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South Korea consults on plans to tighten K-BPR labelling regulations

2022-05-12

Prohibitions to include wording implying a product has no toxicity

South Korea's Ministry of Environment is consulting on plans to tighten the rules for the use of wording in labelling and advertising of chemical products under the consumer chemical products and biocides safety Act (K-BPR).

The proposed regulations cover the wording and descriptions used on packaging and in advertising for all consumer chemical products as defined under the K-BPR.

They would prohibit wording that could:

- imply a product has no toxicity, such as 'non-toxic', 'zero-toxic' or 'pure';
- imply the product has no negative impact on the environment (such as 'natural', 'green', 'eco' or 'extracted from nature') except where extracted substances and their contents are marked in detail;
- imply the product is harmless so encourage excessive or incorrect use, such as 'no impact on body', 'no harmful substances', 'kind [to body/skin]', 'safe for children' or 'protect children'; and
- imply the product has no negative impact on humans or animals, such as 'well-being', 'considered healthy'.

Read More

Chemical Watch, 12-05-22

https://chemicalwatch.com/481884/south-korea-consults-on-plans-to-tighten-k-bpr-labelling-regulations

Hunan Province MPA released 1st reminders on matters related to the implementation of the "Administrative Measures on Cosmetics Labeling"

2022-05-19

On 17th May, 2022, Hunan Province MPA released 1st reminders on matters related to the implementation of the "Administrative Measures on Cosmetics Labeling".

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The reminders includes the following:

1. The Chinese name of the product (main changes: it is clear that there must be a guiding instruction)
2. The registrant, filing person, and domestic responsible person (main changes: changes in the guiding instruction)
3. Production enterprises (main changes: refinement of labeling requirements)
4. Standard number of product implementation (main changes: new items that must be marked)
5. Full ingredients (main changes: labeling form, descending order requirements have changed)
6. Net content
7. Period of use (main changes: refinement of labeling requirements)
8. Method of use (main changes: the new regulations clarify the content)
9. Necessary safety warning terms

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Chemycal, 19-05-22

https://chemycal.com/news/88b40eb8-8ac6-42f3-972e-ed80f0e5abf9/Hunan_Province_MPA_released_1st_reminders_on_matters_related_to_the_implementation_of_the_Administrative_Measures_on_Cosmetics_Labeling

Philippines notified a medical device-related regulation

2022-05-19

FDA Circular No.2021-002-B Amendment to FDA Circular No. 2021-002-A entitled "Addendum to FDA Circular No. 2021-002Re:

Full Implementation of Administrative Order No. 2018-0002 entitled "Guidelines Governing the Issuance of an Authorization for a Medical Device based on the ASEAN Harmonized Technical Requirements"" aims to extend the date wherein all the non-registrable Class B, C and D medical devices stated in Section III of this Circular may continue to be manufactured, imported, exported, distributed, transferred, sold or offered for sale without CMDN. Furthermore, this Circular also aims to amend the start period for requiring CMDN or at least with pending CMDN application for the aforementioned medical devices.

Read More

Chemycal, 19-05-22

https://chemycal.com/news/c849043e-c9b1-417f-8756-1610e0097fda/Philippines_notified_a_medical_device-related_regulation

AMERICA

Why can't smoggy SoCal improve air quality? Local regulators blame the federal government

2022-05-10

With smoggy Southern California poised to miss a critical clean air goal next year, local regulators are now threatening to sue the Environmental Protection Agency, saying the federal government has made their job "impossible."

The South Coast Air Quality Management District recently notified EPA Administrator Michael Regan that it intends to sue the agency for violating the Clean Air Act unless it agrees to adopt new regulatory strategies that would curtail pollution from federal sources, including ocean-faring cargo ships, trains, out-of-state trucks and airplanes.

The notice marks a tense new chapter in the district's 20-year struggle to meet a federal standard set in 1997. If Southern California fails to meet those standards in 2023 — which is all but certain — federal authorities may impose severe penalties, such as the withholding of certain transportation funds.

Although state and local regulators have made considerable progress in curbing smog-forming emissions since 1980, that progress has leveled off in recent years. As a result, Southern California has sought repeated deadline extensions from the EPA.

Read More

Los Angeles Times, 10-05-22

https://www.latimes.com/environment/story/2022-05-10/southland-air-regulators-threaten-to-sue-epa-over-smog

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As DEQ, EPA are slow to act on PFAS, private manufacturers look to fill the gap

2022-05-09

Emily Donovan has waged war against per- and polyfluoroalkyl substances (PFAS) since 2017 when the chemicals were first revealed to be fouling the waters of the Cape Fear River Basin, which provides drinking water to nearly 1 million North Carolinians.

Donovan and her family are among that number.

Brunswick County is where Donovan lives and serves as the co-founder of Clean Cape Fear, a watchdog organization. The county is located near the mouth of the river system, where the waters meet the sea, it's also an area that "has some of the highest levels of PFAS in tap water recorded per multiple nationwide tap water studies," Donavan wrote in an email.

In addition to contaminating the waters of the Cape Fear, PFAS incinerated and sent up smokestacks at the Chemours Fayetteville Works facility have rained down in the vicinity of the Bladen County plant. Spread by the winds, these emissions have fouled wells and small waterways for miles around.

Now in the past month, two possible solutions to this environmental crisis have the potential to provide some relief for the many homeowners who worry about what's coming out of their taps.

And while introduction of such products could provide some peace of mind for affected water customers, the entry of such market-based solutions to an environmental problem parallels the story of two other examples: bisphenol-A (BPA) plastics and the Leadership in Energy and Environmental Design (LEED) initiative, which was established to reduce the carbon footprint in building construction. Those are other instances in which government officials were slow to act, creating an opening for manufacturers and forcing individuals to pay out of pocket for a fix.

Read More

NC Health News, 9-5-22

https://www.northcarolinahealthnews.org/2022/05/09/as-deq-epa-are-slow-to-act-on-pfas-private-manufacturers-look-to-fill-the-gap/

Argentina extends water emergency in Paraná basin

2022-05-19

Argentina's government has extended a water shortage emergency for the second time.

Officials kept the measure – first declared in July 2021 and then extended 90 days in March – for a further 180 days.

Drought conditions, which have impacted hydroelectricity output, have eased but continue, a decree in the official gazette states.

The latest emergency declaration corresponds to territory within the footprint of the Paraná river basin.

Local authorities should consider, among other measures, those linked to temporary special electricity, drinking water and transport price schemes for the business sector, it adds. Dredging is also encompassed.

In April, Argentina generated 10,449GWh. Of this, thermal plants accounted for 5,993GWh (57.4%), hydroelectric plants 2,185GWh (20.9%), nuclear 658GWh (6.3%), and renewables 1,614GWh (15.4%), according to data from wholesale power market administrator Cammesa.

Hydroelectric output in April 2021 was 1,490GWh, helping ease consumption of costly diesel. While water flow rates remain below expected levels in some basins, chiefly Comahue, they improved in April, compared with previous months, in the Uruguay and Paraná basins, Cammesa said in a monthly report.

Argentina has 10.8GW of installed hydropower capacity, out of total capacity of 42.9GW.

Read More

Bnamericas, 19-05-22

https://www.bnamericas.com/en/news/argentina-extends-water-emergency-in-parana-basin

Over half of child car seats have toxic flame retardants and PFAS – US study

2022-05-05

More than half of children's car seats tested for toxic flame retardants and PFAS contain the dangerous substances, a new report in the US has found.

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The analysis, conducted by the Ecology Center, an environmental and consumer advocacy group, also found all car seats costing under $100 contained either PFAS or flame retardant, which means lower-income children are more likely to be exposed.

Meanwhile, there is "no evidence" the nation's flammability standards have prevented car seat deaths over the last 50 years, the Ecology Center wrote in its report.

"Many car seat companies are creating a hazardous exposure problem to follow a broken regulation," it added.

The study checked more than 600 components on 25 seats manufactured by popular brands in the US and EU, like Graco, Baby Trend and Evenflo.

Phosphorus- and bromine-containing flame retardants are linked to developmental disorders, cancer, endocrine disruption, diabetes and other serious issues. PFAS, or per-and polyfluoroalkyl substances, are a class of about 9,000 compounds often used to make products water-, stain- and grease-resistant. The chemicals are linked to cancer, thyroid disease, liver problems, decreased immunity, high cholesterol and more. They are known as "forever chemicals" due to their longevity in the environment.

Read More

The Guardian, 5-05-22

https://www.theguardian.com/environment/2022/may/05/us-child-car-seats-pfas-foxic-flame-retardants-study

Canada faces a chemical pollution crisis — and the time to act is now

2022-05-04

"The most alarming of all assaults upon the environment is the contamination of the air, earth, rivers, and seas with dangerous, and even lethal, materials. This pollution has rapidly become almost universal, and it is for the most part irrecoverable." — Rachel Carson, Silent Spring, 1962.

The world is increasingly aware of the impacts we face from climate chaos and the massive loss of biodiversity. Thanks to extensive media coverage, committed activists and scientific warnings, people everywhere are increasingly demanding governments take bold action to confront these crises. Chemical pollution, and the damage to our well-being and the future of this planet it poses, remains an existential risk.

But, 40 years ago, environmental journalist Rachel Carson warned of an equally perilous crisis; that of the harmful impacts of unregulated chemicals, pesticides and other dangerous substances created by industry. Her work Silent Spring first drew attention to this crisis and is credited with launching the modern environmental movement.

Today, this crisis remains as serious and as threatening as ever. Chemical pollution, and the damage to our well-being and the future of this planet it poses, remains an existential risk.

Read More

Canada National Observer, 4-05-22

https://www.nationalobserver.com/2022/05/04/opinion/canada-faces-chemical-pollution-crisis-and-time-act-now

EUROPE

Publication of GB mandatory classification and labelling (GB MCL) Agency Opinions

2022-05-20

A GB MCL Agency Opinion formally proposes the GB mandatory classification and labelling for chemicals substances, based on the scientific and technical assessment of the scientific data in line with the GB CLP Regulation, together with an assessment of the policy and socio-economic impacts on the UK.

It sets out whether there is adequate scientific evidence to support a new or revised GB MCL of a substance and what the potential impact of the proposed GB MCL may be.

The first batch of 23 GB MCL Agency Opinions are now available for download in the GB MCL publication table (.xlsx).

These GB MCL Agency Opinions relate to substances for which HSE (as the GB CLP Agency) published Agency Technical Reports under Article 37 of the GB CLP Regulation in June 2021.

At the time of publication, the classification and labelling proposed in these Agency Opinions has not been agreed and/or adopted in Great Britain.

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For information on the next steps in the process, please see our webpage on the GB MCL system.

We expect to publish our next batch of Agency Opinions in late May 2022. CLP e-Bulletin alerts will be issued when Agency Opinions are published on the HSE website.

If you have any questions or feedback on the GB MCL Agency Opinions, please contact us at: GBCLP.GBMCL@hse.gov.uk

Read More

HSE, 20-05-2022

https://www.hse.gov.uk/chemical-classification/gb-mcl-list.htm

Stricter limits on POPs do not necessarily mean more waste incineration, explains IPEN in its new factsheet

2022-04-21

A new factsheet published by the International Pollutants Elimination Network (IPEN) claims that the European Union has a unique opportunity to prevent toxic recycling. It could be achieved by strengthening the limits for persistent organic pollutants (POPs) in waste. What can the EU countries do about the waste that is already contaminated with POPs? The factsheet introduces alternatives to combustion technologies that are ready to be used and argues against incineration as the only solution for the liquidation of materials containing POPs.

According to the Stockholm Convention, POPs in waste that exceed the Low POPs Content Levels must be destroyed or irreversibly transformed. However, there are different ways of disposing of toxic waste. The authors of the factsheet claim that incineration of the waste that contains POPs goes directly against the spirit of the Convention as the result is the creation of a vicious circle of dioxin emissions into the air and mountains of toxic ash laced with more POPs.

Several countries are already moving towards alternative, non-combustion technologies that are able to destroy POPs in waste without dioxin emissions and without generating toxic ash residues. Some of these technologies have already proved to be less expensive.

Read More

Arnika, 21-04-22

https://arnika.org/en/news/stricter-limits-on-pops-do-not-necessarily-mean-more-waste-incineration-explains-ipen-in-its-new-factsheet

UK HSE anticipates up to 30 registrations for 'novel' substances in 2022/23 workplan

2022-05-19

Under its 2022/23 UK REACH workplan, the Health and Safety Executive (HSE) is expecting to receive registrations for 20–30 'novel' substances – those that have not been previously registered under UK or EU REACH – and 300–500 for existing ones.

UK REACH came into existence on 1 January 2021 after the UK left the EU on 31 January 2020.

The HSE's regulatory specialist, Dr Andrew Smith, presented the agency's workplan – which is expected to be officially published in the coming weeks – during a panel discussion on UK REACH at the ChemUK event on 11–12 May.

Attendees at the event again raised the ongoing issue around the potential cost of having to generate data to fulfil obligations under the new registration scheme.

Under the new regulation, companies must submit registration dossiers between October 2023 and October 2027, depending on the tonnage and the hazard profile of the substance. But companies can begin the registration process now, through the agency's Article 26 process (see box).

Read More

Chemical Watch, 19-05-22

https://chemicalwatch.com/485456/uk-hse-anticipates-up-to-30-registrations-for-novel-substances-in-202223-workplan

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France Asks Providers to Give Updated R-Nano Declaration Numbers to Customers upon Request

2022-05-18

The French Agency for Food, Environmental and Occupational Health and Safety (ANSES) has posted "important information" for the 2022 reporting period under R-Nano, France's national reporting scheme for substances in nanoparticle form. ANSES states that it is asking providers to give an updated declaration number to their customers upon request, "even if they have no declaration to perform." To do so, providers "must 'duplicate' the substance identity information entered in [fiscal year (FY)] 2021, without submitting it." According to ANSES, this will create a declaration number that allows the client to import the substance identity data and declare their professional activity with the substance acquired in 2020. The declaration in "draft" status will not be considered in the database for FY 2022. ANSES has extended the declaration period to May 31, 2022. For producers and importers that have difficulties in characterization with one of the methods listed in the declaration form, ANSES suggests they follow the procedure detailed in the document published in the help section.

Read More

Nano and Other Emerging Chemical Technologies Blog, 18-05-22

https://nanotech.lawbc.com/2022/05/france-asks-providers-to-give-updated-r-nano-declaration-numbers-to-customers-upon-request/

ECHA ad hoc targeted public consultation: call for comments

2022-05-10

Deadline: 17 May 2022

ECHA has announced a targeted consultation on the harmonised classification and labelling (CLH) of silver (EC 231-131-3; CAS 7440-22-4), a biocidal active substance.

This ad-hoc consultation seeks comments on additional data on human health hazard classes. The original ECHA public consultation on this substance ended on 18 December 2020.

View the detailed consultation on the ECHA website.

UK-based businesses with an interest in the proposal are strongly encouraged to share any relevant information.

Scientific and technical information should be submitted directly to ECHA using their commenting webform by 17 May 2022. Comments will be published on ECHA's website.

Read More

HSE, 10-05-22

hse.gov.uk

ECHA public consultation: call for comments

2022-05-10

Deadline: 24 June 2022

ECHA has announced a public consultation on the following proposals for harmonised classification and labelling (CLH):

- **2-phenylpropene** (EC: 202-705-0; CAS: 98-83-9). Chemical registered under REACH.
- **Chrysanthemum cinerariaefolium**, extract from open and mature flowers of Tanacetum cinerariifolium obtained with hydrocarbon solvents (EC: 289-699-3; CAS 89997-63-7). Biocide active substance.
- **Chrysanthemum cinerariaefolium**, extract from open and mature flowers of Tanacetum cinerariifolium obtained with supercritical carbon dioxide (EC: 289-699-3; CAS: 89997-63-7). Biocide active substance.

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View the detailed consultation on the ECHA website.

UK-based businesses with an interest in the proposal are strongly encouraged to share any relevant information.

Scientific and technical information should be submitted directly to ECHA using their commenting webform by 24 June 2022. Comments will be published on ECHA's website.

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HSE, 10-05-22

hse.gov.uk

Janet's Corner

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Citations Needed

2022-05-27

https://www.smbc-comics.com/comic/citations-needed

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Hazard Alert

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Oxalic Acid

2022-05-27

Oxalic acid (aka ethanedioic acid or oxalate) is an organic compound, with the chemical formula of C2H2O4. In its solid state, the acid forms white crystals, and when combined with water, creates a colourless solution. It is naturally occurring in many vegetables. The compound is classified as the simplest dicarboxylic acid. [1,2]

USES [1]

Oxalic acid is used in a range of chemical applications. Its primary use is as an ingredient in cleaning agents. Its corrosive nature means it is used in a range of bleaches, detergents, cleaning products, and as a rust remover. The acid is also used across the board as a sterilising agent, including in corporate and medical industries. Oxalic acid is used as a bleach in textile mills and factories and in mineral processing.

ROUTES OF EXPOSURE [1]

Oxalic acid is naturally occurring in a range of vegetables, including potatoes, leafy greens, broccoli, and sprouts. Leafy greens, such as spinach, are the most concentrated source of oxalates (in regards to vegetables). Vegetables that are high in the acid are not dangerous in small doses.

More dangerous routes of exposure are from the cleaning products where oxalic acid is included as an ingredient.

Oxalic acid (aka ethanedioic acid or oxalate) is an organic compound, with the chemical formula of C2H2O4.

HEALTH EFFECTS

Oxalic acid poisoning affects a range of systems, including the urinary and integumentary systems.

Acute Effects [1,3]

Severity of symptoms depend on the level and type of exposure.

Acute doses of oxalic acid can occur if large quantities of the acid are accidentally ingested—as a pure substance, or through vegetables that are highly concentrated. High levels of ingestion can cause death. Oxalic acid crystals can cause chemical burns, and acute exposure to the vapour can result in internal chemical burns.

Chronic Effects [1,3]

Chronic exposure to oxalic acid is toxic to multiple body systems. Long term exposure to the acid can corrode tissue throughout the body. This includes on the mucosa of the mouth, the oesophagus, and the stomach. It can also cause great thirst, bloody vomit, convulsions, coma, and death. Over time, oxalate crystals can break down in the body, forming kidney stones. This can cause various gastrointestinal complications and/or kidney failure. People who consume a lot of vitamin C are also in the higher risk category, as when the vitamin is broken down, it releases oxalic acid, which can, again, result in kidney stones.

SAFETY

First Aid Measures [4]

Ingestion: DO NOT INDUCE VOMITING. If spontaneous vomiting occurs, place the victim's head below their hips to prevent the acid moving into their lungs. Get immediate medical attention.

Skin contact: Remove all contaminated clothing, footwear and accessories. Do not re-wear clothing until it has been thoroughly decontaminated. Immediately rinse affected areas with plenty of water. If symptoms persist, contact a doctor immediately.

Eye contact: Flush eyes (including under the eyelids), with water for several minutes. Check for, and remove, any contact lenses (if easy to do so). Continue rinsing. If irritation persists, contact a medical professional.

Inhalation: Take victim to the nearest fresh air source and monitor their breathing. Keep the victim warm. If the victim is not breathing, and you are qualified, you may perform CPR with a one-way valve or protective mask. Immediately contact a medical professional.

General: Never administer anything by mouth to an unconscious, exposed person.

Exposure Controls/Personal Protection [4]

Engineering controls: Emergency eyewash fountains and quick-drench areas should be accessible in the immediate area of the potential

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exposure. Ensure there is adequate ventilation. Use a local exhaust ventilation or process enclosure, to limit the amount of acid in the air.

Personal protection: Safety glasses, protective and dustproof clothing, gloves, an apron and an appropriate mask or dusk respirator. Wear impervious shoes. Do not wear contact lenses. For specifications regarding other PPE, Follow the guidelines set in your jurisdiction.

REGULATION [4]

United States:

The Occupational Safety and Health Administration (OSHA) has set an 8-hour time weighted average (TWA) concentration limit for oxalic acid of 1mg/m3.

Australia [5]

Safe Work Australia has set an 8-hour time TWA for oxalic acid of 1mg/m3.

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2. https://en.wikipedia.org/wiki/Oxalic_acid
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4. https://www.statlab.com/pdfs/sds/Oxalic_Acid_2_Safety_Data_Sheet.pdf
5. https://diggersaustralia.com.au/wp-content/uploads/sds/Rust%20and%20Stain%20Cleaner%20%28Oxalic%20Acid%29%20v4.pdf

Ultrathin fuel cell uses the body's own sugar to generate electricity

2022-05-13

Glucose is the sugar we absorb from the foods we eat. It is the fuel that powers every cell in our bodies. Could glucose also power tomorrow's medical implants?

Engineers at MIT and the Technical University of Munich think so. They have designed a new kind of glucose fuel cell that converts glucose directly into electricity. The device is smaller than other proposed glucose fuel cells, measuring just 400 nanometers thick, or about 1/100 the diameter of a human hair. The sugary power source generates about 43 microwatts per square centimeter of electricity, achieving the highest power density of any glucose fuel cell to date under ambient conditions.

The new device is also resilient, able to withstand temperatures up to 600 degrees Celsius. If incorporated into a medical implant, the fuel cell could remain stable through the high-temperature sterilization process required for all implantable devices.

The heart of the new device is made from ceramic, a material that retains its electrochemical properties even at high temperatures and miniature scales. The researchers envision the new design could be made into ultrathin films or coatings and wrapped around implants to passively power electronics, using the body's abundant glucose supply.

"Glucose is everywhere in the body, and the idea is to harvest this readily available energy and use it to power implantable devices," says Philipp Simons, who developed the design as part of his Ph.D. thesis in MIT's Department of Materials Science and Engineering (DMSE). "In our work we show a new glucose fuel cell electrochemistry."

"Instead of using a battery, which can take up 90 percent of an implant's volume, you could make a device with a thin film, and you'd have a power source with no volumetric footprint," says Jennifer L. M. Rupp, Simons' thesis supervisor and a DMSE visiting professor, who is also an associate professor of solid-state electrolyte chemistry at Technical University Munich in Germany.

Simons and his colleagues detail their design in the journal Advanced Materials. Co-authors of the study include Rupp, Steven Schenk, Marco Gysel, and Lorenz Olbrich.

A 'hard' separation

"Instead of using a battery, which can take up 90 percent of an implant's volume, you could make a device with a thin film, and you'd have a power source with no volumetric footprint."

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The inspiration for the new fuel cell came in 2016, when Rupp, who specializes in ceramics and electrochemical devices, went to take a routine glucose test toward the end of her pregnancy.

"In the doctor's office, I was a very bored electrochemist, thinking what you could do with sugar and electrochemistry," Rupp recalls. "Then I realized, it would be good to have a glucose-powered solid state device. And Philipp and I met over coffee and wrote out on a napkin the first drawings."

The team is not the first to conceive of a glucose fuel cell, which was initially introduced in the 1960s and showed potential for converting glucose's chemical energy into electrical energy. But glucose fuel cells at the time were based on soft polymers and were quickly eclipsed by lithium-iodide batteries, which would become the standard power source for medical implants, most notably the cardiac pacemaker.

However, batteries have a limit to how small they can be made, as their design requires the physical capacity to store energy.

"Fuel cells directly convert energy rather than storing it in a device, so you don't need all that volume that's required to store energy in a battery," Rupp says.

In recent years, scientists have taken another look at glucose fuel cells as potentially smaller power sources, fueled directly by the body's abundant glucose.

A glucose fuel cell's basic design consists of three layers: a top anode, a middle electrolyte, and a bottom cathode. The anode reacts with glucose in bodily fluids, transforming the sugar into gluconic acid. This electrochemical conversion releases a pair of protons and a pair of electrons. The middle electrolyte acts to separate the protons from the electrons, conducting the protons through the fuel cell, where they combine with air to form molecules of water—a harmless byproduct that flows away with the body's fluid. Meanwhile, the isolated electrons flow to an external circuit, where they can be used to power an electronic device.

The team looked to improve on existing materials and designs by modifying the electrolyte layer, which is often made from polymers. But polymer properties, along with their ability to conduct protons, easily degrade at high temperatures, are difficult to retain when scaled down to the dimension of nanometers, and are hard to sterilize. The researchers

wondered if a ceramic—a heat-resistant material which can naturally conduct protons—could be made into an electrolyte for glucose fuel cells.

"When you think of ceramics for such a glucose fuel cell, they have the advantage of long-term stability, small scalability, and silicon chip integration," Rupp notes. "They're hard and robust."

Peak power

The researchers designed a glucose fuel cell with an electrolyte made from ceria, a ceramic material that possesses high ion conductivity, is mechanically robust, and as such, is widely used as an electrolyte in hydrogen fuel cells. It has also been shown to be biocompatible.

"Ceria is actively studied in the cancer research community," Simons notes. "It's also similar to zirconia, which is used in tooth implants, and is biocompatible and safe."

The team sandwiched the electrolyte with an anode and cathode made of platinum, a stable material that readily reacts with glucose. They fabricated 150 individual glucose fuel cells on a chip, each about 400 nanometers thin, and about 300 micrometers wide (about the width of 30 human hairs). They patterned the cells onto silicon wafers, showing that the devices can be paired with a common semiconductor material. They then measured the current produced by each cell as they flowed a solution of glucose over each wafer in a custom-fabricated test station.

They found many cells produced a peak voltage of about 80 millivolts. Given the tiny size of each cell, this output is the highest power density of any existing glucose fuel cell design.

"Excitingly, we are able to draw power and current that's sufficient to power implantable devices," Simons says.

"It is the first time that proton conduction in electroceramic materials can be used for glucose-to-power conversion, defining a new type of electrochemstry," Rupp says. "It extends the material use-cases from hydrogen fuel cells to new, exciting glucose-conversion modes."

The researchers "have opened a new route to miniature power sources for implanted sensors and maybe other functions," says Truls Norby, a professor of chemistry at the University of Oslo in Norway, who did not contribute to the work. "The ceramics used are nontoxic, cheap, and not least inert both to the conditions in the body and to conditions of

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sterilization prior to implantation. The concept and demonstration so far are promising indeed."

Tech Xplore, 13 May 2022

https://techxplore.com

Separated Identical Twins Raised In The US And Korea Have Massive IQ Difference

2022-05-16

A study of a pair of twins who were raised separately across the world from each other has revealed location can have a significant impact on intelligence.

The twin girls, born in Seoul, South Korea, in 1974, became separated at the age of two when one of them got lost at a market.

Despite her parents' appeal to find their missing daughter, she was not reunited with her family and was eventually adopted by a couple from the US.

Growing up on American soil, the twin was completely unaware she had any siblings at all until 2018, when she submitted her DNA to a South Korean program that aimed to reunite lost family members.

In 2020, she discovered she not only had a twin but also an older brother and sister.

When the twins were finally reunited, they completed a series of tests designed to assess their intelligence, mental health, and medical history; resulting in a groundbreaking study of seperate identical twins.

Incredibly, the Korean-raised twin had a significantly higher IQ, coming in at a whopping 16 points over her sister.

The findings of the study, published in the journal Personality and Individual Differences, have contradicted previous research on identical twins, which indicated a difference of no greater than seven IQ points between twins.

While researchers were not able to conclude that the IQ difference was directly related to their difference in geographical location, the twins did have very different upbringings that could have contributed.

The findings of the study […] have contradicted previous research on identical twins, which indicated a difference of no greater than seven IQ points between twins.

The sister who grew up in the United States suffered three concussions throughout her life, which can significantly impact cognitive capacity.

The twin raised in Korea grew up in a happy, harmonious home, whereas the US-based twin had a more turbulent childhood. She lost her family, found a new one, and conflict in her new home resulted in the eventual divorce of her adoptive parents.

Despite these differences, the pair had identical scores for self-esteem and mental health profiles.

Researchers found that 'the overall configuration of the twins' personality was similar, consistent with literature on moderate genetic influences on personality in adulthood',

"Notable is that both twins are distinctively high on conscientiousness, indicating that both are purposeful, well-organised, dutiful, and achievement-striving," the research paper said.

This shows that despite the difference in their upbringings, the two sisters had similar personalities, values, and approaches to life, highlighting that genetics could have a significant impact on personality.

So, to the eternal question: is it nature versus nurture? The jury is still out. It's too hard to tell.

Lad Bible, 16 May 2022

https://ladbible.com

Flu vaccine could cut COVID risk

2022-05-16

Influenza vaccines have a surprising health benefit: they might also prevent COVID-19, particularly in its most severe forms1.

A study of more than 30,000 health-care workers in Qatar found that those who got a flu jab were nearly 90% less likely to develop severe COVID-19 over the next few months, compared with those who hadn't been recently vaccinated against flu.

The study, which was conducted in late 2020, before the roll-out of COVID-19 vaccines, is in line with previous work suggesting that ramping up the immune system using influenza vaccines and other jabs could help the body to fend off the coronavirus SARS-CoV-2.

Collateral benefit

Health-care workers who got the influenza vaccine were also protected from COVID-19 — but the effect might not last long.

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In the early months of the pandemic — while COVID-19 vaccines were still in development — researchers were intensely interested in the possibility that existing vaccines might provide some protection against SARS-CoV-2. But collecting strong evidence for such an effect is difficult, because people who seek vaccination for diseases other than COVID-19 might also make other choices that reduce their risk of being infected with SARS-CoV-2.

To minimize the impact of this 'healthy-user effect', a team led by Laith Jamal Abu-Raddad, an infectious-disease epidemiologist at Weill Cornell Medicine–Qatar in Doha, analysed the health records of 30,774 medical workers in the country. There is probably less variation in health-related behaviour among such workers than in the general population, reducing — but probably not eliminating — bias, Abu-Raddad says.

The researchers tracked 518 workers who tested positive for SARS-CoV-2 and matched them to more than 2,000 study participants who had tested negative for the virus. Those who had received an influenza vaccine that season were 30% less likely to test positive for SARS-CoV-2, and 89% less likely to develop severe COVID-19, compared with workers who had not (although the number of severe cases was small in both groups). The study was posted on the medRxiv preprint server on 10 May.

Günther Fink, an epidemiologist at the University of Basel in Switzerland, says the Qatar analysis reduces the odds that other studies that uncovered the same link were a fluke. His team reported that flu vaccines were associated with a reduced risk of death in people hospitalized with COVID-19 in Brazil2.

"This is an important piece of evidence," says Mihai Netea, an infectious-disease specialist at Radboud University Medical Center in Nijmegen, the Netherlands. The observation that influenza vaccines are linked to a reduction in not just SARS-CoV-2 infections, but also disease severity, strongly suggests that the protection is genuine, he adds.

Time limit

How long this protection lasts is unclear. Among those in the Qatar study who had the flu jab and later contracted COVID-19, Abu-Raddad's team recorded SARS-CoV-2 infections occurring, on average, about six weeks after vaccination. "I don't expect to see this effect lasting long at all," he says. Netea guesses that the benefits last for between six months and two years.

It's not fully clear why flu vaccines — which are composed of killed influenza viruses — would also protect against COVID-19. Vaccines train the immune system to recognize specific pathogens, but they also rev up broad-acting antiviral defences, says Netea, who has found signs of such responses in flu-vaccine recipients3.

Netea's team is also working to better quantify the benefits of vaccines targeting influenza and other diseases against COVID-19. To fully rule out healthy-user effects, his team has launched a randomized, placebo-controlled trial in Brazil that will test whether influenza and measles–mumps–rubella vaccines can protect against COVID-19.

Knowing that vaccines for flu and other diseases can offer protection against COVID-19, even if only partial and for a limited period, could limit the damage caused by a future pandemic before a vaccine for that disease is developed, Netea argues. "If you have something in the beginning, you could save millions of lives."

Nature, 16 May 2022

https://nature.com

Far-UVC light zaps airborne pathogens in realistic conditions

2022-05-03

Far ultraviolet-C light can reduce the level of airborne microbes in a room by more than 92%, according to a new study by researchers in the UK and the US. The result suggests that lamps operating at this wavelength could be used to combat common airborne viruses, including SARS-CoV-2, and thus prevent the transmission of diseases like COVID-19.

While ordinary UVC light is very effective at destroying microbes like bacteria and viruses, it is hazardous for humans because it can damage skin and eyes. A decade ago, researchers at Columbia University in the US discovered that a different wavelength of UVC light, known as far-UVC light, would be just as effective at killing germs, but without the safety concerns. This is because, at 222 nm, its wavelength is too short to penetrate human skin or eye cells. These early tests of the technology were, however, conducted in small experimental chambers, rather than room-sized ones that better reflect real-world human environments.

Testing far-UVC krypton chloride excimer lamps against S. aureus

"In terms of preventing airborne disease transmission, far-UVC light could make indoor places as safe as being outside on the golf course on a breezy day at St Andrews."

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In the new work, scientists from the universities of St Andrews and Leeds in the UK and Columbia University Vagelos College of Physicians and Surgeons tested the efficiency of far-UVC krypton chloride (KCl) excimer lamps in a specially designed room-sized chamber at Leeds. The researchers ventilated this chamber at the same rate as a typical home or office – that is, around three air changes per hour. They then released aerolized S. aureus bacteria into the space continuously, allowing the pathogen load to reach a stable level before sampling the air for an hour.

While continuing to release the aerolized S. aureus into the chamber, the researchers then switched on the far-UVC lamps placed on the ceiling of the chamber and sampled the air for a further hour. "This methodology allowed us to compare the air samples after the lamps had been switched on compared to the air samples before lamp switch-on," explains team member Kenneth Wood, a researcher in the School of Physics and Astronomy at St Andrews.

The team found that the lamps reduced the continuously produced aerolized S. Aureus pathogen load in the room by 92%, which is equivalent to 35 air changes per hour. "This is exciting," Wood tells Physics World, "since this is a higher number of air changes per hour than other technologies (which have been limited to 5 to 20 equivalent air changes). It is also the first time the effect of far-UVC has been demonstrated for aerolized pathogens in a large 'real-world' type environment."

"Spectacular results"

Wood adds that the trials have produced "spectacular results", far exceeding what is possible with ventilation alone. "In terms of preventing airborne disease transmission, far-UVC light could make indoor places as safe as being outside on the golf course on a breezy day at St Andrews," he says.

Team member David Brenner, who leads the Center for Radiological Research at Columbia, says that far UVC-light should be just as good at inactivating current and future variants of SARS-CoV-2; new infectious viruses that have yet to emerge; and "old-fashioned" viruses like influenza and measles. The researchers foresee that far-UVC could become an important "hands off" tool, alongside filtration and ventilation, in a global move towards reducing airborne transmission of disease and improving indoor air quality.

The team have received funding from NHS Scotland Assure to investigate the impact of far-UVC when there are different mechanical ventilation

rates. "With this funding, we also plan to study how far-UVC acts on other pathogens and hopefully short-distance viral inactivation," Wood says. The researchers would now also like to test the technology in real-world environments.

The research is detailed in Scientific Reports.

Physics World, 3 May 2022

https://physicsworld.com

New silicon nanowires can really take the heat

2022-05-17

Scientists have demonstrated a new material that conducts heat 150% more efficiently than conventional materials used in advanced chip technologies.

The device—an ultrathin silicon nanowire—could enable smaller, faster microelectronics with a heat-transfer-efficiency that surpasses current technologies. Electronic devices powered by microchips that efficiently dissipate heat would in turn consume less energy—an improvement that could help mitigate the consumption of energy produced by burning carbon-rich fossil fuels that have contributed to global warming.

"By overcoming silicon's natural limitations in its capacity to conduct heat, our discovery tackles a hurdle in microchip engineering," said Junqiao Wu, the scientist who led the Physical Review Letters study reporting the new device. Wu is a faculty scientist in the Materials Sciences Division and professor of materials science and engineering at UC Berkeley.

Heat's slow flow through silicon

Our electronics are relatively affordable because silicon—the material of choice for computer chips—is cheap and abundant. But although silicon is a good conductor of electricity, it is not a good conductor of heat when it is reduced to very small sizes—and when it comes to fast computing, that presents a big problem for tiny microchips.

Within each microchip reside tens of billions of silicon transistors that direct the flow of electrons in and out of memory cells, encoding bits of data as ones and zeroes, the binary language of computers. Electrical currents run between these hard-working transistors, and these currents inevitably generate heat.

Scientists have demonstrated a new material that conducts heat 150% more efficiently than conventional materials used in advanced chip technologies.

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Heat naturally flows from a hot object to a cool object. But heat flow gets tricky in silicon.

In its natural form, silicon is made up of three different isotopes—forms of a chemical element containing an equal number of protons but different number of neutrons (hence different mass) in their nuclei.

About 92% of silicon consists of the isotope silicon-28, which has 14 protons and 14 neutrons; around 5% is silicon-29, weighing in at 14 protons and 15 neutrons; and just 3% is silicon-30, a relative heavyweight with 14 protons and 16 neutrons, explained co-author Joel Ager, who holds titles of senior scientist in Berkeley Lab's Materials Sciences Division and adjunct professor of materials science and engineering at UC Berkeley.

As phonons, the waves of atomic vibration that carry heat, wind their way through silicon's crystalline structure, their direction changes when they bump into silicon-29 or silicon-30, whose different atomic masses "confuse" the phonons, slowing them down.

"The phonons eventually get the idea and find their way to the cold end to cool the silicon material," but this indirect path allows waste heat to build up, which in turn slows your computer down, too, Ager said.

A big step toward faster, denser microelectronics

For many decades, researchers theorized that chips made of pure silicon-28 would overcome silicon's thermal conductivity limit, and therefore improve the processing speeds of smaller, denser microelectronics.

But purifying silicon down to a single isotope requires intense levels of energy which few facilities can supply—and even fewer specialize in manufacturing market-ready isotopes, Ager said.

Fortunately, an international project from the early 2000s enabled Ager and leading semiconductor materials expert Eugene Haller to procure silicon tetrafluoride gas—the starting material for isotopically purified silicon—from a former Soviet-era isotope manufacturing plant.

This led to a series of pioneering experiments, including a 2006 study published in Nature, whereby Ager and Haller fashioned silicon-28 into single crystals, which they used to demonstrate quantum memory storing information as quantum bits or qubits, units of data stored simultaneously as a one and a zero in an electron's spin.

Subsequently, semiconducting thin films and single crystals made with Ager's and Haller's silicon isotope material were shown to have a 10% higher thermal conductivity than natural silicon—an improvement, but from the computer industry's point of view, probably not enough to justify spending a thousand times more money to build a computer from isotopically pure silicon, Ager said.

But Ager knew that the silicon isotope materials were of scientific importance beyond quantum computing. So he kept what remained in a safe place at Berkeley Lab, just in case other scientists might need it, because few people have the resources to make or even purchase isotopically pure silicon, he reasoned.

A path toward cooler tech with silicon-28

About three years ago, Wu and his graduate student Penghong Ci were trying to come up with new ways to improve the heat transfer rate in silicon chips.

One strategy to make more efficient transistors involves using a type of nanowire called a Gate-All-Around Field Effect Transistor. In these devices, silicon nanowires are stacked to conduct electricity, and heat is generated simultaneously, Wu explained. "And if the heat generated is not extracted out quickly, the device would stop working, akin to a fire alarm blaring in a tall building without an evacuation map," he said.

But heat transport is even worse in silicon nanowires, because their rough surfaces—scars from chemical processing—scatter or "confuse" the phonons even more, he explained.

"And then one day we wondered, 'What would happen if we made a nanowire from isotopically pure silicon-28?'" Wu said.

Silicon isotopes are not something one can easily buy on the open market, and word had it that Ager still had some silicon isotope crystals in storage at Berkeley Lab—not a lot, but still enough to share "if someone has a great idea about how to use it," Ager said. "And Junqiao's new study was such a case."

A surprising big reveal with nano tests

"We're really fortunate that Joel happened to have the isotopically enriched silicon material ready to use for the study," Wu said.

Using Ager's silicon isotope materials, the Wu team tested the thermal conductivity in bulk 1-millimeter-size silicon-28 crystals versus natural

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silicon—and again, their experiment confirmed what Ager and his collaborators discovered years ago—that bulk silicon-28 conducts heat only 10% better than natural silicon.

Now for the nano test. Using a technique called electroless etching, Ci made natural silicon and silicon-28 nanowires just 90 nanometers (billionths of a meter) in diameter—about a thousand times thinner than a single strand of human hair.

To measure the thermal conductivity, Ci suspended each nanowire between two microheater pads outfitted with platinum electrodes and thermometers, and then applied an electrical current to the electrode to generate heat on one pad that flows to the other pad via the nanowire.

"We expected to see only an incremental benefit—something like 20%—of using isotopically pure material for nanowire heat conduction," Wu said.

But Ci's measurements astonished them all. The Si-28 nanowires conducted heat not 10% or even 20%, but 150% better than natural silicon nanowires with the same diameter and surface roughness.

This defied everything that they had expected to see, Wu said. A nanowire's rough surface typically slows phonons down. So what was going on?

High-resolution TEM (transmission electron microscopy) images of the material captured by Matthew R. Jones and Muhua Sun at Rice University uncovered the first clue: a glass-like layer of silicon dioxide on the silicon-28 nanowire surface.

Computational simulation experiments at the University of Massachusetts Amherst led by Zlatan Aksamija, a leading expert on the thermal conductivity of nanowires, revealed that the absence of isotope "defects"—silicon-29 and silicon-30—prevented phonons from escaping to the surface, where the silicon dioxide layer would drastically slow down the phonons. This in turn kept phonons on track along the direction of heat flow—and therefore less "confused"—inside the silicon-28 nanowire's "core." (Aksamija is currently an associate professor of materials science and engineering at the University of Utah.)

"This was really unexpected. To discover that two separate phonon-blocking mechanisms—the surface versus the isotopes, which were previously believed to be independent of each other—now work synergistically to our benefit in heat conduction is very surprising but also very gratifying," Wu said.

"Junqiao and the team discovered a new physical phenomenon," Ager said. "This is a real triumph for curiosity-driven science. It's quite exciting."

Wu said that the team next plans to take their discovery to the next step: by investigating how to "control, rather than merely measure, heat conduction in these materials."

Phys Org, 17 May 2022

https://phys.org

New material can 'capture toxic pollutants from air'

2022-05-18

Researchers at University of Limerick have developed a new material that has the ability to capture toxic chemicals from the air.

The material is capable of capturing trace amounts of benzene, a toxic pollutant, from the air and crucially use less energy than existing materials to do so, according to the researchers.

The sponge-like porous material could revolutionize the search for clean air and have a significant impact in the battle against climate change, the researchers believe.

Professor Michael Zaworotko, Bernal Chair of Crystal Engineering and Science Foundation of Ireland Research Professor at University of Limerick's Bernal Institute, and colleagues developed the new material, with findings reported in Nature Materials.

Volatile organic compounds (VOCs) including benzene are a class of toxic pollutants that cause severe environmental and health issues. Developing technologies to remove benzene from air at trace concentrations and doing it with a low energy footprint are both challenges that have not been overcome until now.

"A family of porous materials—like sponge—have been developed to capture benzene vapor from polluted air and produce a clean air stream for a long working time," explained Professor Zaworotko.

"These materials could be regenerated easily under mild heating, making them candidates for air purification and environmental remediation.

"Our materials can do much better in both sensitivity and working time than traditional materials."

"Breaking up gas mixtures is hard to do. This is especially true for the minor components that comprise air, which include carbon dioxide and water."

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Professor Zaworotko and Dr. Xiang-Jing Kong from the Department of Chemical Sciences at UL, along with colleagues from leading universities in China, developed the new porous material which has such strong affinity for benzene that it captures the toxic chemical even when present at just 1 part in 100,000.

This material resembles Swiss cheese because it is full of holes and it is these holes that attract the benzene molecules, according to the researchers.

In terms of energy, because the capture process is based upon physical rather than chemical bonding, the energy footprint of capture and release is much lower than previous generations of materials.

"Breaking up gas mixtures is hard to do. This is especially true for the minor components that comprise air, which include carbon dioxide and water. The properties of our new material show that breaking up is no longer hard to do for benzene," explained Professor Zaworotko.

Earlier work from Professor Zaworotko's lab resulted in leading materials for carbon capture and water harvesting. The water harvesting material has such favorable properties for capturing and releasing water from the atmosphere that is already being used in dehumidification systems.

Dr. Xiang-Jing Kong explained: "Based on smart design, our materials do well in addressing challenges of both technical and social relevance, such as trace benzene removal from air. This is hard for conventional materials, and thus highlights the charm of porous materials."

Overall, these results suggest that a new generation of bespoke porous materials of the type invented at UL can enable a general approach to the capture of toxic chemicals from air.

"Aromatic isomers are difficult to separate in their mixtures with traditional methods, which are always energy-intensive," Dr. Xiang-Jing Kong explained.

"This research opened up possibilities to design porous materials for efficient separation of these chemicals with low energy input as well as removal of other trace pollutants from air."

Phys Org, 18 May 2022

https://phys.org

Enzyme breaks down PET plastic in record time

2022-05-18

Plastic bottles, punnets, wrap—lightweight packaging made of PET plastic becomes a problem if it is not recycled. Scientists at Leipzig University have now discovered a highly efficient enzyme that degrades PET in record time. The enzyme PHL7, which the researchers found in a compost heap in Leipzig, could make biological PET recycling possible much faster than previously thought. The findings have now been published in the scientific journal ChemSusChem and selected as the cover topic.

One way in which enzymes are used in nature is by bacteria to decompose plant parts. It has been known for some time that some enzymes, so-called polyester-cleaving hydrolases, can also degrade PET. For example, the enzyme LCC, which was discovered in Japan in 2012, is considered to be a particularly effective "plastic eater." The team led by Dr. Christian Sonnendecker, an early career researcher from Leipzig University, is searching for previously undiscovered examples of these biological helpers as part of the EU-funded projects MIPLACE and ENZYCLE. They found what they were looking for in the Südfriedhof, a cemetery in Leipzig: in a sample from a compost heap, the researchers came across the blueprint of an enzyme that decomposed PET at record speed in the laboratory.

The researchers from the Institute of Analytical Chemistry found and studied seven different enzymes. The seventh candidate, called PHL7, achieved results in the lab that were significantly above average. In the experiments, the researchers added PET to containers with an aqueous solution containing either PHL7 or LCC, the previous leader in PET decomposition. Then they measured the amount of plastic that was degraded in a given period of time and compared the values with each other.

The result: within 16 hours, PHL7 caused the PET to decompose by 90 percent; in the same time, LCC managed a degradation of just 45 percent. "So our enzyme is twice as active as the gold standard among polyester-cleaving hydrolases," Sonnendecker explains. For example, PHL7 broke down a plastic punnet—the kind used for selling grapes in supermarkets—in less than 24 hours. The researchers found that a single building block in the enzyme is responsible for this above-average activity. At the site where other previously known polyester-cleaving hydrolases contain a phenylalanine residue, PHL7 carries a leucine.

The result: within 16 hours, [the enzyme] caused the PET to decompose by 90 percent.

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Biological PET recycling has some advantages compared to conventional recycling methods, which rely primarily on thermal processes where the plastic waste is melted down at high temperatures. These processes are highly energy-intensive and the quality of the plastic decreases with each recycling cycle. Enzymes, on the other hand, only require an aqueous environment and a temperature of 65 to 70 degrees Celsius for their work. Another plus is the fact that they break down the PET into its components terephthalic acid and ethylene glycol, which can then be reused to produce new PET—resulting in a closed cycle. So far, however, biological PET recycling has only been tested by a pilot plant in France.

"The enzyme discovered in Leipzig can make an important contribution to establishing alternative energy-saving plastic recycling processes," says Professor Wolfgang Zimmermann, who played a key role in establishing research activity into enzyme-based technologies at Leipzig University. "Due to the enormous problems caused by the global burden of plastic waste on the environment, it is becoming increasingly important to find environmentally friendly methods for reusing plastic in a sustainable circular economy. The biocatalyst now developed in Leipzig has been shown to be highly effective in the rapid decomposition of used PET food packaging and is suitable for use in an environmentally friendly recycling process in which new plastic can be produced from the decomposition products."

The researchers from Leipzig hope that the newly discovered enzyme PHL7 can advance biological recycling in practice and are looking for industrial partners for this purpose. They are convinced that the higher speed will significantly reduce recycling costs. Over the next two to three years, they aim to create a prototype that will make it possible to quantify the economic benefits of their rapid biological recycling process more precisely.

The scientists on Professor Jörg Matysik's team at the Institute of Analytical Chemistry also want to elucidate the structure and function of the enzymes using NMR spectroscopy. They are also working on a new pretreatment method to solve a problem in biological recycling: PET decomposition by enzymes has so far only worked for so-called amorphous PET, which is used in things like fruit packaging, but not for plastic bottles made of PET with higher crystallinity.

Phys Org, 18 May 2022

https://phys.org

Boost in nerve-growth protein helps explain why running supports brain health

2022-05-16

Exercise increases levels of a chemical involved in brain cell growth, which bolsters the release of the "feel good" hormone dopamine, a new study shows. Dopamine is known to play a key role in movement, motivation, and learning.

Experts have long understood that regular running raises dopamine activity in the brain and may protect nerve cells from damage. In addition, past research has tied exercise-driven boosts in the dopamine-triggering chemical called brain-derived neurotrophic factor (BDNF) and in dopamine levels to improvements in learning and memory. However, the precise way these three factors interact has until now remained unclear.

Led by researchers at NYU Grossman School of Medicine, the investigation showed that mice running on a wheel for 30 days had a 40% increase in dopamine release in the dorsal stratium, the part of the brain involved in movement, compared to levels in mice that did not exercise. The runners also showed a nearly 60% increase in BDNF levels compared to their non-running counterparts. Notably, the increase in dopamine release remained elevated even after a week of rest. Additionally, when BDNF levels were artificially reduced, running did not lead to additional dopamine release.

"Our findings suggest that BDNF plays a key role in the long-lasting changes that occur in the brain as a result of running," says study lead author and neurobiologist Guendalina Bastioli, Ph.D. "Not only do these results help explain why exercise makes you move, think, and feel better, they also show that these benefits continue even if you do not work out every day," adds Bastioli, a postdoctoral fellow in the Department of Neuroscience at NYU Langone Health.

While researchers have previously measured dopamine activity during running, the new investigation provides insight into the longer-term behavior of the hormone and its effects on the brain well after exercise stops, according to Bastioli. The report is publishing online May 16 in the Journal of Neuroscience.

For the investigation, researchers provided dozens of male mice with unlimited access to either a freely rotating wheel or a locked wheel that could not move. After one month, the team measured dopamine release and BDNF levels in brain slices. They repeated this same process on a

Increased evoked dopamine release persists even seven days after exercise ends.

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new group of rodents, some of which had been genetically modified to produce half as much BDNF as regular mice.

The study authors note that patients with Parkinson's disease and other movement disorders are often treated with drugs that mimic dopamine's effects on motor neurons. However, the mechanism behind dopamine's role in this protective benefit of exercise had not been thoroughly explored.

"Our results help us understand why exercise alleviates the symptoms of Parkinson's disease, as well as those of neuropsychiatric disorders such as depression," says study senior author and neuroscientist Margaret Rice, Ph.D. "Now that we know why physical activity helps, we can explore it as a means of augmenting or even replacing the use of dopamine-enhancing drugs in these patients."

Rice, a professor in the Departments of Neurosurgery and Neuroscience and Physiology at NYU Langone, cautions that while the preliminary findings in rodents were promising, future studies in humans will be required to fully understand the role of BDNF and dopamine in Parkinson's disease.

She adds that the study team next plans to investigate the relationship between exercise and these chemicals in female mice, which notably run more frequently than males. In addition, the researchers intend to directly examine whether active mice indeed have improved motor skills compared with those with limited physical activity.

In addition to Bastioli and Rice, other NYU study investigators involved in the study were Moses Chao, Ph.D.; Jennifer Arnold, Ph.D.; Maria Mancini, Ph.D.; Adam Mar, Ph.D.; Begoña Gamallo-Lana, Ph.D.; and Khalil Saadipour, Ph.D.

Medical Xpress, 16 May 2022

https://medicalxpress.com

Scientists devise method to prevent deadly hospital infections without antibiotics

2022-05-19

A hospital or medical clinic might be the last place you'd expect to pick up a nasty infection, but approximately 1.7 million Americans do each year, resulting in nearly 100,000 deaths from infection-related complications and roughly $30 billion in direct medical costs.

A hospital or medical clinic might be the last place you'd expect to pick up a nasty infection, but approximately 1.7 million Americans do each year

The biggest culprits, experts say -- accounting for two-thirds of these infections -- are medical devices like catheters, stents, heart valves and pacemakers, whose surfaces often become covered with harmful bacterial films. But a novel surface treatment developed by a UCLA-led team of scientists could help improve the safety of these devices and ease the economic burden on the health care system.

The new approach, tested in both laboratory and clinical settings, involves depositing a thin layer of what is known as zwitterionic material on the surface of a device and permanently binding that layer to the underlying substrate using ultraviolet light irradiation. The resulting barrier prevents bacteria and other potentially harmful organic materials from adhering to the surface and causing infection.

The team's findings are published May 19 in the journal Advanced Materials.

In the laboratory, researchers applied the surface treatment to several commonly used medical device materials, then tested the modified materials' resistance to various types of bacteria, fungi and proteins. They found that the treatment reduced biofilm growth by more than 80% -- and in some cases up 93%, depending on the microbial strain.

"The modified surfaces exhibited robust resistance against microorganisms and proteins, which is precisely what we sought to achieve," said Richard Kaner, UCLA's Dr. Myung Ki Hong Professor of Materials Innovation and senior author of the research. "The surfaces greatly reduced or even prevented biofilm formation.

"And our early clinical results have been outstanding," Kaner added.

The clinical research involved 16 long-term urinary catheter users who switched to silicone catheters with the new zwitterionic surface treatment. This modified catheter is the first product made by a company Kaner founded out of his lab, called SILQ Technologies Corp., and has been cleared for use in patients by the Food and Drug Administration.

Ten of the patients described their urinary tract condition using the surface-treated catheter as "much better" or "very much better," and 13 chose to continue using the new catheter over conventional latex and silicone options after the study period ended.

"One patient came to UCLA a few weeks ago to thank us for changing her life -- something that, as a materials scientist, I never thought was possible," Kaner said. "Her previous catheters would become blocked after

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four days or so. She was in pain and needed repeated medical procedures to replace them. With our surface treatment, she now comes in every three weeks, and her catheters work perfectly without encrustation or occlusion -- a common occurrence with her previous ones."

Such catheter-related urinary tract problems are illustrative of the issues plaguing other medical devices, which, once inserted or implanted, can become breeding grounds for bacteria and harmful biofilm growth, said Kaner, a member of the California NanoSystems Institute at UCLA who is also a distinguished professor of chemistry and biochemistry, and of materials science and engineering. The pathogenic cells pumped out by these highly resilient biofilms then cause recurring infections in the body.

In response, medical staff routinely give strong antibiotics to patients using these devices, a short-term fix that poses a longer-term risk of creating life-threatening, antibiotic-resistant "superbug" infections. The more widely and frequently antibiotics are prescribed, Kaner said, the more likely bacteria are to develop resistance to them. A landmark 2014 report by the World Health Organization recognized this antibiotic overuse as an imminent public health threat, with officials calling for an aggressive response to prevent "a post-antibiotic era in which common infections and minor injuries which have been treatable for decades can once again kill."

"The beauty of this technology," Kaner said, "is that it can prevent or minimize the growth of biofilm without the use of antibiotics. It protects patients using medical devices -- and therefore protects all of us -- against microbial resistance and the proliferation of superbugs."

The surface treatment's zwitterion polymers are known to be extremely biocompatible, and they absorb water very tightly, forming a thin hydration barrier that prevents bacteria, fungi and other organic materials from adhering to surfaces, Kaner said. And, he noted, the technology is highly effective, non-toxic and relatively low in cost compared with other current surface treatments for medical devices, like antibiotic- or silver-infused coatings.

Beyond its use in medical devices, the surface treatment technique could have non-medical applications, Kaner said, potentially extending the lifetimes of water-treatment devices and improving lithium-ion battery performance.

Funding sources for the study included the National Institutes of Health, the National Science Foundation, the Canadian Institutes of Health

Research, SILQ Technologies Corp. and the UCLA Sustainability Grand Challenge.

Co-lead authors of the study are Brian McVerry, Alex Polasko and Ethan Rao. McVerry helped develop this and other surface treatments during his UCLA doctoral research with Kaner and co-founded SILQ Technologies Corp., where is he now chief technology officer. Rao, director of research and development at SILQ, and study co-author Na He, a process engineer at SILQ, have conducted UCLA research in Kaner's laboratory.

Other co-authors are the UCLA Samueli School of Engineering's Shaily Mahendra, a professor of civil and environmental engineering, and Dino Di Carlo, a professor of bioengineering and of mechanical and aerospace engineering; Amir Sheikhi, an assistant professor of chemical and biomedical engineering at Penn State University; and Ali Khademhosseini, CEO of the Terasaki Institute for Biomedical Innovation and formerly a professor of bioengineering, chemical and biomolecular engineering, and radiological sciences at UCLA.

Science Daily, 19 May 2022

https://sciencedaily.com

'Night-time solar' technology can now deliver power in the dark

2022-05-17

UNSW researchers have made a major breakthrough in renewable energy technology by producing electricity from so-called "night-time" solar power.

The team from the School of Photovoltaic and Renewable Energy Engineering generated electricity from heat radiated as infrared light, in the same way as the Earth cools by radiating into space at night.

A semiconductor device called a thermoradiative diode, composed of materials found in night-vision goggles, was used to generate power from the emission of infrared light.

The results of the research have now been published in ACS Photonics.

Although the amount of power generated at this stage is very small—around 100,000 times less than that supplied by a solar panel—the researchers believe the result can be improved in the future.

The UNSW team's breakthrough is an exciting confirmation of a previously theoretical process.

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"We have made an unambiguous demonstration of electrical power from a thermoradiative diode," said team lead, Associate Professor Ned Ekins-Daukes.

"Using thermal imaging cameras you can see how much radiation there is at night, but just in the infrared rather than the visible wavelengths. What we have done is make a device that can generate electrical power from the emission of infrared thermal radiation."

Flow of energy

A/Prof Ekins-Daukes says the process is ultimately still harnessing solar power, which hits the Earth during the day in the form of sunlight and warms up the planet.

At night, this same energy radiates back into the vast, cold void of outer space in the form of infrared light with the thermoradiative diode now proven to be able to generate electricity by taking advantage of this process.

"Whenever there is a flow of energy, we can convert it between different forms," he said. "Photovoltaics, the direct conversion of sunlight into electricity, is an artificial process that humans have developed in order to convert the solar energy into power. In that sense the thermoradiative process is similar; we are diverting energy flowing in the infrared from a warm Earth into the cold universe," Dr. Phoebe Pearce, one of the paper's co-authors, added.

"In the same way that a solar cell can generate electricity by absorbing sunlight emitted from a very hot sun, the thermoradiative diode generates electricity by emitting infrared light into a colder environment. In both cases the temperature difference is what lets us generate electricity."

The UNSW team's breakthrough is an exciting confirmation of a previously theoretical process and is the first step in making specialized, and much more efficient, devices that could one day capture the energy at much larger scale.

A/Prof. Ekins-Daukes likens the new research to the work of engineers at Bell Labs who demonstrated the first practical silicon solar cell in 1954.

That first silicon solar cell was only around 2% efficient, but now modern-day cells are able to convert around 23% of the sun's light into electricity.

And Dr. Michael Nielsen, co-author of the paper, said: "Even if the commercialization of these technologies is still a way down the road,

being at the very beginning of an evolving idea is such an exciting place to be as a researcher.

"By leveraging our knowledge of how to design and optimize solar cells and borrowing materials from the existing mid-infrared photodetector community, we hope for rapid progress towards delivering the dream of solar power at night."

The research team believe the new technology could have a range of uses in the future by helping to produce electricity in ways not currently possible.

Power from body heat

One of these could be powering bionic devices, such as artificial hearts, which currently run off batteries which need to be regularly replaced.

A/Prof. Ekins-Daukes said: "In principle it is possible for us to generate power in the way we have demonstrated just from body heat—which you can see glowing if you look through a thermal camera.

"Down the line, this technology could potentially harvest that energy and remove the need for batteries in certain devices—or help to recharge them. That isn't something where conventional solar power would necessarily be a viable option."

The new UNSW results build on previous work from the group where co-author Andreas Pusch developed a mathematical model that helped guide their laboratory experiments.

The research team now hopes that industry leaders will recognize the potential for the new technology and support its further development.

"Right now, the demonstration we have with the thermoradiative diode is relatively very low power. One of the challenges was actually detecting it. But the theory says it is possible for this technology to ultimately produce about 1/10th of the power of a solar cell," A/Prof. Ekins-Daukes said.

"I think for this to be breakthrough technology, we shouldn't underestimate the need for industries to step in, and really drive it. I'd say there's still about a decade of university research work to be done here. And then it needs industry to pick it up.

"If industry can see this is a valuable technology for them, then progress can be extremely fast.

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"The miracle of solar power today owes itself to world-renowned researchers like Scientia Professor Martin Green at UNSW, but also to industrialists who have raised large sums of money to scale up manufacturing."

Tech Xplore, 17 May 2022

https://techxplore.com

How fast-growing algae could enhance growth of food crops

2022-05-19

A new study provides a framework to boost crop growth by incorporating a strategy adopted from a fast-growing species of green algae. The algae, known as Chlamydomonas reinhardtii, contain an organelle called the pyrenoid that speeds up the conversion of carbon, which the algae absorb from the air, into a form that the organisms can use for growth. In a study published May 19, 2022 in the journal Nature Plants, researchers at Princeton University and Northwestern University used molecular modeling to identify the features of the pyrenoid that are most critical for enhancing carbon fixation, and then mapped how this functionality could be engineered into crop plants.

This isn't just an academic exercise. For many people today, the bulk of food calories come from crop plants domesticated thousands of years ago. Since then, advancements in irrigation, fertilization, breeding and the industrialization of farming have helped feed the burgeoning human population. However, by now only incremental gains can be extracted from these technologies. Meanwhile, food insecurity, already at crisis levels for much of the world's population, is predicted to worsen due to a changing climate.

New technology could reverse this trend. Many scientists believe the algal pyrenoid offers just such an innovation. If scientists can engineer a pyrenoid-like ability to concentrate carbon into plants such as wheat and rice, these important food sources could experience a major boost to their growth rates.

"This work provides clear guidance for engineering a carbon-concentrating mechanism into plants, including major crops," said Martin Jonikas, a senior author of the study who is an associate professor of molecular biology at Princeton and an investigator at the Howard Hughes Medical Institute.

Chlamydomonas reinhardtii achieves carbon fixation due to the action of the enzyme Rubisco, which catalyzes the conversion of CO2 into organic carbon.

Terrestrial plants also use Rubisco to accomplish carbon fixation, but in most plants, Rubisco only works at about a third of its theoretical capacity because it cannot access enough CO2 to operate faster. Much effort has therefore gone into studying the carbon-concentrating mechanisms,

Terrestrial plants also use [the enzyme] Rubisco to accomplish carbon fixation, but in most plants, Rubisco only works at about a third of its theoretical capacity because it cannot access enough CO2 to operate faster.

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particularly those found in cyanobacteria and in Chlamydomonas, with the hope of eventually providing this function for terrestrial crop plants. But there's a problem:

"While the structure of the pyrenoid and many of its components are known, key biophysical questions about its mechanism remain unanswered, due to a lack of quantitative and systematic analysis," said senior co-author Ned Wingreen, Princeton's Howard A. Prior Professor of the Life Sciences and professor of molecular biology and the Lewis-Sigler Institute of Integrative Genomics.

To gain insights about how the algal pyrenoid carbon-concentrating mechanism works, Princeton graduate student Chenyi Fei collaborated with undergraduate Alexandra Wilson, Class of 2020, to develop a computational model of the pyrenoid with the help of co-author Niall Mangan, assistant professor of engineering sciences and applied mathematics at Northwestern University.

Prior work has shown that the Chlamydomonas reinhardtii pyrenoid consists of a spherical Rubisco matrix traversed by a vasculature of membrane-enclosed projections called pyrenoid tubules, and surrounded by a sheath made of starch. It's thought that CO2 taken up from the environment is converted into bicarbonate and then transported into the tubules, where it then enters the pyrenoid. An enzyme present in the tubules converts bicarbonate back into CO2, which then diffuses into the Rubisco matrix. But is this picture complete?

"Our model demonstrates that this conventional picture of the pyrenoid carbon-concentrating mechanism can't work because CO2 would just rapidly leak back out of the pyrenoid before Rubisco could act on it," Wingreen said. "Instead, the starch shell around the pyrenoid must act as a diffusion barrier to trap CO2 in the pyrenoid with Rubisco."

In addition identifying this diffusion barrier, the researchers' model pinpointed other proteins and structural features needed for CO2 concentration. The model also identified non-necessary components, which should make engineering pyrenoid functionality into plants a simpler task. This simplified model of the pyrenoid, the researchers showed, behaves similarly to the actual organelle.

"The new model developed by Fei, Wilson, and colleagues is a game changer," said Alistair McCormick, an expert in Plant Molecular Physiology and Synthetic Biology at the University of Edinburgh, who has worked with the Princeton scientists but was not involved in this study.

"One of the key findings of this paper, which differentiates the Chlamydomonas carbon-concentrating mechanism from those found in cyanobacteria, is that introducing active bicarbonate transporters may not be necessary," McCormick said. "This is important because active bicarbonate transport has been a key challenge hindering progress in the engineering of biophysical carbon-concentrating mechanisms."

Phys Org, 19 May 2022

https://phys.org

The colors of hydrogen explained

2022-05-17

Hydrogen has emerged as the energy technology that could help nations like Australia to decarbonize their economies. But did you know that, beyond green and blue hydrogen, there's a whole rainbow of hydrogen types?

Swinburne University of Technology's Victorian Hydrogen Hub (VH2) is delving deeper than anyone has before to explore the extreme limits of what hydrogen can deliver, including investigating the capabilities of the hydrogen rainbow.

Hydrogen is the most common element in the universe, a colorless, odorless, tasteless yet flammable substance. Despite its massive abundance throughout the universe, it is virtually non-existent in its original form on Earth and requires energy to release it from the material forms where it is found. It forms part of other common chemical compounds such as water (H_2O), methane (CH_4) and ammonia (NH_3), which is often found in fertilizer and cleaning products.

Several chemical processes have been invented to harness the energy of hydrogen, all of which have environmental strengths and weaknesses. The hydrogen industry has assigned colored nicknames to each hydrogen process, based on the source it was produced from and the process used to separate it from that source.

One of the VH2's leading hydrogen experts, Dr. Kim Beasy, takes us on a journey over the rainbow, starting with some of the most commonly-discussed types of hydrogen, ordered from most sustainable to least, before exploring a few more experimental and emerging types.

Green hydrogen

There are eight colors within the hydrogen rainbow, determined by the source it was produced from and the process used to separate it from that source.

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Green hydrogen is produced through electrolysis, a process where electric currents from surplus renewable energy sources (such as solar or wind power) separate water into hydrogen and oxygen molecules. The hydrogen is then stored as an energy vector, which allows the transferring, in space and time, of a quantity of energy.

Because the energy used in this process comes from renewable sources, the process does not release any carbon emissions into the atmosphere. However, green hydrogen is more expensive than gray hydrogen, another promising form in the industry.

Yellow hydrogen

Yellow hydrogen is a relatively new concept, referring to hydrogen that is specifically produced through electrolysis using solar energy.

Blue hydrogen

Blue hydrogen is produced through steam reformation, a process that uses steam to separate hydrogen molecules from natural gas. This process produces carbon emissions, though most are stored underground or repurposed.

It is sometimes described as "low-carbon hydrogen" as the steam reforming process doesn't actually avoid the creation of greenhouse gases. But unlike gray hydrogen (described below), it promises the cost benefits of steam reformation without the pollution.

Gray hydrogen

Gray hydrogen is produced through steam reformation of natural gas in the same way as blue hydrogen. However, none of the carbon is captured in this process. Instead, all of the carbon emissions are released into the atmosphere.

Brown hydrogen

Brown hydrogen is produced by gasification, where carbonous materials are heated into a gas. This extraction process involves turning coal into gas and produces large quantities of carbon emissions that are released into the atmosphere.

Any hydrogen made from fossil fuels via gasification is often called black hydrogen or brown hydrogen interchangeably.

Turquoise hydrogen

Turquoise hydrogen is extracted through methane via a process called methane pyrolysis, where fossil fuels are heated to such high temperatures that the fuel decomposes into hydrogen and solid carbon, emitting no carbon emissions.

Turquoise hydrogen is similar to blue hydrogen but has only been used experimentally. The hydrogen is captured as a gas, and the solid carbon that falls to the ground can be buried underground or used in industrial processes. The entire process still results in fugitive methane emissions from natural gas extraction.

Pink hydrogen

Pink hydrogen, also known as purple hydrogen or red hydrogen, uses the electrolysis method. However, instead of being powered through renewable energy, it is powered through nuclear energy.

While there are few carbon emissions produced with this method, there can be other environmental impacts such as the production of radioactive nuclear waste.

White hydrogen

White hydrogen is naturally-occurring geological hydrogen found underground through the by-product of industrial processes such as oil or natural gas extraction (fracking).

There is not much known about white hydrogen, with research currently underway. In its production, there are few carbon emissions created. But, like pink hydrogen, there can be other environmental impacts.

Tech Xplore, 17 May 2022

https://techxplore.com

This unusual tooth is the first fossil evidence of Denisovans in Southeast Asia

2022-05-17

In 2018, a child living in the village of Long Gua Pa in northeastern Laos approached a team of archaeologists, eager to show them a cave full of bones. The team began to chisel into the cave's cementlike walls, exposing the remains of ancient rhinoceroses, tapirs, pigs, rodents—and a single, humanlike molar. Now, the researchers have identified the tooth as that of a Denisovan, mysterious cousins of Neanderthals and modern humans

Researchers have identified the tooth as that of a Denisovan, mysterious cousins of Neanderthals and modern humans who likely died out about 30,000 years ago.

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who likely died out about 30,000 years ago. The new find is the first fossil evidence of Denisovans in Southeast Asia—and it supports clues in the DNA in modern Indigenous populations that these ancient people once roamed the region.

"We have assumed that Denisovans were in Southeast Asia … but we just didn't have the fossils for it," says Bence Viola, a paleoanthropologist at the University of Toronto who has analyzed Denisovan teeth but was not involved in the new study. "This one is in the right place at the right time."

Denisovans coexisted in Eurasia with Neanderthals beginning hundreds of thousands of years ago, and later with anatomically modern Homo sapiens as well. Although traces of their DNA live on in several modern populations—most notably in one group of Indigenous Filipinos who inherited about 5% of their genome from Denisovans—fossil evidence of their existence has been hard to come by. Researchers have uncovered a few teeth, a finger bone, and a piece of skull from Denisova Cave in Siberia, and a mandible with a pair of intact molars in Xiahe Cave on the Tibetan Plateau. Despite the genetic clues that Denisovans at one point dwelled in Southeast Asia, no fossils have turned up there.

The archaeologists who were led to the cave in 2018 had been excavating early modern human sites in Laos's lush Annamite Mountains for 15 years. Now, in the depths of Cobra Cave, also known as Tam Ngu Hao 2, they dissolved rocky accretions around the mysterious tooth. The researchers pegged it as a permanent lower hominin molar. But from which species?

"We knew it looked kind of human, but not quite right for a modern human," says Laura Shackelford, a paleoanthropologist at the University of Illinois, Urbana-Champaign, and senior author of the new study. It was much bigger, and the thickness of its enamel was distributed differently. Its pattern of ridges and hills didn't match that of modern humans, either.

Study co-author Clément Zanolli, a paleoanthropologist at the University of Bordeaux and a dental structure expert, helped eliminate a few other possibilities: The molar was too big to have come from the diminutive island-dwelling humans H. floresiensis or H. luzonensis; its crown was too complex to belong to H. erectus. It looked a bit like a Neanderthal molar, but there is no genetic or fossil evidence that Neanderthals ever lived in Southeast Asia.

The researchers digitized the strange tooth using an x-ray scanner at the Max Planck Institute for Evolutionary Anthropology, precisely measuring its cusps, ridges, and crests. Next, they compared those measurements

with the teeth of other humans and great apes. They found it most closely matched the lower molars on the Denisovan mandible from Xiahe Cave, they report today in Nature Communications.

The team used a variety of techniques to date the sediment in which the molar was found, as well as the animal bones alongside it, and determined the molar was deposited in the cave sometime 130,000 to 160,000 years ago, making it roughly the same age as the Xiahe Cave mandible.

Because of the tooth's extreme age and the region's hot, tropical climate, its ancient DNA was unlikely to be salvageable. Instead, the researchers took small chips of tooth enamel and analyzed them for the presence of ancient proteins; these are hardier than DNA but offer less precise answers about ancestry and other characteristics. The makeup of the Lao molar's proteins confirmed it came from a member of our genus Homo, Shackelford says, and suggested its owner was most likely female. The tooth's incompletely formed root and lack of wear indicates it hadn't yet erupted, suggesting its owner was probably a juvenile when she died.

Shara Bailey, a dental paleoanthropologist at New York University, says she's "sufficiently convinced" the tooth is Denisovan. She hopes other examples of Denisovan teeth will turn up in the collections of universities and museums, helping pin down the group's impressive geographic range. "You can start building a picture of just how adaptable this group was," Bailey says. "They lived in Siberia, they lived at high altitude, they lived in tropical forests. That's pretty amazing."

Science, 17 May 2022

https://science.org

Your Google searches and tweets might help forecast the next disease outbreak

2022-05-18

It seems like yet another punchline for anyone joking about the past two years of pandemic life. But to scientists forecasting future disease outbreaks, it's important data.

Scented candles began receiving an influx of negative reviews online in 2020. Dissatisfied customers proclaimed that some of the most fragrant, most popular products from famous companies like Yankee Candle had "no smell" or even smelled bad.

People leave a trail of breadcrumbs when they navigate the digital world, offering clues about what is happening in their lives—including their health.

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This wasn't just a few bad reviews. The most popular scented candles sold on Amazon were receiving an average of 4 to 4½ stars before 2020, but over the course of that first year of the pandemic, the reviews fell by about a full star. Social media users mused about a link between these negative reviews and the loss of the sense of smell associated with COVID-19 infections.

When COVID-19 cases rose again at the end of 2021 due to the omicron variant, researchers noted another uptick in those negative "no smell" reviews.

Those negative online reviews are what Mauricio Santillana calls "breadcrumbs." As people navigate the digital world, they leave traces of what is going on in their offline lives, explains the director of the Machine Intelligence Group for the betterment of Health and the Environment (MIGHTE) in the Network Science Institute at Northeastern. Those "breadcrumbs" leave a trail for researchers like Santillana to follow as they project potential future outbreaks of COVID-19 and other diseases.

If there are anomalies in online trends—a spike in Google searches for shops that deliver chicken noodle soup, a sudden flurry of Tweets about navigating a quarantining family member, or bad reviews on scented candles—it could indicate that trouble is brewing. So Santillana is creating machine-learning models to spot the anomalies, make sense of these clues, and create an early warning system for disease outbreaks.

By adding human behavior to the mix, "we're creating an observatory of disease activity using different telescopes," says Santillana, a professor of physics and of electrical and computer engineering who recently joined Northeastern from Harvard University.

Santillana is teaming up with Alessandro Vespignani, director of the Network Science Institute and Sternberg Family Distinguished Professor at Northeastern, who leads a team of infectious-disease modelers that have been developing a set of projections about the possible futures of the COVID-19 pandemic since the crisis began.

Vespignani's models integrate details such as case counts, hospitalizations, deaths, human mobility patterns, how often humans interact, how the virus transmits and more data focused on the disease spread itself. Santillana says his research adds a different sort of thermometer by looking at digital traces of human behaviors that are a step removed from the epidemiological data.

"In a way, we're trying to bring together these two perspectives to provide a more whole picture of outbreaks like COVID-19," Santillana says.

Santillana and Vespignani have already been collaborating, combining this digital behavioral data with epidemiological data in their modeling work. In a paper published in Science Advances last year, they showed that such a harmonized early warning system could anticipate a surge in COVID-19 cases and deaths by two to three weeks. With Santillana joining the Network Science Institute, the pair will work together to further develop this early-warning system for disease outbreaks—and not just for COVID-19.

The data that Santillana gathers encompasses a vast, diverse collection of information—not just Google search trends, social media posts, and online shopping reviews or orders. He has also used anonymized smart thermometer data to identify when some sort of illness might be ticking up in a region, anonymized mobility data from smartphones that illustrates when more people might be staying home sick, as well as trends in clinician searches for certain kinds of treatments or symptoms.

Even the Google searches and social media posts encompass a wide range of data. People could be searching for more information about their symptoms or quarantine recommendations, or they could simply be trying to figure out where to buy cough syrup or soup.

An uptick in just one of these behaviors in a region might indicate that COVID-19 or another infectious disease is sweeping into a community, or it might just be that there was a new sci-fi film that came out and piqued people's curiosity about pandemics more generally. That's why Santillana says it's important for his models to take into account many different data sources. The machine learning models are also designed to figure out whether a rise in certain Google searches, for example, actually correlates with a rise in infections and hospitalizations in order to determine if it is worth considering as a harbinger of a disease outbreak.

This new type of "telescope," as Santillana termed it, will be a component of the U.S.'s new disease forecasting initiative, the Center for Forecasting and Outbreak Analytics (CFA). Santillana is part of a team of experts advising that effort.

"In the same way that the weather forecasting systems around the world work," he explains, "the idea is to contribute different ways to look at information that is being produced in real time and design systems that will recognize when something anomalous happens."

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Like weather forecasting agencies, the CFA will essentially be an early warning system, identifying when and where disease outbreaks might occur so that public-health officials can take action to prevent them from becoming devastating.

Tech Xplore, 18 May 2022

https://techxplore.com

Could we learn to love slugs and snails in our gardens?

2022-05-13

Before you squash or poison the next slug or snail you see in your garden, consider this: The British Royal Horticultural Society no longer classifies these gastropods as pests. Why on earth would a leading gardening organisation do that, you might wonder. After all, slugs and snails are usually seen as a problem, given their eagerness to devour the plants you've lovingly nurtured.

The issue is that they are part of nature. Slugs and snails play a key role in healthy ecosystems, acting to break down organic material as well as providing a source of food for blue-tongued lizards, frogs and kookaburras.

So can we learn to live with slugs and snails? Yes, if we reframe how we see these invertebrates. After all, the definition of "pest" is based on our perception and can change over time. By rejecting the "pest" status of many invertebrates and advocating planet friendly gardening, the horticultural society directly connects the local actions of gardeners to our global biodiversity crisis.

Their principal entomologist, Andrew Salisbury, has argued that "now is the time to gracefully accept, even actively encourage, more of this life into our gardens".

This doesn't have to mean letting them destroy your lettuces. Nature can help. Enticing lizards, frogs and birds to your garden can help control slugs and snails and boost biodiversity.

Are these 'pests' actually legitimate garden inhabitants?

Gardening increased in popularity during the pandemic. With widespread rainy weather across Australia's east coast, gardeners are more likely to see – and potentially be annoyed by – slugs and snails.

Australia has a huge diversity of land snails, with many species yet to be described. Many species are in decline, however, due to introduced predators and loss of habitat, and now require conservation efforts.

So should Australian gardeners follow the UK's example? Should we try to welcome all species into the garden? Responses to these questions typically describe slugs and snails as "pests", invoke the idea of a native/non-native species divide or describe the perceived damage done by invasive species.

Let's tackle the pest argument first. We define pests based on perception. That means what we think of as a pest can change. The garden snail is a good example. Many gardeners consider them a pest, but they are cherished by snail farmers who breed them for human consumption.

By contrast, many scientists consider the concept of an invasive species to be less subjective. Australia's environment department defines them as species outside their normal distribution (often representing them as non-native) which "threaten valued environmental, agricultural or other social resources by the damage it causes". Even this definition, however, is a little rubbery.

In recent decades, researchers in the humanities, social sciences and some natural sciences have shown our ideas of nativeness and invasiveness also undergo change. Is the dingo a native animal, for instance, after being introduced thousands of years ago? Would it still be considered a native if it was introduced to Tasmania where it does not occur?

Despite these questions over their worth, the ideas of "pest" and "invasive species" have proven remarkably persistent in ecological management.

What exactly are the slugs and snails we find in our gardens?

Australia has a huge diversity of land snails, with many species yet to be described. Many species are in decline, however, due to introduced predators and loss of habitat, and now require conservation efforts.

Does that include our gardens? Well, most snails and slugs found in gardens are considered non-native species which were introduced accidentally. The ability of snails to spread far and wide means these humble gastropods are listed on Australia's official list of priority pests. We already have biosecurity measures in place to avoid unwanted introduction of new snail species.

The common garden snail, which hails from the Mediterranean, has now spread to every state and territory. But other species are still spreading, such as the Asian tramp snail on the east coast or the green snail, which is currently limited to Western Australia. So if we accept the existence of all

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kinds of snails and slugs in the garden, we could be undermining efforts to detect and control some of these species.

While slugs and snails don't usually seriously threaten our home gardens, some species are known agricultural pests. The common garden snail can cause major damage to citrus fruit and young trees, while slugs such as the leopard slug or the grey field slug can devastate fields of seedlings. The damage they can do means farmers and their peak bodies would feel uneasy about changing how we think of these land molluscs.

Some snails can also carry dangerous parasites like the rat lungworm or the trematode worm Brachylaima cribbi. These can hurt us, particularly if a snail is accidentally eaten, or if vegetables in the garden are contaminated. If we let snails move around unhindered, we could increase the number of infections. Pets and children are the most at risk.

So should we follow the UK's example?

It is not straightforward to rethink how we view and respond to creatures typically considered pests in the garden. But it is worthwhile thinking this through, as it requires appreciating how humans and nonhumans are interdependent. And we can gain a better understanding of how our simple actions in our gardens can scale up to affect human and planetary health and well-being.

The world's ongoing loss of biodiversity and the steadily changing climate must inform how we relate to and care for the nonhuman life – from mycelium in the soil to gastropods – that enliven our gardens.

This does not mean everything must have an equal opportunity to flourish. But it does require us to pay attention. To observe, to wonder and to be curious about our entangled lives. This kind of attention could help us take a more ethical approach to the everyday life and death decisions we make in our patch.

What does that look like? By understanding gardens as interconnected natural and cultural spaces, we can work to limit our resident slug and snail population and promote biodiversity. A perfect way to start is to design a lizard, frog and bird friendly site.

The Conversation, 13 May 2022

https://theconversation.com

Bucking the trend: Is there a future for ultra long-haul flights in a net zero carbon world?

2022-05-18

This year, Qantas announced two plans in direct conflict. In March, Australia's largest airline group went public with the admirable goal of achieving net zero emissions by 2050 and a 25% reduction by 2030 by using new clean fuels, boosting efficiency and using carbon offsets. For the aviation industry, this was a watershed moment, containing world-leading detail and bold links between executive pay and improved sustainability.

But only two months later, Qantas confirmed its order for 12 new Airbus planes capable of ultra long-distance flights, making possible non-stop flights from Sydney and Melbourne to London or New York.

What's the conflict? These long distance flights must carry substantially more fuel and, as a result, fewer passengers, making them markedly less efficient.

If the aviation industry heads down this route, it will be a backwards step in the fight against climate change. While Qantas intends these flights to be carbon neutral, this will have to involve carbon offsets given there are no other options at present.

As the world gets more serious about climate action, flights like this will come under scrutiny.

Flying the furthest comes with a carbon cost

For decades, Qantas has hoped to overcome Australia's tyranny of distance, beginning ultra long-haul test flights as early as 1989. These tests didn't translate into regular flights, however, leaving the door open to key competitor Singapore Airlines, which currently has the world's top two ultra long flights.

Qantas seems determined to change that. In 2025, the carrier's new Sydney-London non-stop flight will cover 17,800km non-stop to become the world's longest flight.

While it might seem like a single flight would produce less emissions, the opposite is true.

The most efficient flights (based on fuel burned per kilometre) are those between 3,000 and 5,000km, depending on aircraft type. By contrast,

The most efficient flights (based on fuel burned per kilometre) are those between 3,000 and 5,000km, depending on aircraft type.

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non-stop ultra long haul flights produce more carbon emissions than two shorter journeys with a stop-over.

The reason is simple physics. Planes flying ultra long distances must carry lots of fuel, especially at take-off, to cover the later stages of the journey. For the new planes Qantas has ordered, it takes about 0.2kg of fuel to transport a kilo a thousand kilometres.

Given the long distance, this means it's not a very efficient use of fuel. Not only that, but the high fuel load means there is less space for passengers.

That gives an even less favourable result based on the metric of carbon dioxide emitted per passenger-kilometre. For example, the non-stop flight from Auckland to Dubai of 14,193km produces 876kg of CO2 per person in economy class, whereas the same journey with a stop-over in Singapore would produce 772kg. Exact emission rates may differ due to flight paths, freight weight, and weather, among other issues.

So while a typical A350-900 seats between 300 and 350 passengers, Singapore Airline's existing marathon flights using these planes can only carry half that, namely 161 passengers. Similarly, the planned Qantas flights would have just 238 passengers, 112 to 172 seats fewer than what Airbus recommends.

As you'd expect, less passengers increases the ticket cost and makes these flights more exclusive, adding to the problem that a small wealthy elite have a disproportionately high environmental impact.

Can long-haul ever be low carbon?

Marathon non-stop flights stand in the way of a wider shift towards a low-emissions world. If airlines are serious about tackling their sector's growing contribution to fossil fuel emissions, they must look to research into alternative fuels and technologies by programs like the EU's Clean Sky.

These programs have shown sustainable fuels and new technologies are much better suited to shorter flights. Electric aircraft, for instance, are becoming viable for short flights in the near-term future. In Sydney, electric seaplanes will soon enter the short-hop sector, while hybrid-electric technology has the potential to support flights of up to 1500km, depending on progress in battery technology.

So what about long distance? We have two options. One is hydrogen and the other is sustainable aviation fuels.

While there is a huge amount of hype around clean hydrogen at present, the reality is green hydrogen derived from renewable electricity currently makes up just 1% of all hydrogen we produce. We would need a monumental effort to scale up to fill the demand from aviation.

Another challenge is hydrogen's low energy density, which will restrict flying range to an estimated maximum of 7,000km by 2040.

That leaves sustainable aviation fuel as the only option for long-haul flights. The airline industry is pinning their hopes on fuels derived either from biological feedstocks (used cooking oils or oil derived from algae) or produced synthetically.

The sustainability of these fuels depends on the feedstock, the production process (which, again, will demand large amounts of renewable energy) and a detailed understanding of impacts on the atmosphere from any gases emitted. That suggests these fuels will likely be expensive, with volumes hard to secure to fully replace fossil fuels. Even so, these fuels will have to be part of aviation's future.

New ways of travel

The way we think about flying is changing, with climate impact front of mind for many travellers.

In response, some countries have begun to ramp up their focus and infrastructure spending on rail travel, to encourage new travel patterns. The growing regenerative tourism movement – which emphasises deeper engagement with place and people – signals there is real potential to shift mass travel away from far-and-fast destinations to close-and-deep.

The role of flying in tourism is already changing, and it will change more in coming years. You can already glimpse this in the trends towards more climate-friendly travel closer to home. Soon, electric and hybrid planes will encourage shorter flights in a carbon-constrained world.

As for ultra long-haul flights, it is difficult to picture how these are compatible with the goal of net-zero emissions.

The Conversation, 18 May 2022

https://theconversation.com

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What is storm surge? It's often a hurricane's deadliest and most destructive threat

2022-05-18

Storm surge, the massive mound of water that builds up and comes ashore during a hurricane, is often the deadliest and most destructive threat from these devastating storms.

In fact, storm surge has accounted for about half of all the deaths in hurricanes since 1970, according to the National Hurricane Center. It caused most of the 1,800 deaths in Hurricane Katrina in 2005.

Storm surge is characterized by water being pushed toward the shore by the force of the winds moving around the storm, the National Oceanic and Atmospheric Administration (NOAA) said.

Storm surge watches and warnings are now separated from hurricane alerts because hurricane-force winds and storm surges don't always occur at the same place or the same time, said Rick Knabb, the former director of the hurricane center, and now the hurricane expert at the Weather Channel.

Preparing for hurricane-force winds is different than for storm surge, he said. For storm surge, people should evacuate, while for wind, they can stay in place in a strong structure as long as it's away from flood-prone areas, Knabb said.

What is a storm surge warning?

A "storm surge watch" is issued when flooding is possible, while a "warning" is issued when flooding is expected. Every coastal city along the Gulf or East Coast of the U.S. is at risk of storm surge, the hurricane center said.

In addition to being the deadliest threat, storm surge is also typically the most destructive part of a hurricane. In Hurricane Sandy in 2012, storm surge-induced flooding measured as high as nine feet above ground in parts of New York and New Jersey, leading to billions of dollars in damage.

The damage occurred even though Sandy spun ashore as the equivalent of only a Category 1 hurricane, with winds of about 80 mph, and was downgraded below hurricane status shortly thereafter.

Impact of climate change

Storm surge has accounted for about half of all the deaths in hurricanes since 1970, according to the National Hurricane Center.

Another factor: Climate change could worsen storm surge, one recent study suggests. The frequency of extreme storm surges is projected to increase by as much as 10 times in coming decades because of warming temperatures, a 2013 study found. Global warming has already doubled the chance of storms like Katrina, according to the study, which was led by climate scientist Aslak Grinsted of the University of Copenhagen in Denmark.

Storm surge flooding does not include floods caused by the heavy rain from a hurricane, such as what happened in 2017 in the Houston area with Hurricane Harvey and in North Carolina in 2016 during Hurricane Matthew.

It also has nothing to do with tsunamis, large ocean waves generated by offshore earthquakes that are not related to weather.

Phys Org, 18 May 2022

https://phys.org

Astronauts may one day drink water from ancient moon volcanoes

2022-05-18

Billions of years ago, a series of volcanic eruptions broke loose on the moon, blanketing hundreds of thousands of square miles of the orb's surface in hot lava. Over the eons, that lava created the dark blotches, or maria, that give the face of the moon its familiar appearance today.

Now, new research from CU Boulder suggests that volcanoes may have left another lasting impact on the lunar surface: sheets of ice that dot the moon's poles and, in some places, could measure dozens or even hundreds of feet thick.

"We envision it as a frost on the moon that built up over time," said Andrew Wilcoski, lead author of the new study and a graduate student in the Department of Astrophysical and Planetary Sciences (APS) and the Laboratory for Atmospheric and Space Physics (LASP) at CU Boulder.

He and his colleagues published their findings this month in The Planetary Science Journal.

The researchers drew on computer simulations, or models, to try to recreate conditions on the moon long before complex life arose on Earth. They discovered that ancient moon volcanoes spewed out huge amounts of water vapor, which then settled onto the surface—forming stores of

The new study adds to a growing body of evidence that suggests that the moon may be awash in a lot more water than scientists once believed.

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ice that may still be hiding in lunar craters. If any humans had been alive at the time, they may even have seen a sliver of that frost near the border between day and night on the moon's surface.

It's a potential bounty for future moon explorers who will need water to drink and process into rocket fuel, said study co-author Paul Hayne.

"It's possible that 5 or 10 meters below the surface, you have big sheets of ice," said Hayne, assistant professor in APS and LASP.

Temporary atmospheres

The new study adds to a growing body of evidence that suggests that the moon may be awash in a lot more water than scientists once believed. In a 2020 study, Hayne and his colleagues estimated that nearly 6,000 square miles of the lunar surface could be capable of trapping and hanging onto ice—mostly near the moon's north and south poles. Where all that water came from in the first place is unclear.

"There are a lot of potential sources at the moment," Hayne said.

Volcanoes could be a big one. The planetary scientist explained that from 2 to 4 billion years ago, the moon was a chaotic place. Tens of thousands of volcanoes erupted across its surface during this period, generating huge rivers and lakes of lava, not unlike the features you might see in Hawaii today—only much more immense.

"They dwarf almost all of the eruptions on Earth," Hayne said.

Recent research from scientists at the Lunar and Planetary Institute in Houston shows that these volcanoes likely also ejected towering clouds made up of mostly carbon monoxide and water vapor. These clouds then swirled around the moon, potentially creating thin and short-lived atmospheres.

That got Hayne and Wilcoski wondering: Could that same atmosphere have left ice on the lunar surface, a bit like frost forming on the ground after a chilly fall night?

Forever ice

To find out, the duo alongside Margaret Landis, a research associate at LASP, set out to try to put themselves onto the surface of the moon billions of years ago.

The team used estimates that, at its peak, the moon experienced one eruption every 22,000 years, on average. The researchers then tracked how volcanic gases may have swirled around the moon, escaping into space over time. And, they discovered, conditions may have gotten icy.According to the group's estimates, roughly 41% of the water from volcanoes may have condensed onto the moon as ice.

"The atmospheres escaped over about 1,000 years, so there was plenty of time for ice to form," Wilcoski said.

There may have been so much ice on the moon, in fact, that you could, conceivably, have spotted the sheen of frost and thick, polar ice caps from Earth. The group calculated that about 18 quadrillion pounds of volcanic water could have condensed as ice during that period. That's more water than currently sits in Lake Michigan. And the research hints that much of that lunar water may still be present today.

Those space ice cubes, however, won't necessarily be easy to find. Most of that ice has likely accumulated near the moon's poles and may be buried under several feet of lunar dust, or regolith.

One more reason, Hayne said, for people or robots to head back and start digging.

"We really need to drill down and look for it," he said.

Phys Org, 18 May 2022

https://phys.org

How cranberries could improve memory and ward off dementia

2022-05-19

A new study published today highlights the neuroprotective potential of cranberries.

The research team studied the benefits of consuming the equivalent of a cup of cranberries a day among 50 to 80-year-olds.

They hope that their findings could have implications for the prevention of neurodegenerative diseases such as dementia.

Lead researcher Dr David Vauzour, from UEA's Norwich Medical School, said: "Dementia is expected to affect around 152 million people by 2050.

Adding cranberries to your diet could help improve memory and brain function, and lower 'bad' cholesterol.

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There is no known cure, so it is crucial that we seek modifiable lifestyle interventions, such as diet, that could help lessen disease risk and burden.

"Past studies have shown that higher dietary flavonoid intake is associated with slower rates of cognitive decline and dementia. And foods rich in anthocyanins and proanthocyanidins, which give berries their red, blue, or purple colour, have been found to improve cognition.

"Cranberries are rich in these micronutrients and have been recognized for their antioxidant and anti-inflammatory properties.

"We wanted to find out more about how cranberries could help reduce age-related neurodegeneration."

The research team investigated the impact of eating cranberries for 12 weeks on brain function and cholesterol among 60 cognitively healthy participants.

Half of the participants consumed freeze-dried cranberry powder, equivalent to a cup or 100g of fresh cranberries, daily. The other half consumed a placebo.

The study is one of the first to examine cranberries and their long-term impact on cognition and brain health in humans.

The results showed that consuming cranberries significantly improved the participants' memory of everyday events (visual episodic memory), neural functioning and delivery of blood to the brain (brain perfusion).

Dr Vauzour said: "We found that the participants who consumed the cranberry powder showed significantly improved episodic memory performance in combination with improved circulation of essential nutrients such as oxygen and glucose to important parts of the brain that support cognition -- specifically memory consolidation and retrieval.

"The cranberry group also exhibited a significant decrease in LDL or 'bad' cholesterol levels, known to contribute to atherosclerosis -- the thickening or hardening of the arteries caused by a build-up of plaque in the inner lining of an artery. This supports the idea that cranberries can improve vascular health and may in part contribute to the improvement in brain perfusion and cognition.

"Demonstrating in humans that cranberry supplementation can improve cognitive performance and identifying some of the mechanisms responsible is an important step for this research field.

"The findings of this study are very encouraging, especially considering that a relatively short 12-week cranberry intervention was able to produce significant improvements in memory and neural function," he added.

"This establishes an important foundation for future research in the area of cranberries and neurological health."

The study was supported by a grant from The Cranberry Institute. It was led by the University of East Anglia in collaboration with researchers at the Leiden University Medical Center (Netherlands), the University of Parma (Italy) and the Quadram Institute (UK).

Science Daily, 19 May 2022

https://sciencedaily.com

How a cognitive bias is blocking the rise of electric cars

2022-05-19

What are the barriers to the adoption of electric cars? Although the main financial and technological obstacles have been removed, their market share still needs to increase. In a recent study, a team from the University of Geneva (UNIGE) investigated the cognitive factors that still dissuade many people from switching to electric cars. They found that car owners systematically underestimate the capacity of electric driving ranges to meet their daily needs. These results, published in Nature Energy, open up new avenues to speed up the electrification of mobility in addition to conventional policy approaches.

The increase of greenhouse gases (GHG) in the atmosphere is one of the main causes of global warming. Among the GHGs is carbon dioxide—the well-known CO2—of which the transport sector is one of the main emitters. Fossil fuel vehicles alone account for nearly 18% of global CO2 emissions. The electrification of the vehicle fleet has therefore become one of the major challenges of the energy transition.

The number of electric vehicles is increasing in many countries. However, they are still far from having the market share that would allow a significant reduction in road traffic emissions. In 2020, they represented only 1% of the global vehicle fleet, including hybrid vehicles. To meet the 2030 climate targets, this proportion needs to reach at least 12%.

It's (almost) all in the head

In 2020, [electric vehicles] represented only 1% of the global vehicle fleet, including hybrid vehicles. To meet the 2030 climate targets, this proportion needs to reach at least 12%.

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Now that the main financial and technological barriers have been removed (more affordable purchase prices, financial incentives, denser network of charging stations), what factors are still blocking widespread adoption of this mode of transportation? A large part of the answer lies in the cognitive biases and shortcuts of car drivers.

"Until now, initiatives related to the energy transition generally focused on the technological and financial barriers to their realization. Psychological factors have been given very little consideration. However, many studies show that individuals do not automatically adopt the behaviors most beneficial for themselves or society, often due to a lack of access to complete information," explains Mario Herberz, first author of the study and researcher at the Consumer Decision and Sustainable Behavior Laboratory of the Department of Psychology at the Faculty of Psychology and Educational Sciences of the UNIGE.

The solution: Tailored information

By interviewing more than 2,000 car drivers of different backgrounds and ages in Germany and the United States, the UNIGE scientists identified the source of the cognitive biases that were holding them back from adopting an electric vehicle. "We observed that the participants systematically underestimated the compatibility of electric battery capacities available on the current market with their real needs," says Tobias Brosch, director of the Consumer Decision and Sustainable Behavior Laboratory and last author of the research.

In other words, consumers wrongly believe that the autonomy of current batteries is not sufficient to cover their daily journeys. This underestimation is substantial, the researchers estimating it at around 30%. "To reassure people, the solution is not only to densify the network of charging stations or to increase the size of batteries, which require scarcer resources such as lithium and cobalt. It is the provision of information adapted to the concrete needs of drivers that will reduce their concern and increase their willingness to adopt an electric vehicle," explains Mario Herberz.

250 kilometers, the ideal range

The research team found that more than 90% of car trips could be completed with vehicles with a driving range of 200 kilometers, a modest range among the currently available batteries. "The trend is to increase performance, but we have observed that a greater range, beyond 300km for example, does not increase the fit to daily needs. It would only have a

minimal impact on the number of additional trips that can be completed with one electric charge. Increasing the size of the batteries is therefore not a key element in the energy transition," says Mario Herberz.

This research, partly financed by the Swiss Federal Office of Energy, demonstrates the importance of psychological factors and access to relevant information when implementing the energy transition. It opens up new avenues for promoting the electrification of mobility with scientifically informed interventions, as a complement to conventional policy approaches.

Tech Xplore, 19 May 2022

https://techxplore.com

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