controls to engage in therapeutic chelation. Such treatment is likely to translocate cadmium from pulmonary or other tissue to renal tissue. Get medical attention immediately.
- **Inhalation:** If large amounts of cadmium are inhaled, the exposed person must be moved to fresh air at once. If breathing has stopped, perform cardiopulmonary resuscitation. Administer oxygen if available. Keep the affected person warm and at rest. Get medical attention immediately.

# Bulletin Board

## Hazard Alert

JUN. 14, 2024

- **Rescue:** Move the affected person from the hazardous exposure. If the exposed person has been overcome, attempt rescue only after notifying at least one other person of the emergency and putting into effect established emergency procedures. Do not become a casualty yourself. Understand your emergency rescue procedures and know the location of the emergency equipment before the need arises.

### Workplace Controls & Practices [4]

#### Engineering Controls

Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

### Personal Protective Equipment [5]

The following personal protective equipment is recommended when handling cadmium:

- Safety glasses;
- Lab coat;
- Dust respirator (be sure to use an approved/certified respirator or equivalent);
- Gloves

Personal Protection in Case of a Large Spill:

- Splash goggles;
- Full suit;
- Dust respirator;
- Boots;
- Gloves;

A self-contained breathing apparatus should be used to avoid inhalation of the product.

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

# Bulletin Board

## Hazard Alert

JUN. 14, 2024

### REGULATION

#### United States

Exposure Limit	Limit Values	HE Codes	Health Factors and Target Organs
<b>OSHA Permissible Exposure Limit (PEL) - General Industry*</b> See <a href="#">29 CFR 1910.1027</a>	5 µg/m <sup>3</sup> TWA 2.5 µg/m <sup>3</sup> Action Level	HE1	Increased risk of lung and prostate cancer
		HE3	Kidney damage
		HE11	Acute pulmonary oedema
		HE16	Mild irritation of the upper respiratory tract, a sensation of throat constriction, a metallic taste and/or cough
		HE17	Asphyxia
<b>OSHA PEL - Construction Industry</b> See <a href="#">29 CFR 1926.1127</a>	5 µg/m <sup>3</sup> TWA 2.5 µg/m <sup>3</sup> Action Level	HE1	Increased risk of lung and prostate cancer
		HE3	Kidney damage
		HE11	Acute pulmonary oedema
		HE16	Mild irritation of the upper respiratory tract, a sensation of throat constriction, a metallic taste and/or cough
		HE17	Asphyxia

## Bulletin Board

## Hazard Alert

JUN. 14, 2024

Exposure Limit	Limit Values	HE Codes	Health Factors and Target Organs
<b>OSHA PEL - Shipyard Employment</b> See 29 CFR 1915.1027	5 µg/m <sup>3</sup> TWA 2.5 µg/m <sup>3</sup> Action Level	HE1	Increased risk of lung and prostate cancer
		HE3	Kidney damage
		HE11	Acute pulmonary oedema
		HE16	Mild irritation of the upper respiratory tract, a sensation of throat constriction, a metallic taste and/or cough
<b>National Institute for Occupational Safety and Health (NIOSH) Recommended Exposure Limit (REL)</b> See Appendix A	Not established (lowest feasible concentration) Note: The REL applies to all cadmium compounds (as Cd) Ca	HE1	Prostate cancer
		HE3	Kidney dysfunction
		HE10	Pulmonary changes, including emphysema
		HE12	Anaemia
<b>American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value (TLV) (2001)</b>	0.01 mg/m <sup>3</sup> TWA (total particulate)	HE3	Preclinical kidney dysfunction
		HE4	Metal fume fever*
	0.002 mg/m <sup>3</sup> TWA (respirable particulate fraction)	HE1	Lung cancer
		HE4	Metal fume fever**
CAL/OSHA PEL	0.005 mg/m <sup>3</sup>		

**EPA:** The Environmental Protection Agency has determined that exposure to cadmium in drinking water at concentrations of 0.04 ppm for up to 10 days is not expected to cause any adverse effects in a child.

The Environmental Protection Agency has determined that lifetime exposure to 0.005 ppm cadmium is not expected to cause any adverse effects.

## Bulletin Board

## Hazard Alert

JUN. 14, 2024

**FDA:** The Food & Drug Administration has determined that the cadmium concentration in bottled drinking water should not exceed 0.005 ppm.

## REFERENCES

- <http://en.wikipedia.org/wiki/Cadmium>
- <http://www.epa.gov/osw/hazard/wastemin/minimize/factshts/cadmium.pdf>
- <http://www.lenntech.com/periodic/elements/cd.htm>
- [http://toxipedia.org/display/toxipedia/Cadmium+\(Cd\)](http://toxipedia.org/display/toxipedia/Cadmium+(Cd))
- <http://www.atsdr.cdc.gov/toxfaqs/tf.asp?id=47&tid=15>
- <http://www.npi.gov.au/substances/cadmium/source.html>
- [http://www.osha.gov/pls/oshaweb/owadisp.show\\_document?p\\_id=10036&p\\_table=STANDARDS](http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_id=10036&p_table=STANDARDS)
- [http://en.wikipedia.org/wiki/Cadmium\\_poisoning](http://en.wikipedia.org/wiki/Cadmium_poisoning)
- <http://www.sciencelab.com/msds.php?msdsId=9923223>
- [https://www.osha.gov/dts/chemicalsampling/data/CH\\_223897.html](https://www.osha.gov/dts/chemicalsampling/data/CH_223897.html)

## Bulletin Board

## Gossip

JUN. 14, 2024

PFAS Linked to an Increased Risk of Heart Diseases in Postmenopausal Women

2024-06-06

New research from the University of Illinois Urbana-Champaign has linked multiple types of per- and polyfluoroalkyl substances (PFAS, also known as “forever chemicals”) with increased risk of cardiovascular diseases in postmenopausal women. Specifically, the study reveals how PFAS chemicals interact with pro-inflammatory pathways in older women, providing potential explanations for the increased risk.

“Previous research suggests PFAS exposures may play a role in the development of cardiovascular disease during the menopause transition, but the biological mechanisms were not well understood,” said lead study author Alicia Arredondo Eve, a postdoctoral researcher in the Department of Food Science and Human Nutrition (FSHN) in the College of Agricultural, Consumer and Environmental Sciences (ACES) at Illinois. “We focused on specific PFAS chemicals as well as the cardiovascular diseases that are more common in older women.”

It’s difficult to escape PFAS. The man-made chemicals coat nonstick pans, waterproof clothing, food wrappers, receipts, and many more items we come in contact with daily, not to mention being present in much of our water supply. Some forms — and there are thousands of chemical variants — could persist in the environment for hundreds or thousands of years, hence their “forever chemicals” moniker.

Not surprisingly, studies suggest nearly all Americans carry PFAS in their blood and other bodily tissues. But premenopausal women are a little better off. Thanks to childbirth, breastfeeding, and their monthly menstrual cycle, premenopausal women expel more PFAS than men and postmenopausal women. After menstruation stops, PFAS accumulates and can cause problems.

Scientists are still piecing together exactly what PFAS chemicals do in the body, but they appear to disrupt hormone signaling, interfering with normal reproductive and cardiovascular function. Most PFAS studies have focused on men or women during their reproductive years, but Arredondo Eve and co-author Zeynep Madak-Erdogan say postmenopausal women experience unique cardiovascular issues.

Motivated to fill the knowledge gap, the researchers analyzed data and samples from 70 postmenopausal women in Turkey. About a third of the women had been diagnosed with coronary artery disease, the world’s

## Bulletin Board

## Gossip

JUN. 14, 2024

leading form of heart disease. Another third had coronary microvascular disease, which is common in postmenopausal women. The remaining third had no sign of heart disease.

All of the samples were tested for the presence and levels of two long-chain “legacy” PFAS (no longer manufactured in the U.S.) — PFOS and PFOA — and a newer short-chain PFAS chemical known as PFBS. Next, the researchers used complex machine-learning techniques to analyze the relationships between the PFAS and various blood metabolites and proteins.

“When you have multiple factors and you want to focus on one or two, machine learning techniques are very efficient in reducing that number,” said Madak-Erdogan, an associate professor in FSHN. “We found PFOS was closely associated with coronary artery disease, while PFOA was more predictive of coronary microvascular disease.”

Further, the two chemicals interacted with proteins and pathways associated with inflammation. Chronic inflammation, triggered by stress, poor diet, infections, or other causes, is a risk factor for both coronary artery and coronary microvascular disease. While interactions with inflammatory pathways weren’t a surprise given the diseases in question, an unexpected pattern emerged.

“The PFAS we studied affected the abundance of circulating pro-inflammatory factors differently. We did not expect that,” Arredondo Eve said. “PFOA and PFOS aren’t that different in terms of their chemical structure. Our results show you can’t lump all PFAS together.”

Higher levels of PFOA, which predicted coronary microvascular disease, were associated with higher levels of amino acids isoleucine and leucine and higher levels of pro-inflammatory cytokines. On the flipside, higher PFOS, related to coronary artery disease, was associated with lower isoleucine and leucine levels.

In addition to these opposing effects on metabolites, each PFAS was associated with a distinct set of pro-inflammatory proteins. The researchers say further preclinical research is needed to understand the mechanistic basis of these differences.

Ultimately, the study corroborates earlier research linking exposure to PFAS with cardiovascular disease in postmenopausal women, providing hints at how the chemicals interact with pro-inflammatory processes in the body. Unfortunately, the authors say there’s not much women can

# Bulletin Board

## Gossip

JUN. 14, 2024

do to get rid of PFAS after they get into the body. Instead, they caution women to avoid prolonged exposure by choosing PFAS-free clothing, cookware, and other materials.

“We need more education as to how we can reduce our exposure to PFAS,” Madak-Erdogan said. “There also needs to be more action to regulate and mitigate these chemicals getting into the environment.”

Technology Networks, 6 June 2024

<https://technologynetworks.com>

### Looking for a new battery platform? Focus on the essentials

2024-06-11

In facing life’s many challenges, we often opt for complex approaches to finding solutions. Yet, upon closer examination, the answers are often simpler than we expect, rooted in the core “essence” of the issue. This approach was demonstrated by a research team at Pohang University of Science and Technology (POSTECH) in their publication on addressing the inherent issues of solid-state batteries.

Led by Professor Byoungwoo Kang and Dr. Abin Kim (currently, working for LG Energy Solution) from the Department of Materials Science and Engineering at POSTECH, the team recently developed a solid electrolyte with unique properties. This innovation enables an ultra-thin lithium metal solid-state battery platform with high stability and energy density. Their findings were published in ACS Energy Letters.

Solid-state batteries, which use solid electrolytes instead of liquids to enhance energy density and safety, are considered the next generation of batteries and are often called “dream batteries.” Among these, the garnet-type oxide solid electrolyte ( $\text{Li}_7\text{La}_3\text{Zr}_2\text{O}_{12}$ , or LLZO) has high ionic conductivity. However, LLZO is highly reactive and forms a contamination layer ( $\text{Li}_2\text{CO}_3$ ) on its surface when exposed to air. This layer acts as a resistive barrier in cell construction, diminishing the contact and interfacial properties of the electrolyte and reactants, especially with the lithium (Li) metal anode.

Currently, various approaches are being explored to address these issues such as coating the LLZO surface or using additional chemical or heat treatment processes post-synthesis. While these methods improve the situation, they do not completely resolve the problem as the LLZO is

# Bulletin Board

## Gossip

JUN. 14, 2024

again exposed to the atmosphere, leading to the reformation of the contamination layer.

The research team focused on the “LLZO” itself rather than developing an effective coating or additional processes. By focusing on the essentials, they created an air-handleable LLZO (AH-LLZO) technology that simultaneously enhances the surface and internal properties of LLZO, preventing the formation of contaminant layers in the first place.

Experiments demonstrated that the developed garnet-type solid electrolyte inhibited contamination layer formation by creating a new hydrophobic compound (Li-Al-O) on both the surface and inside the material. As a result, even if a contamination layer forms, it barely reacts with moisture in the air, effectively preventing it from spreading internally. This advancement improved contact (and wettability) with lithium metal, allowing the team to develop ultra-thin ( $\sim 3.43 \mu\text{m}$ ) lithium solid-state batteries, approximately one-tenth the thickness of a human hair.

The significance of this research lies in the ability to prepare ultra-thin lithium metal layers, resulting in very low capacity ratio of the anode to cathode,  $\sim 0.176$  in solid-state batteries through a simple wetting process without complex post-processing steps. This innovation allows for a significant reduction in the amount of lithium metal used, thereby decreasing the overall battery weight and volume and dramatically improving energy density. Additionally, the technology enables storage in air without the need for special handling or facilities, simplifying the process and enhancing the practical usability of garnet-type solid electrolytes.

Professor Byoungwoo Kang remarked, “We have solved the problem of LLZO’s inherent contaminant layer without the need for a post-processing step.” He added, “We will continue to work on ultra-thin lithium metal solid-state batteries that can achieve high safety and high energy density.”

The research was conducted with support from the Basic Research Lab Program of the National Research Foundation of Korea and the Multilayer Ceramic Battery (MLCB) Development Project of the Ministry of Trade, Industry and Energy.

Science Daily, 11 June 2024

<https://sciencedaily.com>

# Bulletin Board

## Gossip

JUN. 14, 2024

### Vitamin B6: New compound could delay degradation

2024-06-13

A low vitamin B6 level has negative effects on brain performance. A research team from Würzburg University Medicine has now found a way to delay the degradation of the vitamin.

Vitamin B6 is important for brain metabolism. Accordingly, in various mental illnesses, a low vitamin B6 level is associated with impaired memory and learning abilities, with a depressive mood, and even with genuine depression. In older people, too little vitamin B6 is linked to memory loss and dementia.

Although some of these observations were made decades ago, the exact role of vitamin B6 in mental illness is still largely unclear. What is clear, however, is that an increased intake of vitamin B6 alone, for example in the form of dietary supplements, is insufficient to prevent or treat disorders of brain function.

A research team from Würzburg University Medicine has now discovered another way to increase vitamin B6 levels in cells more effectively: namely by specifically inhibiting its intracellular degradation. Antje Gohla, Professor of Biochemical Pharmacology at the Department of Pharmacology and Toxicology at Julius-Maximilians-Universität Würzburg (JMU), is responsible for this.

Other participants come from the Rudolf Virchow Center for Integrative and Translational Bioimaging at JMU, the Leibniz-Forschungsinstitut für Molekulare Pharmakologie-FMP Berlin and the Institute for Clinical Neurobiology at Würzburg University Hospital. The team has now published the results of their investigations in the journal eLife.

#### Enzyme blockade improves learning ability

“We were already able to show in earlier studies that genetically switching off the vitamin B6-degrading enzyme pyridoxal phosphatase in mice improves the animals’ spatial learning and memory capacity,” explains Gohla. In order to investigate whether such effects can also be achieved by pharmacological agents, the scientists have now looked for substances that bind and inhibit pyridoxal phosphatase.

“In our experiments, we identified a natural substance that can inhibit pyridoxal phosphatase and thus slow down the degradation of vitamin B6,” explains the pharmacologist. The working group was actually able to increase vitamin B6 levels in nerve cells that are involved in

# Bulletin Board

## Gossip

JUN. 14, 2024

learning and memory processes. The name of this natural substance: 7,8-Dihydroxyflavone.

#### New approach for drug therapy

7,8-Dihydroxyflavone has already been described in numerous other scientific papers as a molecule that can improve learning and memory processes in disease models for mental disorders. The new knowledge of its effect as an inhibitor of pyridoxal phosphatase now opens up new explanations for the effectiveness of this substance. This could improve the mechanistic understanding of mental disorders and represent a new drug approach for the treatment of brain disorders, the scientists write in their study.

The team also considers it a great success that 7,8-Dihydroxyflavone has been identified as an inhibitor of pyridoxal phosphatase for the first time—after all, this class of enzymes is considered to be particularly challenging for drug development.

#### A long way to a drug

When will people benefit from this discovery? “It’s too early to say,” explains Marian Brenner, a first author of the study. However, there is much to suggest that it could be beneficial to use vitamin B6 in combination with inhibitors of pyridoxal phosphatase for various mental disorders and neurodegenerative diseases.

In a next step, Gohla and her team now want to develop improved substances that inhibit this enzyme precisely and highly effectively. Such inhibitors could then be used to specifically test whether increasing cellular vitamin B6 levels is helpful in mental or neurodegenerative diseases.

Phys Org, 13 June 2024

<https://phys.org>

### Fast-charging sodium-ion battery uses anodes made from trees

2024-06-09

A month after Natron Energy began its first-of-kind sodium-ion battery mass production, Swedish sodium-ion developer Altris has identified a means of making the lithium-free batteries even more sustainable.

# Bulletin Board

## Gossip

JUN. 14, 2024

Together with partner Stora Enso, it's adapting tree pulp-sourced carbon toward use as an anode material.

A byproduct of wood pulp manufacturing, lignin has long been investigated for possible use as a more sustainable electrode material. Finnish renewable materials company Stora Enso made headlines in 2022 when it partnered up with Swedish battery manufacturer Northvolt toward using its proprietary Lignode material in lithium-ion battery anodes. Stora Enso describes Lignode as a hard carbon material refined from lignin.

By teaming with Altris, Stora Enso looks to go even more sustainable while further localizing the European battery supply chain. As we looked at when Natron Energy kicked off production a few weeks ago, sodium-ion batteries eliminate the need for rare minerals like lithium, cobalt and nickel, relying on abundant sodium that can be sourced locally without harmful mining.

By swapping the graphite typically used in anode construction with natural byproduct-sourced Lignode, Altris and Stora Enso can further cut reliance on Chinese imports, the source of more than 90 percent of the European Union's graphite, working to secure a local EU supply chain. Stora Enso also says Lignode anodes come with the promise of faster charging and discharging rates.

Stora Enso calls itself one of the largest privately owned forests in the world, owning and leasing over 5 million acres (2 million hectares) of land. It's been processing wood pulp at its mill in Kotka, Finland for over 80 years and extracting lignin on an industrial scale since 2015. It began pilot production of Lignode in 2021 and is now working to expand to commercial scale.

The company points out that 20 to 30 percent of a tree is composed of lignin, making it abundantly available and readily replaceable with sustainable forest management practices, going so far as to say the Lignode-inclusive Altris sodium-ion cells have the potential to become the world's most sustainable battery.

"Bio-based materials are key to improving the sustainability of battery cells," Stora Enso senior VP Juuso Konttinen said in the joint announcement this week. "With Lignode having the potential to become the most sustainable anode material in the world, this partnership with Altris aligns perfectly with our common commitment to support the ambition of more sustainable electrification."

# Bulletin Board

## Gossip

JUN. 14, 2024

Over on the other side of the battery cell, Altris makes its cathode out of Prussian white, made from abundant, inexpensive, non-conflict materials like iron, nitrogen, sodium and carbon. Like Natron's Prussian blue, it is free from rare, problematic minerals like lithium and cobalt.

Does a "world's most sustainable" sodium battery with wood pulp-derived anode sound too good to be true? Well, for now it is. Beyond the fact that the ink has barely dried on the collaboration announcement, Altris has yet to begin commercial production and still refers to itself as a sodium-ion battery developer and prototype manufacturer.

Last year, Altris showed a commercial-sized cell with an energy density of 160-Wh/kg, on par with the lithium-iron-phosphate (LFP) batteries used in today's electric vehicles. The cell was developed as part of a research collaboration with Northvolt. Altris CEO Björn Mårlid said at the time the company would target 200-Wh/kg moving forward.

New Atlas, 9 June 2024

<https://newatlas.com>

## How Do Milk Proteins Interact With Caffeine in Your Espresso?

2024-06-06

The swirl of milk and espresso — a small storm in your mug — doesn't impact the dynamics of the milk proteins, according to research published in ACS Food Science & Technology. Researchers took a molecular view of how milk proteins and caffeine molecules interact in water and in a coffee drink. The results suggest that the structures of milk proteins remain intact, meaning they retain their original mouthfeel and taste in your morning brew.

Pouring milk into coffee causes the proteins to interact (e.g., combine or repel) with compounds extracted from the roasted, ground coffee beans, and that could change the proteins' mouthfeel and the way they are digested. Milk proteins could also potentially affect the absorption, or bioavailability, of caffeine by the human body. To shed light on these mysteries, Tobias Weidner and Fani Madzharova used 2D infrared spectroscopy to investigate milk proteins' molecular structures and dynamics when in a coffee beverage. They assessed increasingly complex mixtures of a store-bought whole fat (3.5%) milk, water solutions with milk and caffeine, and then a handmade cappuccino.

# Bulletin Board

## Gossip

JUN. 14, 2024

They found that the folding of milk proteins was unaltered by the presence of caffeine in these beverages, even in the cappuccino, which contained components extracted from the coffee grounds, such as chlorogenic acid. Additionally, while previous studies have reported that caffeine slows the molecular movement of water, this study didn't show substantial effects from caffeine on the mobility or dynamics of milk proteins. These experimental results provide a useful molecular picture about some components that affect the texture, flavor and nutritional properties of coffee beverages with milk ingredients, which the researchers say could be applied toward engineering future drinks.

Technology Networks, 6 June 2024

<https://technologynetworks.com>

### Nanosized blocks spontaneously assemble in water to create tiny floating checkerboards

2024-06-13

Researchers have engineered nanosized cubes that spontaneously form a two-dimensional checkerboard pattern when dropped on the surface of water. The work, published in Nature Communications, presents a simple approach to create complex nanostructures through a technique called self-assembly.

"It's a cool way to get materials to build themselves," said study co-senior author Andrea Tao, a professor in the Aiiso Yufeng Li Family Department of Chemical and Nano Engineering at the University of California San Diego. "You don't have to go into a nanofabrication lab and do all these complex and precise manipulations."

Each nanocube is composed of a silver crystal with a mixture of hydrophobic (oily) and hydrophilic (water-loving) molecules attached to the surface. When a suspension of these nanocubes is introduced to a water surface, they arrange themselves such that they touch at their corner edges. This arrangement creates an alternating pattern of solid cubes and empty spaces, resulting in a checkerboard pattern.

The self-assembly process is driven by the surface chemistry of the nanocubes. A high density of hydrophobic molecules on the surface brings the cubes together to minimize their interaction with water. Meanwhile, the long chains of hydrophilic molecules cause enough repulsion to create voids between the cubes, creating the checkerboard pattern.

# Bulletin Board

## Gossip

JUN. 14, 2024

To fabricate the structure, researchers applied drops of the nanocube suspension onto a petri dish containing water. The resulting checkerboard can be easily transferred to a substrate by dipping the substrate into the water and slowly withdrawing it, allowing the nanostructure to coat it.

This study stems from a collaborative effort between multiple research groups that are part of the UC San Diego Materials Research Science and Engineering Center (MRSEC). The work featured a synergistic combination of computational and experimental techniques. "We've built a continuous feedback loop between our computations and experiments," said Tao. "We used computer simulations to help us design the materials at the nanoscale and predict how they will behave. We also used our experimental results in the lab to validate the simulations, fine tune them and build a better model."

In designing the material, researchers chose silver crystal nanocubes due to the Tao lab's expertise in their synthesis. Determining the optimal surface chemistry required extensive computational experimentation, which was led by Gaurav Arya, a professor in the Department of Mechanical Engineering and Materials Science at Duke University and co-senior author of the study. The simulations identified the best molecules to attach to the nanocubes and predicted how the cubes would interact and assemble on the water surface. The simulations were iteratively refined using experimental data obtained by Tao's lab. Electron microscopy performed by the lab of study co-author Alex Frañó, a professor in the Department of Physics at UC San Diego, confirmed the formation of the desired checkerboard structures.

Tao envisions applications for the nanocube checkerboard in optical sensing. "Such a nanostructure can manipulate light in interesting ways," she explained. "The spaces between the cubes, particularly near the corner edges where the cubes connect, can act as tiny hotspots that focus or trap light. That could be useful for making new types of optical elements like nanoscale filters or waveguides."

The researchers plan to explore the optical properties of the checkerboard in future studies.

This work was supported by the National Science Foundation, UC San Diego Materials Research Science and Engineering Center (DMR-2011924). The work was performed in part at the San Diego Nanotechnology Infrastructure (SDNI) at UC San Diego, a member of the National



## Bulletin Board

## Gossip

JUN. 14, 2024

Nanotechnology Coordinated Infrastructure, which is supported by the National Science Foundation (grant ECCS-2025752).

Science Daily, 13 June 2024

<https://sciencedaily.com>

### Sweaty cattle may boost food security in a warming world

2024-06-13

Sweaty cows may not sound like the most exciting company, but in a warming world, researchers can't get enough of them. When cattle are too hot, they tend to stop eating, said Raluca Mateescu, University of Florida Institute of Food and Agricultural Sciences (UF/IFAS) professor in the department of animal science. This affects the cattle's health and growth and threatens the longevity of the food supply coming from that herd.

Climate change is making it more difficult to raise cattle—growth and reproduction are affected by heat—so it's critical to breed cattle better adapted to a hotter and longer summer. Cows eliminate about 85% of their body heat via sweat, she said.

Heat stress in subtropical regions, which are the areas just north and south of the tropics and generally considered the hottest in the world, is such a significant limiting factor that about \$369 million of beef production is lost annually due to reduced performance nationally, she said.

"Heat stress is the main threat of food security. Under heat stress, the growth, production and reproduction of cattle are affected," Mateescu said.

A new study from Mateescu and her colleagues published in the Journal of Animal Science and Biotechnology shows it's possible to identify the genes within breeds of cattle that would lead to the sweatiest, heat-tolerant offspring.

She said the study found there is a lot of variation between cows of the same breed, in this case, Brangus—which are a cross between Brahman and Angus. Being able to select cattle to breed based on sweating ability could lead to herds that can tolerate hotter climates and still grow and reproduce.

## Bulletin Board

## Gossip

JUN. 14, 2024

"Unless we're doing something to affect the ability of our cattle to thrive in heat stress conditions, they are not going to reproduce, so there's a food security concern there," she said.

The study looked at 2,401 Brangus cattle from two commercial ranches in Florida. Skin biopsies helped the researchers determine the phenotypes that contributed to the animals' ability to manage heat stress, such as sweat-gland area, depth and length. Scientists genotyped all animals and used software to estimate genetic parameters.

The study found that a moderate amount of variation in sweating ability is genetic, so farmers could select sweatier cattle based on genetic markers. It found that genetics from both the Brahman and Angus genes positively contribute to sweating ability in Brangus cattle.

Phys Org, 13 June 2024

<https://phys.org>

### Pan-cancer approval shows huge potential for antibody–drug conjugates

2024-05-21

Enhertu (trastuzumab deruxtecan), has become the first antibody–drug conjugate (ADC) to receive US approval for treating cancer based on the molecular profile of the tumour rather than its location of origin. The approval is based on positive results from clinical trials of the drug against a range of cancers expressing human epidermal growth factor receptor 2 (HER2).

'This is a globally important finding because there are many cancers where there is HER2 expression,' says Funda Meric-Bernstam, an oncologist at the University of Texas, US, who coordinated one of the trials that supported pan-tumour approval by the US Food and Drug Administration (FDA).

The drug combines an antibody (trastuzumab – marketed as a cancer therapy on its own as Herceptin) for homing in on the target, with a cell-killing payload of deruxtecan, a topoisomerase 1 inhibitor that interfere with DNA replication during cell division. It was jointly developed by Daiichi Sankyo and AstraZeneca.

Enhertu had already been approved for breast cancer, metastatic lung cancer and stomach cancer. Its recent pan-tumour approval was based on three specially-designed clinical trials where it shrank a variety of tumours in many people with advanced HER2-positive cancers.

## Bulletin Board

## Gossip

JUN. 14, 2024

There are a small number of other antibody and small-molecule therapies that have some degree of location-agnostic approval based on molecular or gene profiling. More pan-tumour ADC approvals could follow on from Enhertu. 'This has great implications for the field because many other antibody-drug conjugates were being developed based on disease types, but maybe we can look more broadly,' says Meric-Bernstam.

**Broad approval**

One standout finding with Enhertu was that it was active not only in tumours with high HER2 expression, but also in breast cancer with lower HER2 expression. 'HER2 is an especially compelling target because it is expressed across many tumour types,' says Meric-Bernstam.

The Destiny-PanTumor02 trial was designed to indicate whether the drug could work in cancers that would be too rare to run individual clinical trials for, but that can be tested for HER2. There were positive results in gynaecological cancers, even with lower expression of HER2. And while the results pancreatic and biliary cancer were less dramatic, there were still clear benefits, says Meric-Bernstam. 'Over half the patients had responses, meaning 30% or greater decrease in their tumour burden, and these responses last for a long time,' she adds.

'We can have confidence that if a patient has a disease with HER2 expression, there is a likelihood that trastuzumab deruxtecan will have anti-tumour efficacy,' says Meric-Bernstam, adding that the results make it worthwhile routinely testing patients with advanced metastatic cancer for HER2 expression.

Of the 15 ADCs so far approved to treat cancer, ten gained approval since 2019. Another dozen or so are in late-stage clinical trials. 'There's been a lot of excitement over the past five years with these ADCs that have shown very impressive activity as compared with chemotherapy,' says Aditya Bardia, an oncologist at the University of California, Los Angeles in the US.

Since the first ADCs were developed, there have been major advances in antibody design, target selection, linkers and cell-killing payloads. 'A problem with the first generation of antibody-drug conjugates was that the linker was not stable and resulted in significant off-tumour toxicity,' Bardia explains.

Linkers are crucial for safety and potency. Once the antibody has bound to its target on the cell surface, the whole drug must get inside a cell to release the cytotoxic compounds. If the linker is unstable, the payload

## Bulletin Board

## Gossip

JUN. 14, 2024

can fall off and affect healthy cells. 'Newer ADCs have a more stable linker, which has reduced toxicities,' says Bardia.

**Loading up**

There have been arguably surprising trends in the types of drugs placed on ADCs. Newer, highly potent agents that bind DNA (such as pyrrolobenzodiazepine) proved mostly too toxic in trials, with only Zynlonta (loncastuximab tesirine) for B-cell lymphoma approved. This had a drug-antibody ratio (DAR) of just two – meaning on average there are two payload molecules attached to each antibody.

If a warhead is extremely potent, then a lower DAR is suitable. To reach an effective dose of a less-toxic payload, a higher DAR is required. But that can mean more payload molecules may fall off, which can kill healthy cells and cause side effects. 'Conventional thinking five to 10 years ago favoured highly toxic payloads, but Enhertu goes the other way,' says Andy Hsieh, market analyst with William Blair.

Higher DARs required advances in linker technology. For example, making linkers more hydrophobic helped overcome problems of hydrophobicity of the payload molecules. This allows the DARs of between seven and eight achieved with less potent topoisomerase 1 inhibitor payloads in in Enhertu and Gilead's Trodelvy (sacituzumab govitecan).

'The DAR of eight allows you to target what were inaccessible tumour cells,' says Hsieh. This is because more cancer-killing molecules are around to spill out of target cancer cells and kill nearby bystander cells. This is useful because tumours are often complex and heterogeneous, with not all cells expressing the same genetic profile.

Trodelvy and Enhertu are believed to also kill cells that lack the target receptor for their antibodies by diffusion of the payload. For example, when Enhertu gets inside a cancer cell, deruxtecan is released and kills the cell. However, because deruxtecan is membrane permeable, it can then enter nearby cells that do not express HER2 and terminate them. However, there is also the possibility of damaging healthy cells around the site of the tumour.

Overall, this has delivered benefits to patients. Trodelvy – which targets tumour-associated calcium signal transducer 2 – was approved for metastatic breast cancer and bladder cancer in the US in 2020 and in the EU in 2021. 'It showed doubling of overall survival, something we had not seen in triple-negative breast cancer [tumours that don't express receptors

## Bulletin Board

## Gossip

JUN. 14, 2024

for either oestrogen, progesterone or HER2],’ says Bardia, who led the clinical trials of Trodelvy.

He says ADCs have ‘changed the therapeutic landscape for breast cancer.’ His group’s focus now is to move the drug to early breast cancer to prevent the return of triple-negative breast cancer.

**Commercial clamour**

For now, commercial interests in ADCs are focused on cancer. ‘Most pharma companies want exposure to ADCs as part of their strategy, but some companies really have ADCs as an anchoring strategy,’ says Hsieh. Earlier this year, it was reported that Daiichi Sankyo raised its sales forecast for the 12 months ending in March to \$2.6 billion (£2 billion) for Enhertu. This success is drawing renewed attention on the commercial potential of ADCs for cancer.

AstraZeneca’s partnership with Daiichi Sankyo for its linker-payload technology, which produced Enhertu, positions them as leaders in the field. Meanwhile, Pfizer agreed to pay \$43 billion in 2023 for Seattle-based ADC pioneer Seagen. And earlier this year Johnson & Johnson completed its \$2 billion acquisition of Ambrx.

In February, AbbVie completed a \$10 billion takeover of ImmunoGen, giving it the only ADC approved for ovarian cancer, Elahere (mirvetuximab soravtansine). Genmab agreed to buy ProfoundBio for \$1.8 billion to boost its ADCs for solid tumours in April.

‘There’s a lot of excitement related to ADCs. Every few months, we read about big pharma buying a smaller company for its ADC portfolio,’ says Bardia.

Also active in this space are GSK, Roche, Takeda Pharmaceuticals and Bristol Myers Squibb, which signed a \$1 billion licensing agreement with Tubulis to develop ADCs. ‘For big pharma, decisions are always revenue driven and ADCs are becoming de-risked,’ says Hsieh.

**Linker letdown**

Despite progress, there are still many opportunities to improve linker chemistry. ‘The majority of ADCs are attached to an antibody via a maleimide cysteine linkage,’ says David Spring, an organic chemist at the University of Cambridge, UK.

‘It’s very good for chemical biology and short-term studies,’ he says, ‘but these are unstable linkages, and the drug can be falling off within a matter

## Bulletin Board

## Gossip

JUN. 14, 2024

of days, leading to systemic toxicity.’ This is because it is unstable in blood plasma, at pH 7.3, leading to a retro-Michael addition, a reverse of the reaction that formed the linkage.

His group has reported on arylsulfate-containing ADC linkers that are stable in plasma, but can be cleaved by sulfatase enzymes in the lysosome once inside the cell. The team has also developed a strategy for loading odd-integer DARs (which are harder to produce than even numbers) using disulfide re-bridging. Spring says not enough chemists have been involved in improving linker technology.

This all leaves plenty of room to improve an already commercially successful strategy for treating cancer. And there are moves to attach not just cell-killing molecules to the antibodies of ADCs. For example, Genentech has developed an experimental ADC to eliminate reservoirs of *Staphylococcus aureus* bacteria inside cells. More recently, Spring and colleagues in Cambridge have been looking into antibodies that target tuberculosis. ‘Other strategies are being considered such as adding immune modulators or novel payload to antibodies,’ says Meric-Bernstam.

Chemistry World, 21 May 2024

<https://chemistryworld.com>

**Life’s vital chemistry may have begun in hot, cracked rock**

2024-04-03

Chemical reactions key to the origin of life on Earth could have occurred as molecules moved along thermal gradients within networks of thin rock fractures deep underground.

Such networks, which would have been common on the early Earth, could have provided a kind of natural laboratory in which many of life’s building blocks were concentrated and separated from other organic molecules.

‘It’s very difficult to get a more general environment where you could have these purifications and intermediate steps,’ says Christof Mast at the Ludwig Maximilian University of Munich in Germany.

He and his colleagues created a heat flow chamber about the size of a playing card to model how a mix of organic molecules might behave in such rock fractures.

## Bulletin Board

## Gossip

JUN. 14, 2024

They heated one side of the 170-micrometre-thick chamber to 25°C (77°F) and the other to 40°C (104°F), creating a temperature gradient along which molecules would move in a process called thermophoresis. How sensitive a molecule is to this process depends on its size and electrical charge and how it interacts with the fluid in which it is dissolved.

In an 18-hour experiment in the heat flow chamber, they found a variety of molecules were concentrated at different parts of the chamber according to their sensitivity to thermophoresis. Among these molecules were many amino acids and the A, T, G and C nucleobases, which are a key component of DNA. This effect was magnified further when they created a network of three interconnected chambers, again with one side of the chamber network at 25°C and the other side at 40°C. The additional chambers further enriched compounds concentrated by the first.

In a mathematical simulation with 20 interconnected chambers, which might better resemble the complexity of a natural system of fractures, they found the enrichment of different molecules could be amplified yet again. In one chamber, the amino acid glycine reached concentrations around 3000 times higher than that of a different amino acid, isoleucine, despite them entering the network at the same concentration.

The researchers also demonstrated that this process of enrichment could enable a reaction to occur that would otherwise be extremely challenging. They showed that glycine molecules were able to bond to each other as the concentration of a molecule that catalyses the reaction called trimetaphosphate (TMP) increased. TMP is a noteworthy molecule to enrich as it would have been rare on the early Earth, says Mast. "Since [the chambers] are all randomly connected you could implement all sorts of reaction conditions."

"It's extremely interesting to have regions in a crack with different ratios of compounds," says Evan Spruijt at Radboud University in the Netherlands, who was not involved with the research. "You can create more diversity out of very simple building blocks with this added enrichment."

However, he says enrichment in rock fractures is still far from a viable scenario for an origin of life. "In the end, they still need to come together to form anything that resembles a cell or a protocell."

New Scientist, 3 April 2024

<https://newscientist.com>

## Bulletin Board

## Gossip

JUN. 14, 2024

### Engineered plants produce human milk sugars that could lead to healthier baby formula

2024-06-13

Worldwide, a majority of babies—approximately 75%—drink infant formula in their first six months of life, either as a sole source of nutrition or as a supplement to breastfeeding. But while formula provides essential food for growing babies, it currently does not replicate the full nutritional profile of breast milk.

That's in part because human breast milk contains a unique blend of approximately 200 prebiotic sugar molecules that help prevent disease and support the growth of healthy gut bacteria. However, most of these sugars remain difficult—if not impossible—to manufacture.

New research led by scientists at the University of California, Berkeley, and the University of California, Davis, shows how genetically engineered plants may help close this gap.

In a new study published today in the journal *Nature Food*, the study team reprogrammed plants' sugar-making machinery to produce a diverse array of these human milk sugars, also called human milk oligosaccharides. The findings could lead to healthier and more affordable formula for babies, or more nutritious non-dairy plant milk for adults.

"Plants are these phenomenal organisms that take sunlight and carbon dioxide from our atmosphere and use them to make sugars. And they don't just make one sugar—they make a whole diversity of simple and complex sugars," said study senior author Patrick Shih, an assistant professor of plant and microbial biology and an investigator at UC Berkeley's Innovative Genomics Institute. "We thought, since plants already have this underlying sugar metabolism, why don't we try rerouting it to make human milk oligosaccharides?"

All complex sugars—including human milk oligosaccharides—are made from building blocks of simple sugars, called monosaccharides, which can be linked together to form a vast array of chains and branched chains. What makes human milk oligosaccharides unique are the specific set of linkages, or rules, for connecting simple sugars together that are found in these molecules.

To convince plants to make human milk oligosaccharides, study first author Collin Barnum engineered the genes responsible for the enzymes that make these specific linkages. Working with Daniela Barile, David Mills

## Bulletin Board

## Gossip

JUN. 14, 2024

and Carlito Lebrilla at UC Davis, he then introduced the genes into the *Nicotiana benthamiana* plant, a close relative of tobacco.

The genetically modified plants produced 11 known human milk oligosaccharides, along with a variety of other complex sugars with similar linkage patterns.

“We made all three major groups of human milk oligosaccharides,” Shih said. “To my knowledge, no one has ever demonstrated that you could make all three of these groups simultaneously in a single organism.”

Barnum then worked to create a stable line of *N. benthamiana* plants that were optimized to produce a single human milk oligosaccharide called LNFP1.

“LNFP1 is a five-monosaccharide-long human milk oligosaccharide that is supposed to be really beneficial, but so far cannot be made at scale using traditional methods of microbial fermentation,” said Barnum, who completed the work as a graduate student at UC Davis. “We thought that if we could start making these larger, more complex human milk oligosaccharides, we could solve a problem that that industry currently can’t solve.”

Currently, a small handful of human milk oligosaccharides can be manufactured using engineered *E. coli* bacteria. However, isolating the beneficial molecules from other toxic byproducts is a costly process, and only a limited number of baby formulas include these sugars in their mixtures.

As part of the study, Shih and Barnum worked with collaborator Minliang Yang at North Carolina State University to estimate the cost of producing human milk oligosaccharides from plants at an industrial scale and found that it would likely be cheaper than using microbial platforms.

“Imagine being able to make all the human milk oligosaccharides in a single plant. Then you could just grind up that plant, extract all the oligosaccharides simultaneously and add that directly into infant formula,” Shih said. “There would be a lot of challenges in implementation and commercialization, but this is the big goal that we’re trying to move toward.”

Additional authors include Bruna Paviani, Garret Couture, Chad Masarweh, Ye Chen, Yu-Ping Huang, David A. Mills, Carlito B. Lebrilla and Daniela Barile

## Bulletin Board

## Gossip

JUN. 14, 2024

of UC Davis; Kasey Markel of UC Berkeley; and Minliang Yang of North Carolina State University.

website, date

<https://website>

# Bulletin Board

## Curiosities

JUN. 14, 2024

### Erectile Dysfunction Drug May Improve Brain Blood Flow and Help Prevent Dementia

2024-06-10

This new study, published in *Circulation Research*, marks a potentially pivotal step in the fight against this debilitating condition.

Dr. Alastair Webb, as Associate Professor at the Wolfson Centre for Prevention of Stroke and Dementia at Oxford University said: 'This is the first trial to show that sildenafil gets into the blood vessels in the brain in people with this condition, improving blood flow and how responsive these blood vessels are. These two key factors are associated with chronic damage to the small blood vessels in the brain, which is the commonest cause of vascular dementia. This demonstrates the potential of this well-tolerated, widely-available drug to prevent dementia, which needs testing in larger trials.'

The significance of this research lies in its potential to transform the treatment and prevention of vascular dementia, which currently lacks specific therapies. Chronic damage to the small blood vessels in the brain is not only the leading cause of vascular dementia but also contributes to 30% of strokes and 80% of brain bleeds. High blood pressure, reduced blood flow to the brain, and impaired blood vessel function exacerbate these conditions, making the findings of this trial particularly crucial.

The OxHARP trial was a meticulously designed double-blind, placebo-controlled study involving 75 participants who had experienced a minor stroke and showed signs of mild to moderate small vessel disease. Each participant received sildenafil, a placebo, and cilostazol (a similar drug) over three-week periods in a randomised order. The study employed cardiovascular physiology tests, ultrasound, and functional MRI scans to evaluate the drugs' effects.

Key findings include:

- Sildenafil increased blood flow in both large and small brain vessels as measured by ultrasound and MRI scans.
- Sildenafil enhanced the blood flow response to carbon dioxide, indicating improved cerebrovascular function.
- Both sildenafil and cilostazol lowered blood vessel resistance in the brain.
- Sildenafil caused fewer side effects compared to cilostazol, particularly with less incidence of diarrhoea.

# Bulletin Board

## Curiosities

JUN. 14, 2024

- Looking ahead, the next steps involve larger-scale trials to confirm these findings and explore sildenafil's potential in preventing vascular dementia on a broader scale.

This research was generously funded by the Wellcome Trust and supported by the National Institute for Health and Care Research, with special thanks to all the partners and participants involved.

Professor Peter Rothwell, Founding Director of the Wolfson Centre for Prevention of Stroke and Dementia said: 'Professor Webb's findings are very encouraging and highlight the potential for preventing vascular dementia using existing drugs that target the underlying reduction in flow in the small blood vessels in the brain.'

Technology Networks, 10 June 2024

<https://technologynetworks.com>

### A 'liquid battery' advance—strategies for electrocatalytic hydrogenation

2024-06-12

As California transitions rapidly to renewable fuels, it needs new technologies that can store power for the electric grid. Solar power drops at night and declines in winter. Wind power ebbs and flows. As a result, the state depends heavily on natural gas to smooth out highs and lows of renewable power.

"The electric grid uses energy at the same rate that you generate it, and if you're not using it at that time, and you can't store it, you must throw it away," said Robert Waymouth, the Robert Eckles Swain Professor in Chemistry in the School of Humanities and Sciences.

Waymouth is leading a Stanford team to explore an emerging technology for renewable energy storage: liquid organic hydrogen carriers (LOHCs). Hydrogen is already used as fuel or a means for generating electricity, but containing and transporting it is tricky.

"We are developing a new strategy for selectively converting and long-term storing of electrical energy in liquid fuels," said Waymouth, senior author of a study detailing this work in the *Journal of the American Chemical Society*. "We also discovered a novel, selective catalytic system for storing electrical energy in a liquid fuel without generating gaseous hydrogen."

## Bulletin Board

## Curiosities

JUN. 14, 2024

**Liquid batteries**

Batteries used to store electricity for the grid—plus smartphone and electric vehicle batteries—use lithium-ion technologies. Due to the scale of energy storage, researchers continue to search for systems that can supplement those technologies.

Among the candidates are LOHCs, which can store and release hydrogen using catalysts and elevated temperatures. Someday, LOHCs could widely function as “liquid batteries,” storing energy and efficiently returning it as usable fuel or electricity when needed.

The Waymouth team studies isopropanol and acetone as ingredients in hydrogen energy storage and release systems. Isopropanol—or rubbing alcohol—is a high-density liquid form of hydrogen that could be stored or transported through existing infrastructure until it’s time to use it as a fuel in a fuel cell or to release the hydrogen for use without emitting carbon dioxide.

Yet methods to produce isopropanol with electricity are inefficient. Two protons from water and two electrons can be converted into hydrogen gas, then a catalyst can produce isopropanol from this hydrogen.

“But you don’t want hydrogen gas in this process,” said Waymouth. “Its energy density per unit volume is low. We need a way to make isopropanol directly from protons and electrons without producing hydrogen gas.”

Daniel Marron, lead author of this study who recently completed his Stanford Ph.D. in chemistry, identified how to address this issue. He developed a catalyst system to combine two protons and two electrons with acetone to generate the LOHC isopropanol selectively, without generating hydrogen gas. He did this using iridium as the catalyst.

A key surprise was that cobaltocene was the magic additive. Cobaltocene, a chemical compound of cobalt, a non-precious metal, has long been used as a simple reducing agent and is relatively inexpensive. The researchers found that cobaltocene is unusually efficient when used as a co-catalyst in this reaction, directly delivering protons and electrons to the iridium catalyst rather than liberating hydrogen gas, as was previously expected.

**A fundamental future**

Cobalt is already a common material in batteries and in high demand, so the Stanford team is hoping their new understanding of cobaltocene’s properties could help scientists develop other catalysts for this process.

## Bulletin Board

## Curiosities

JUN. 14, 2024

For example, the researchers are exploring more abundant, non-precious earth metal catalysts, such as iron, to make future LOHC systems more affordable and scalable.

“This is basic fundamental science, but we think we have a new strategy for more selectively storing electrical energy in liquid fuels,” said Waymouth.

As this work evolves, the hope is that LOHC systems could improve energy storage for industry and energy sectors or for individual solar or wind farms.

And for all the complicated and challenging work behind the scenes, the process, as summarized by Waymouth, is actually quite elegant, “When you have excess energy, and there’s no demand for it on the grid, you store it as isopropanol. When you need the energy, you can return it as electricity.”

Additional Stanford co-authors are Conor Galvin, Ph.D. ’23, and Ph.D. student Julia Dressel. Waymouth is also a member of Stanford Bio-X and the Stanford Cancer Institute, a faculty fellow of Sarafan ChEM-H, and an affiliate of the Stanford Woods Institute for the Environment.

Phys Org, 12 June 2024

<https://phys.org>

**World-first tooth-regrowing drug will be given to humans in September**

2024-05-28

The world’s first human trial of a drug that can regenerate teeth will begin in a few months, less than a year on from news of its success in animals. This paves the way for the medicine to be commercially available as early as 2030.

The trial, which will take place at Kyoto University Hospital from September to August 2025, will treat 30 males aged 30-64 who are missing at least one molar. The intravenous treatment will be tested for its efficacy on human dentition, after it successfully grew new teeth in ferret and mouse models with no significant side effects.

“We want to do something to help those who are suffering from tooth loss or absence,” said lead researcher Katsu Takahashi, head of dentistry and oral surgery at Kitano Hospital. “While there has been no treatment to date

# Bulletin Board

## Curiosities

JUN. 14, 2024

providing a permanent cure, we feel that people's expectations for tooth growth are high."

Following this 11-month first stage, the researchers will then trial the drug on patients aged 2-7 who are missing at least four teeth due to congenital tooth deficiency, which is estimated to affect 1% of people. The team is recruiting for this Phase IIa trial now.

Researchers are then looking at expanding the trial to those with partial edentulism, or people missing one to five permanent teeth due to environmental factors. The incidence of this varies from country to country, but it's estimated around 5% of Americans are missing teeth, with a much higher incidence among older adults.

The medicine itself deactivates the uterine sensitization-associated gene-1 (USAG-1) protein, which suppresses tooth growth. As we reported in 2023, blocking USAG-1's interaction with other proteins encourages bone morphogenetic protein (BMP) signaling, which triggers new bone to generate.

It resulted in new teeth emerging in the mouths of mice and ferrets, species that share close to the same USAG-1 properties as humans.

"The USAG-1 protein has a high amino acid homology of 97% between different animal species, including humans, mice, and beagles," the researchers noted. However, there's no word on a beagle trial just yet...

Molecular biologist and dentist Takahashi has been working on tooth regeneration since 2005, and hopes this treatment won't just be for congenital dental conditions but for anyone who has lost teeth, at any age.

If successful, this therapy could be available to patients with any permanently missing teeth within six years.

New Atlas, 28 May 2024

<https://newatlas.com>

### Dark Chocolate May Pose Slight Heavy Metal Risk to Children

2024-06-05

Most dark chocolate bars don't pose a heavy metal health risk to adults or children, according to a new study.

# Bulletin Board

## Curiosities

JUN. 14, 2024

A minority of bars (4 out of 155) tested by researchers, however, did contain levels of cadmium unsafe for children to consume in excess (more than 2 bars per week).

The findings appear to stand in contrast to the well-publicized results of a 2023 Consumer Report, which concluded that a third of chocolate products tested contained harmful levels of lead and cadmium.

The results of the new study were published in Food Research International.

### Heavy handed

Cocoa crops can absorb heavy metals, particularly cadmium, from surrounding soil. The harvested cocoa beans can then become contaminated with lead during handling and processing.

To help determine the level of heavy metals in chocolate in the US, Tulane University researchers first went out to stores and bought 155 chocolate bars, 101 of which were dark chocolate, all made from cocoa sourced from 5 major regions: Asia Pacific, West Africa, East Africa, South America and Central America.

Samples from bars were tested for 16 heavy metals, ranging from the toxic (lead and cadmium) to the essential (copper, iron, zinc).

To gauge the safety of eating the bars, the researchers modeled the risk of eating 1 ounce (28 grams) of the chocolates per day, which is equivalent to consuming more than 2 whole chocolate bars a week.

For every respective heavy metal, the average level found in the 155 bars was within acceptable, safe-to-consume limits for adults.

Only 1 brand of Colombian dark chocolate exceeded the international limit for cadmium in bars (800 micrograms per kilogram) set by the European Commission Regulation. Four dark chocolate bars contained cadmium levels that could pose a risk to children weighing 33 pounds (15 kilograms) or less, the average weight of a 3-year-old in the US.

"For adults there is no adverse health risk from eating dark chocolate, and although there is a slight risk for children in 4 of the 155 chocolate bars sampled," said lead author Dr. Tewodros Godebo, assistant professor of environmental health sciences at Tulane University School of Public Health and Tropical Medicine.



# Bulletin Board

## Curiosities

JUN. 14, 2024

Godebo tempered the concerning finding, however, saying that a child would need to consume at least two bars of dark chocolate a week to be at significant risk.

“It is not common to see a three-year-old regularly consume more than two bars of chocolate per week,” she added. “What we’ve found is that it’s quite safe to consume dark chocolate and milk chocolates.”

Cacao originating from West African countries tended to contain lower cadmium and lead levels than those sourced from Central and South America.

Two chocolate bars contained lead levels above California’s interim standards for dark chocolates, but neither bar was determined by the researchers to pose adverse risks to children or adults.

All essential heavy metals (magnesium, calcium, etc.) were more present in the dark chocolate bars than the milk chocolate ones. Several of the bars provided more than 50% of the daily requirement for children and adults – a health benefit of dark chocolates that shouldn’t be overshadowed by the study’s few unsavory findings, said Godebo.

“Not only is it [dark chocolate] packed with these essential minerals, but they can potentially reduce the absorption of toxic metals in the intestine since these metals compete for the same site,” Godebo said.

Technology Networks, 5 June 2024

<https://technologynetworks.com>

### Water droplets accelerate formation of mineral nanoparticles essential for life

2024-06-19

Water microdroplets may play a role in the formation of soil. Experiments have revealed that microdroplets in electrosprayed aerosols can cause the disintegration of minerals into the nanoparticles found in soils, some of which are essential for life.

Nanomaterials have been found to confer a number of beneficial properties to soil. Nanoclays can improve soil permeability, stability and plasticity, while nano-metal oxides and other materials can help by fertilising soils and enhancing the bioavailability of soil nutrients such as phosphorus. Previous work has suggested that nanomaterials are naturally present in soil due to weathering and mineral formation processes in the

# Bulletin Board

## Curiosities

JUN. 14, 2024

soil itself. This latest report suggests that aerosol microdroplets, which are naturally prevalent in the atmosphere, may play an important role in expediting these natural weathering processes.

Interest in microdroplet chemistry and its impact on a number of fields – though still controversial – has been attracting increasing interest over the past 10 years. ‘Aerosols are everywhere,’ says corresponding author Thalappil Pradeep at the Indian Institute of Technology Madras, India. ‘[I thought] there must be a connection between [aerosols and soil].’

As well as Pradeep’s own work a lot of the current interest in microdroplets was prompted by the work of Purdue University’s Graham Cooks, Stanford’s Richard Zare, Hong Gil Nam at South Korea’s Institute of Basic Science and their collaborators. They reported spontaneous reduction of gold ions and the formation of hydrogen peroxide evolution in water microdroplets in the late 2010s. Since then there have been reports of numerous intriguing chemical phenomena that take place in water droplets, suggesting explanations for various mysteries from the presence of hydrogen deposits where people dig for oil to the reactions that first initiated life itself.

### Size matters

According to Zare, the unique chemistry found in water microdroplets is primarily brought about by two effects. One is the partial solvation of the hydrogen and hydroxide ions that all water at neutral pH contains. The other is the high electric field at the interface of the droplet and whatever medium it is in – in this case air. Crucially, these effects do not become significant unless the droplets are very small – micro-sized. ‘Normal water is, we consider, generally benign, a great solvent,’ he explains. ‘Water microdroplets – I’m telling you are highly reactive.’

In the new work, Pradeep and his collaborators ground up quartz into particles 5–10µm in size and suspended them in water. They then electrosprayed the suspension through a capillary and then measured the deposit collected. Characterising the deposited minerals using transmission electron microscopy, x-ray diffraction and Raman spectroscopy revealed particles of quartz with an average diameter of 16nm. The results were similar using both ruby and fused alumina.

Pradeep emphasises the importance of multimodal characterisation for this kind of study, particularly as the phenomena that occur in microdroplets are controversial. ‘You may do some transmission electron microscopy, but that is not enough,’ he tells Chemistry World.

# Bulletin Board

## Curiosities

JUN. 14, 2024

Pradeep and his collaborators also used density functional theory to calculate the cleavage and stacking fault energies. They also suggest that the presence of protons and an electric field plays a role in enhancing the fragmentation of the minerals into nanoparticles, which their mass spectrometry measurements corroborate.

In the experiment the microdroplets are generated by an electrospray but droplets of this size occur wherever water condenses. 'This is the same thing, which goes on to cause all types of weathering and other types of chemical reactions,' says Zare. 'Am I surprised? No, no. No, no, not at all.'

Pradeep would now like to investigate how the fragmentation takes place in real time but in the longer term he has his sights on the potential benefits for agriculture. 'I want to convert sand into soil,' he says. This will require a better understanding of both experiment and theory but the key challenge, as he sees it, is scale. 'It is not milligrams right, it is now mega tonnes,' he says. 'Extreme scale-up is required.'

Chemistry World, 10 June 2024

<https://chemistryworld.com>

### Are plant-based burgers really bad for your heart? Here's what's behind the scary headlines

2024-06-13

We're hearing a lot about ultra-processed foods and the health effects of eating too many. And we know plant-based foods are popular for health or other reasons.

So it's not surprising new research out this week including the health effects of ultra-processed, plant-based foods is going to attract global attention.

And the headlines can be scary if that research and the publicity surrounding it suggests eating these foods increases your risk of heart disease, stroke or dying early.

#### Here's how some media outlets interpreted the research. The Daily Mail ran with:

Vegan fake meats are linked to increase in heart deaths, study suggests: Experts say plant-based diets can boost health – but NOT if they are ultra-processed

# Bulletin Board

## Curiosities

JUN. 14, 2024

#### The New York Post's headline was:

Vegan fake meats linked to heart disease, early death: study

But when we look at the study itself, it seems the media coverage has focused on a tiny aspect of the research, and is misleading.

So does eating supermarket plant-based burgers and other plant-based, ultra-processed foods really put you at greater risk of heart disease, stroke and premature death?

Here's what prompted the research and what the study actually found.

#### Remind me, what are ultra-processed foods?

Ultra-processed foods undergo processing and reformulation with additives to enhance flavour, shelf-life and appeal. These include everything from packet macaroni cheese and pork sausages, to supermarket pastries and plant-based mince.

There is now strong and extensive evidence showing ultra-processed foods are linked with an increased risk of many physical and mental chronic health conditions.

Although researchers question which foods should be counted as ultra-processed, or if all of them are linked to poorer health, the consensus is that, generally, we should be eating less of them.

We also know plant-based diets are popular. These are linked with a reduced risk of chronic health conditions such as heart disease and stroke, cancer and diabetes. And supermarkets are stocking more plant-based, ultra-processed food options.

#### How about the new study?

The study looked for any health differences between eating plant-based, ultra-processed foods compared to eating non-plant based, ultra-processed foods. The researchers focused on the risk of cardiovascular disease (such as heart disease and stroke) and deaths from it.

Plant-based, ultra-processed foods in this study included mass-produced packaged bread, pastries, buns, cakes, biscuits, cereals and meat alternatives (fake meats). Ultra-processed foods that were not plant-based included milk-based drinks and desserts, sausages, nuggets and other reconstituted meat products.

# Bulletin Board

## Curiosities

JUN. 14, 2024

The researchers used data from the UK Biobank. This is a large biomedical database that contains de-identified genetic, lifestyle (diet and exercise) and health information and biological samples from half a million UK participants. This databank allows researchers to determine links between this data and a wide range of diseases, including heart disease and stroke.

They used data from nearly 127,000 people who provided details of their diet between 2009 and 2012. The researchers linked this to their hospital records and death records. On average, the researchers followed each participant's diet and health for nine years.

### What did the study find?

With every 10% increase of total energy from plant-sourced, ultra-processed foods there was an associated 5% increased risk of cardiovascular disease (such as heart disease or stroke) and a 12% higher risk of dying from cardiovascular disease.

But for every 10% increase in plant-sourced, non-ultra-processed foods consumed there was an associated 7% lower risk of cardiovascular disease and a 13% lower risk of dying from cardiovascular disease.

The researchers found no evidence for an association between all plant-sourced foods (whether or not they were ultra-processed) and either an increased or decreased risk of cardiovascular disease or dying from it.

This was an observational study, where people recalled their diet using questionnaires. When coupled with other data, this can only tell us if someone's diet is associated with a particular risk of a health outcome. So we cannot say that, in this case, the ultra-processed foods caused the heart disease and deaths from it.

### Why has media coverage focused on fake meats?

Much of the media coverage has focused on the apparent health risks associated with eating fake meats, such as sausages, burgers, nuggets and even steaks.

These are considered ultra-processed foods. They are made by deconstructing whole plant foods such as pea, soy, wheat protein, nuts and mushrooms, and extracting the protein. They are then reformulated with additives to make the products look, taste and feel like traditional red and white meats.

# Bulletin Board

## Curiosities

JUN. 14, 2024

However this was only one type of plant-based, ultra-processed food analysed in this study. This only accounted for an average 0.2% of the dietary energy intake of all the participants.

Compare this to bread, pastries, buns, cakes and biscuits, which are other types of plant-based, ultra-processed foods. These accounted for 20.7% of total energy intake in the study.

It's hard to say why the media focused on fake meat. But there is one clue in the media release issued to promote the research.

Although the media release did not mention the words "fake meat", an image of plant-based burgers, sausages and meat balls or rissoles featured prominently.

The introduction of the study itself also mentions plant-sourced, ultra-processed foods, such as sausages, nuggets and burgers.

So it's no wonder people can be confused.

### Does this mean fake meats are fine?

Not necessarily. This study analysed the total intake of plant-based, ultra-processed foods, which included fake meats, albeit a very small proportion of people's diets.

From this study alone we cannot tell if there would be a different outcome if someone ate large amounts of fake meats.

In fact, a recent review of fake meats found there was not enough evidence to determine their impact on health.

We also need more recent data to reflect current eating patterns of fake meats. This study used dietary data collected from 2009 to 2012, and fake meats have become more popular since.

### What if I really like fake meat?

We have known for a while that ultra-processed foods can harm our health. This study tells us that regardless if an ultra-processed food is plant-based or not, it may still be harmful.

We know fake meat can contain large amounts of saturated fats (from coconut or palm oil), salt and sugar.

# Bulletin Board

## Curiosities

JUN. 14, 2024

So like other ultra-processed foods, they should be eaten infrequently. The Australian Dietary Guidelines currently recommends people should only consume foods like this sometimes and in small amounts.

### Are some fake meats healthier than others?

Check the labels and nutrition information panels. Look for those lowest in fat and salt. Burgers and sausages that are a “pressed cake” of minced ingredients such as nuts, beans and vegetables will be preferable to reformulated products that look identical to meat.

You can also eat whole plant-based protein foods such as legumes. These include beans, lentils, chickpeas and soy beans. As well as being high in protein and fibre, they also provide essential nutrients such as iron and zinc. Using spices and mushrooms alongside these in your recipes can replicate some of the umami taste associated with meat.

The Conversation, 13 June 2024

<https://theconversation.com>

### First US state bans PFAS, other chemicals from period products

2024-06-12

Vermont has become the first state in the US to ban multiple chemicals from menstrual products such as tampons and sanitary pads. The chemicals banned include per- and polyfluoroalkyl substances (PFAS), phthalates, formaldehyde, 1,4-dioxane and mercury. The law is set to come into force in January 2026.

‘I support the action of state governments, such as Vermont, to begin the process of identifying uses of PFAS that are not essential,’ Jamie DeWitt, a toxicologist at Oregon State University who has studied the immunotoxicological effects of PFAS, tells Chemistry World. ‘While I do not know of any studies that have been conducted to look at how much of the PFAS reported to be in certain consumer items, such as menstrual products, can get into the bodies of people who use them, the use of PFAS in these products does contribute to human exposure.’

Sally Gaw, the director of environmental science at the University of Canterbury’s physical and chemical sciences school in New Zealand, welcomed the move to regulate hazardous chemicals in everyday consumer products. She says there is limited regulatory oversight of the hazardous chemicals used in the manufacture of everyday products,

# Bulletin Board

## Curiosities

JUN. 14, 2024

including menstrual products and clothing. ‘Regulating hazardous chemicals in everyday products will benefit the communities and ecosystems where the consumer products are made, the users of the products and the receiving environments when the products are disposed of,’ Gaw states.

Legislation recently introduced in California proposes a 10ppm maximum threshold for PFAS for all menstrual products by 2027. The bill, introduced in March, is currently under consideration. Beyond PFAS limits, it also mandates that the California Department of Toxic Substances Control collaborate with stakeholders to evaluate chemical alternatives to PFAS that are safer and make that information publicly available.

Similar legislation was rejected by California Governor Gavin Newsom last year due to concerns about a lack of regulatory oversight. ‘Previously enacted single-product chemical bans, which also lack oversight, are proving challenging to implement, with inconsistent interpretations and confusion among manufacturers about how to comply with the restrictions,’ he stated at the time.

### Phasing out PFAS elsewhere

Other US states are also taking steps to phase out PFAS in products and replace them with safer alternatives. Colorado, Maine and Minnesota have enacted their own legislation to phase out PFAS in menstrual products, according to a national alliance of environmental health organisations called Safer States.

Maine, Minnesota and Washington state legislatures have given state agencies the authority to ban PFAS in a wide range of products, and seven states – including those three as well as California, Colorado, Maryland and Oregon – are taking action to eliminate PFAS in cosmetics.

Washington state has just finalised regulatory actions to restrict PFAS in consumer products. The Washington state Department of Ecology has identified safer alternatives to PFAS in clothing and cleaning products, and it will be moving forward with regulations to ban PFAS in these two product categories.

The agency is also proposing that companies disclose and report the use of PFAS in other products, including personal protective equipment, floor and ski waxes, and shoes.

‘It is encouraging to see many states taking the lead in banning PFAS from a variety of products. We need to stop the use of all PFAS unless absolutely

# Bulletin Board

## Curiosities

JUN. 14, 2024

essential; states Linda Birnbaum, a toxicologist and microbiologist who formerly headed the US National Institute of Environmental Health Sciences and the National Toxicology Program.

The EU is currently considering a ban on all PFAS in consumer products except for essential use.

Chemistry World, 12 June 2024

<https://chemistryworld.com>

### Study reveals antiviral properties of solid wood surfaces

2024-06-12

Researchers from the University of Eastern Finland (UEF) and the University of Jyväskylä (JYU) have collaborated to publish research on the antiviral capabilities of solid wood surfaces.

The study, led by the research groups of Varpu Marjomäki at JYU and Antti Haapala at UEF, investigated the antiviral potential of different wood species against enveloped coronaviruses and non-enveloped enteroviruses. The work has been published in ACS Applied Materials & Interfaces.

The COVID-19 pandemic and recurrent viral outbreaks have underscored the urgent need for innovative strategies to reduce virus transmission.

While wood has been a fundamental material in human environments for centuries, its antiviral properties have not been extensively explored—until now. This research is the first to systematically evaluate the inherent antiviral efficacy of the sawn wood material from various tree species, including both coniferous and deciduous trees, under different environmental conditions.

#### Key findings

- Pine and Spruce: These coniferous species demonstrated excellent antiviral activity against enveloped coronaviruses, significantly reducing viral infectivity within just 10 to 15 minutes. However, their efficacy against non-enveloped enteroviruses was less pronounced.
- Oak: This hardwood species was notably effective against non-enveloped enteroviruses, showcasing its potential for broader antiviral applications.

# Bulletin Board

## Curiosities

JUN. 14, 2024

- Chemical Composition: Analysis at UEF revealed that the antiviral properties are primarily governed by the chemical composition of the wood, including the presence of resin acids, terpenes, and phenolic compounds. These chemicals vary significantly between species and are influenced by environmental factors such as temperature and humidity.
- Porosity and Absorption: While the porosity of wood and the absorption characteristics of viruses play a role, the study highlights that the chemical makeup of the wood is the key determinant in its antiviral functionality.
- The research also found that thermal treatments and the addition of plastics to wood, such as in wood-plastic composites, can compromise the antiviral properties of the material. This insight opens new avenues for utilizing untreated or minimally processed wood surfaces in public health applications.

#### Future directions

The research teams from UEF and JYU will continue their investigation into the most effective antiviral components of wood and their mechanisms of action as part of the ongoing European Doctorate Program DESTINY. This future research aims to identify specific bioactive compounds that can be harnessed to develop sustainable and effective antiviral materials and coatings.

“This study marks a significant step forward in understanding how natural materials can be leveraged to enhance public health,” said Varpu Marjomäki, lead virologist at JYU.

“Our findings suggest that wood, a sustainable and widely available material, could play a crucial role in reducing viral transmission in various settings,” added Antti Haapala, lead material engineer at UEF.

“The synergistic roles between the different chemicals present are a continuing theme of investigation,” states Professor Haapala from Department of Chemistry.

Phys Org, 12 June 2024

<https://phys.org>

# Bulletin Board

## Curiosities

JUN. 14, 2024

### Mobile monitoring for an airborne carcinogen in Louisiana's 'Cancer Alley'

2024-06-12

Louisiana's southeastern corridor is sometimes known colloquially as "Cancer Alley" for its high cancer incidence rates connected to industrial air pollution. Most of the region's air pollution-related health risks are attributed to ethylene oxide, a volatile compound used to make plastics and sterilize medical equipment. Researchers reporting in ACS' Environmental Science & Technology measured concerning levels of ethylene oxide in this area with mobile optical instruments, a technique they say could improve health risk assessments.

In 2016, the U.S. Environmental Protection Agency (EPA) classified ethylene oxide as carcinogenic to humans, particularly when it is inhaled. Despite significant concern over chronic ethylene oxide exposure for people living between Baton Rouge and New Orleans, there are no published reports of ambient concentrations of the carcinogen that aren't derived from industry self-reported emissions data. So, Peter DeCarlo and colleagues proposed measuring the levels of this gas using optical instruments that quickly measure airborne chemicals and provide results in real time.

They used a mobile monitoring system with equipment mounted on a small truck or van. These mobile laboratories drove a fixed route along a heavily industrialized portion of the corridor.

One small truck carried a tunable infrared laser direction absorption spectrometer, which measured ambient ethylene oxide in the surrounding air.

The van carried a cavity ringdown spectrometer to detect downwind of petrochemical sites contaminant plumes, i.e., mixtures of ethylene oxide and other chemicals, which indicate the type of facility that emitted them.

DeCarlo and the team completed 23 130-mile laps with their mobile monitoring vans from January to February 2023. All of the ethylene oxide measurements were higher than EPA estimates, which were gleaned from industry-reported emissions. Specifically, the researchers' ambient air measurements revealed that most of the region had ethylene oxide levels that correspond to risk levels above EPA's acceptable upper limit. A few locations had contaminant concentrations that represent potentially serious health risks for facility workers. And the team's second van, with the cavity ringdown spectrometer, identified chemical plumes up to 7 miles from their likely sources, which are beyond the 6-mile distance of

# Bulletin Board

## Curiosities

JUN. 14, 2024

"fenceline communities." EPA defines fenceline communities as those where people live close enough to highly polluting facilities that they could be directly affected by the emissions of operation.

The researchers hope that this demonstration of a mobile monitoring system helps increase accurate measurements of hazardous air pollution in an area densely populated with ethylene oxide emitters. Their work also highlights important issues related to current detection and reporting methods and associated health impacts on people living near potential pollution sources.

The authors acknowledge funding from Bloomberg Philanthropies and the National Institute of Environmental Health Sciences.

Some coauthors are employed at Aerodyne Research, Inc., which provided a mobile laboratory and field sampling equipment. Some coauthors are employed at Picarro, Inc. which manufactures one of the instruments used in the study.

Science Daily, 12 June 2024

<https://sciencedaily.com>

### Eggshell Waste Recovers Rare Earth Elements Needed for Green Energy

2024-06-07

A collaborative team found that humble eggshell waste could recover REEs from water, offering a new, environmentally friendly method for their extraction.

The researchers, from Trinity's School of Natural Sciences, and iCRAG, the Science Foundation Ireland research centre in applied geosciences, have just published their ground-breaking findings in the international journal ACS Omega.

REEs, which are essential for the technologies used in electric cars and wind turbines, for example, are in increasing demand but in relatively short supply. As a result, scientists must find new ways of extracting them from the environment – and in sustainable ways, with current methods often harmful.

Here, the researchers discovered that calcium carbonate (calcite) in eggshells can effectively absorb and separate these valuable REEs from water.

# Bulletin Board

## Curiosities

JUN. 14, 2024

The researchers placed eggshells in solutions containing REEs at various temperatures from a pleasant 25 °C to a scorching 205 °C, and for different time periods of up to three months. They found that the elements could enter the eggshells via diffusion along the calcite boundaries and the organic matrix, and, at higher temperatures, that the rare earth built new minerals on the eggshell surface.

At 90 °C, the eggshell surface helped recover formations of a rare earth compound called kozoite. As things got hotter, the eggshells underwent a complete transformation with the calcite shells dissolving and being replaced by polycrystalline kozoite.

And at the highest temperature of 205°C, this mineral gradually transitioned into bastnasite, the stable rare earth carbonate mineral that is used by industry to extract REEs for technology applications.

This innovative method suggests that waste eggshells could be repurposed as a low-cost, eco-friendly material to help meet the growing demand for REES, as the eggshells trap distinct rare earths within their structure over time.

Lead author Dr Remi Rateau commented on the significance of the research, stating, "This study presents a potential innovative use of waste material that not only offers a sustainable solution to the problem of rare earth element recovery but also aligns with the principles of circular economy and waste valorisation."

Principal Investigator, Prof. Juan Diego Rodriguez-Blanco, emphasised the broader implications of the findings, adding: "By transforming eggshell waste into a valuable resource for rare earth recovery, we address critical environmental concerns associated with traditional extraction methods and contribute to the development of greener technologies."

Technology Networks, 7 June 2024

<https://technologynetworks.com>

# Bulletin Board

## Technical Notes

JUN. 14, 2024

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

### CHEMICAL EFFECTS

[Macroinvertebrate communities respond strongly but non-specifically to a toxicity gradient derived by effect-based methods](#)

[Exploring BPA alternatives - Environmental levels and toxicity review](#)

[Effects of persistent organic pollutants on telomere dynamics are sex and age-specific in a wild long-lived bird](#)

### ENVIRONMENTAL RESEARCH

[From Port to Planet: Assessing NO2 Pollution and Climate Change Effects in Maritime Zones](#)

[Eco-health risks and main sources of persistent pollutants bound by bus stops dust in Qingyang city, an important energy base on the west side of the Ziwuling primitive Forest](#)

[High-throughput screening of 222 pesticides in road environments in a megacity of northern China: A new approach to urban population exposure](#)

### PHARMACEUTICAL/TOXICOLOGY

[Carbon and Metal Based Magnetic Porous Materials - Role in Drug Removal: A Comprehensive Review](#)

### OCCUPATIONAL

[Response of a simulated aquatic fungal community to nanoplastics exposure and functional consequence on leaf decomposition](#)

[Co-exposure to cadmium and triazophos induces variations at enzymatic and transcriptional levels in \*Opsariichthys bidens\*](#)

[Preservative contact allergy in occupational dermatitis: a machine learning analysis](#)