CHEMWATCH

Bulletin Board

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JUN. 04, 2021

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ASIA PACIFIC

Chemicals added to the Inventory 5 years after issues of assessment certificate—25 May 2021

2021-05-25

The following industrial chemicals have been added to the Australian Inventory of Industrial Chemicals in accordance with section 82 of the Industrial Chemicals Act 2019 because 5 years have passed since the assessment certificates for the industrial chemicals were issued.

CAS Number	2103279-22-5
Chemical name	Silane, ethenyltriethoxy-, reaction products with ethylene-1-hexene polymer
Molecular formula	Unspecified
Specific information requirements	Obligations to provide information apply. You must tell us within 28 days if the circumstances of your importation or manufacture (introduction) are different to those in our assessment.
Listing date	28 April 2021

CAS number	17351-62-1
Chemical name	1-Butanaminium, *N,N,N*-tributyl-, carbonic acid (1:1)
Molecular formula	C16H36N.CHO3
Specific information requirements	Obligations to provide information apply. You must tell us within 28 days if the circumstances of your importation or manufacture (introduction) are different to those in our assessment.

The following industrial chemicals have been added to the Australian Inventory of Industrial Chemicals in accordance with section 82 of the Industrial Chemicals Act 2019 because 5 years have passed since the assessment certificates for the industrial chemicals were issued.

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CAS number	17351-62-1
Listing date	3 May 2021

CAS number	478796-04-2
Chemical name	1-Butanaminium, *N,N,N*-tributyl-, ethyl carbonate (1:1)
Molecular formula	C16H36N.C3H5O3
Specific information requirements	Obligations to provide information apply. You must tell us within 28 days if the circumstances of your importation or manufacture (introduction) are different to those in our assessment.
Listing date	3 May 2021

CAS number	1338579-13-7
Chemical name	1-Butanaminium, *N,N,N*-tributyl-, propyl carbonate (1:1)
Molecular formula	C16H36N.C4H7O3
Specific information requirements	Obligations to provide information apply. You must tell us within 28 days if the circumstances of your importation or manufacture (introduction) are different to those in our assessment.
Listing date	3 May 2021

CAS number	10353-86-3
Chemical name	2-Propanol, 1,1′ -[(2-hydroxyethyl) imino]bis-
Molecular formula	C8H19NO3
Specific information requirements	Obligations to provide information apply. You must tell us within 28 days if the circumstances of your importation or manufacture (introduction) are different to those in our assessment.
Listing date	3 May 2021

CAS number	1548594-88-2
Chemical name	Paraffin waxes and Hydrocarbon waxes, oxidized, polymers with acrylic acid, Bu acrylate, fumaric acid, polyethylene glycol ether with bisphenol A (2:1), polypropylene glycol ether with bisphenol A (2:1), styrene, terephthalic acid and trimellitic anhydride, *tert*-Bu peroxide-initiated
Molecular formula	Unspecified
Specific information requirements	Obligations to provide information apply. You must tell us within 28 days if the circumstances of your importation or manufacture (introduction) are different to those in our assessment.
Listing date	6 May 2021

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CAS number	1449492-46-9
Chemical name	Isocyanic acid, polymethylenepolyphenylene ester, Me Et ketone oxime- and polyethylene glycol mono-Me ether-blocked
Molecular formula	Unspecified
Specific information requirements	Obligations to provide information apply. You must tell us within 28 days if the circumstances of your importation or manufacture (introduction) are different to those in our assessment.
Listing date	14 May 2021

CAS number	2640158-23-0
Chemical name	Fatty acids, C18-unsatd., dimers, polymers with bisphenol A, cashew nutshell liq., 1,3-cyclohexanedimethanamine, epichlorohydrin and polyethylenepolyamines
Molecular formula	Unspecified
Specific information requirements	Obligations to provide information apply. You must tell us within 28 days if the circumstances of your importation or manufacture (introduction) are different to those in our assessment.
Listing date	18 May 2021

CAS number	131298-48-1
Chemical name	Polysiloxanes, methoxy vinyl
Molecular formula	Unspecified
Specific information requirements	Obligations to provide information apply. You must tell us within 28 days if the circumstances of your importation or manufacture (introduction) are different to those in our assessment.
Listing date	21 May 2021

CAS number	53185-52-7
Chemical name	Propanamide, 3-methoxy-*N*,*N*-dimethyl-
Molecular formula	C6H13NO2
Specific information requirements	Obligations to provide information apply. You must tell us within 28 days if the circumstances of your importation or manufacture (introduction) are different to those in our assessment.
Listing date	21 May 2021

Read More

Australian Industrial Chemicals Introduction Scheme, 25 May 2021

https://www.industrialchemicals.gov.au/news-and-notices/chemicals-added-inventory-5-years-after-issue-assessment-certificate-25-may-2021

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I manufacture or import antibacterial skin-care products—do I need to register AICIS?

2021-05-21

We've added an A4 information sheet to our page on antibacterial skin-care products to help you work out whether your introduction is a therapeutic good or a cosmetic. Once you've worked this out, you can determine whether you need to register with AICIS.

Designed to be downloaded and shared, our information sheet — called 'What is a cosmetic antibacterial skin-care product?' — is based on the questions you've been asking.

Read More

Australian Industrial Chemicals Introduction Scheme, 21 May 2021

https://www.industrialchemicals.gov.au/news-and-notices/i-manufacture-or-import-antibacterial-skin-care-products-do-i-need-register-aicis

I manufacture or import anti-dandruff and anti-acne skin-care products—do I need to register with AICIS?

2021-05-21

We've added an A4 information sheet to our page on anti-dandruff and anti-acne skin-care products to help you work out whether your introduction is a therapeutic good or a cosmetic — and whether you need to register with AICIS.

Read More

Australian Industrial Chemicals Introduction Scheme, 21 May 2021

https://www.industrialchemicals.gov.au/news-and-notices/i-manufacture-or-import-anti-dandruff-and-anti-acne-skin-care-products-do-i-need-register-aicis

Once you've worked this out, you can determine whether you need to register with AICIS.

AMERICA

EPA poised to propose TSCA Section 8(a) reporting rule on PFAS chemicals

2021-05-25

On March 1, 2021, the White House Office of Management and Budget (OMB) received for review under Executive Order 12866 (Regulatory Planning and Review) from the U.S. Environmental Protection Agency (EPA) a proposed rule entitled "Reporting and Recordkeeping for Perfluoroalkyl or Polyfluoroalkyl Substances Under Section 8(a)(7) of the Toxic Substances Control Act (TSCA)" (Proposed Rule). This action is required under Section 7351 of the National Defense Authorization Act for Fiscal Year 2020 (NDAA) that amended TSCA Section 8(a). NDAA Section 7351 and TSCA Section 8(a)(7) require EPA to promulgate a rule by January 1, 2023, requiring each person who has manufactured a perfluoroalkyl or polyfluoroalkyl substance (PFAS) in any year since January 1, 2011, to submit to EPA a report that includes, for each year since January 1, 2011, the information described in TSCA Section 8(a)(2)(A)-(G). This includes, to the extent known or reasonably ascertainable to the manufacturers (including importers) of the PFAS:

(A) The common or trade name, the chemical identity, and the molecular structure of each chemical substance for which such a report is required.

(B) The categories or proposed categories of use of each such substance.

(C) The total amount of each such substance manufactured or processed, reasonable estimates of the total amount to be manufactured or processed, the amount manufactured or processed for each of its categories of use, and reasonable estimates of the amount to be manufactured or processed for each of its categories of use or proposed categories of use.

Read More

Bergeson & Campbell PC, 25 May 2021

https://www.lawbc.com/regulatory-developments/entry/epa-poised-to-propose-tsca-section-8a-reporting-rule-on-pfas-chemicals

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High levels of toxic chemicals found in some Mass. water supplies

2021-05-24

Massachusetts communities are monitoring PFAS in their drinking water, a group of chemicals also found in consumer products and food

Massachusetts communities are finding elevated levels of chemicals in their drinking water since the state implemented new safety regulations last fall.

The town of Wayland has been handing out cases of bottled water since it first found certain per- and polyfluoroalkyl substances (PFAS) in two of three wells at the Happy Hollow wellfield in February. In their most recent update, town officials said they plan to shut down one well, treat the second well showing elevated levels and blend the treated water with water from the third well.

"It's our understanding that it's really the sensitive population that is more at risk of having PFAS in the water," said Thomas Holder, Wayland's director of public works.

The short-term solution will bring the Happy Hollow supply into compliance with regulations set by the Massachusetts Department of Environmental Protection (MassDEP), officials said, but work continues to find a long-term solution.

"Nothing has changed" Holder said. "The water is the same, it is just the regulation has dropped from 70 parts per trillion to 20 parts per trillion"

MassDEP adopted a strict drinking water standard in October 2020, limiting the sum of six specific PFAS to no more than 20 parts per trillion. The standard is meant to protect people against adverse health effects from drinking the water.

Read More

NBC Boston, 24 May 2021

https://www.nbcboston.com/news/local/high-levels-of-toxic-chemicals-found-in-water-supplies/2388163/

Massachusetts communities are finding elevated levels of chemicals in their drinking water since the state implemented new safety regulations last fall.

Under the rule, about 1,590 landfill operators will have 30 months to install or update control systems to meet EPA's standards.

With landfill emissions regulation, EPA enforces once-delayed methane pollution rule

2021-05-24

Dive Brief:

- The U.S. EPA recently issued a final rule on emissions thresholds for municipal solid waste (MSW) landfills, which stakeholders see as a significant step in the Biden administration's climate change plan to slash greenhouse gas emissions in half by 2030.
- The final rule brings clarity to a drawn-out legal battle over the timeline for implementing state or federal emission rules, industry groups say, helping landfill operators make plans to update emissions systems if necessary. Environmental groups see the rule as an important way to more quickly take a bite out of air pollution, as MSW landfills are the third-largest source of human-related methane emissions in the United States.
- The rule is significant because it applies to the majority of MSW landfills in the United States, said David Biderman, CEO of the Solid Waste Association of North America. Under the rule, about 1,590 landfill operators will have 30 months to install or update control systems to meet EPA's standards.

Read More

Waste Dive, 24 May 2021

https://www.wastedive.com/news/epa-landfill-emissions-regulation-methane-biden/600675/

EUROPE

Turkey slams the door on European plastic garbage

2021-05-21

Turkey is choking on vast inflows of garbage from Europe, prompting a looming ban on almost all plastic waste imports.

That could result in more landfilling and incineration.

The Turkish trade ministry announced earlier this week it would ban all polyethylene plastics starting in early July. The plastics, used in countless items ranging from yogurt containers to plastic bottles, account for the bulk of all imported waste.

That could result in more landfilling and incineration.

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Simon Ellin, chief executive of the U.K.-based Recycling Association, called the decision a "seminal moment" that could radically reshape the global recycling industry.

"I have no idea where the waste that has been going to Turkey will go now," said Ellin, adding that it will take years before the U.K. has sufficiently scaled up its own recycling capacity.

"I suspect the next best option in the short term is waste-to-energy," he said, referring to burning non-recyclable waste for electricity or heat.

EU countries started shifting their waste exports to Turkey in 2017, after China banned the import of many types of plastic. In 2020, nearly a quarter of waste exported by EU countries — some 31.7 million tons — went to Turkey. That's 20 times more than in 2016, and amounts to some 241 truckloads of plastic waste every day, according to a Greenpeace report published earlier this week.

Under EU and U.K. regulations, plastic waste can only be exported if it is going to be recycled. But Turkey has a recycling rate of just 12 percent, indicating the country "lacks the infrastructure to cope with" all of its imported waste, the Greenpeace report said.

The NGO also found that vast amounts of European plastics are being illegally dumped and burned in Turkey, and that some exporters purposely mislabeled their waste to get around a January ban on the import of mixed polymers and plastics that have to be mechanically processed at specialist recycling facilities.

Read More

Pollitico, 21 May 2021

https://www.politico.eu/article/europe-turkey-plastic-waste-landfill-recycling/

Going green, or greenwashing? A proposed climate law divides France

2021-05-19

Emmanuel Macron's credentials as a leader on climate issues are being tested as business and environmental groups spar over changes to the French way of life.

Less meat in French cafeterias. Bans on short-distance flights. Gas heaters on cafe terraces would be outlawed.

Less meat in French cafeterias. Bans on short-distance flights. Gas heaters on cafe terraces would be outlawed.

As President Emmanuel Macron moves to make France a global champion in the fight against climate change, a wide-ranging environmental bill passed by the French National Assembly this month promises to change the way the French live, work and consume.

It would require more vegetarian meals at state-funded canteens, block expansion of France's airports and curb wasteful plastics packaging. Polluters could be found guilty of "ecocide," a new offense carrying jail terms of up to 10 years for destroying the environment. If Mr. Macron gets his way, the fight against climate change would even be enshrined in the French constitution through a referendum.

But those lofty ambitions are running into a barrage of resistance.

Environmentalists and politicians from France's Green party, rather than backing the legislation, have accused Mr. Macron's government of watering down ambitious measures and putting corporate interests above tough proposals by a 150-person "citizens climate panel," which Mr. Macron himself convened last year to address climate concerns.

Read More

New York Times, 19 May 2021

https://www.nytimes.com/2021/05/19/business/macron-france-climate-bill.html

New active substances: Public consultation

2021-05-24

HSE has received a dossier from BASF Agro B.V for the following active substance/uses:

- Cinmethylin (BAS 684 H) is a new herbicidal active substance for controlling the growth of annual grasses and several broadleaf weed species in cereals.

The dossier is for the first approval of this substance in Great Britain (GB) under retained Regulation 1107/2009; the assessment was performed by the Chemicals Regulation Division of HSE.

Any interested third parties are strongly invited to comment on the content and conclusions of the Draft Assessment Report (DAR) or share

The deadline for comment is 19 July 2021

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any relevant information. Comments can be submitted by any member of the public or interested party.

Consultation details can be viewed here.

The deadline for comment is 19 July 2021

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HSE e-Bulletin, 24 May 2021

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

The odds of your takeaway food packaging containing intentionally, harmful PFAS 1 in 3

2021-05-24

A whopping 32 out of 99 disposable paper and cardboard food packaging samples collected across Europe contained intentionally added PFAS, according to a new test study. But Denmark leads the way, proving that it's possible – and necessary – to move away from PFAS in food contact material. Marketplace has the alternatives.

One in three. That alarming ratio is the result of a study testing for intentionally added PFAS, short for per- and polyfluoroalkyl substances, in disposable paper and cardboard food packaging. The study was conducted by Czech NGO Arnika in collaboration with the Health and Environment Alliance (HEAL), CHEM Trust, and six other European NGOs: BUND, Danish Consumer Council, Générations Futures, Tegengif-Erase all Toxins, International Pollutants Elimination Network (IPEN) and ClientEarth.

The study team purchased 99 samples of disposable food packaging and tableware – for example sandwich and bakery bags, as well as take-away food boxes – made of paper, board and moulded plant fibre. The samples were collected from six different countries between May and December of 2020: the United Kingdom, Denmark, Germany, France, the Netherlands, and the Czech Republic.

Read More

Chemsec, 24 May 2021

https://marketplace.chemsec.org/articles/news/2021/05/24/the-odds-of-your-pizza-box-containing-pfas-are-1-in-3/

Twenty companies are responsible for producing more than half of all the single-use plastic waste in the world…

INTERNATIONAL

Twenty firms produced 55% of world's plastic waste, report reveals

2021-05-18

Plastic Waste Makers index identifies those driving climate crisis with virgin polymer production

Twenty companies are responsible for producing more than half of all the single-use plastic waste in the world, fuelling the climate crisis and creating an environmental catastrophe, new research reveals.

Among the global businesses responsible for 55% of the world's plastic packaging waste are both state-owned and multinational corporations, including oil and gas giants and chemical companies, according to a comprehensive new analysis.

Read More

The Guardian, 18 May 2021

https://www.theguardian.com/environment/2021/may/18/twenty-firms-produce-55-of-worlds-plastic-waste-report-reveals

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UK Reach government decision expected in June

2021-05-27

UK chemicals industry officials are expecting the government to reach a decision on the nation's post-Brexit regulations in June, the Chemical Business Association (CBA) said on Thursday.

Business groups have finished a series of meetings and discussions with the UK's Department for Environment, Food and Rural Affairs (Defra) to improve the workability and affordability of UK Reach.

Discussions centred on proposals outlined in a joint letter signed by 25 industry organisations in February suggesting alternative models for UK Reach, arguing that it needs to be adapted to suit the size of the UK's market.

"We believe that it fundamentally threatens the competitiveness of UK manufacturing for chemical-based products. In its current form it is an almost identical version of EU REACH, which was designed for a market ten times the size of the UK and took ten years to implement," the letter reads.

"We believe that it fundamentally threatens the competitiveness of UK manufacturing for chemical-based products. […]

"All in all, this will hit UK industry hard across a range of manufacturing sectors, reduce the competitiveness of UK manufacturing, and lead to a loss of inward investment, as companies look outside the UK for their manufacturing hubs for Europe."

Along with rightsizing the regulatory model, the letter urges a reduction of unnecessary red tape and increased support for cooperation between the European Chemicals Agency (ECHA) and the UK equivalent.

As well as the CBA – which supports small and medium-sized companies in the UK's chemicals supply chain – meetings with the government were attended by representatives of the Chemical Industries Association (CIA) and British Coatings Federation (BCF).

A letter from charity CHEM Trust written on behalf of 26 UK public authorities and non-governmental organisations (NGOs) outlined their 12 key requests for the UK's new chemicals strategy concerning the safe handling of hazardous materials.

Read More

ICIS, 27 May 2021

https://www.icis.com/explore/resources/news/2021/05/27/10645290/uk-reach-government-decision-expected-in-june

REACH Update

JUN. 04, 2021

Time to transition to lead-free contacts

2021-05-21

Those with limited knowledge of the details of the RoHS, REACH and ELV regulations (**R**estriction **o**f **H**azardous **S**ubstances, **R**egistration, **E**valuation, **A**uthorisation and Restriction of **Ch**emicals and **E**nd of **L**ife **V**ehicles) may not immediately recognise the importance of a lead-free product range.

As a result of exemptions in environmental regulations, lead is still permitted as a material in a number of applications. But with its lead-free product range, Würth Elektronik ICS shows that this transitional solution does not need to be exploited to the bitter end.

This is the current situation:

The REACH Regulation (EC 1907/2006) regulates the manufacture, placing on the market and use of chemical substances. Here, lead is considered to be a **S**ubstance of **V**ery **H**igh **C**oncern and is subject to documentation requirements. Since the beginning of 2021, product sellers have been obliged to register in the SCIP database (**S**ubstances of **C**oncern **I**n articles as such or in complex objects (**P**roducts)) in addition to the IMDS (part number, designation, proportion of SVHC substance) in the automotive sector.

Read More

ee News Europe, 21 May 2021,

https://www.eenewseurope.com/news/time-transition-lead-free-contacts#

As a result of exemptions in environmental regulations, lead is still permitted as a material in a number of applications.

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Janet's Corner

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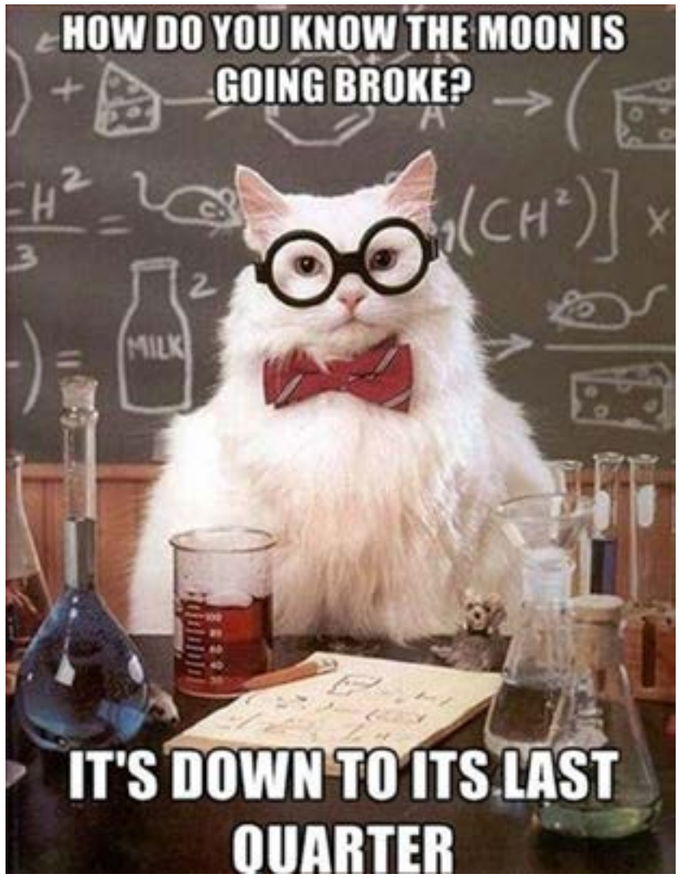
Broke Moon

2021-06-04



https://www.ranker.com/list/funny-science-puns/nathandavidson

Carbofuran

2021-06-04

Carbofuran is one of the most toxic carbamate pesticides. It is marketed under the trade names Furadan, by FMC Corporation and Curater, among several others. The technical or chemical name of carbofuran is 2,3-dihydro-2,2-dimethyl-7-benzofuranyl methylcarbamate and its CAS number is 1563-66-2. It is manufactured by the reaction of methyl isocyanate with 2,3-dihydro-2,2-dimethyl-7-hydroxybenzofuran. [1] Carbofuran is a white crystalline solid with a slightly phenolic odour. [2] It is a systemic insecticide, which means that the plant absorbs it through the roots, and from here the plant distributes it throughout its organs where insecticidal concentrations are attained. Carbofuran also has contact activity against pests. [1]

USES [2]

Carbofuran is a broad spectrum insecticide that is sprayed directly onto soil and plants just after emergence to control beetles, nematodes and rootworm. The greatest use of carbofuran is on alfalfa and rice, with turf and grapes making up most of the remainder. Earlier uses were primarily on corn crops. Carbofuran is allowed for use on only a few U.S. crops and will soon be banned for use on corn and sorghum in California.

ENVIRONMENTAL FATE

Breakdown in Soil and Groundwater

- Carbofuran is soluble in water and is moderately persistent in soil. Its half-life is 30 to 120 days. In soil, carbofuran is degraded by chemical hydrolysis and microbial processes. Hydrolysis occurs more rapidly in alkaline soils.
- Carbofuran breaks down in sunlight.
- Carbofuran has a high potential for groundwater contamination
- Carbofuran is mobile to very mobile in sandy loam, silty clay, and silty loam soils; moderately mobile in silty clay loam soils; and only slightly mobile in muck soils. Small amounts of carbofuran have been detected (1 to 5 ppb) in water table aquifers beneath sandy soils in New York and Wisconsin.

Carbofuran, chemical name 2,3-dihydro-2,2-dimethyl-7-benzofuranyl methylcarbamate and CAS number is 1563-66-2, is a white crystalline solid with a slightly phenolic odour. It is a systemic insecticide, which means that the plant absorbs it through the roots, and from here the plant distributes it throughout its organs where insecticidal concentrations are attained.

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Breakdown in Water

In water, carbofuran is subject to degradation by chemical hydrolysis under alkaline conditions. Photodegradation and aquatic microbes may also contribute to degradation. The hydrolysis half-lives of carbofuran in water at 25 C are 690, 8.2, and 1.0 weeks at pH values of 6.0, 7.0, and 8.0, respectively. Carbofuran does not volatilise from water, nor does it adsorb to sediment or suspended particles.

Breakdown in vegetation

The half-life of carbofuran on crops is about 4 days when applied to roots, and longer than 4 days if applied to the leaves.

ROUTES OF EXPOSURE [3]

Carbofuran is highly toxic by inhalation and ingestion and moderately toxic by dermal absorption. Carbofuran causes cholinesterase inhibition in both humans and animals, affecting nervous system function. As with other carbamate compounds, carbofuran's cholinesterase-inhibiting effect is short-term and reversible. Carbofuran is poorly absorbed through the skin. It is metabolised in the liver and eventually excreted in the urine. The half-life in the body is from 6 to 12 hours. Less than 1% of a dose will be excreted in a mother's milk. It does not accumulate in tissue.

HEALTH EFFECTS [3]

Acute Effects

Symptoms of carbofuran poisoning include: nausea, vomiting, abdominal cramps, sweating, diarrhoea, excessive salivation, weakness, imbalance, blurring of vision, breathing difficulty, increased blood pressure, and incontinence. Death may result at high doses from respiratory system failure associated with carbofuran exposure. Complete recovery from an acute poisoning by carbofuran, with no long-term health effects, is possible if exposure ceases and the victim has time to regain their normal level of cholinesterase and to recover from symptoms. The oral LD50 is 5 to 13 mg/kg in rats, 2 mg/kg in mice, and 19 mg/kg in dogs. The dermal LD50 is >1000 mg/kg in rabbits. The LC50 (4-hour) for inhalation of carbofuran is 0.043 to 0.053 mg/L in guinea pigs.

Chronic Effects

Rats given very high doses (5 mg/kg/day) for two years showed decreases in weight. Similar tests with mice gave the same results. Prolonged or repeated exposure to carbofuran may cause the same effects as an acute exposure.

Reproductive Effects

Consuming high doses over long periods of time caused damage to testes in dogs, but carbofuran did not have any reproductive effects on rats or mice. Available studies indicate carbofuran is unlikely to cause reproductive effects in humans at expected exposure levels.

Teratogenic Effects

Studies indicate carbofuran is not teratogenic. No significant teratogenic effects have been found in offspring of rats given carbofuran (3 mg/kg/day) on days 5 to 19 of gestation. No effects were found in offspring of mice given as much as 1 mg/kg/day throughout gestation. In rabbits, up to 1 mg/kg/day on days 6 to 18 of gestation was not teratogenic.

Mutagenic Effects

Weak or no mutagenic effects have been reported in animals and bacteria. Carbofuran is most likely nonmutagenic.

Carcinogenic Effects

Data from animal studies indicate that carbofuran does not pose a risk of cancer to humans.

SAFETY [4]

First Aid Measures

- Inhalation: If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.
- Dermal contact: Wash off with soap and plenty of water. Take victim immediately to hospital. Consult a physician.
- Eye contact: Flush eyes with water as a precaution.
- Ingestion: Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

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Personal Protection Equipment

- Respiratory protection: Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N100 (US) or type P3 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).
- Hand protection: Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands. The selected protective gloves have to satisfy the specifications of EU Directive 89/686/EEC and the standard EN 374 derived from it.
- Eye protection: Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).
- Skin and body protection: Complete suit protecting against chemicals, the type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.
- Hygiene measures: Avoid contact with skin, eyes and clothing. Wash hands before breaks and immediately after handling the product.

REGULATION [1,2,5,6,7]

United States

- Under the Safe Drinking Water Act, the U.S EPA has set a Maximum Contaminant Level (MCL) = 0.04 milligrams per Litre (mg/L) or 40 parts per billion (ppb) and a Maximum Contaminant Level Goal (MCLG) = 0.04 mg/L or 40 ppb
- In May 2009 the U.S EPA cancelled all food tolerances, an action which amounts to a de facto ban on its use on all crops grown for human consumption.
- American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value (TLV): 0.1 mg/m3 TWA (Inhalable Fraction) (Vapour and Aerosol); Appendix A4 - Not Classifiable as a Human Carcinogen; BEI

- National Institute for Occupational Safety and Health (NIOSH) Recommended Exposure Limit (REL): 0.1 mg/m3 TWA

Australia

- Safe Work Australia has set an exposure standards of 0.1 TWA (mg/m^3)
- Under the Australia Drinking Water Guidelines (2011), based on human health concerns, carbofuran in drinking water should not exceed 0.01 mg/L.

European Union

The use of carbofuran has been banned in the European Union.

REFERENCES

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3. http://extoxnet.orst.edu/pips/carbofur.htm
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Bling man regains some vision, with some help from light-sensing algal protein

2021-05-24

A blind man who received a gene for a light-sensing algal protein can now see and touch objects with the help of special goggles, researchers report today.

His vision gains are modest—he cannot see colors or discern faces or letters. But if the treatment helps other study participants, it may offer advantages over other vision technologies for severely blind people. And for neuroscientists, the result is a milestone: the first published report of using a relatively new technology called optogenetics to treat a disease in people.

"It's not the kind of vision people dream of, but it's a big step," says Jean Bennett of the University of Pennsylvania, who works on gene therapy for blindness but was not involved in the study.

And for neuroscientists, the result is a milestone: the first published report of using a relatively new technology called optogenetics to treat a disease in people.

Optogenetics uses light to control neurons. Scientists add the gene for a light-sensitive protein called an opsin from algae or bacteria and then shine a light on the cell to trigger the opsin to change shape, which switches the neuron's activity on or off. Since it was developed nearly 20 years ago, optogenetics has mostly been used as a tool to study brain circuitry in animals. But researchers hope it can one day treat diseases such as Parkinson's and blindness.

"The eye is the simplest place" to start because it is small and easy to access, study co-leader Botond Roska, a physician-scientist at the University of Basel, said at a press conference last week.

The patients in the study—a clinical trial—have an inherited disease called retinitis pigmentosa and have lost the retinal photoreceptor cells that use human opsins to turn light into electrical signals relayed to the brain. But their eyes still have the ganglion cells that route these signals to the brain via the optic nerve. That means the patients could potentially gain vision by giving these cells a microbial opsin.

The first volunteer was a 58-year-old French man who began going blind 40 years ago. When the experiment started, he could sense light but could not distinguish shapes. He received an injection in his worse eye of a harmless virus called an adeno-associated virus, which carried the gene for an opsin from algae. The researchers waited a few months for the ganglion cells in the patient's eye to begin to produce the new protein. Then they

began to train him to use special goggles that amplify incoming light from an image and focus it on the retina in the amber wavelength sensed by the opsin.

Within a few months, the man reported he could see the white stripes at a pedestrian crossing while walking outside wearing the goggles. He was "very excited," although perhaps "not as much as we were," study co-leader José-Alain Sahel, a physician-scientist at the University of Pittsburgh School of Medicine and the Vision Institute in Paris, said at the press conference.

Then the man started to pass lab tests: He could usually find and touch dark objects set on a white table, such as a notebook or box of staples, that he could not see without the goggles. And he could count up to three glass tumblers (see videos below). When the patient wore an electrode-studded cap that measures brain activity, the signals showed activity in the visual cortex, the part of the brain involved in seeing, the team reports today in Nature Medicine.

The man also told the researchers his daily life has improved. Wearing the goggles, he said, he can more easily find a plate or phone or detect furniture or a door.

The seven other patients treated so far in the trial haven't been able to complete training with the goggles because of the coronavirus pandemic. Some are receiving higher doses of the viral vector that could help them see in more detail, as could tweaks to the goggles, the researchers say—though none of these improvements would allow for color vision.

"It's fabulous that they got this to work in humans," says neuroscientist Pieter Roelfsema of the Netherlands Institute for Neuroscience. Right now, the only approved treatment for such patients is a device that sends signals from a camera mounted on a pair of glasses to electrodes implanted in the eye. It can improve light perception and allow some people to see shapes, but it requires surgery. Roelfsema's lab is developing a brain implant that has helped monkeys see letters, but it would be "much more invasive" than an eye injection, he notes.

The company that sponsored the trial, GenSight Biologics, isn't the only one working on optogenetics for blindness. RetroSense Therapeutics launched a trial 5 years ago but hasn't reported results. Another company, Bionic Sight, reported in March in a press release that four patients can

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now "detect light and motion" when looking into a device similar to a virtual reality set.

sciencemag.org, 24 May 2021

https://www.sciencemag.org

Cargo ship carrying 25 tons of acid sinks in Sri Lankan waters; marks one of the worst environmental disasters in decade

2021-06-02

Acargo ship on its way to Singapore caught fire off Sri Lanka and tons of chemicals were destroyed or spilled into the Indian Ocean as a result of the flaming containers.

The MV X-Press Pearl caught fire on May 20, as flame erupted on deck from what authorities believed to be a nitric acid leak, although Agence France-Presse (AFP) reported that Sri Lankan authorities are launching a criminal investigation. The fire burned for 13 days before finally being extinguished on Tuesday, AFP reported.

The Sri Lankan government and navy said this is the country's worst marine disaster, as the sinking ship was carrying 1,486 containers filled with chemicals, including 25 metric tons of nitric acid.

Sri Lankan police said that the captain and chief engineer of the ship, both reportedly Russian nationals, as well as a third officer, have been questioned in an official investigation and AFP reported that their passports have been impounded.

Sri Lanka's Marine Environment Protection Authority (MEPA) said in a statement that microplastic pollution could cause years of ecological damage to the Indian Ocean island. Waves of plastic waste are washing up on shore, and navy sailors were deployed to clean the beaches of the plastic pellets.

"This is like the coronavirus, no end in sight," Sailor Manjula Dulanjala told AFP. "We removed all the plastic yesterday, only to see more of it dumped by the waves overnight."

While the flames on the ship have been extinguished, authorities now face an even bigger problem as they attempt to tug the sinking ship further out to the sea while 278 metric tons of bunker oil and 50 metric tons of gasoline threaten to leak into the Indian Ocean.

The Sri Lankan government and navy said this is the country's worst marine disaster, as the sinking ship was carrying 1,486 containers filled with chemicals, including 25 metric tons of nitric acid.

On Wednesday, authorities attempted to tug the ship, but a navy spokesperson reported to AFP that as they dragged the ship, it began to sink.

"The stern of the ship is underwater, the water level is above the deck," spokesperson Indika de Silva said. "The ship will be towed as further away from the coast as possible before it goes down completely."

The ship is sinking in a rich fishing area, and Reuters reported that the government has suspended fishing along a 50-mile stretch of coastline. Fishing, which is a primary career in coastal towns, has taken a massive hit as a result of the incident.

Sujeewa Athukorale, a Roman Catholic priest, told AFP that there are 4,500 fishing families in his parish alone.

Joshua Anthony, head of a region fishing union, told Reuters: "The ship has dealt a death blow to our lives. We can't go into the sea, which means we can't make a living."

Local fisherman Peter Fernando told AFP he had never seen such destruction, even when a tsunami rocked the coastline in 2004.

Sri Lankan President Gotabaya Rajapaksa asked Australia to help evaluate the environmental damage.

"This is probably the worst beach pollution in our history," MEPA Chairman Dharshani Lahandapura said in a statement.

Newsweek reached out to Sri Lanka's Marine Environment Protection Authority for comment but did not hear back before publication.

newsweek.com, 2 June 2021

https://www.newsweek.com

The oldest known tattoo tools were found at an ancient Tennessee site

2021-05-25

Ancient tattooing tools are tough to find or even recognize as implements for creating skin designs. But new microscopic studies of two turkey leg bones with sharpened ends indicate that Native Americans used these items to make tattoos between around 5,520 and 3,620 years ago.

The find suggests that Native American tattoo traditions in eastern North America extend back more than a millennium earlier than previously thought (SN: 3/4/19).

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These pigment-stained bones are the world's oldest known tattooing tools, say archaeologist Aaron Deter-Wolf of the Tennessee Division of Archaeology in Nashville and his colleagues. The find suggests that Native American tattoo traditions in eastern North America extend back more than a millennium earlier than previously thought (SN: 3/4/19). Ötzi the Iceman, who lived around 5,250 years ago in Europe, displays the oldest known tattoos (SN: 1/13/16), but researchers haven't found any of the tools used to make the Iceman's tattoos.

Excavations in 1985 revealed these turkey bones and other elements of a probable tattoo kit in a man's burial pit at Tennessee's Fernvale site, the researchers report in the June Journal of Archaeological Science: Reports. Damage on and near the tips of the two turkey leg bones resembles distinctive wear previously observed on experimental tattooing tools made from deer bones, Deter-Wolf's team says. In that research, tattooed lines in fresh slabs of pig skin were produced by a series of punctures with tools that had tips coated in a homemade ink. Experimental tattooing left ink remnants several millimeters from tools' tips, a pattern also seen with red and black pigment residues on the Fernvale tools.

Two turkey wing bones found in the same Fernvale grave display microscopic wear and pigment residues that likely resulted from applying pigment during tattooing, the scientists say. Pigment-stained seashells in the grave may have held solutions into which tattooers dipped those tools.

sciencenews.org, 25 May 2021

https://www.sciencenews.org

Pesticides are killing the world's soils

2021-06-01

Scoop up a shovelful of healthy soil, and you'll likely be holding more living organisms than there are people on the planet Earth.

Like citizens of an underground city that never sleeps, tens of thousands of subterranean species of invertebrates, nematodes, bacteria and fungi are constantly filtering our water, recycling nutrients and helping to regulate the earth's temperature.

But beneath fields covered in tightly knit rows of corn, soybeans, wheat and other monoculture crops, a toxic soup of insecticides, herbicides and fungicides is wreaking havoc, according to our newly published analysis in the journal Frontiers in Environmental Science.

Currently, regulators completely ignore pesticides' harm to earthworms, springtails, beetles and thousands of other subterranean species.

The study, the most comprehensive review ever conducted on how pesticides affect soil health, should trigger immediate and substantive changes in how regulatory agencies like the EPA assess the risks posed by the nearly 850 pesticide ingredients approved for use in the U.S.

Currently, regulators completely ignore pesticides' harm to earthworms, springtails, beetles and thousands of other subterranean species.

Our study leaves no doubt that must change.

For our analysis, conducted by researchers at the Center for Biological Diversity, Friends of the Earth and the University of Maryland, we looked at nearly 400 published studies that together conducted over 2,800 experiments on how pesticides affect soil organisms. Our review encompassed 275 unique species or types of soil organisms and 284 different pesticides or pesticide mixtures.

In just over 70 percent of those experiments, pesticides were found to harm organisms that are critical to maintaining healthy soils—harms that currently are never considered in the EPA's safety reviews.

The ongoing escalation of pesticide-intensive agriculture and pollution are major driving factors in the precipitous decline of many soil organisms, like ground beetles and ground-nesting bees. They have been identified as the most significant driver of soil biodiversity loss in the last decade.

Yet pesticide companies and our pesticide regulators have ignored that research.

The EPA, which is responsible for pesticide oversight in the U.S., openly acknowledges that somewhere between 50 percent to 100 percent of all agriculturally applied pesticides end up on the soil. Yet to assess pesticides' harms to soil species, the agency still uses a single test species—one that spends its entire life above ground in artificial boxes to estimate risk to all soil organisms—the European honeybee.

The fact that the EPA relies on a species that literally may never touch soil in its entire life to represent the thousands of species that live or develop underground offers a disturbing glimpse of how the U.S. pesticide regulatory system is set up to protect the pesticide industry instead of species and their ecosystems.

What this ultimately means is that pesticide approvals happen without any regard to how those pesticides can harm soil organisms.

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To add to this, as principles of regenerative agriculture and soil health gain popularity around the world, pesticide companies have jumped on the bandwagon to greenwash their products.

Every major pesticide company now has Web materials touting its role in promoting soil health, often advocating for reducing tilling and planting cover crops. As general principles, both of these practices are indeed good for soil health and, if adopted responsibly, are great steps to take.

However, pesticide companies know that these practices are often accompanied by increased pesticide use. When fields aren't tilled, pesticides are often used to kill weeds, and cover crops are often killed by pesticides before crop planting.

This "one step forward, one step back" approach is preventing meaningful progress to protect our soils. Pesticide companies have so far been successful in coopting "healthy soil" messaging because our regulators have demonstrated no desire or willingness to protect soil organisms from pesticides.

The long-term environmental cost of that failure can no longer be ignored.

Soils are some of the most complex and biodiverse ecosystems on the planet, containing nearly a quarter of the planet's diversity.

Protecting them should be a priority, not an afterthought.

Our research indicates that achieving this will require that we face the task of reducing the world's growing and unsustainable addiction to pesticide-intensive agriculture.

And it will require that the EPA take aggressive steps to begin protecting the health of our soil by addressing the well-documented harms of pesticides to our long-overlooked subterranean species.

This is an opinion and analysis article.

ScientificAmerican.com, 1 June 2021

https://www.scientificamerican.com

So which period underwear are less likely to be made with a PFAS coating?

65% of period underwear tested could be contaminated with PFAS chemicals

2021-05-25

Period underwear or period panties are super absorbent and a lifesaver for consumers when their period has come, but some of them could also be coated with persistent & hormone-disrupting Per- and polyfluoroalkyl substances (PFAS) chemicals. The Mamavation community members asked us to start testing period underwear to see if it had any traces of PFAS so we did. So which period underwear are less likely to be made with a PFAS coating? You've trusted Mamavation to bring you topics like best non-toxic cookware, best air purifiers for the home, & best organic mattresses, now join us for the best & worst non-toxic period underwear with lab results showing that 65% of products tested could be contaminated with PFAS.

See more

mamavation.com, 25 May 2021

https://www.mamavation.com

PFAS found in widely used home garden fertilizers

2021-05-25

"Forever chemicals" have made their way into widely available fertilizers used in home gardens, according to a new study out today that warns of stark implications for human health.

Samples taken from nine different widely available fertilizers used for home gardening contain per- and polyfluoroalkyl substances, according to the findings from the Ecology Center in Ann Arbor, Mich., and the Sierra Club. Eight of those nine fertilizers exceeded PFAS screening guidelines established by Maine, the state that has taken the most sweeping actions on PFAS in agricultural land application.

The report traces the chemicals back to biosolids — the nutrient-rich organic matter left over following traditional wastewater treatment practices. Fertilizer products are commonly made using that waste.

Researchers tested for 33 different PFAS in each of the home fertilizers, finding 24 of those total. Each fertilizer contained between 14 and 20 PFAS compounds. They also showed two to eight times greater mass of precursor compounds — which break down into other PFAS — along with "hundreds to thousands" of other unidentified fluorine compounds.

Eight of those nine fertilizers exceeded PFAS screening guide-lines established by Maine, the state that has taken the most sweeping actions on PFAS in agricultural land application.=

Sonya Lunder, senior toxics adviser for the Sierra Club and a report author, said that the products are marketed as being "organic" or "eco-friendly," but that the presence of the PFAS raises concerns.

"This home use on foods that people eat raw is a particularly egregious thing," Lunder argued in an interview, noting people might consume raw items like lettuce grown in a garden containing those fertilizer products. "That this could be called 'organic' is troubling."

A former director of the National Institute of Environmental Health Sciences and the National Toxicology Program, Linda Birnbaum, said in a statement that the discovery should put more pressure on federal regulators. "The EPA needs to take immediate action to prevent the reckless contamination of our food and water, soil and air by limiting the use of PFAS chemicals wherever possible," said Birnbaum.

PFAS are a family of thousands of chemicals, only some of which have been closely studied. They do not break down in the environment, and several PFAS have been repeatedly linked to cancer, kidney problems and other health issues. The new findings come as EPA weighs cracking down on PFAS, an issue Administrator Michael Regan has called a "top priority."

Much of the agency's focus has been on drinking water, but advocates hope the new report will draw attention to issues like the presence of PFAS in the waste stream, given some EPA scrutiny of PFAS disposal (Greenwire, Feb. 24).

Biosolids are often applied to farmland and other areas in need of fertilizer, a process that reduces costs for water utilities and helps farmers, in addition to recycling waste that would otherwise be hauled away for disposal. The waste industry, local governments and other stakeholders are supportive of the practice, while some environmental groups maintain that biosolids application poses a health hazard. EPA has identified a number of chemical pollutants in biosolids, including PFAS and polychlorinated biphenyls, or PCBs.

Researchers behind the new study say their findings underscore misgivings about biosolids usage. A family of thousands of chemicals, PFAS are prized for their nonstick properties. But they are virtually impossible to avoid in the waste stream due to their presence in a flurry of products, from dental floss to cellphones. That reality means they can be found in essentially all biosolids, according to multiple industry experts.

The report advises against purchasing "biosolids-derived fertilizers for use on fruit and vegetable beds" given the potential for human consumption.

"Available evidence suggests that PFAS and related chemicals in sewage sludge could jeopardize the safety of the commercial food supply and home gardens," the report said.

Solutions remain 'elusive'

PFAS in biosolids have sparked panic in states like Maine, where contamination led to aggressive screening requirements for biosolids on agricultural fields — including for PFOS at 2.5 parts per billion and PFOA at 5.2 parts per billion. That effectively established a biosolids application ban on some of those lands, according to members of the waste industry.

Other states have eyed similar steps, including Michigan, which has scrutinized PFAS in wastewater, as well as Massachusetts, New Hampshire and Vermont.

But simple solutions to the issue of PFAS in biosolids are "elusive," the report said, echoing some of what public utilities and the waste industry have long asserted.

Landfilling biosolids is costly and can be ineffective, as PFAS still come out in the liquid wastes produced by those sites. Meanwhile, incineration remains contentious — some research has indicated PFAS can escape and migrate during that process. Many incinerators and landfills are also near low-income communities of color, and advocates worry that biosolids disposal at those sites could have environmental justice implications.

"What we see writ large with disposal issues is that waste travels from more privileged communities to the most vulnerable areas," said Lunder. "That's true across our waste systems."

Ultimately, the report lobbied for broader regulations on PFAS and a crackdown on the production of the chemicals to begin with.

"While this investigation highlights the challenges posed by wastewater disposal and biosolids reuse," the researchers stated, "it is important to note upfront that it is far simpler, less expensive and more effective to stop using the chemicals in most consumer and industrial uses, rather than attempt to contain and manage wastes."

Lunder also expressed hope that EPA would pay more attention to PFAS in biosolids, while assessing health risks differently than it often does for many other chemicals. She noted that dilution is often used to

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lessen impacts from toxic substances, including in biosolids, which are sometimes mixed with sand or other materials to reduce any risks.

"I think that mindset falls apart when you're talking about chemicals that never break down," Lunder said.

Costs and pushback

Issues around biosolids are part of larger conversations playing out for local governments and the waste industry as they struggle with fallout stemming from PFAS contamination.

Public and private industry stakeholders have raised alarm over PFAS regulations, emphasizing that they cannot afford many of the costs associated with testing for and then treating the problem. Lobbying over the issue has increasingly pitted water utilities against advocacy groups (E&E Daily, June 11, 2020).

Some local governments and factions of the waste and water industries maintain that PFAS manufacturers should foot the bill for costs relating to cleanup. Companies involved in biosolids land application have also emphasized that they cannot completely remove PFAS from their products and that government-imposed level limits will put many out of business.

The Northeast Biosolids and Residuals Association, which serves the northeastern United States and Canada, has both pushed for a stop to nonessential uses of PFAS and argued that its members are falling victim to mistakes made by other industries.

"The most significant action we can all take is to support removal from commerce of chemicals of high risk," NEBRA notes on its website. "That reduces risks to human health — and it also reduces potential concerns related to wastewater, biosolids, septage, and other residuals."

NEBRA Executive Director Janine Burke-Wells said via email that finding PFAS in biosolids does not pose a default threat to human health. She also pointed to research finding PFAS in non-biosolids-based fertilizers along with biosolids-based products, indicating that the issue extends far beyond one industry sector.

"The presence of PFAS in biosolids does not mean there is a risk — that requires consideration of exposure routes and pollutant levels," Burke-Wells said. "The EPA has started the risk assessment process for PFAS in biosolids and we look forward to more definitive studies on this issue."

NEBRA's special products manager, Ned Beecher, emphasized that even in Maine, many biosolids products and other PFAS-laden composts continue to be used despite the state's screening levels. He added that the organization does support limitations on PFAS in commerce and agrees with those components of the report.

eenews.net, 25 May 2021

https://www.eenews.net

U.K. set to loosen rules for gene-edited crops and animals

2021-05-26

When Boris Johnson became prime minister of the United Kingdom in 2019, he pledged to "liberate the U.K.'s extraordinary bioscience sector from anti–genetic modification rules." The country had to hew to strict European biotech regulations until it finalized its divorce from the European Union in January. Next month, the government is widely expected to follow through on Johnson's promise by making it easier to test and commercialize some genetically engineered crops and livestock.

The decision, which will be announced by 17 June, applies to plants and animals whose genes have been edited with precision techniques such as CRISPR. It will put the United Kingdom in line with several countries including the United States, and U.K. biotechnologists say it will speed research and stimulate investment.

"Much as I have to swallow hard and say it through gritted teeth, Brexit has at least one dividend," says Jonathan Jones, a plant biologist at the Sainsbury Laboratory, a nonprofit center investigating plant disease resistance. Tina Barsby, CEO of the National Institute of Agricultural Botany, says the shift may be "the most significant policy breakthrough in plant breeding for more than 2 decades."

Traditional genetic engineering endows organisms with new traits by inserting "transgenes" from other species. In contrast, gene editing alters a species' own genes without permanently adding any new genetic material. Proponents argue gene editing is merely an acceleration of classical breeding techniques, which select for traits enhanced by mutations (often created by chemicals or radiation). "We have no reason to believe that they will be any more inherently risky than crops made with traditional breeding," says Angela Karp, director of Rothamsted Research, a U.K. nonprofit agricultural research center.

Tina Barsby, CEO of the National Institute of Agricultural Botany, says the shift may be "the most significant policy breakthrough in plant breeding for more than 2 decades."

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Under the U.K. policy change, gene-edited plants and animals might not need detailed applications and reviews before field trials and commercial approval. In Europe, by contrast, any commercialized genetically modified organism (GMO), regardless of how it was created, faces a lengthy risk assessment by the European Food Safety Authority and must be approved by a majority of member nations before it can be planted. "It means everything just grinds to a halt," says Wendy Harwood, head of crop transformation at the John Innes Center, a U.K. public research organization. In 2018, the European Court of Justice reaffirmed that gene-edited organisms require the same regulatory scrutiny as other GMOs.

Only a few gene-edited crops have been commercialized anywhere. One example is a tomato called the Sicilian Rouge High GABA that makes more of an amino acid said to promote relaxation, approved for sale in Japan last year. Just two gene-edited crops have made it to U.K. field trials. One, in 2018, evaluated the performance of camelina, a mustard relative, engineered to produce an olive oil–like product. And in a recent trial, researchers tested broccoli edited for improved nutrition.

Others are in the works. Rothamsted Research this month applied for a permit to field test wheat edited to contain less asparagine, an amino acid that becomes the carcinogen acrylamide when baked. The Roslin Institute, a research center at the University of Edinburgh that works on livestock, has created pigs resistant to a virus that causes porcine reproductive and respiratory syndrome, which costs U.S. and European pig farmers $2.6 billion per year. Genus PLC is commercializing the pigs in several nations.

The government decision on gene editing, which will come from the Department for Environment, Food & Rural Affairs (Defra), will not apply outside England. Other parts of the United Kingdom—Scotland, Wales, and Northern Ireland—regulate GMOs themselves and are skeptical of their value. And opponents to GM liberalization say Defra is moving too fast. They worry, for example, that animals and crops modified to resist disease could promote environmentally damaging intensive farming practices.

It's important to address such concerns, says Colin Campbell, director of the James Hutton Institute, a public research center that focuses on sustainable management of natural resources. Biotechnologists "need a license from society to operate," he says. "The commercialization can follow when you've won the trust."

Proponents also need to have realistic expectations about gene editing, says Johnathan Napier, a plant biotechnologist at Rothamsted Research.

Knocking out a few genes might improve disease resistance or remove an allergen. But more complicated traits powered by many genes, such as drought tolerance, will be much more difficult to engineer without transgenic modifications, Napier warns. "This really is not a magic bullet," he says. But controls on transgenic GMOs could someday be loosened as well; Defra has requested public comments on whether reform is needed.

Even the European Union is rethinking its approach on gene editing. An April report by the European Commission finds it could make agriculture more sustainable and found "strong indications" that EU law isn't suitable for regulating it. Dirk Inzé, a molecular biologist at the Flanders Institute for Biotechnology, a Belgian research center, is heartened. But he predicts any reforms would run into problems with the European Parliament, where anti-GMO sentiment is still strong. "The debate will be very fierce," Inzé says.

sciencemag.org, 26 May 2021

https://www.sciencemag.org

The last 30 years were the hottest on record for the United States

2021-05-26

There's a new normal for U.S. weather. On May 4, the National Oceanic and Atmospheric Administration announced an official change to its reference values for temperature and precipitation. Instead of using the average values from 1981 to 2010, NOAA's new "climate normals" will be the averages from 1991 to 2020.

This new period is the warmest on record for the country. Compared with the previous 30-year-span, for example, the average temperature across the contiguous United States rose from 11.6° Celsius (52.8° Fahrenheit) to 11.8° C (53.3° F). Some of the largest increases were in the South and Southwest — and that same region also showed a dramatic decrease in precipitation (SN: 8/17/20).

The United States and other members of the World Meteorological Organization are required to update their climate normals every 10 years. These data put daily weather events in historical context and also help track changes in drought conditions, energy use and freeze risks for farmers.

Compared with the previous 30-year-span, for example, the average temperature across the contiguous United States rose from 11.6° Celsius (52.8° Fahrenheit) to 11.8° C (53.3° F).

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That moving window of averages for the United States also tells a stark story about the accelerating pace of climate change. When each 30-year period is compared with the average temperatures from 1901 to 2000, no part of the country is cooler now than it was during the 20th century. And temperatures in large swaths of the country, from the American West to the Northeast, are 1 to 2 degrees Fahrenheit higher.

sciencenews.org, 26 May 2021

https://www.sciencenews.org

Cancer-causing chemical found in 78 sunscreen products

2021-05-28

An independent testing lab has detected the chemical benzene, a known human carcinogen, in 78 sunscreen products and is now calling on the U.S. Food and Drug Administration (FDA) to recall the products.

The lab, Valisure, checks medications and health care products for quality. Recently, the company tested nearly 300 sunscreen products and found that 27% contained benzene, according to a statement from the company. Fourteen of the products (5%) contained benzene at levels higher than 2 parts per million (ppm), which is the FDA's recommended limit for benzene in medically valuable drugs that can't be made without it.

"The presence of this known human carcinogen in products widely recommended for the prevention of skin cancer and that are regularly used by adults and children is very troubling," David Light, founder and CEO of Valisure, said in the statement.

Benzene is a colorless or light yellow liquid that forms naturally but is also produced by human activities, according to the Centers for Disease Control and Prevention (CDC). For example, automobile emissions and the burning of coal and oil can release benzene into the air; the chemical is also used in the manufacturing of some plastics, rubbers, dyes, detergents, drugs and pesticides, according to the CDC.

Exposure to high levels of benzene causes cancer in humans, particularly blood cancer, including leukemia. The U.S. Occupational Safety & Health Administration limits workplace exposure to benzene in the air to 1 ppm on an average day and a maximum of 5 ppm over a 15-minute period, according to the American Cancer Society. The Environmental Protection

Fourteen of the products (5%) contained benzene at levels higher than 2 parts per million (ppm), which is the FDA's recommended limit for benzene in medically valuable drugs that can't be made without it.

Agency limits benzene in drinking water to 0.005 ppm, or 5 parts per billion (ppb), which is also the limit for bottled water.

The FDA says that benzene should not be used in the manufacturing of drug products except in special circumstances, mainly if their use is unavoidable and the drug product makes a significant therapeutic advance. In these cases, benzene levels should be limited to 2 ppm "unless otherwise justified," the FDA says. In the beginning of the COVID-19 pandemic when there was a shortage of hand sanitizer, the FDA temporarily allowed hand sanitizers to contain up to 2 ppm of benzene. But in March 2021, Valisure announced they had detected benzene above this level in nearly two dozen hand sanitizer products, at least one of which was later recalled.

In light of its new findings of benzene in sunscreens, Valisure has petitioned the FDA to recall the 78 products and to conduct its own investigation into the manufacturing of these products. A full list of the sunscreen products with benzene can be found in the petition. Nearly all of the 14 sunscreen products with benzene levels above 2 ppm were sprays; but the chemical also showed up in lotions and sunburn-relief gels.

Although the FDA says benzene should not be used in the manufacturing of drugs, the agency does not define a specific limit for drugs like sunscreen (The FDA regulates sunscreen as an over-the-counter drug.). The 2 ppm limit applies only to the "special circumstances" outlined by the agency. So Valisure is also calling on the FDA to set a limit for benzene levels in sunscreen and other drug products in standard situations, and to set a limit for exposure in a single day.

Since benzene wasn't detected in most of the sunscreens Valisure tested, the company says that the use of benzene in sunscreens is not "unavoidable," and any detectable amount of the chemical shouldn't be allowed.

"It is critical that regulatory agencies address benzene contamination in sunscreens … so that all individuals feel safe using sunscreen products," Dr. Christopher Bunick, an associate professor of dermatology at Yale University, said in the statement.

In a statement provided to Live Science, the FDA said it is reviewing the petition. "The FDA takes seriously any safety concerns raised about products we regulate, including sunscreen. While the agency evaluates the submitted citizen petition, we will continue to monitor the sunscreen marketplace and manufacturing efforts to help ensure the availability of

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safe sunscreens for U.S. consumers," the statement said. The agency added that it generally does not comment on pending petitions.

The findings do not mean that people should stop using sunscreen, which can help prevent skin cancer, Bunick said

"Many sunscreen products tested by Valisure did not have benzene contamination, and those products are presumably safe and should continue to be used, along with appropriate hats and sun-protective clothing, to mitigate skin cancer risk," Bunick said.

Editor's note: This article has been updated to include comments from the FDA.

livescience.com, 28 May 2021

https://www.livescience.com

Plague of ravenous, destructive mice tormenting Australians

2021-05-28

BOGAN GATE, Australia (AP) — At night, the floors of sheds vanish beneath carpets of scampering mice. Ceilings come alive with the sounds of scratching. One family blamed mice chewing electrical wires for their house burning down.

Vast tracts of land in Australia's New South Wales state are being threatened by a mouse plague that the state government describes as "absolutely unprecedented." Just how many millions of rodents have infested the agricultural plains across the state is guesswork.

Just how many millions of rodents have infested the agricultural plains across the state is guesswork.

"We're at a critical point now where if we don't significantly reduce the number of mice that are in plague proportions by spring, we are facing an absolute economic and social crisis in rural and regional New South Wales," Agriculture Minister Adam Marshall said this month.

Bruce Barnes said he is taking a gamble by planting crops on his family farm near the central New South Wales town of Bogan Gate.

"We just sow and hope," he said.

The risk is that the mice will maintain their numbers through the Southern Hemisphere winter and devour the wheat, barley and canola before it can be harvested.

NSW Farmers, the state's top agricultural association, predicts the plague will wipe more than 1 billion Australian dollars ($775 million) from the value of the winter crop.

The state government has ordered 5,000 liters (1,320 gallons) of the banned poison Bromadiolone from India. The federal government regulator has yet to approve emergency applications to use the poison on the perimeters of crops. Critics fear the poison will kill not only mice but also animals that feed on them. including wedge-tail eagles and family pets.

"We're having to go down this path because we need something that is super strength, the equivalent of napalm to just blast these mice into oblivion," Marshall said.

The plague is a cruel blow to farmers in Australia's most populous state who have been battered by fires, floods and pandemic disruptions in recent years, only to face the new scourge of the introduced house mouse, or Mus musculus.

The same government-commissioned advisers who have helped farmers cope with the drought, fire and floods are returning to help people deal with the stresses of mice.

The worst comes after dark, when millions of mice that had been hiding and dormant during the day become active.

By day, the crisis is less apparent. Patches of road are dotted with squashed mice from the previous night, but birds soon take the carcasses away. Haystacks are disintegrating due to ravenous rodents that have burrowed deep inside. Upending a sheet of scrap metal lying in a paddock will send a dozen mice scurrying. The sidewalks are strewn with dead mice that have eaten poisonous bait.

But a constant, both day and night, is the stench of mice urine and decaying flesh. The smell is people's greatest gripe.

"You deal with it all day. You're out baiting, trying your best to manage the situation, then come home and just the stench of dead mice," said Jason Conn, a fifth generation farmer near Wellington in central New South Wales.

"They're in the roof cavity of your house. If your house is not well sealed, they're in bed with you. People are getting bitten in bed," Conn said. "It doesn't relent, that's for sure."

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Colin Tink estimated he drowned 7,500 mice in a single night last week in a trap he set with a cattle feeding bowl full of water at his farm outside Dubbo.

"I thought I might get a couple of hundred. I didn't think I'd get 7,500," Tink said.

Barnes said mouse carcasses and excrement in roofs were polluting farmers' water tanks.

"People are getting sick from the water," he said.

The mice are already in Barnes' hay bales. He's battling them with zinc phosphide baits, the only legal chemical control for mice used in broad-scale agriculture in Australia. He's hoping that winter frosts will help contain the numbers.

Farmers like Barnes endured four lean years of drought before 2020 brought a good season as well as the worst flooding that some parts of New South Wales have seen in at least 50 years. But the pandemic brought a labor drought. Fruit was left to rot on trees because foreign backpackers who provide the seasonal workforce were absent.

Plagues seemingly appear from nowhere and often vanish just as fast.

Disease and a shortage of food are thought to trigger a dramatic population crash as mice feed on themselves, devouring the sick, weak and their own offspring.

Government researcher Steve Henry, whose agency is developing strategies to reduce the impact of mice on agriculture, said it is too early to predict what damage will occur by spring.

He travels across the state holding community meetings, sometimes twice a day, to discuss the mice problem.

"People are fatigued from dealing with the mice," Henry said.

apnews.com, 28 May 2021

https://www.apnews.com

Why do we grow more bodies on our heads than on our bodies?

2021-05-25

Humans are the oddballs of the mammalian class. Hippos and naked mole rats aside, nearly every other mammal has fur covering its body. Humans are practically naked, besides the hair on our heads. So why are people mostly hairless apart from our head hair?

First, it's crucial to understand why mammals have fur in the first place, said Mark Pagel, an evolutionary biologist at the University of Reading in the United Kingdom. Fur keeps animals warm when it's cold at night and protects them from the sun during the day. Human ancestors were able to lose most of their body hair because they had the unique ability to compensate with fire, shelter and clothing.

That explains why our human ancestors could survive without most of their hair, but not why it disappeared over time. Hairlessness must have given humans some sort of evolutionary advantage. There are three main theories about what the advantage could have been, Pagel told Live Science.PLAY SOUND

First, a thick coat of fur could have led ancient humans to overheat in the hot noonday sun. "If you're wearing a great big fur coat in the middle of the African savanna in the hot season, you're going to be way too hot," Pagel said. "Wouldn't it be nice if you could take your great big fur coat off? Which is what we did." Moreover, humans evolved to have more sweat glands than our primate relatives. If we had kept our long body hair, it likely would have gotten soaked with sweat, which would have made it hard for the sweat to evaporate and cool us down, Yana Kamberov, an assistant professor of genetics at the University of Pennsylvania, previously told Live Science.

However, the so-called body-cooling hypothesis fails to explain some aspects of human body hair patterns, such as why men tend to be hairier than women. Of note, humans are covered with tiny and colorless vellus hairs, except on the palms, soles of the feet, lips and nipples, Kamberov previously told Live Science. Hormones that emerge during puberty can transform some of these vellus hairs into longer, colored terminal hairs. But aside from this sometimes scruffy body hair, long hair tends to grow only on our heads.

The second theory, known as the aquatic ape hypothesis, proposes that ancient humans spent a lot of time in water. Fur weighed them down

So why are people mostly hairless apart from our head hair?

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while swimming, so they gradually lost their hair. However, there is no evidence that humans spent a significant amount of time in water during the evolutionary past, so Pagel finds this hypothesis hard to believe. It also fails to explain why humans didn't evolve to gain their fur back after leaving the waterside.

Pagel proposed the third theory, the ectoparasite hypothesis, in a 2003 study published in the journal Proceedings of the Royal Society B: Biological Sciences. Ectoparasites are parasites that live on the outside of the host's body. These parasites — which include lice, ticks and fleas — are a major cause of disease and mortality across species. Ectoparasites may be less attracted to hairless skin, and it may be easier to get rid of them when they're not buried in fur. In turn, having less hair, and thus fewer parasites, may have presented a survival advantage.

But if hair can lead to harm, why did we keep it on our heads?

As bipeds, or animals that walk upright on two legs, our heads are directly exposed to the sun. Near the equator, where humans evolved, sun exposure can be overbearing, and head hair helps people avoid overheating. "It's sort of a built-in hat," Pagel said.

Head hair also helps retain heat at night. "Our brains are relatively small compared to the rest of our bodies, but they're enormously metabolically active," Pagel said. This activity produces heat, and head hair could insulate this area of concentrated warmth.

Sexual selection also may play a role. Humans don't just have head hair; we style it. Ancient people may have, too. Hair doesn't fossilize well, so researchers don't have much direct evidence of this, except for preserved mummies in places such as Egypt and Peru. However, researchers have studied modern-day Indigenous people who haven't had contact with the outside world and found that they also style their hair, suggesting that their ancestors did, too. This hair care may help attract a mate, Pagel said.

"We don't just have head hair," Pagel said, "but we have it in a form that we can make really attractive to members of the opposite sex."

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https://www.livescience.com

How mRNA and adenovirus vector vaccines work

2021-05-26

A killed whole-virus vaccine is one of the oldest vaccine technologies. To make such a vaccine for Covid, a manufacturer will grow large quantities of the SARS-CoV-2 virus, and inactivate it using heat or a chemical. The surface of this inactivated virus is dotted with dozens of antigens, or proteins. When this virus is injected into the body, these antigens provoke an immune response.

In contrast, the mRNA vaccine consists only of the genetic code for a single antigen of the SARS-CoV-2 virus, called the spike antigen, wrapped in an oily shell. When this is injected into the body, human cells use this code to churn out the antigen. The body then reacts by making antibodies.

This explains why mRNA vaccine manufacturers don't need Bio Safety Level 3 labs, as inactivated vaccine manufacturers do. No live virus capable of infecting humans needs to be grown; the genetic code is just a harmless chemical. It also explains why the risk of enhanced respiratory disease (ERD) is different for mRNA vaccines and inactivated vaccines. The former introduce a single antigen into the body, while the latter introduce a large number.

Adenovirus vector vaccines also use the genetic code of the spike antigen, but deploy it differently. Instead of using an oily shell to carry the code into the body, they use a harmless virus as a vehicle. For instance, the AstraZeneca vaccine and Covishield use an adenovirus that causes common cold in chimpanzees. Russia's Sputnik V uses human adenoviruses engineered to prevent replication. When these adenoviruses, containing DNA for the spike protein, enter the body, human cells start making the antigen.

But making such an adenovirus vector vaccine requires live adenovirus to be grown in large quantities first. Again, as with inactivated vaccines, precautions have to be taken to ensure the virus is contained in the lab, because adenoviruses can infect humans too. However, because these viruses do not pose as great a danger to humans as SARS-CoV-2 does, a BSL-2 facility is enough.

livemint.com, 26 May 2021

https://www.livemint.com

In contrast, the mRNA vaccine consists only of the genetic code for a single antigen of the SARS-CoV-2 virus, called the spike antigen, wrapped in an oily shell.

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Can diet and exercise lower your risk of dementia? Rigorous clinical trials aim to find out

2021-05-27

For the past 3 years, about 6000 middle-aged and elderly Australians have pumped iron, loaded up on greens and whole grains, strived to quell stress, and challenged their wits with computer exercises, all in an effort to preserve their cognition. They're part of a clinical trial called Maintain Your Brain, one of about 30 current or planned studies that eschew pharmaceutical interventions and test whether altering multiple aspects of participants' lives improves brain health. Such multidomain studies may finally reveal whether modifying diet, exercise, and other factors can slow cognitive decline as people age—or even prevent dementia.

"There's a lot of hope for multidomain trials," says psychologist Kaarin Anstey of the University of New South Wales, Sydney, one of the principal investigators of the Maintain Your Brain trial, which will finish by the end of this year.

Although people can't escape some mental decline as they get older, lifestyle exerts a powerful influence over the risk of developing dementia—the type of severe cognitive impairment seen in conditions such as Alzheimer's disease. Last year, an international committee of scientists and psychiatrists known as the Lancet Commission on dementia prevention, intervention, and care estimated that so-called modifiable factors account for 40% of dementia risk. Their report highlighted a dozen factors, including many familiar villains—diabetes, high blood pressure, smoking, obesity, and lack of exercise.

Researchers are still probing exactly how these risk factors steal people's faculties, but they've identified some likely mechanisms. Lack of physical activity may impair cognition, for instance, because exercise stimulates formation of new neurons and soothes brain inflammation.

For decades scientists concentrated on developing drugs to treat Alzheimer's disease, but after several candidates recently failed in clinical trials, "the climate has really shifted to focus on … prevention," says neuropsychiatrist and epidemiologist Kristine Yaffe of the University of California, San Francisco. Some researchers urge governments to step up dementia prevention with measures such as public health campaigns that encourage salutary habits. "We have knowledge about some of the actions to take for society to make a difference," says psychiatrist Gill Livingston of

Such multidomain studies may finally reveal whether modifying diet, exercise, and other factors can slow cognitive decline as people age—or even prevent dementia.

University College London, who heads the Lancet Commission. "The time is now."

The combined effect of lifestyle factors is strong, but researchers lack conclusive evidence that modifying any of them spares the brain. "A gazillion observational studies" point to factors that influence cognitive aging, Yaffe says. "Can we say, 'Do X, Y, and Z and that will prevent Alzheimer's disease'? I don't think so."

Large, randomized, controlled trials would provide the strongest support for particular interventions. But these costly studies are rare. Multiyear trials, which have the best shot at detecting an impact on a slow-developing condition like dementia, are even rarer.

The only study to show that any lifestyle intervention cuts dementia risk was the Advanced Cognitive Training for Independent and Vital Elderly trial, launched in the late 1990s. A group of nearly 700 elderly people in the study underwent 6 weeks of cognitive training to improve their thinking speed. Ten years later, they had a 6% lower incidence of dementia than participants who received no training. But the benefits of "brain training" remain unsettled, and many commercially available games and apps lack rigorous evidence to support their claims.

Scientists are eager to nail down the value of other interventions. Observational studies suggest the Mediterranean diet, which is heavy on olive oil, fish, and whole grains but light on red meat and sugars, improves some aspects of cognition. But no large, randomized, controlled trial has tested the preventive effects of switching to the diet—or compared it with other promising regimens such as dietary approaches to stop hypertension (DASH), designed to reduce blood pressure. A 3-year study wrapping up later this year will evaluate the Mediterranean-DASH intervention for neurodegenerative delay diet, which merges the Mediterranean and DASH diets, in 600 people over age 60 who are at high risk for developing dementia. That could provide "the first evidence of whether changing diet prevents cognitive decline in older adults," says cognitive neuropsychologist Lisa Barnes of Rush University, principal investigator of the $14 million, NIH-funded study.

However, most randomized trials that have focused on only one aspect of lifestyle have come up empty. Many researchers agree that multidomain trials like Maintain Your Brain offer a better chance of finding meaningful effects. Dementia results from multiple causes, the argument goes, so preventing it will require a combination of interventions.

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A Finnish trial launched in 2009 was the pioneer of the genre. The Finnish Geriatric Intervention Study to Prevent Cognitive Impairment and Disability (FINGER) included 1260 people in their 60s and 70s who were susceptible to dementia because of risk factors such as hypertension. Half of them took part in an intensive program to improve their diet, heart health, mental acuity, and exercise habits. The control group received health advice from nurses but no help implementing it.

The finding that people in the intensive program improved their cognitive test scores over the 2-year study period electrified a major Alzheimer's conference in 2014, says Heather Snyder, vice president for medical and scientific relations at the nonprofit Alzheimer's Association. "It was the first study to demonstrate on that scale and scope that these interventions in synergy could affect cognition."

Two similar studies, conducted in the Netherlands and France, also suggested a cognitive benefit in a subset of people with high dementia risk. No one knows how long the effects persist or whether the interventions prevent dementia, but ongoing follow-up of FINGER participants might provide some answers.

Now, scientists in other countries are setting up trials tailored to the diets and habits of their populations. One of Maintain Your Brain's goals is to determine whether multidomain interventions can be delivered remotely. Participants log into the trial's website to obtain coaching, access materials such as cooking demonstrations, and record their progress.

The U.S. Study to Protect Brain Health Through Lifestyle Intervention to Reduce Risk, scheduled to finish in 2024, aims to reproduce the results of the FINGER trial in the more racially and ethnically diverse U.S. population. It will test whether subjects do better when they are assigned a specific plan or when they have freedom to customize their own. "If we can create a sustainable program that's accessible for everyone … that would be a huge success," says cognitive neuroscientist Laura Baker of Wake Forest School of Medicine, who heads the trial.

Whether lifestyle changes can stall dementia or cognitive decline remains unproved for now, but Baker anticipates a mountain of new evidence. "In the next 10 years, we will see if lifestyle works."

sciencemag.org, 27 May 2021

https://www.sciencemag.org

'Green steel' is hailed as the next big thing in Australian industry. Here's what the hype is all about

2021-06-02

Steel is a major building block of our modern world, used to make everything from cutlery to bridges and wind turbines. But the way it's made – using coal – is making climate change worse.

On average, almost two tonnes of carbon dioxide (CO_2) are emitted for every tonne of steel produced. This accounts for about 7% of global greenhouse gas emissions. Cleaning up steel production is clearly key to Earth's low-carbon future.

Fortunately, a new path is emerging. So-called "green steel", made using hydrogen rather than coal, represents a huge opportunity for Australia. It would boost our exports, help offset inevitable job losses in the fossil fuel industry and go a long way to tackling climate change.

Australia's abundant and cheap wind and solar resources mean we're well placed to produce the hydrogen a green steel industry needs. So let's take a look at how green steel is made, and the challenges ahead.

Steeling for change

Steel-making requires stripping oxygen from iron ore to produce pure iron metal. In traditional steel-making, this is done using coal or natural gas in a process that releases CO_2. In green steel production, hydrogen made from renewable energy replaces fossil fuels.

Australia exports almost 900 million tonnes of iron ore each year, but only makes 5.5 million tonnes of steel. This means we have great capacity to ramp up steel production.

A Grattan Institute report last year found if Australia captured about 6.5% of the global steel market, this could generate about A$65 billion in annual export revenue and create 25,000 manufacturing jobs in Queensland and New South Wales.

Steel-making is a complex process and is primarily achieved via one of three processes. Each of them, in theory, can be adapted to produce green steel. We examine each process below.

1. Blast furnace

Globally, about 70% of steel is produced using the blast furnace method.

Cleaning up steel production is clearly key to Earth's low-carbon future.

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As part of this process, processed coal (also known as coke) is used in the main body of the furnace. It acts as a physical support structure for materials entering and leaving the furnace, among other functions. It's also partially burnt at the bottom of the furnace to both produce heat and make carbon monoxide, which strips oxygen from iron ore leaving metallic iron.

This coal-driven process leads to CO_2 emissions. It's feasible to replace a portion of the carbon monoxide with hydrogen. The hydrogen can strip oxygen away from the ore, generating water instead of CO_2. This requires renewable electricity to produce green hydrogen.

And hydrogen cannot replace carbon monoxide at a ratio of 1:1. If hydrogen is used, the blast furnace needs more externally added heat to keep the temperature high, compared with the coal method.

More importantly, solid coal in the main body of the furnace cannot be replaced with hydrogen. Some alternatives have been developed, involving biomass – a fuel developed from living organisms – blended with coal.

But sourcing biomass sustainably and at scale would be a challenge. And this process would still likely create some fossil-fuel derived emissions. So to ensure the process is "green", these emissions would have to be captured and stored – a technology which is currently expensive and unproven at scale.

2. Recycled steel

Around 30% of the world's steel is made from recycled steel. Steel has one of the highest recycling rates of any material.

Steel recycling is mainly done in arc furnaces, driven by electricity. Each tonne of steel produced using this method produces about 0.4 tonnes of CO_2 – mostly due to emissions produced by burning fossil fuels for electricity generation. If the electricity was produced from renewable sources, the CO_2 output would be greatly reduced.

But steel cannot continuously be recycled. After a while, unwanted elements such as copper, nickel and tin begin to accumulate in the steel, reducing its quality. Also, steel has a long lifetime and low turnover rate. This means recycled steel cannot meet all steel demand, and some new steel must be produced.

3. Direct reduced iron

"Direct reduced iron" (DRI) technology often uses methane gas to produce hydrogen and carbon monoxide, which are then used to turn iron ore into iron. This method still creates CO_2 emissions, and requires more electricity than the blast furnace method. However its overall emission intensity can be substantially lower.

The method currently accounts for less than 5% of production, and offers the greatest opportunity for using green hydrogen.

Up to 70% of the hydrogen derived from methane could be replaced with green hydrogen without having to modify the production process too much. However work on using 100% green hydrogen in this method is ongoing.

Becoming a green steel superpower

The green steel transition won't happen overnight and significant challenges remain.

Cheap, large-scale green hydrogen and renewable electricity will be required. And even if green hydrogen is used, to achieve net-zero emissions the blast furnace method will still require carbon-capture and storage technologies – and so too will DRI, for the time being.

Private sector investment is needed to create a global-scale export industry. Australian governments also have a big role to play, in building skills and capability, helping workers retrain, funding research and coordinating land-use planning.

Revolutionising Australia's steel industry is a daunting task. But if we play our cards right, Australia can be a major player in the green manufacturing revolution.

theconversation.com, 2 June 2021

https://www.theconversation.com

Our brains have more in common with testicles than you ever wanted to know

2021-06-02

That delightful saying about men thinking with their nether regions has gained a new meaning. A new study has found an unnerving lot of similarities between men's brains and the innards of their scrotums.

"Brain and testis have the highest number of common proteins, compared with other human body tissues," […]

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"Brain and testis have the highest number of common proteins, compared with other human body tissues," a team led by biomedical scientist Bárbara Matos from the University of Aveiro in Portugal writes in their new paper.

While the brain has a highly complex role - controlling our bodies, receiving and interpreting signals from sensory organs, not to mention doing all our thinking and feeling, human testes have just two main functions - the production of sperm and hormones. (Although, many of us should be forgiven for attributing these gonads with their own thoughts and feelings too.)

Previous studies have suggested there are links between sexual dysfunction and brain disorders, and even between intelligence and semen quality. Of course, such links do not mean much by themselves, but now the team of researchers from Portugal and the UK has found an explanation for why they might exist.

They compared proteins across 33 tissue types, including the heart, intestine, cervix, ovaries and placenta, and found that testes and brains share 13,442 proteins in common. This is corroborated by gene expression studies showing these two distantly positioned organs share the highest number of genes among all the organs in the body.

Taking a closer look at the shared proteins most highly expressed in these tissues, Matos and colleagues found they're mostly involved in tissue development and cell communication. These shared proteins make sense when you consider how unexpectedly similar the two tissues are in many ways, the team explains.

The brain and testes are both greedy for energy to fuel highly demanding processes like thinking and the production of several million little sperms per day. So both organs have specialized cells to support the hard-working neurons in the brain and germ cells in the testes - to keep them well fed and physically comfortable.

Also, despite being very differently purposed cells, neurons function similarly to sperm in several ways. Both cells have important tasks involving moving stuff from within themselves to their outside environment - a process called exocytosis.

This is how brain cells pass neurotransmitters between each other. In sperm, the same process is used to release important fertilization factors.

In neurons, exocytosis is also involved in the growth of their reaching little branching arms collectively called neurites (dendrites and axons), while in sperm this process allows its innards to fuse with an egg.

"This is an underexplored topic, and the connection between these tissues needs to be clarified, which could help to understand the dysfunctions affecting brain and testis," the team wrote.

These findings raise a lot of questions, the obvious being how did two such disparate organs end up sharing so much in common? The researchers suspect it's because they're both strongly influenced by the speciation process.

Just like animals separated by millions of years of evolution and evolved half a world away from each other can develop the same traits, so too can different tissue groups within the human body.

For example, unlike most other animals, koalas have fingerprints confusingly similar to ours - thanks to the obvious selection pressure exerted by our (well, our primate ancestors') need to grip trees - despite 70 million years of evolution between us. This process is called convergent evolution.

In this case, the researchers propose the same selection pressures involved in keeping species distinct from each other may be imposed on both organs, causing them to evolve convergently. They point to 60 protein-coding genes, unique to humans, many of which are found within the brain and testis.

"The highest expression levels in cerebral cortex and testis suggested that these genes may contribute to phenotypic features that are exclusive of humans, such as the improved cognitive ability," the team wrote.

While owners of testes may not be so thrilled by these biological revelations, the rest of us might be inclined to think it makes an awful lot of sense. But before we get too ahead of ourselves, this finding means female brains share these similarities with balls, too.

Their research was published in Royal Society Open Biology.

sciencealert.com, 2 June 2021

https://www.sciencealert.com

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What are Homo Sapiens?

2021-05-26

In the last 15 years the number of known Homo species has more than doubled from four to nine, according to human evolution expert Chris Stringer of the British Natural History Museum. Now, the genus includes H. neanderthalensis (Neanderthals) and ancient species H. erectus (whose name translates to "upright man"). Scientists described the most recent addition, H. luzonensis, in a paper published in Nature in 2019.

"There's a H. sapiens fossil from Ethiopia that's about 195,000 years old, and it has the basic features of modern humans," Stringer told Live Science. "From 195,000 years onwards, we find fossils we can call H. sapiens reasonably accurately."

But there is possibly an even older example of H. sapiens: As described in a 2017 paper in Nature, fossilized remains found along with stone tools in a Moroccan cave suggest that "modern" humans may have appeared as early as 315,000 years ago.

"From 195,000 years onwards, we find fossils we can call H. sapiens reasonably accurately."

There isn't a clear line between humans and our close relatives, and researchers use either anatomy or behavior to separate human remains from the rest. Anatomists argue that H. sapiens can be identified by their skeletons, while some archaeologists say that behavior is what defines modern humans.

THE ANATOMICAL DEFINITION OF A HUMAN

Scientists do not agree on an exact definition of what constitutes the genus Homo, according to a 2015 review published in Science. That said, most Homo species have "a long, low braincase, and strong continuous brow ridge," as described in a 2019 review published in the Journal of Quaternary Science. However, H. sapiens have distinctive "modern" physical characteristics: a large rounded braincase, lack of a brow-ridge, a chin (even in infancy) and a narrow pelvis compared to other species in the Homo genus.

But early H. sapiens may not have had all the same features that modern H. sapiens do, Stringer said. "Humans like to classify and keep things simple, but nature doesn't recognize our definitions," he said.

THE ARCHAEOLOGICAL DEFINITION OF A HUMAN

Some scholars believe that behavior is what sets H. sapiens apart from other Homo species — and all other species in the world, for that matter.

There are a number of behaviors that are categorized as "human." In a 2003 review published in the journal Current Anthropology, researchers listed traits that have historically been used to identify H. sapiens. These included evidence of behaviors such as burial of the dead, ritual art, decorations, worked bone and antler material, blade technology and fishing, among others. However, the authors of that review also pointed out that many of those behaviors are Eurocentric, and may not be applicable to H. sapiens found in other parts of the world.

"The current archaeological approach is to look at the set of skills as well as the behavioral implications," Silje Bentsen, project manager of SapienCE at the University of Bergen in Norway, told Live Science. SapienCE, which stands for the Centre for Early Sapiens Behaviour, aims to "increase our understanding of how and when Homo sapiens evolved into who we are today," according to the group's website.

"There's been a long debate on what to call a modern human, and the debate is still ongoing," Bentsen said. Rather than a checklist of traits, archaeologists are rather looking at what certain traits imply about cognition. For example, engravings or symbols depicting seasons or animal migrations suggest that early humans were intelligent enough to understand those concepts. "It shows planning and advanced cognition," Bentsen explained. "It's a complicated behavior package."

However, the behavioral method of distinguishing modern humans is complicated by evidence that other Homo species, such as Neanderthals, have been shown to exhibit similar abilities. These stocky cave-dwellers used tools, buried their dead and controlled fire — activities once thought of as distinctly human. Indeed, Stringer dismisses behavior as a way to differentiate species. "Behavior is not a valid way of defining a species," he said. "Behavior is shared much more easily than anatomy."

ARE HUMANS A DISTINCT SPECIES?

One definition of a species is: "Groups of interbreeding natural populations that are reproductively isolated from other such groups," according to Encyclopedia Britannica. However, that definition may not apply for Homo species, as recent research describes evidence of interbreeding between Neanderthals, H. sapiens and H. denisovans (a hominin species discovered in Denisova Cave in Russia). For example, a 2018 paper published in the journal Nature reported evidence of multiple episodes of interbreeding between Neanderthals and H. sapiens. Another 2018 paper, also in Nature, described evidence of an ancient human hybrid, who had both Neanderthal and Denisovan DNA.

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This has led some scholars to argue that many Homo species, including ours, should be lumped together, Stringer said. In this paradigm, modern humans are H. sapiens sapiens, while Neanderthals are H. sapiens neanderthalensis and Denisovans are H. sapiens denisovans.

Stringer, however, maintains that humans and Neanderthals are separate species because their bone structure is different. "If Neanderthals and H. sapiens remained separate long enough to evolve such distinctive skull shapes, pelvises, and ear bones, they can be regarded as different species, interbreeding or not," he wrote in an article for the The Natural History Museum in London.

livescience.com, 26 May 2021

https://www.livescience.com

Could a distaste for broccoli indicate greater resistance to COVID-19?

2021-05-29

It sounds a little hard to swallow, but a new study suggests that how people react to bitter flavors correlates with the severity of their COVID-19 infection.

It's an exciting insight because during the past 16 months, it's become clear that people don't respond to SARS-CoV-2 predictably. It's been impossible to determine whether someone will experience mild symptoms or develop life-threatening respiratory disease. Imagine if a simple taste test could indicate a person's risk of developing severe COVID-19.

Henry Barham, a rhinologist at the Baton Rouge General Medical Center, in Louisiana, published a study in the medical journal JAMA Network Open on May 25 that analyzed nearly 2,000 patients and found that "supertasters"—individuals who are overly sensitive to some bitter compounds—were less likely to test positive for the virus. If this association holds true, it implies, for example, that people who don't find broccoli too bitter are in a higher risk group for severe COVID-19.

"This is a very interesting study that suggests that receptors on our tongue that allow us to sense bitter flavors are also linked to our vulnerability to respiratory infections like COVID-19," says David Aronoff, director of the division of infectious diseases at Vanderbilt University Medical Center, in

Imagine if a simple taste test could indicate a person's risk of developing severe COVID-19.

Nashville, Tennessee, who was not involved with this research. That taste receptors may also be involved with immunity is surprising, he says.

Do "supertasters" have super powers?

At Yale University in the 1990s, psychologist Linda Bartoshuk pioneered the study of genetic variations in taste perception. She coined the term "supertaster" to describe the 25 percent of people who are intensively sensitive to bitter flavors. Another 25 percent of people are "nontasters" who barely detect bitter flavors, and the remaining 50 percent are just "tasters"—those who register the bitterness but not to the degree that it's distasteful.

Supertasters are more sensitive to bitter flavors because they have up to four times as many taste buds on their tongue. Bitter compounds in certain foods and drinks are recognized by type 2 taste receptors, which are made by a family of genes called T2R. The T2R38 gene is among the best studied of these. Variations in the structure of the T2R38 protein the gene encodes correlates with a person's tolerance of bitter compounds—such as phenylthiocarbamide and propylthiouracil—which are abundant in many vegetables, including broccoli, cabbage, and brussels sprouts.

This is not the first time being a supertaster had been linked to a medical condition. Supertasters have a higher likelihood of having polyps in their colon, a risk factor for cancer associated with lower intake of those bitter vegetables.

But supertasters can experience physiological advantages as well. As it happens, the T2R38 proteins are found in places other than the tongue. These "extraoral" areas include the epithelial cells that line the nose and upper respiratory tract, where they respond to invading pathogens.

A 2012 study led by Noam Cohen, a rhinologist at the University of Pennsylvania, in Philadelphia, found that bacteria responsible for sinus infections activate the T2R38 protein receptors on cells lining the respiratory tract, causing them to produce nitric oxide. Nitric oxide is a key component of our immune response, the first line of defense against invading pathogens. It stimulates hair-like structures called cilia in the respiratory passageways that remove foreign particles and pathogens from the body. Consequently, supertasters experience fewer bacterial sinus infections.

Barham, who studies T2Rs as they relate to innate immunity within the respiratory tract, was also aware that nitric oxide could poison SARS-CoV,

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a coronavirus (related to SARS-CoV-2 that causes COVID-19) first reported in Asia in 2003 that caused a respiratory illness that spread to 22 countries before it was contained. This prompted him to investigate whether a link exists between COVID-19 and supertasters.

Tasteful study bitter pill for nontasters

Barham's team studied 1,935 adults, 266 of whom tested positive for SARS-CoV-2. Nontasters were significantly more likely than tasters and supertasters to test positive for SARS-CoV-2, to be hospitalized once infected, and to suffer symptoms for a longer time. Eighty-six percent of those with severe COVID-19 requiring hospitalization were nontasters. Less than 6 percent of supertasters tested positive for SARS-CoV-2.

Barham also speculates that the possible connection between T2Rs and COVID-19 might be linked to why children generally are less susceptible. The numbers of "taste receptors decrease with age, which potentially explains why the elderly population seems to do worse than their younger counterparts," Barham says. Conversely, most children, who have more T2Rs, suffer less severe symptoms or illness when infected with SARS-CoV-2. "The 25 percent of children who are nontasters show few to none of these T2Rs, resulting in potentially more severe symptoms," he says.

According to Aronoff, the study has limitations. The relatively small number of adults examined were in a fairly narrow age range, so it's not known whether the correlation between taste preferences and COVID-19 severity exists in children or the elderly. In addition, he says, the population studied may differ in unknown ways that influenced the results.

Are COVID-19 taste tests coming?

Being able to determine quickly who is most at risk from SARS-CoV-2 would be a valuable tool as society emerges from quarantine. Barham's findings suggest that taste-testing could provide a safe, fast, and inexpensive way to categorize people into risk groups for COVID-19 and other infections.

"At this point, the results of this work are premature to help us manage COVID-19 in the clinic," Aronoff cautions. "But the results could impact our understanding of what leads people to be more or less vulnerable to infections like COVID-19." Aronoff emphasizes that supertasters shouldn't overinterpret these conclusions: "People who hate broccoli should not avoid vaccination," he says.

Danielle Reed, associate director of the Monell Chemical Senses Center, in Philadelphia, also warns against overinterpreting the findings. Reed, who studies genetic differences in taste and smell, performed the genetic testing in the Barham study but declined to be named as an author because she interpreted the results differently.

Reed points out that Barham's analysis didn't account for "general taste loss, which is an early and cardinal feature of COVID-19." As a result, she believes that some patients "were categorized incorrectly as nontasters." Furthermore, T2R genes were not identified as being involved with COVID-19 severity in an independent genomic analysis.

Reed says taste tests to help guide medical care are "a goal we can work toward. But the first step is to make screening for taste and smell a regular part of health care, like we do with vision and hearing. As we add taste and smell checks to routine health care, how these senses predict health and disease may emerge and be useful tools."

Barham agrees that more research is needed and says his team has continued gathering data to "explore the relationship" between taste receptors and COVID-19. He expresses optimism about extending the work to other infectious diseases. "We are also studying this family of receptors as they influence innate immunity to influenza, along with other upper respiratory infections."

nationalgeographic.com, 29 May 2021

https://www.nationalgeographic.com

Was Einstein wrong? Why some astrophysicists are questioning the theory of space-time

2021-05-25

As in history, revolutions are the lifeblood of science. Bubbling undercurrents of disquiet boil over until a new regime emerges to seize power. Then everyone's attention turns to toppling their new ruler. The king is dead, long live the king.

This has happened many times in the history of physics and astronomy. First, we thought Earth was at the center of the solar system — an idea that stood for over 1,000 years. Then Copernicus stuck his neck out to say that the whole system would be a lot simpler if we are just another planet orbiting the sun. Despite much initial opposition, the old geocentric

The discovery of gravitational waves in 2015 was a decisive victory, but, like its predecessors, it too might be about to fall.

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picture eventually buckled under the weight of evidence from the newly invented telescope.

Then Newton came along to explain that gravity is why the planets orbit the sun. He said all objects with mass have a gravitational attraction towards each other. According to his ideas we orbit the sun because it is pulling on us, the moon orbits Earth because we are pulling on it. Newton ruled for two-and-a-half centuries before Albert Einstein turned up in 1915 to usurp him with his General Theory of Relativity. This new picture neatly explained inconsistencies in Mercury's orbit, and was famously confirmed by observations of a solar eclipse off the coast of Africa in 1919.

Instead of a pull, Einstein saw gravity as the result of curved space. He said that all objects in the universe sit in a smooth, four-dimensional fabric called space-time. Massive objects such as the sun warp the space-time around them, and so Earth's orbit is simply the result of our planet following this curvature. To us that looks like a Newtonian gravitational pull. This space-time picture has now been on the throne for over 100 years, and has so far vanquished all pretenders to its crown. The discovery of gravitational waves in 2015 was a decisive victory, but, like its predecessors, it too might be about to fall. That's because it is fundamentally incompatible with the other big beast in the physics zoo: Quantum theory.

The quantum world is notoriously weird. Single particles can be in two places at once, for example. Only by making an observation do we force it to 'choose'. Before an observation we can only assign probabilities to the likely outcomes. In the 1930s, Erwin Schrödinger devised a famous way to expose how perverse this idea is. He imagined a cat in a sealed box accompanied by a vial of poison attached to a hammer. The hammer is hooked up to a device that measures the quantum state of a particle. Whether or not the hammer smashes the vial and kills the cat hinges on that measurement, but quantum physics says that until such a measurement is made, the particle is simultaneously in both states, which means the vial is both broken and unbroken and the cat is alive and dead.

Such a picture cannot be reconciled with a smooth, continuous fabric of space-time. "A gravitational field cannot be in two places at once," said Sabine Hossenfelder, a theoretical physicist at the Frankfurt Institute for Advanced Studies. According to Einstein, space-time is warped by matter and energy, but quantum physics says matter and energy exist in multiple states simultaneously — they can be both here and over there. "So where

is the gravitational field?" asks Hossenfelder. "Nobody has an answer to that question. It's kind of embarrassing," she said.

Try and use general relativity and quantum theory together, and it doesn't work. "Above a certain energy, you get probabilities that are larger than one," said Hossenfelder. One is the highest probability possible — it means an outcome is certain. You can't be more certain than certain. Equally, calculations sometimes give you the answer infinity, which has no real physical meaning. The two theories are therefore mathematically inconsistent. So, like many monarchs throughout history, physicists are seeking a marriage between rival factions to secure peace. They're searching for a theory of quantum gravity— the ultimate diplomatic exercise in getting these two rivals to share the throne. This has seen theorists turn to some outlandish possibilities.

Arguably the most famous is string theory. It's the idea that sub-atomic particles such as electrons and quarks are made from tiny vibrating strings. Just as you can play strings on a musical instrument to create different notes, string theorists argue that different combinations of strings create different particles. The attraction of the theory is that it can reconcile general relativity and quantum physics, at least on paper. However, to pull that particular rabbit out of the hat, the strings have to vibrate across eleven dimensions — seven more than the four in Einstein's space-time fabric. As yet there is no experimental evidence that these extra dimensions really exist. "It might be interesting mathematics, but whether it describes the space-time in which we live, we don't really know until there is an experiment," said Jorma Louko from the University of Nottingham.

Partly inspired by string theory's perceived failings, other physicists have turned to an alternative called Loop Quantum Gravity (LQG). They can get the two theories to play nicely if they do away with one of the central tenets of general relativity: That space-time is a smooth, continuous fabric. Instead, they argue, space-time is made up of a series of interwoven loops — that it has structure at the smallest size scales. This is a bit like a length of cloth. At first glance it looks like one smooth fabric. Look closely, however, and you'll see it is really made of a network of stitches. Alternatively, think of it like a photograph on a computer screen: Zoom in, and you'll see it is really made of individual pixels.

The trouble is that when LQG physicists say small, they mean really small. These defects in space-time would only be apparent on the level of the Planck scale —around a trillionth of a trillionth of a trillionth of a meter.

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That's so tiny that there would be more loops in a cubic centimeter of space than cubic centimeters in the entire observable universe. "If space-time only differs on the Planck scale then this would be difficult to test in any particle accelerator," says Louko. You'd need an atom smasher a 1,000-trillion-times more powerful than the Large Hadron Collider (LHC) at CERN. How, then, can you detect space-time defects that small? The answer is to look across a large area of space.

Light arriving here from the furthest reaches of the universe has traveled through billions of light years of space-time along the way. While the effect of each space-time defect would be tiny, over those distances interactions with multiple defects might well add up to a potentially observable effect. For the last decade, astronomers have been using light from far-off Gamma Ray Bursts to look for evidence in support of LQG. These cosmic flashes are the result of massive stars collapsing at the ends of their lives, and there is something about these distant detonations we currently cannot explain. "Their spectrum has a systematic distortion to it," said Hossenfelder, but no one knows if that is something that happens on the way here or if it's something to do with the source of the bursts themselves. The jury is still out.

To make progress, we might have to go a step further than saying space-time isn't the smooth, continuous fabric Einstein suggested. According to Einstein, space-time is like a stage that remains in place whether actors are treading its boards or not —even if there were no stars or planets dancing around, space-time would still be there. However, physicists Laurent Freidel, Robert Leigh, and Djordje Minic think that this picture is holding us back. They believe space-time doesn't exist independently of the objects in it. Space-time is defined by the way objects interact. That would make space-time an artifact of the quantum world itself, not something to be combined with it. "It may sound kooky," said Minic, "but it is a very precise way of approaching the problem."

The attraction of this theory — called modular space-time — is that it might help solve another long-standing problem in theoretical physics regarding something called locality, and a notorious phenomenon in quantum physics called entanglement. Physicists can set up a situation whereby they bring two particles together and link their quantum properties. They then separate them by a large distance and find they are still linked. Change the properties of one and the other will change instantly, as if information has traveled from one to the other faster than the speed of light in direct violation of relativity. Einstein was so perturbed by this phenomenon that he called it 'spooky action at a distance'.

Modular space-time theory can accommodate such behavior by redefining what it means to be separated. If space-time emerges from the quantum world, then being closer in a quantum sense is more fundamental than being close in a physical sense. "Different observers would have different notions of locality," said Minic, "it depends on the context." It's a bit like our relationships with other people. We can feel closer to a loved one far away than the stranger who lives down the street. "You can have these non-local connections as long as they are fairly small," said Hossenfelder.

Freidel, Leigh, and Minic have been working on their idea for the last five years, and they believe they are slowly making progress. "We want to be conservative and take things step-by-step," said Minic, "but it is tantalizing and exciting". It's certainly a novel approach, one that looks to "gravitationalize" the quantum world rather than quantizing gravity as in LQG. Yet as with any scientific theory, it needs to be tested. At the moment the trio are working on how to fit time into their model.

This may all sound incredibly esoteric, something only academics should care about, but it could have a more profound effect on our everyday lives. "We sit in space, we travel through time, and if something changes in our understanding of space-time this will impact not only on our understanding of gravity, but of quantum theory in general," said Hossenfelder. "All our present devices only work because of quantum theory. If we understand the quantum structure of space-time better that will have an impact on future technologies — maybe not in 50 or 100 years, but maybe in 200," she said.

The current monarch is getting long in tooth, and a new pretender is long overdue, but we can't decide which of the many options is the most likely to succeed. When we do, the resulting revolution could bear fruit not just for theoretical physics, but for all.

livescience.com, 25 May 2021

https://www.livescience.com

Is Latin a dead language?

2021-06-02

The Latin language used to be spoken all over the Roman Empire. But no country officially speaks it now, at least not in its classic form. So, did Latin really peter out when the Roman Empire ceased to exist?

Rome used to be one of the largest empires in the world, but gradually Rome's sway over its colonies dwindled until it completely lost control.

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So, did Latin really peter out when the Roman Empire ceased to exist?

Despite this, Latin continued to be the lingua franca throughout much of Europe hundreds of years after that happened. The answer to the question of when Latin, ancient Rome's language, died is a complicated one. There's no date in the annals of history to mark the end of Latin as a spoken language, and some would argue that's because it never really died.

The Vatican may still deliver some masses in Latin, but virtually no one in Italy is using Latin on a day-to-day basis. Nevertheless, this doesn't equate to the death of Latin, said Tim Pulju, a senior lecturer in linguistics and classics at Dartmouth College in New Hampshire.PLAY SOUND

"Latin didn't really stop being spoken," Pulju told Live Science. "It continued to be spoken natively by people in Italy, Gaul, Spain and elsewhere, but like all living languages, it changed over time."

Crucially, the alterations to Latin were particular to the many different regions of the old Roman Empire, and over time these differences grew to create entirely new but closely related languages. "They gradually added up over the centuries, so that eventually Latin developed into a variety of languages distinct from one another, and also distinct from classical Latin," Pulju said. Those new languages are what we now refer to as the Romance languages, which include French, Italian, Portuguese, Romanian and Spanish.

Such linguistic evolutions happen with every language. Take English, for example. "English has been spoken in England for over a millennium, but it has changed over time, as is obvious if you compare present-day English to Elizabethan English, as seen in Shakespeare," Pulju said. "Elizabethan English, from about four centuries ago, is still mostly comprehensible to us, but Chaucer's English, dating from the 14th century, is much less so. And the English of 'Beowulf,' from about the year 1000, is so different from modern English [it's] not comprehensible to us today." But no one would say English is a dead language — it simply changed very gradually over a long period of time.

The only difference between English and Latin is that old English developed into modern English and modern English alone, whereas classical Latin diversified and gave rise to a number of different languages. That's why people tend to think, perhaps erroneously, of Latin as an extinct language.

Languages can go extinct, though; sometimes native speakers of a language all die, or over time their first language switches until eventually there are no fluent speakers left.

This happened with the Etruscan language, originally spoken in what is modern day Tuscany in Italy. "After the Romans conquered Etruria, succeeding generations of Etruscans continued to speak Etruscan for hundreds of years, but some Etruscans, naturally, learned Latin as a second language; moreover, many children grew up bilingual in Etruscan and Latin," Pulju said. "Eventually, the social advantages of speaking Latin and having an identity as a Roman outweighed those of speaking and being Etruscan, so that over the generations, fewer and fewer children learned Etruscan." The end result is that the Etruscan language simply died.

Dying languages aren't just an ancient phenomenon, either. "It's also happening to Indigenous languages in numerous places around the world today," Pulju said. The Middle East is something of a hotspot for dying languages, which can happen when there is societal stigma attached to speaking a non-mainstream language, the language not being taught in schools and more brutal measures are taken, such as ethnic cleansing and violence perpetrated against minorities. UNESCO estimates that at least half of the world's 7,000 languages spoken today will be extinct before the end of this century.

So, when did Latin die? It didn't, it simply evolved.

Editor's Note: This story was updated at 3:36 p.m. EDT on June 2 to correct the photo caption. The statue depicts Antoninus Pius, not Emperor Augustus as was previously stated.

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https://wwww.livescience.com

What's nature worth?

2021-06-01

WHAT'S NATURE WORTH? — Biodiversity is setting up to be the next big fight in sustainable investing, as financial companies, regulators and environmentalists act to protect natural landscapes on a global scale.

Following in the footsteps of greenhouse gas activism, which has countries and corporations mapping carbon footprints and trying to put the brakes on global warming, global leaders are redoubling efforts to stem plant and animal extinction that could upset ecosystems vital to clean air, water and raw materials.

It took business leaders decades to join the climate fight, but now that they're on board with clean air, it might be easier to bring them on board with biodiversity protections.

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While world attention is laser-focused on November's climate meeting in Glasgow, Scotland, G-7 climate and environment ministers are planning a big push for biodiversity at a summit in China in October, with a 10-year goal of conserving at least 30 percent of the world's land and oceans.

It took business leaders decades to join the climate fight, but now that they're on board with clean air, it might be easier to bring them on board with biodiversity protections.

"We are where climate was five to six years ago," said Chris Hart, a senior sustainable finance associate at environmental group Global Canopy. "People are seeing connections between the destruction of nature and how that might have a material impact on investments and lending. How do we measure that? This is where we run up against a dead end."

France's BNP Paribas Asset Management is partnering with reporting alliance CDP to develop biodiversity disclosure metrics for corporations. And the Taskforce on Nature-Related Financial Disclosures, or TNFD, a group that organized last June with the backing of the U.N., is aiming to put a value on nature so capital can be channeled to companies and investments that protect it.

Biodiversity isn't a new thing. What's new is the attention being paid. World leaders set goals a decade ago under the Convention on Biological Diversity, or CBD, but none were met by the deadline of 2020.

The pandemic has underscored the problem's urgency. Biodiversity loss and climate change are interlinked crises that have made humans more vulnerable to emerging diseases such Covid-19, scientists say.

Any new framework will need strong accountability measures to track countries that are or aren't making progress in industries driving biodiversity loss, such as fishing, agriculture, mining and construction.

"What the CBD lacks is implementation and resources, as in finance and capacity building and human resources," said Li Shuo, a climate and energy campaigner at Greenpeace China. "It tells the world where it needs to be, but without answering how we actually get there."

Li wants China to take the lead on thorny political issues, such as helping persuade wealthy countries to help biodiversity efforts in developing nations such as Brazil and Argentina.

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A rights-based approach for indigenous peoples who manage much of the world's forests and waterways also is key, said Guido Broekhoven, head of policy research and development at the nonprofit World Wildlife Fund.

But the U.S. isn't a party to the Convention on Biological Diversity. Congress never ratified it. A State Department official said the U.S. is "very engaged" and working closely with Canada, Japan, Australia, New Zealand, Norway and other allies.

President Joe Biden's plan to conserve 30 percent of U.S. land and water by 2030 is the administration's way of showing commitment to biodiversity, the official said.

While negotiators negotiate, analysts are getting ahead of policy. They want to pinpoint private-sector contributions to biodiversity loss and how it could affect profits. It's a nascent effort.

politico.com, 1 June 2021

https://www.politico.com

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